BNWL-1169
UC-80

5-
1-70

PACTOLUS: A CODE FOR COMPUTING
NUCLEAR POWER COSTS

January 1970

AEC RESEARCH &
DEVELOPMENT REPORT

<i>L. J. Werfs</i>		<i>3.3666 Math</i>	MAY 5 1970

BNWL-1169

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

PACIFIC NORTHWEST LABORATORY

RICHLAND, WASHINGTON

operated by

BATTELLE MEMORIAL INSTITUTE

for the

UNITED STATES ATOMIC ENERGY COMMISSION UNDER CONTRACT AT(45-1)-1830

3 3679 00061 4901

BNWL-1169
UC-80, Reactor
Technology

PACTOLUS: A CODE FOR COMPUTING
NUCLEAR POWER COSTS

By

C. H. Bloomster

J. H. Nail

D. R. Haffner

Systems Engineering Department
Physics and Engineering Division

January 1970

1970

BATTELLE MEMORIAL INSTITUTE
PACIFIC NORTHWEST LABORATORIES
RICHLAND, WASHINGTON 99352

Printed in the United States of America
Available from
Clearinghouse for Federal Scientific and Technical Information
National Bureau of Standards, U.S. Department of Commerce
Springfield, Virginia 22151
Price: Printed Copy \$3.00; Microfiche \$0.65

PACTOLUS: A CODE FOR COMPUTING
NUCLEAR POWER COSTS

C. H. Bloomster

J. H. Nail

D. R. Haffner

ABSTRACT

PACTOLUS is a code for computing nuclear power costs using the discounted cash flow method. The cash flows are generated by PACTOLUS from input unit costs, time schedules, and burnup data. This report describes the code and illustrates the calculations. A listing of the code and an example cash flow and power cost calculation for a light water reactor are included.

CONTENTS

ABSTRACT	iii
FIGURES	vii
TABLES	vii
INTRODUCTION	1
SUMMARY	2
DISCUSSION	2
The Nuclear Fuel Cycle	3
Cash Flow	6
Capital Investment Costs	6
Reactor Operating Data	7
Operating and Maintenance Costs	7
Fuel Cycle Costs	8
Taxes	10
Capital Structure	11
Net Present Worth	12
Cost of Energy	13
Depreciation	15
Bond Interest	16
Inventory Accounting for Nuclear Fuel and Annual Fuel Expense	17
Financial Statements	19
DESCRIPTION OF CALCULATIONS	20
Plant Capital Costs	20
Operating and Maintenance Costs	20
FUEL CYCLE	22
Fabrication Costs	22
Reprocessing	22
Shipping Costs	23
²³⁵ U Enrichment Costs	23
Cascade Calculations	24
Optimum Tails Composition	24
Fuel Purchases and Credits	25
Fuel Losses	25

Schedule of Events	▪	▪	▪	▪	▪	▪	▪	▪	▪	26
Cost of Capital	▪	▪	▪	▪	▪	▪	▪	▪	▪	27
Cost of Energy	▪	▪	▪	▪	▪	▪	▪	▪	▪	28
Assumptions	▪	▪	▪	▪	▪	▪	▪	▪	▪	28
Calculation of Revenues	▪	▪	▪	▪	▪	▪	▪	▪	▪	28
Expense Schedule	▪	▪	▪	▪	▪	▪	▪	▪	▪	29
Depreciation	▪	▪	▪	▪	▪	▪	▪	▪	▪	29
Initial Core Depletion	▪	▪	▪	▪	▪	▪	▪	▪	▪	29
Tax Credits	▪	▪	▪	▪	▪	▪	▪	▪	▪	29
Present Worth Factor	▪	▪	▪	▪	▪	▪	▪	▪	▪	30
Unit Cost of Energy	▪	▪	▪	▪	▪	▪	▪	▪	▪	30
DATA SUPPLIED FOR USE IN LINEAR PROGRAMMING CALCULATIONS	▪	▪	▪	▪	▪	▪	▪	▪	▪	32
HOW OF INFORMATION	▪	▪	▪	▪	▪	▪	▪	▪	▪	32
Program Listing and Printout	▪	▪	▪	▪	▪	▪	▪	▪	▪	34
ACKNOWLEDGEMENT	▪	▪	▪	▪	▪	▪	▪	▪	▪	37
REFERENCES	▪	▪	▪	▪	▪	▪	▪	▪	▪	37

FIGURES

1. Uranium Fuel Cycle	4
2. PACTOLUS Flow Diagram	33

TABLES

1. Present Worth of Cash Flows	13
2. Typical Income Statement	15
3. Each Year's Depreciation	16
4. Income Statements for Firms A and B	17
5. Components of Unit Cost of Power	20
6. Example Input Data	21
7. Input Data for Cost of Power Calculation	28
8. Values for 5.87% Present Worth Factor	30
9. Unit Cost of Energy Calculation	31

PACTOLUS: A CODE FOR COMPUTING
NUCLEAR POWER COSTS

C. H. Bloomster

J. H. Nail

D. R. Haffner

INTRODUCTION

The calculation of nuclear power costs requires detailed cash flow information for return on investment analyses. Because wide variations exist in the fixed and variable costs, financing methods, tax rates, and operating modes of nuclear reactors, the determination of the cash flow requirements can become very complicated. This problem is not unique to nuclear reactors, but applies to many other capital investments.

A computer code, called PACTOLUS, was developed to facilitate the calculation of the cash flows. The objectives of the PACTOLUS code were to:

- Transform reactor investment, operating data, and fuel cycle cost and time information into material and cash flow schedules,
- Calculate the taxes, and
- Transmit this information for use in a computer model of the United State's electrical power economy.

A user's manual⁽¹⁾ describes some of the features of PACTOLUS and how to prepare input data. This report describes the calculations and the basis for the various segments of PACTOLUS and includes the latest revisions to the code. Parts of PACTOLUS are derived from other computer codes--UCOST,⁽²⁾ QUICK,⁽³⁾ and POWERCO.⁽⁴⁾ PACTOLUS is often used in conjunction with another computer code, CLOTHO,⁽⁵⁾ which calculates the effect of a variable load factor on fuel burnup.

SUMMARY

PACTOLUS is a computer code for calculating nuclear power costs using the discounted cash flow method. In addition, PACTOLUS calculates fuel material requirements, depreciation, and taxes, and also generates cash flow, income, and balance sheet information. A model of the gaseous diffusion process for uranium enrichment is included in the code for the calculation of enrichment costs, optimum tails composition, and materials flow. The effect of a variable load factor on cash flow and power cost is calculated using standard fixed and variable cost accounting methods.

The input data required by PACTOLUS consists of mass and energy balances (i.e., fuel burnup and power generation), capital costs, unit process costs, capital structure, rates of return on capital, rates of taxation, process times, depreciation method, and debt retirement schedule.

Although PACTOLUS was developed for nuclear power cost analyses, the code is adaptable to cost studies for other projects through appropriate redefinition of the input data.

DISCUSSION

PACTOLUS is a computer code which was developed to generate the basic accounting information contained in income statements, cash flow budgets, and balance sheets. By combining information on the costs of materials and processes, material flow, and fixed and variable costs, PACTOLUS calculates the cash flows for the entire life of a project. PACTOLUS calculates the revenues and unit cost of power required to earn a specified return on investment from which annual income statements and year-end balance sheets are prepared. The contribution of each of the major cost components to the unit cost of power is also calculated. The calculations are based on discounted cash flow techniques, standard methods for depreciation and debt repayment, tax rates, and capital structure.

PACTOLUS was developed primarily for computing the costs and material flows associated with nuclear power plants. Much of the discussion, terminology, and calculations here is associated with the specialized requirements of the nuclear industry. PACTOLUS is, however, based on standard accounting principles and may be used to calculate the cost of power from other types of power plants. For instance, PACTOLUS has been used to calculate the power costs for fossil-fueled plants. In addition, since many capital investment analyses require similar information, PACTOLUS could be extended to calculate the cash flow and unit costs for other products or services by appropriately redefining certain input.

THE NUCLEAR FUEL CYCLE

Nuclear power reactors consume nuclear fuel to produce power. After the fuel is consumed, some residual values which can be reclaimed for reuse remain in the spent fuel. The processing of nuclear fuel from its natural state as a uranium or thorium ore through its use in the nuclear reactor and the subsequent reclamation of the residual fuel values comprise the nuclear fuel cycle. The nuclear fuel cycle consists of a number of separate processes which take place sequentially. The costs of some processes (ore processing, for example) may be incurred several years before the fuel is consumed and revenue is obtained.

Figure 1 illustrates the nuclear fuel cycle for uranium and shows the process classification used in PACTOLUS. The uranium fuel cycle begins with the purchase of U_3O_8 , the refined form of uranium ore. This step includes the conversion of U_3O_8 to UF_6 . The enrichment phase consists of the enrichment of UF_6 in the ^{235}U isotope by the gaseous diffusion process. The fabrication phase consists of the conversion of enriched UF_6 to UO_2 and the fabrication of fuel assemblies. The reprocessing phase includes the dissolution of the spent

FIGURE 1. *Uranium Fuel Cycle*

fuel, the recovery as nitrates of the residual fuel values of uranium and plutonium, the storage of waste products, and the conversion of uranium to UF_6 in preparation for re-enrichment. In the case of plutonium recycle, the conversion of plutonium nitrate to oxide is included in the fabrication base. Of course, in addition to the uranium fuel cycle illustrated above, PACTOLUS can calculate nuclear power costs using any other fuel cycle.

Nuclear fuel consumption and thus the demand for all nuclear fuel cycle services varies directly with power production. Several computer codes have been developed which generate basic fuel consumption (burnup) information at a fixed power level. Since most reactors will operate under a varying load history and not at fixed power, this fuel consumption information is transformed by another computer code, CLOTHO, into a fuel consumption history corresponding to the varying load history for the reactor. The input to CLOTHO is usually from punched cards which transmit the isotopic consumption and production information at the fixed power, but CLOTHO is also designed specifically to obtain fuel consumption data directly from the magnetic tape output of the ALTHAEA⁽⁶⁾ burnup code. PACTOLUS obtains the mass and energy balance information directly from CLOTHO and converts this information, using lead and lag times, into material requirement schedules for each phase of the nuclear fuel cycle. Similarly, if the reactor history contains a change in the fuel cycle, such as a change in fuel exposure, the new fuel consumption information is also calculated in CLOTHO from the burnup data and transmitted to PACTOLUS, which then calculates the material requirement schedules for the balance of the fuel cycle.

CASH FLOW

Cash outlays are required throughout the life of a project. Some of the outlays are single occurrences, as the initial construction costs, while others are continuing costs, as the fuel cycle costs. Some costs are fixed and do not vary with the level of production, while other costs are variable. The categories of costs associated with a nuclear power plant and their method of treatment in PACTOLUS are discussed in the following paragraphs. An example problem is discussed in a later section of the report to further illustrate the calculation.

CAPITAL INVESTMENT COSTS

Capital investments are expenditures for assets having an expected useful life exceeding one year. Capital investments include the acquisition cost of land, buildings, plant and equipment, interim capital replacements, and working capital. At the conclusion of the enterprise, some of these items may have salvage or resale value from which payment or credit is received. Capital investments give rise to fixed costs associated with the recovery of the investment and the return on investment.

In a nuclear power plant a special capital investment is incurred for the initial fuel loading in the reactor. Although fuel is consumed as power is generated, a large fuel inventory must be maintained in the reactor throughout the life of the plant. The accounting method adopted for the fuel inventory may have a considerable effect on the apparent total capital investment and fuel consumption expenditures. The inventory accounting method does not affect the cash flow for nuclear fuel expenditures, but it does affect the annual payments for income and property taxes.

In PACTOLUS, the capital investments including interim capital replacements are simply entered as cash outlays at the time incurred. Salvage values and recoverable investments are credited at the time and value received. The capital investments may be classified in considerable detail or lumped together as a single item at the user's option. Special cost categories are used for the handling of non-depreciable investments such as working capital, the moderator for a heavy water reactor, and fluoride salt for a molten salt reactor. Non-depreciable investments are treated as cash outlays at the beginning of the project and as cash receipts at the end of the project.

REACTOR OPERATING DATA

The plant startup date, operating life, thermal power, and electrical conversion efficiency are input constants to PACTOLUS and may be specified over a wide range. The annual load factors are input variables; any schedule may be specified.

OPERATING AND MAINTENANCE COSTS

The operating and maintenance costs or simply operating costs are the annual costs incurred in the operation of the nuclear power plant. Some of the costs are fixed and do not vary with the level of plant operation; other costs vary directly with the level of plant operation. Nuclear liability insurance is classified as a fixed operating cost.

In PACTOLUS, the fixed cost is input expressed as dollars per year and the variable cost components are input expressed in dollars per year for full capacity or 100% plant operation. The variable operating cost for each year is calculated by multiplying the variable cost by the load factor for that year.

Nuclear liability insurance may be input as \$/year or \$/year/MWe or both. The variable and fixed operating costs are added to obtain the total operating cost for each year.

FUEL CYCLE COSTS

Fuel cycle costs vary almost directly with the level of plant operation. Slight deviation from true variable cost is caused by batch operation and the fuel inventory. Fuel cycle costs are incurred for the purchase of fuel materials, fabrication of fuel, shipping, and chemical reprocessing; credits are obtained for residual values in the irradiated fuel. In some analyses the fuel cycle cost includes the initial fuel loading and all subsequent fuel loadings within the period of interest. In other analyses, only the equilibrium fuel cycle costs are considered. The costs associated with the first core and achieving equilibrium are excluded or treated separately.

Fuel purchases are the direct expenses for nuclear fuel materials. The cost of U_3O_8 , ThO_2 , Pu, and ^{233}U , and the conversion of natural U_3O_8 to UF_6 are input as unit costs (\$/lb, \$/kg, or \$/g). The cost of U_3O_8 , Pu, and ^{233}U may be varied to any specified schedule. A minimum cost of \$3/kg for tails is built into the code. The total fuel purchases are calculated in PACTOLUS from the unit cost and material requirements. The material requirements, which are calculated in PACTOLUS, include allowances for subsequent processing losses of material. The time of the cost incurrence is calculated in PACTOLUS from input shipping and processing lead time information.

Uranium enrichment costs are calculated in PACTOLUS using a model of the UF_6 diffusion process. The model is described in a later section. The tails composition may be set arbitrarily to simulate a uniform operation of the diffusion plant,

or the optimum or lowest cost tails composition may be selected for the enrichment and economic factors pertaining to a specific nuclear fuel. In either case, input data is required on the unit cost of separative work, the ^{235}U enrichment level of the feed and discharge fuel, and the quantity of enriched uranium required.

Fabrication costs consist of the conversion of the raw fuel materials into finished fuel assemblies for use in the nuclear reactor. The fabrication costs may include some conversion steps, such as U_3O_8 to UO_2 , UF_6 to UO_2 , $\text{Pu}(\text{NO}_3)_4$ to PuO_2 , which vary with fuel cycle and reactor type. The fabrication cost includes the cost of cladding and assembly hardware. Fabrication costs are calculated in PACTOLUS from input unit cost data (\$/kg) and material flow. The unit cost data may be input as either a single number or to any schedule. In addition, an incremental fabrication cost penalty may be specified or may be input to any schedule for ^{233}U and Pu containing fuels. Separate fabrication costs to any schedule may be specified for fast reactor core and blankets fuels. The material and unit cost data refer to the finished fuel output from the fabrication plant.

Chemical reprocessing costs are incurred following irradiation. Uranium, plutonium, and other valuable products are reclaimed from the mixture of fuel and fission products discharged from the reactor. Chemical reprocessing costs are calculated in PACTOLUS from input unit cost data (\$/kg) and material flow. The unit cost data may be input as either a single number or to any schedule. The material and unit cost data are based on the original weight of fuel charged into the reactor.

Chemical reprocessing costs may also be calculated using a model of the costs for the Nuclear Fuel Services (NFS) plant. The NFS cost model which is based on daily costs, throughput, and enrichment is described in a later section.

Losses of nuclear fuel occur during fabrication and reprocessing. In PACTOLUS an allowance for the lost fuel is added to the fuel purchases. The losses are charged against the fabrication and reprocessing costs. Separate loss rates for fabrication and reprocessing are input as constants.

Shipping costs are incurred in transporting fuel between processing locations prior to irradiation (pre-reactor shipping) and irradiated fuel from the reactor to the reprocessing plant (post-reactor shipping). In PACTOLUS, shipping costs may be categorized in more detail: prefabrication shipping (two subclassifications available for standard and recycle fuel); post fabrication shipping (two subclassifications for standard and recycle fuel); post reactor shipping, and shipping to final destination. Different unit cost data may be used for each category. Shipping charges are calculated in PACTOLUS using input unit costs data (\$/kg) and material flow.

TAXES

Several types of taxes are levied against firms. These taxes are part of the normal cash flow and are recovered through higher selling prices. Property taxes may be levied against both real and intangible assets of a firm. Revenue taxes are levied against sales. State and federal income taxes are levied against the taxable income. State and local taxes are deductible expenses for federal income tax purposes. Taxes usually comprise a large fraction of the cash flow and are very important in financial analyses.

The tax rates are inputs to PACTOLUS. Property taxes are applied only to the initial plant and fuel investments.

CAPITAL STRUCTURE

The capital structure of a firm consists of the amount and type of long term financing, debt, and equity. Debt financing (bonds) requires periodic interest payments and repayment of the principal. The method of repayment of the principle may vary and is specified in the indenture. Equity financing (stock) requires neither interest (dividend) payments nor repayment of principal; the return on equity is derived from the profits of the enterprise. Since bonds entail less risk than stock, the return on investment for debt is usually less than for equity.

The overall cost of capital to a firm is the weighted average return on investment of both debt and equity financing. This is the average rate of return on investments that the firm must make in order to meet the bond interest payments and the anticipated return on equity. Conversely, if the firm earns this average rate of return on all its investments, then the firm exactly meets its bond interest payments and the anticipated return on equity. This point is emphasized because it is the basis for the cost of power calculation to be discussed later.

In PACTOLUS, the user has the following options to specify:

- Any debt to equity ratio,
- The return on debt,
- The return on equity, and
- The schedule for debt repayment.

One particularly useful option is the maintenance of a constant debt-to-equity ratio. In this option, debt and equity are increased or decreased in proportion to the original ratio as required by the cash flow. This method simulates the long

term situation of many mature firms, particularly utilities, and results in a constant cost of capital throughout the life of the project.

NET PRESENT WORTH

The net present worth method is used in PACTOLUS to calculate the cost of energy. In this method, the anticipated cash outlays for a project are discounted at the cost of capital to the firm to obtain the present worth of the cash outlays. Similarly, the anticipated cash incomes for the project are discounted to obtain the present worth of the incomes. For example, at a cost of capital of 10%, the present worth of \$100 obtained one year hence is:

$$\text{Present worth} = \frac{1}{(1 + i)^n} \text{ (payment)}$$

i = interest rate or cost of capital.

n = number of years until payment is received.

$$\text{Present Worth of \$100} = \frac{1}{(1 + 0.10)^1} (\$100) = \$90.90.$$

The present worth factor is the term $\frac{1}{(1 + i)^n}$.

If several projects are under simultaneous consideration, the project with the greatest excess of present worth income over outlays affords the greatest return. For example, consider two potential investments, A and B, each lasting 2 years and yielding \$100 at the end of each year. Investment A requires an initial investment of \$100 followed by \$10 in operating expenses payable at the end of each year. Investment B requires an initial investment of \$30 followed by \$50 in operating expenses payable at the end of each year. Which investment yields the greatest return if the cost of capital is 10%? The present worth of the cash flows is shown in

Table 1. In this table, the negative signs denote cash outlays and the positive signs denote cash incomes.

TABLE 1. *Present Worth of Cash Flows*

<u>Year</u>	<u>Investment A</u>		<u>Present Worth Factor @ 10%</u>	<u>Investment B</u>	
	<u>Cash Flow</u>	<u>Present Worth</u>		<u>Cash Flow</u>	<u>Present Worth</u>
0	-100	-100.0	1.00	-30	-30.0
1	-10	-9.1	0.91	-50	-45.5
	+100	+91.0	0.91	+100	+91.0
2	-10	-8.3	0.83	-50	-41.5
	<u>+100</u>	<u>+83.0</u>	0.83	<u>+100</u>	<u>+83.0</u>
	+80	+56.6		+70	+57.0

Although the net cash income from Investment A exceeds the cash income from Investment B by \$10, the present worth of Investment B exceeds Investment A; therefore, Investment B yields a slightly higher rate of return.

Sometimes a different discount rate, the opportunity value of money, is used for the income stream rather than the cost of capital. The opportunity value of money takes into account the greater or smaller rate applied to income as contrasted to outlay.

COST OF ENERGY

In PACTOLUS the unit cost of energy for a project is calculated by equating the income and outlay cash flows and using the same cost of capital for discounting for both streams. When the present worth of the income and outlay streams are equal over the life of the project, a firm earns exactly its cost of capital. This includes interest payments on debt, return on equity, and the complete recovery of debt and equity capital.

In a nuclear power plant, the incomes are derived from sales of energy, credits contained in the discharged fuel, and working capital recovery and salvage. The cash outlays are the capital, operating, and fuel cycle costs previously described.

The energy sales in dollars are equal to the amount of energy sold (kilowatt hours) multiplied by the unit selling price (\$/kilowatt hour).

By equating the income and outlay streams, the average unit cost of energy can be calculated if the cash outlays, fuel credits, and energy supply schedule are known:

Present worth of income = present worth of outlays.

Present worth of energy sales + present worth of fuel credits = present worth of outlays.

Present worth of energy supplies $\times$ unit cost of energy = present worth of outlays - present worth of fuel credits.

Unit cost of energy

$$= \frac{\text{present worth of outlays} - \text{present worth of fuel credits}}{\text{present worth of energy supplied}}$$

The introduction of revenue and income taxes complicates the equation. The present worth of the taxes must be added to the present worth of the outlays (or equivalently subtracted from the present worth of the revenues). A typical income statement (Table 2), shows that both the revenue and income taxes can be expressed as coefficients of gross revenues and deductible expenses. This permits the unit cost of power to be expressed as follows:

Unit cost of power =
$$\frac{\text{Present worth of the outlays} - \text{present worth of the tax credits arising from tax deductible expenses} - \text{present worth of fuel credits}}{(\text{present worth of power generated})(\text{tax term})}$$

where tax term is a coefficient expressing the revenue tax rate and the state and federal income tax rates on gross revenues. This increases revenues to provide for the payment of the taxes.

TABLE 2. Typical Income Statement

<u>Revenues</u>		<u>Remarks</u>
Gross Revenues	100	
Revenue Tax	<u>1</u>	Revenue Tax Rate (RTR) = 1%
Net Revenues	99	(Gross Revenues)(1 - RTR) = (100)(0.99) = 99
<u>Expenses</u>		
Deductible Expenses	39	Operating costs + Deprecia- tion
Operating Costs	25	
Depreciation	<u>14</u>	
<u>Income</u>		
Gross Income	60	Net Revenue - Deductible Expenses
State Income Tax	<u>6</u>	
Federal Taxable Income	54	State Tax Rate (STR) = 10% (Gross Income)(1 - STR)
Federal Income Tax	<u>27</u>	Federal Tax Rate (FTR) = 50% (Federal Taxable Income)
Net Income	27	(1 - FTR)
<u>Taxes</u>		
Revenue Tax	= (Gross Revenue)(RTR) = (100)(0.01) = 1	
State Income Tax	= (Net Revenues - Deductible Expenses) STR = [(100)(1 - RTR) - 39] 0.10 = 6	
Federal Income Tax	= (Net Revenue - Ded. Exp. - State Income Tax) FTR = [(100) (1 - RTR) - 39 - 6] (0.50) = 27	

DEPRECIATION

One of the deductible expenses is depreciation. Depreciation is not a cash expense and thus differs from most other deductible expenses. Depreciation is a "book" expense which is used to recover capital cost. Depreciation reduces income taxes and is a source of cash in-flow. Two options are available in PACTOLUS to calculate depreciation--the straight line method and the sum-of-the-years-digits method. In straight

line depreciation the capital asset is depreciated at a uniform annual rate over the useful life of the asset. The sum-of-the-years-digits depreciation is one of the accelerated depreciation methods. In this method, the digits for the years of the useful life are added to obtain a denominator. The numerator is obtained by reversing the sequence of digits such that the numerator for the first year is the last yearly digit, etc. The annual depreciation is obtained by dividing the capital asset by the denominator, which is common for all years, and multiplying by the numerator appropriate to each year. To illustrate, assume a capital asset value of \$300 and a 5-year useful life. The sum of the years digits = $1 + 2 + 3 + 4 + 5 = 15$. By reversing the order of the digits to obtain the numerator, each year's depreciation is calculated as follows:

TABLE 3. *Each Year's Depreciation
(sum-of-the-years-digits)*

<u>Year</u>	<u>Numerator</u>	<u>Denominator</u>	<u>Fraction</u>	<u>Capital Asset</u>	<u>Annual Depreciation</u>	<u>Straight-Line Annual Depreciation</u>
1	5	15	5/15	\$300	\$100	60
2	4	15	4/15	\$300	80	60
3	3	15	3/15	\$300	60	60
4	2	15	2/15	\$300	40	60
5	1	15	<u>1/15</u>	\$300	<u>20</u>	<u>60</u>
			15/15		\$300	300

BOND INTEREST

Since bond interest is a deductible expense from taxable income, the tax rate reduces the effective bond interest rate to the debtor. To illustrate, suppose firm A has a gross income of \$100, no tax deductible expenses, and the income tax rate is 40%; firm B is identical to firm A except that firm B

has a tax deductible interest expense from a \$1000 bond outstanding at 5 percent interest rate. The income statements for the two firms are:

TABLE 4. Income Statements for Firms A and B

<u>FIRM A</u>		<u>FIRM B</u>	
Gross Income	\$100	Gross Income	\$100
Income Tax	<u>40</u>	Bond Interest	<u>50</u>
Net Income	\$ 60	Taxable Income	50
		Income Tax	<u>20</u>
		Net Income	30

The bond interest payment has reduced the income tax payment by \$20, or equivalently, the effective bond interest rate was reduced to 3%. For instance.

Normal bond interest payment	\$50
Tax saving	<u>20</u>
Effective bond interest payment	\$30

In this example, the effective bond interest rate after taxes equals the normal bond interest rate times (1 - income tax rate) or $0.03 = 0.05 (1 - 0.40)$. Therefore, if the effective bond interest rate is used to calculate the weighted cost of capital for a project, the bond interest credit can be eliminated from the deductible expense tax credit term in the cost of energy calculations. The effective bond interest expense is recovered through the discounting factor along with the return on equity.

INVENTORY ACCOUNTING FOR NUCLEAR FUEL AND ANNUAL FUEL EXPENSE

The inventory accounting method has a significant effect on the reported income and inventory valuation of a firm. The annual fuel expense is a "book" cost like depreciation which does not affect the direct cash flow for fuel purchases or credits. It does however, affect the allowable deductions for fuel expense and, hence, income tax payments and net profit. Nuclear fuel has the characteristics of a short term capital

investment, having a useful life of ~5 years, a salvage value, an associated revenue stream, and a choice of alternative investment and financing decisions. The accounting method used for income determination and fuel inventory valuation will strongly influence these decisions.

Four accounting options are available to PACTOLUS for inventory costing: first in-first out (FIFO), last in-first out (LIFO), weighted average cost, and standard cost. All four are common methods of inventory valuation and have individual advantages and disadvantages. Under conditions of constant prices all four methods are identical.

The FIFO method most nearly represents the physical flow of fuel through the reactor and the inventory replacement value of the current fuel inventory. The FIFO method, however, may most seriously misstate the current cost of fuel consumption.

The LIFO method most nearly represents the current cost of fuel consumption, but LIFO may most seriously misstate the inventory replacement value.

The weighted average cost method most accurately represents the actual original cost of fuel consumption during a period. The weighted average cost method is intermediate between LIFO and FIFO in representing the current consumption cost and the current inventory replacement value.

With the above inventory valuation methods, sales are credited at the market price each year. The difference between market price and inventory price is the inventory adjustment. The inventory adjustment which may be positive or negative is deducted annually from consumption to obtain the annual fuel expenses. The annual ending inventory is equal to the beginning inventory plus purchases and inventory adjustments minus consumption and sales.

In the standard cost inventory accounting method all fuel expenses are directly proportional to energy production. The standard cost is obtained by summing the fuel expenses and energy production and dividing the total fuel expenses by the total energy production. The annual fuel expense is the product of the annual energy production and the standard cost. The standard cost is the average fuel expense over the study period. The standard cost method is useful when:

- Complete information on expenditures and energy generation is available for the life of the study, and it is desired to compare many different reactor concepts existing during different time periods.
- Costs fluctuate mildly about a mean.

The standard cost method is not as useful when consistent price trends (either up or down) exist or when large price fluctuations occur.

FINANCIAL STATEMENTS

After the unit cost of energy is calculated, PACTOLUS calculates the gross revenues and annual tax payments and prepares annual income statements over the life of the study. The annual tax payments are added to the other cash outlays to form a complete schedule of cash outlays or a cash budget. Balance sheets are prepared annually to report changes in capitalization.

The contribution of each of the fixed and variable cost components to the total unit cost of energy is also calculated and reported (see Table 5 and similar tables in the PACTOLUS output in Appendix).

TABLE 5. Components of Unit Cost of Power

Depreciable plant		2.50 mills/kW-hr
Operating & maintenance cost	Fixed	0.10 mills/kW-hr
	Variable	0.40 mills/kW-hr
Fuel cycle costs	Fixed	0.20 mills/kW-hr
	Variable	<u>0.80</u> mills/kW-hr
Total		4.00 mills/kW-hr

DESCRIPTION OF CALCULATIONS

Table 6 gives an example of PACTOLUS input data for a light water reactor. We will use these data to describe the calculations and the combining of data for all of the cost components.

PLANT CAPITAL COSTS

The cost of the original plant investment in the example problem is \$150 million. This amount includes all construction, equipment, and interest during construction. In PACTOLUS, the \$150 million is simply entered as a cash outlay at the date incurred, time zero in this case.

OPERATING AND MAINTENANCE COSTS

The fixed operating cost, the nuclear liability insurance, the property insurance, and the variable operating costs form the total yearly operating and maintenance charge. The variable operating cost is the product of the variable operating charge and the load factor.

$$\begin{aligned}
 \text{Annual Operating and Maintenance} &= \text{Fixed O\&M} + \text{Insurance} + (\text{Variable O\&M}) \\
 &\quad \cdot (\text{Load factor}) \\
 &= \$1.003 \times 10^6 + \$0.322 \times 10^6 + (\$0.810 \times 10^6) \\
 &\quad \cdot (0.80) \\
 &= \$1.973 \times 10^6
 \end{aligned}$$

TABLE 6. Example Input DataFuel Cycle Data

Fabrication Cost = \$100/kg, losses 0.45%
 Reprocessing Cost = \$30/kg, losses 0.45%
 Alternate NFS Model
 1 Tonne/day throughput
 \$24,000/day operating charge
 Fuel Values: ^{238}U = \$8/lb
 Tails Composition = 0.2% Pu Fissile Value = \$10/g
 Separative Duty = \$26/kg
 Tails Value = 0
 Time in Reactor = 3 years
 Ship to Fabricator = 10 days, cost included in fabrication cost
 Fabrication Time = 60 days
 Uranium Enrichment Lead Time = 100 days
 Ship to Reactor = 10 days, \$3/kg

LWR Refueling Batch

30 Tonnes of Enriched U
 30,000 MWd/Tonne Exposure
 Charged at 1975.0

	Charged, kg		Discharged, kg
^{235}U	900	} 3% Enrichment	289.7
^{238}U	29,100		28,660.3
^{239}Pu	--		90
^{240}Pu	--		30
^{241}Pu	--		22.5
^{242}Pu	--		7.5
TOTAL	30,000		29,100.0 (@ 1 g/MWd fissioned)

Average Prereactor Inventory Time = 30 days
 Cooling Period = 120 days
 Ship to Reprocessor = 20 days, \$7/kg
 Reprocessing Time = 40 days (unit cost method only)
 Ship to Final Destination = 30 days, cost included in conversion cost
 $\text{UNH} \rightarrow \text{UF}_6$ Conversion = \$5.60/kg U
 $\text{U}_3\text{O}_8 \rightarrow \text{UF}_6$ Conversion = \$2.20/kg U

Capital Cost Data

Capital Cost = $\$150 \times 10^6$
 Startup Time = 1975.0

Operating Cost Data

Base Operating Cost = $\$1.003 \times 10^6$
 Nuclear Liability Insurance = $\$0.332 \times 10^6$
 Variable Operating Cost = $\$0.810 \times 10^6$

Interest, Taxes and Capitalization

Equity return rate = 10%/yr
 Bond interest rate = 4.23%/yr
 Fraction of investment in bonds = 52%
 Federal Income Tax Rate = 50%/yr
 State Income Tax Rate = 3%/yr
 State Gross Revenue Tax Rate = 4%/yr
 Property Tax Rate = 3.2%/yr

Energy Production

Operate at 80% load

FUEL CYCLEFABRICATION COSTS

The product of the unit fabrication costs (\$/kg) and the quantity of fuel fabricated yields the cash flow requirements for the fuel fabrication process. The fabrication calculation is illustrated in the following example:

$$\begin{aligned}\text{Unit Cost} &= \$100/\text{kg} \\ \text{Quantity Fabricated} &= 30,000 \text{ kg} \\ \text{Fabrication Cost} &= (\$100/\text{kg})(30,000 \text{ kg}) = \$3 \times 10^6.\end{aligned}$$

If this batch were part of the initial fuel loading, the fabrication cost would be included in the initial core investment.

REPROCESSING

The cost of reprocessing can be handled by either of two options. The first option is a unit cost approach and is identical in method to the fabrication cost. The quantity of fuel reprocessed is based on the quantity of fuel charged into the reactor.

$$\begin{aligned}\text{Unit Cost} &= \$30/\text{kg} \\ \text{Quantity} &= 30,000 \text{ kg} \\ \text{Reprocessing Cost} &= (30)(30,000) = \$0.9 \times 10^6.\end{aligned}$$

The second option is a cost model of a reprocessing plant patterned after the Nuclear Fuel Services (NFS)⁽⁷⁾ plant. This model describes a plant having a basic throughput for initial fuel enrichment up to 3%, and a throughput decreasing with higher initial enrichments. The costs are calculated as follows:

$$\text{Reprocessing Cost} = (\text{cost/day})(\text{reprocessing time} + \text{cleanup time})(\text{kg U reprocessed})$$

$$\text{Conversion Cost} = (\text{UF}_6 \text{ unit conversion cost})(\text{kg U converted})$$

Where: Cleanup time = 8 days or 1/3 of reprocessing time, whichever is greater.

The example calculation from Table 6 is shown:

Reprocessing throughput	= 1000 kg/day
Reprocessing cost	= \$24,000/day
Conversion cost	= \$5.60/kg
Quantity (HM) repro.	= 30,000 kg
Quantity (U) conversion	= 28,950 kg
Reprocessing and conversion cost	= $(24,000)(30,000/1000)(1 + 1/3)$ + $(\$5.60)(28,950)$ = $\$1.089 \times 10^6$

This is equivalent to a unit cost of \$32/kg for reprocessing or a combined cost of \$37.60/kg for reprocessing and conversion.

SHIPPING COSTS

Shipping costs are calculated from unit cost and quantity data in the same manner as fabrication costs. The example using the data from Table 6 is shown as follows:

(1) Ship to fabricator	= (30,000 kg)(0) = 0
(2) Ship to reactor	= (30,000 kg)(\$3/kg) = \$90,000
(3) Ship to reprocessor	= (30,000)(\$7/kg) = \$210,000
(4) Ship to final destination (U)	= (28,950)(0) = 0.

Note in Item (3) above that the quantity shipped was 30,000 kg since the fuel was still contained in the fuel elements and the mass converted to energy is assumed negligible. However, after reprocessing the fission products have been removed and only the fuel remaining (uranium in this example) is shipped.

²³⁵U ENRICHMENT COSTS

The varying price of U₃O₈ is used to calculate the price of enriched uranium in a model of the diffusion cascade. This model is also used to calculate the separative work and U₃O₈ credits contained in the discharged fuel.

A short description of the diffusion cascade calculations is given in the following sections. This model which is described in BNWL-189 was adapted for use in PACTOLUS as the TAILS and SKED subroutines.

CASCADE CALCULATIONS

$$\text{Cost } (\$) = C_s \Delta + C_f F - C_w W.$$

Where:

C_s = Unit cost of separative duty

Δ = Separative duty stream flow rate

C_f = Unit cost of feed

F = Feed material stream flow rate

C_w = Unit cost of tails

W = Flow rate of tails stream.

and

$$\Delta = W\phi(X_w) + P\phi(X_p) - F\phi(X_p).$$

X_w = Tails stream composition

X_p = Product stream composition

P = Flow rate of product stream

$$\phi(X_i) = (1 - 2X_i) \ln \frac{1 - X_i}{X_i}$$

X_i = Composition of i^{th} flow stream fraction. Units of Δ are kg's.

Note that $F = P + W$.

OPTIMUM TAILS COMPOSITION

Optimum tails is calculated by setting $\frac{\partial (\text{Cost})}{\partial X_w} = 0$.

$$\text{This yields: } \frac{C_f - C_w}{C_s} = \phi(X_F) - \phi(X_O) - (X_F - X_O)\phi'(X_O).$$

X_O = Optimum tails composition

X_F = Feed material composition

Above solved by iteration for X_0 . Note that the desired product enrichment does not affect X_0 .

FUEL PURCHASES AND CREDITS

Using a tails enrichment of 0.2%, \$8/lb U_3O_8 and \$26/kg separative duty cost, the following results:

U_3O_8 Purchase = 235.4 tons

U_3O_8 Credit = 65.1 tons

Separative Duty Purchase = 129,300 kg

Separative Duty Credit = 11,009 kg

The fuel purchases and credits are then calculated from the unit values and the quantities of each material.

U_3O_8 Purchase	(235.4)(2000)(\$8.00)	= 3.77×10^6
$U_3O_8 \rightarrow UF_6$ Conversion	(235.4)(0.848)(2000) • (1/2.2)(\$2.20)	= $.40 \times 10^6$
Separative Work	(129,300)(\$26)	= 3.36×10^6
Total Fuel Purchases		$\$7.53 \times 10^6$
U_3O_8 Credits	(65.1)(2000)(\$8.00)	= 1.04×10^6
Sep. Work Credits	(11,009)(\$26.00)	= $.29 \times 10^6$
Fissile Pu Credits	(90,000 + 22,500) • (\$10.00)	= 1.13×10^6
Total Fuel Credits		$\$2.46 \times 10^6$

FUEL LOSSES

In the example problem, losses in fabrication and reprocessing are 0.45% each. To allow for the fabrication losses, the fuel purchases are increased by 0.45%. The fuel losses are assumed to have the same unit values as the material charged to the process. The dollar value of the loss is charged to the fabrication process and not to fuel purchases. Reprocessing losses are treated the same as fabrication losses, except that the unit value of the materials differ. This is illustrated for the example problem as follows:

Fabrication Losses

^{233}U	0
Enr. U	$(0.0045) (\$7.53 \times 10^6) = \0.034×10^6
^{239}Pu	0
^{240}Pu	0
^{241}Pu	0
^{242}Pu	0
^{232}Th	0

Reprocessing Losses

^{233}U	0
Enr. U	$(0.0045) (\$1.33 \times 10^6) = \0.006×10^6
^{239}Pu	$(0.0045) (\$0.90 \times 10^6) = \0.004×10^6
^{240}Pu	0
^{241}Pu	$(0.0045) (\$0.225 \times 10^6) = \0.001×10^6
^{242}Pu	0
^{232}Th	0

SCHEDULE OF EVENTS

The time of each event or process can be calculated from the input time schedule data. In the example, if everything is referenced to the startup date, the following schedule of events results:

(a) U Purchase	$= 1975.0 - (30 + 10 + 60 + 10 + 100)/365.3 = 1974.43$
(b) Pu Purchase	$= 1975.0 - (30 + 10 + 60 + 10)/365.3 = 1974.70$
(c) Pre-Fab. Shipping	$= 1975.0 - (30 + 10 + 60)/365.3 = 1974.73$
(d) Fabrication	$= 1975.0 - (30 + 10)/365.3 = 1974.89$
(e) Post-Fab. Shipping	$= 1975.0 - (30)/365.3 = 1974.92$
(f) Post-Reactor Shipping	$= 1978.0 + (120 + 20)/365.3 = 1978.38$
(g) Reprocessing	$= 1978.0 + (120 + 20 + 40)/365.3 = 1978.49$
(h) Post-Rep. Shipping	$= 1978.0 + (120 + 20 + 40 + 30)/365.3 = 1978.57$
(also point of receipt of fuel credit)	

In the present version of PACTOLUS two options are available: all costs and revenues may be assumed to occur at midyear, or they may be assumed to occur at year end. In order to compensate for the loss of detail between the actual event and the assumed fixed time of the event, another option is available in PACTOLUS which applies an interest charge or credit for the time interval between the actual event and the assumed fixed time.

COST OF CAPITAL

The cost of capital in the example problem is:

$$\begin{aligned}
 & \text{(Bond interest rate)} \\
 & \bullet \text{ (Fraction of investment in bonds)} = (4.23)(0.52) = 2.20 \\
 & \text{(Equity return rate)} \\
 & \bullet \text{ (Fraction in equity)} = (10)(1 - 0.52) = \underline{4.80} \\
 & \text{Cost of Capital (\%)} = 7.00
 \end{aligned}$$

The combined federal and state income tax rate is:

$$\begin{aligned}
 & \text{(Federal tax rate)(1 - State tax rate)} \\
 & + \text{State tax rate} = (0.50)(1 - 0.03) \\
 & \quad \quad \quad + 0.03 \\
 & \quad \quad \quad = 0.515.
 \end{aligned}$$

The effective bond interest rate (after income taxes) is:

$$\begin{aligned}
 & \text{(Bond interest rate)} \\
 & \bullet \text{ (1 - Combined federal and state} \\
 & \quad \text{income tax rate)} = (4.23)(1 - 0.515) \\
 & \quad \quad \quad = 2.05.
 \end{aligned}$$

The cost of capital using the effective bond interest rate is:

$$\begin{aligned}
 & \text{(Effective bond interest rate)} \\
 & \bullet \text{ (Fraction investment in bonds)} = (2.05)(0.52) = 1.07 \\
 & \text{Cost of equity capital} = (10)(1 - 0.52) = \underline{4.80} \\
 & \text{Effective cost of capital (\%)} = 5.87
 \end{aligned}$$

COST OF ENERGY

The cost of energy is calculated in this example using the simplified input data illustrated in Table 7. For purposes of identification and cross-checking the digits are carried to the nearest dollar without regard to significance.

TABLE 7. *Input Data for Cost of Power Calculation*

<u>Expenses</u>	<u>Cost</u>	<u>Incurred</u>
Capital Investment	\$150,000,000	1975
Operating Expense (including fuel cycle)	\$5,000,000/year	1975 1976 1977
Salvage Value	0	
Fuel Cycle Credits	\$1,000,000/year	1975 1976 1977
Energy Production	1,000,000 kWhr/year	1975 1976 1977
Initial Core Investment	\$4,000,000	1975
<u>Interest, Taxes, and Capitalization</u>		
Same as Table 6		

ASSUMPTIONS

In this example, all expenses and revenues are assumed to be incurred at year end. Depreciable life is 3 years. Straight line depreciation is used. The spent fuel has no salvage value other than the fuel cycle credit.

CALCULATION OF REVENUES

1975 (power production)(unit cost of power) + fuel cycle credits = total revenues 1975

1975 (1,000,000)(unit cost of power) + \$1,000,000 = total revenue 1975

1976 (1,000,000)(unit cost of power) + \$1,000,000 = total revenue 1976

1977 (1,000,000)(unit cost of power) + \$1,000,000 = total revenue 1977

(Total revenue for 1975-1977)(1 - revenue tax rate)(1 - combined state and federal income tax rate) = net revenue for 1975-1977 excluding taxes.

EXPENSE SCHEDULE

Initial investment = capital investment + initial core
= \$150,000,000 + \$4,000,000 = \$154,000,000

1975 = operating expense = \$5,000,000

1976 = operating expense = \$5,000,000

1977 = operating expense = \$5,000,000

DEPRECIATION

Straight line depreciation for 3 years of \$150,000,000 is equal to an annual depreciation of \$50,000,000.

INITIAL CORE DEPLETION

To simplify the fuel consumption in this example, we will treat the initial core in the same manner as depreciation. We assume that the initial core is valued at \$4,000,000 and lasts 3 years with no salvage value, and an annual depletion (or fuel consumption) allowance of \$1,333,333 is incurred.

TAX CREDITS

The deductible expenses are the sum of the depreciation, operating expenses, and initial core depletion. In the example problem, this is \$50,000,000 + \$5,000,000 + \$1,333,333 or \$56,333,333 for each year.

Using the combined tax rates for federal and state income taxes which was previously calculated to be 0.515, the annual tax credit is then:

$$(0.515)(56,333,333) = \$29,011,667.$$

PRESENT WORTH FACTOR

By setting the present worth of the revenues equal to the present worth of the expenses, the unit cost of energy can be calculated. The present worth discount factor is based on the cost of capital using the effective bond interest rate after taxes. This was previously calculated to be 5.87%; values for this present worth factor for 3 years are shown in Table 8.

The present worth factor is calculated from the formula

$\frac{1}{(1 + i)^n}$, where i = interest rate and n is the number of years from the present.

TABLE 8. *Values for 5.87% Present Worth Factor*

<u>Year</u>	<u>Value</u>
0	1.000
1	0.945
2	0.892
3	0.843

UNIT COST OF ENERGY

The unit cost of energy is calculated in Table 9 using the present worth method.

TABLE 9. Unit Cost of Energy Calculation

<u>Present Worth of Revenues</u>		<u>Present Worth of Expenses</u>	
Unit cost of energy =		present worth of the expenses - present worth of tax credits	
		(present worth of power production)(1 - revenue tax rate)(1 - combined income tax rate)	
		- $\frac{\text{present worth of fuel credits}}{\text{present worth of power production}}$	
Present worth of expenses		= (154,000,000)(1.000) + (0.945)(5,000,000) + (0.892)(5,000,000) + (0.843)(5,000,000)	
		= 159,000,000 + 4,725,000 + 4,460,000 + 4,215,000	
		= \$167,400,000	
Present worth of tax credits		= (0.945)(29,011,667) + (0.892)(29,011,667) + (0.843)(29,011,667)	
		= \$77,751,268	
Present worth of fuel credits		= (0.945 + 0.892 + 0.843)(1,000,000)	
		= \$2,680,000	
Present worth of energy production =		(0.945 + 0.892 + 0.843)(1,000,000)	
		= 2,680,000 kWhr	
1 - Revenue tax rates		= 1 - 0.03 = 0.97	
1 - Combined income tax rate		= 1 - 0.515 = 0.485	
Unit cost of energy		= $\frac{\$167,400,000 - \$77,751,268}{(2,680,000)(0.97)(0.485)} - \frac{\$2,680,000}{2,680,000} = \$70.104/\text{kWhr}$	

This figure is unrealistic, of course, and is only intended to illustrate the calculational method.

DATA SUPPLIED FOR USE IN LINEAR PROGRAMMING CALCULATIONS

PACTOLUS was developed to transmit data to a linear programming computer model of the United States electric power economy. The data include the yearly summaries of quantities of fuel bought and sold (material balances), amounts of services required (fabrication, reprocessing, shipping, and separative duty), tax payment, and sample cost data based on the input costs for the particular run. While the model may use variable cost data as a function of demand, the basic material balances and the requirements for services are not changed. The PACTOLUS calculations are useful bases for comparisons, verification, and interpretation of results from the linear programming model.

FLOW OF INFORMATION

The flow diagram in Figure 2 shows the sequence of calculations in PACTOLUS by subroutine name and function. The main program PACTOLUS (outlined by dashed lines) serves as a main logical link for the flow of information to and from a series of subroutines. The subroutines and their functions are as follows:

- CINPUT - reads card input containing basic cost data and holdup times and stores time dependent input data in proper arrays.
- INTAP - used if burnup data is in a special form or magnetic tape--stores the contents of tape on a drum.
- READ - reads input data from drum and processes into arrays for use by other subroutines.
- FAB - calculates fabrication costs and allocates cost to proper point prior to reactor startup.
- SEP - calculates reprocessing costs and allocates cost to proper point.
- SHIP - calculates shipping costs and allocates cost to proper point.

FIGURE 2. PACTOLUS Flow Diagram

- PRICE - calculates fuel purchases and credits and allocates these costs to proper point in sequence of charges--uses TAILS and SKED routines to calculate price of ^{235}U from cascade model.
- LOSS - calculates cost of fabrication and reprocessing losses.
- PRODUCT - calculates quantities of each isotope bought and sold--one table for purpose of printout and another for use by the DAEDALUS code.
- CFTABL - handles printout of cash flow and input cost data upon completion of reactor life data--also writes most of data to tape for use by DAEDALUS code.
- PHYSIC - calculates and prints certain reactor performance data.
- TABLE - prints table of quantities of fuel fabricated and reprocessed.
- POWERCO - calls subroutines listed below.
- DEPREC - calculates depreciation.
- EXPENS - calculates prorated fuel expenses.
- BONDPY - calculates bond repayment schedules.
- COST EQ - calculates unit cost of energy.
- PAYOUT - calculates annual income statement and balance sheet information.
- OUTPUT - writes annual income statement and balance sheet information.
- FIX CHG - calculates fixed charge rates and component parts of unit energy costs.

PROGRAM LISTING AND PRINTOUT

A complete program listing for PACTOLUS is contained in Appendix A. A recent printout for a light water reactor is contained in Appendix B. This case is more complex than the

example used in the text and illustrates the results of a full calculation. An elaboration of some of the items in the printout follows:

- Page B4 summarizes most of the economic input data for the reactor. Page B4 shows the yearly fuel cycle costs.

$$\text{Capacity factor} = \frac{\text{net generation for year}}{(\text{total hours in year})(\text{rated capacity})} \times 100$$

$$\text{Variable operating charge} = \frac{(\text{variable operating cost at full capacity}) \times (\text{capacity factor}/100)}{100}$$

The "Total Cost" column does not include the variable operating charge.

- Page B5 shows the price schedules for fabrication, reprocessing, and fuel materials. The "Fab Penalty" column is added to the fabrication charge for ^{233}U and Pu fuels.
- Page B6 summarizes the results of the cascade calculations. The last three columns refer to the ^{235}U values in the discharged fuel. The "Tail Consumed" column lists the quantity of tails which, when added to the discharged fuel, adjusts the ^{235}U content to the natural concentration.
- Page B7 lists the important economic factors comprising the production function for the reactor.
- Pages B8-B11 list the isotopic composition and quantities of fuel fabricated and reprocessed by year for the reactor.
- Page B12 restates some of the input data used in the cost of power calculation.
- Pages B13-B16 list the cash flow, income statement, and balance sheet items pertaining to this reactor.
- Column 5, "Fabrication Cost," page B13, includes fabrication, prereactor shipping, and fuel losses incurred in the fabrication process.

- Column 6, "Reprocessing Cost," page B13, includes reprocessing, postreactor shipping, and losses in reprocessing.
- Column 3, headed "5.867 Percent Present Worth Factor," page B14 is the present worth factor for midyear discounting for the input capital structure and tax rates.
- Column 4, "Fuel Operating Expenses," page B14 is the summation of columns 4-7 of page B13.
- Column 5, "Annual Fuel Expenses," page B14, is the summation of all fuel expenses prorated annually according to power generation.

Column 6, "Non-fuel Operating Expense," page B14 is the summation of the annual:

- base operating cost,
- variable operating costs,
- property insurance,
- nuclear liability insurance, and
- property taxes.

Column 5, "Total Tax Deductible Expenses," page B15 is the summation of columns 5-9, page B14.

- Column 6, "Taxable Income (Federal)," page B15, is equal to column 4, total power sales, minus column 5, total tax deductible expenses.
- Column 8, "Total Cash Expenditures," page B15, is the summation of fuel operating expenses, nonfuel operating expenses, total state and local taxes, federal income tax, and interim capital expenditures.
- Column 9, "Total Cash Receipts," page B15 is the summation of power sales and capital recovery, if any. Capital recovery includes working capital and salvage values.
- Column 3, "Total Cash Flow," page B16 is the difference between cash receipts and cash expenditures.
- Pages B18-B19 show the allocation of power costs as calculated from a fixed charge rate basis. Column 2, "Annual Expenses," includes (a) interim capital replacements,

property insurance, property taxes, and revenue taxes for the depreciable plant category, and (b) revenue taxes and variable expenses as applicable, for the operating and maintenance and fuel cycle cost categories. Column 1, "Cash per kW-hr," is the summation of all cash expenses, excluding income and revenue taxes and return on investment divided by the total energy generation. Column 7, "Total," is the summation of the present worth of all expenses for each category divided by the summation of the present worth of the annual energy generations.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the assistance of R. L. Reynolds, J. G. Rake, and J. L. Westra in the preparation of this program.

REFERENCES

1. J. H. Nail. PACTOLUS: A Code for Computing Nuclear Power Costs, Part 1: User's Manual, BNWL-429. Battelle-Northwest, Richland, Washington, June 1967.
2. D. E. Deonigi et al. UCOST - A Computer Code for Calculating the Cost of Enriched Uranium, BNWL-189. Battelle-Northwest, Richland, Washington, February 1966.
3. E. A. Eschbach, D. E. Deonigi, and S. Goldsmith. "QUICK - A Simplified Fuel Cost Code", HW-71812. Available from Division of Technical Information Extension, January 1962.
4. Royes Salmon. "A Procedure and a Computer Code (POWERCO) for Calculating the Cost of Electricity Produced by Nuclear Power Stations," ORNL-3944. Oak Ridge National Laboratory, Oak Ridge, Tennessee, June 1966.
5. J. H. Nail. "CLOTHO: A Code for Communicating Reactor Mass Balance Data to Reactor Economics Codes," BNWL-770, Battelle-Northwest, Richland, Washington, June 1968.
6. E. T. Merrill. "ALTHAEA Part 1 - A One-Dimensional Two-Group Diffusion Code with an Effective Four-Group Burnup," BNWL-362, to be published.
7. T. C. Runion. "NFS Chemical Processing Plant--Capability and Cost Bases," 1962 Nuclear Congress, Paper No. 42, June 1962.

BNWL-1169

APPENDIX A
PACTOLUS PROGRAM LISTING

Q ELT BONDPY,1,691212, 19600

000001		SUBROUTINE BONDPY	BND 020
000002	C		BND 022
000003		INCLUDE COM2	
000004	C		BND 040
000005		TAA(1)=BND*(PLT+D(11)+WC)	
000006		TAB(1)=PLT+D(11)+WC-TAA(1)	
000007	32	GO TO (31,41,51,61,81),LL1	
000008	41	AUR=TAA(1)/FLOAT(NY)	2/28/67R
000009		DO 42 N=1,NY	
000010		TAL(N)=AUR	
000011		TAA(N+1)=TAA(N)-TAL(N)	
000012	42	TAJ(N)=TAA(N)*RRB	
000013		RETURN	
000014	51	BBR=(1.+RRB)**NY	2/01/67R
000015		PBR=(BBR-1.)/(RRB*BBR)	
000016		ANP=TAA(1)/PBR	
000017		DO 52 N=1,NY	
000018		TAJ(N)=TAA(N)*RRB	
000019		TAL(N)=ANP-TAJ(N)	
000020	52	TAA(N+1)=TAA(N)-TAL(N)	
000021		RETURN	
000022	61	DO 62 N=1,NY	
000023		TAL(N)=BRP(N)	
000024		TAJ(N)=TAA(N)*RRB	
000025	62	TAA(N+1)=TAA(N)-TAL(N)	
000026		RETURN	
000027	81	DO 600 N = 1,NY	BND 560
000028		TAJ(N) = 0.0	BND 570
000029	600	TAL(N) = 0.0	BND 600
000030		DTL = NY+1-LL6	BND 620
000031		TALT = TAA(1)/DTL	BND 640
000032		DO 700 N = LL6,NY	BND 680
000033	700	TAL(N) = TALT	BND 700
000034		DO 800 N = 1,NY	BND 720
000035		TAJ(N) = TAA(N)*RRB	BND 740
000036	800	TAA(N+1) = TAA(N)-TAL(N)	BND 800
000037	C		BND 810
000038	31	RETURN	
000039		END	-

A-1

BNWL-1169

@ ELT CALCLF,1,691212, 19603

```
000001      FUNCTION CALCLF(X)
000002      COMMON / CDLF / X1(6),Y1(6),X2(6),Y2(6)
000003      DO 100 I =1,5
000004      IF (X2(I+1) .GT. 0.00001) GO TO 80
000005      70 CALCLF = Y2(I)
000006      RETURN
000007      80 IF (X2(I+1) - X) 100,200,200
000008      100 CONTINUE
000009      CALCLF = Y2(6)
000010      RETURN
000011      200 SLOPE = (Y2(I+1) -Y2(I))/(X2(I+1) - X2(I))
000012      CALCLF = Y2(I) + SLOPE*(X-X2(I))
000013      RETURN
000014      1011 FORMAT (8H0TIME OF ,F7.3,32H EXCEEDS THE LOAD FACTOR TIME OF ,
000015      1 F7.3 )
000016      END
```

12/12/69
12/12/69

@ ELT CFTABL,1,691212, 19613

000001	C	ROUTINE TO WRITE CASH FLOW TABLE	CFTB 010
000002		SUBROUTINE CFTABL	CFTB 020
000003	C		CFTB 021
000004	C		037
000005	C	COMMON FOR PACTOLUS AND POWERCO PROGRAMS	040
000006		INCLUDE COM1	050
000007		INCLUDE COM2	055
000008		INCLUDE COM5	
000009		DIMENSION IDAED(2200)	12/12/69
000010		EQUIVALENCE (DAED,IDAED)	12/12/69
000011	C		100
000012		DIMENSIONXVARFT(40)	
000013		DATA BLANKY/1H /	3/16/67R
000014	C		CFTB 190
000015		ISTOP = 0	
000016		DINT = (DFAB + DSHP + DPUR + DLOS)*FCINT	12/12/69
000017	C		CFTB 240
000018	C	WRITE HEADING LINES FOR CASH FLOW TABLE	CFTB 250
000019		1 CALL PHDG	CFTB 260
000020	C		CFTB 280
000021	C	WRITE FIRST PAGE OF CASH FLOW REPORT	CFTB 290
000022		WRITE (LTR,630)	08/09/67
000023		WRITE (LTR,640) TSTART	08/09/67
000024		WRITE (LTR,641) UBUYTM	
000025		WRITE (LTR,650) RTP	08/09/67
000026		WRITE (LTR,800) SHPFAB	08/09/67
000027		WRITE (LTR,660) EFF	08/09/67
000028		WRITE (LTR,802) TFAB	08/09/67
000029		WRITE (LTR,670) RTONS	08/09/67
000030		WRITE (LTR,804) SHPREA	08/09/67
000031		WRITE (LTR,680) TLIFE	08/09/67
000032		WRITE (LTR,806) PRI	08/09/67
000033		WRITE (LTR,700)	08/09/67
000034		WRITE (LTR,808) COOL	08/09/67
000035		WRITE (LTR,700)	08/09/67
000036		WRITE (LTR,810) SHPSEP	08/09/67
000037		WRITE (LTR,710)	08/09/67
000038		WRITE (LTR,814)	08/09/67
000039		WRITE (LTR,712) D(5)	08/09/67
000040		WRITE (LTR,816) SHPDES	08/09/67
000041		WRITE (LTR,714) D(6)	08/09/67
000042		WRITE (LTR,715) CINS	08/09/67
000043		WRITE (LTR,716) D(21)	08/09/67
000044		WRITE (LTR,825)	08/09/67

A-3

BNWL-1169

000045	WRITE (LTR,761)	D(19)	08/09/67
000046	WRITE (LTR,828)	CSHP1	08/09/67
000047	WRITE (LTR,717)	CYR	08/09/67
000048	WRITE (LTR,830)	CSHP2	08/09/67
000049	WRITE (LTR,718)	D(7)	08/09/67
000050	WRITE (LTR,829)	DLSP1	
000051	WRITE (LTR,762)	D(15)	
000052	WRITE (LTR,831)	DLSP2	
000053	WRITE (LTR,719)	D(17)	
000054	WRITE (LTR,832)	CSHP3	
000055	WRITE (LTR,763)	D(16)	
000056	WRITE (LTR,836)	CSHP4	
000057	WRITE (LTR,764)	D(22)	12/12/69
000058	WRITE (LTR,765)	D(18)	
000059	WRITE (LTR,860)		
000060	WRITE (LTR,700)		
000061	WRITE (LTR,862)	THRUPT	
000062	WRITE (LTR,700)		
000063	WRITE (LTR,864)	SEPCST	
000064	WRITE (LTR,720)		
000065	WRITE (LTR,722)	TCONST	
000066	WRITE (LTR,890)		
000067	WRITE (LTR,724)	CSTMOD	
000068	WRITE (LTR,892)	DFAB	
000069	WRITE (LTR,725)	SALT	
000070	WRITE (LTR,894)	DSHP	
000071	WRITE (LTR,728)	CSTCON	
000072	WRITE (LTR,896)	DPUR	
000073	WRITE (LTR,732)	CSTTG	
000074	WRITE (LTR,897)	DL0S	
000075	WRITE (LTR,730)	CSTPR	08/09/67
000076	WRITE (LTR,898)	DINT	12/12/69
000077	WRITE (LTR,734)	CSTHT	08/09/67
000078	WRITE (LTR,750)		08/09/67
000079	WRITE (LTR,736)	CSTRS	08/09/67
000080	WRITE (LTR,752)		08/09/67
000081	WRITE (LTR,738)	CSTOTH	08/09/67
000082	WRITE (LTR,753)	UCONV	
000083	WRITE (LTR,735)	D(24)	08/09/67
000084	WRITE (LTR,754)	XF	08/09/67
000085	WRITE (LTR,737)	D(23)	08/09/67
000086	WRITE (LTR,756)	CS	08/09/67
000087	WRITE (LTR,700)		08/09/67
000088	WRITE (LTR,758)	CW	08/09/67
000089	WRITE (LTR,700)		
000090	C WRITE OUT ISOTOPE PRICES		CFT8 327
000091	DO 25 I=1,20		3/16/67R
000092	IF (ANAM(I).NE.0) GO TO 25		
000093	23 ANAM(I)=BLANKY		3/16/67R

000094	25	CONTINUE		3/16/67R
000095		WRITE (LTR,900) (ANAM(I),PISO(I),I=1,20)		CFTB 340
000096	C	CALCULATE NUMBER OF YEARS TO PRINT OUT		CFTB 347
000097		NY = IFIX(D(2)) + 1		CFTB 350
000098		NYRS = IFIX(TIM(N3)/365,30001) + 1		12/12/69
000099		IDU = 0		
000100		NYR = ((TIM(N3) + SHPSEP+COOL+TSEP+SHPDES)/365.3)/1.000001		
000101		IBEGIN = TCONST/1.000001 + 1.0		
000102		NYR = NYR + 1		
000103		ICNSTR = TCONST/1.000001		
000104		ICNSTR = ICNSTR + 1		
000105		DO 202 I = 1,IBEGIN		
000106		CCI = I - 1		
000107		TCYR(I) = TSTART + CCI - TCONST		
000108	202	CONTINUE		
000109	100	DO 221 I=1,NY		
000110		TIMX = TSTART + FLOAT(I-1)		
000111		XLDF(I) = TMLIB(5)		
000112		XXLDF(I) = (CALCLF(FLOAT(I)) + CALCLF(FLOAT(I-1)))/2.0	12/12/69	
000113		IF (ABS(CALCLF(FLOAT(I) - 0.5) - XXLDF(I)) .LE. .00001) GO TO 160	12/12/69	
000114		NPPYR = 10	12/12/69	
000115		TLDF = 0.	12/12/69	
000116		DO 150 J=1,NPPYR	12/12/69	
000117		TLDF = TLDF + CALCLF(FLOAT(I-1)+(FLOAT(J)-.5)/FLOAT(NPPYR))	12/12/69	
000118	150	CONTINUE	12/12/69	
000119		XXLDF(I) = TLDF/NPPYR	12/12/69	
000120	160	CONTINUE	12/12/69	
000121		XYRS = NYRS		
000122		IF(I,LT,NYRS) XFT(I) = 1.0		
000123		IF(I,EQ,NYRS) XFT(I) = 1. + TIM(N3)/365.3 -XYRS		
000124		IF(I,GT,NYRS) XFT(I) = 0.		
000125		XXLDF(I) = XXLDF(I)*XFT(I)		
000126	221	CONTINUE		
000127		DO 99 I=1,NYR		
000128		IP = I + ICNSTR		
000129		YI = I		
000130		IP = I + IBEGIN		
000131		TCYR(IP) = TSTART + YI - 1.0		
000132		XVARFT(I) = CVARYR*XXLDF(I)		
000133		PRESHP(I) = SHP1(I) + SHP2(I)		
000134		POSTSH(I) = SHP3(I) + SHP4(I)		
000135		TOTAL(I) = FPURC(I) - FCRED(I) + FABCH(I) + REPCH(I) + PRESHP(I) +		
000136		1POSTSH(I) + FLOSS(I)		
000137	99	CONTINUE		
000138		NYR = ((TIM(N3)+SHPSEP+COOL+TSEP+SHPDES)/365.3+TCONST)/1.000001		
000139		NYR = NYR + 1	12/12/69	
000140		IF (ITAP .LE. 0) GO TO 420	12/12/69	
000141	C		12/12/69	
000142	C	STORE DAEDALUS INFORMATION FOR FIRST BINARY RECORD	12/12/69	

000143			12/12/69
000144	C	DAED (2) = RTP	
000145		DAED (3) = EFF	
000146		DAED (4) = TLIFE	
000147		DAED (5) = CSTMOD + SALT	
000148		DAED (6) = CSTCON + CSTTG + CSTPR + CSTHT +CSTRS + CSTOTH	
000149		DAED (7) = DFAB	
000150		DAED (8) = DSHP	
000151		DAED (9) = DPUR	
000152		DAED (10) = DLOS	
000153		DO 448 IN = 1,20	
000154		IX = IN + 10	
000155	448	DAED(IX) = PISO(IN)	
000156		DO 449 I = 1,13	
000157		IX = 30 + I	
000158	449	DAED(IX) = AHDG(I)	
000159		DAED (44) = ADATE(1)	
000160		DAED (45) = ADATE(2)	
000161		IDAED(46) = NYR	12/12/69
000162		IDAED(47) = IBEGIN	12/12/69
000163		DAED (48) = TSTART	
000164		DAED(49) = CYR + D(19)*D(1) + CINS + D(21)*RTP*EFF + D(22)	12/12/69
000165		DAED(50) = CINS	
000166		DO 453 I=51,59	12/12/69
000167		IXL = I - 39	12/12/69
000168	453	IDAED(I) = ANAM(IXL)	12/12/69
000169		DAED(60) = ACVERS	12/12/69
000170		DAED(61) = PVERS	12/12/69
000171		DO 455 I=62,99	
000172	455	DAED(I) = 0	
000173		I49 = 99	
000174		DO 7001 I = 1,NYR	
000175		I50 = I49 + 60*(I - 1)	
000176		DAED(I50+1) = TCYR(I)	12/12/69
000177		IF(I,LE, IBEGIN) GO TO 450	
000178		IP = I - IBEGIN	
000179		J = I-1	
000180		DAED(I50 + 2) = XXLDF(IP)	
000181		DAED(I50 + 3) = TOTAL(IP)	
000182		DAED(I50 + 4) = FPURC(IP)	
000183		DAED(I50 + 5) = FCRED(IP)	
000184		DAED(I50 + 6) = FABCH(IP)	
000185		DAED(I50 + 7) = REPCB(IP)	
000186		DAED(I50 + 8) = FABLSS(IP)	
000187		DAED(I50 + 9) = REPLSS(IP)	
000188		DAED(I50 + 10) = PRESHP(IP)	
000189		DAED(I50 + 11) = POSTSH(IP)	
000190		YR = IP	12/12/69
000191		DAED(I50+12) = XVARFT(IP) +	12/12/69

000192	1	D(17)*(D(1)*(1.-(YR-1.)/D(9)*(1.-D(18)/D(1)*YR*0.5))	12/12/69
000193	2	+ ((TLIFE+1.-IP)/TLIFE)*(DFAB+DSHP+DPUR+DLOS)	12/12/69
000194		GO TO 451	
000195	450	DAED(I50 + 2) = 0	
000196		DAED(I50 + 3) = 0	
000197		DAED(I50 + 4) = 0	
000198		DAED(I50 + 5) = 0	
000199		DAED(I50 + 6) = 0	
000200		DAED(I50 + 7) = 0	
000201		DAED(I50 + 8) = 0	
000202		DAED(I50 + 9) = 0	
000203		DAED(I50 + 10) = 0	
000204		DAED(I50 + 11) = 0	
000205		DAED(I50 + 12) = 0	
000206	451	DAED(I50 + 13) = RRKG(I)	
000207		DAED(I50 + 14) = RRKG(I)	
000208		DAED(I50+15) = XKGU(I)*2000./2,20462	12/12/69
000209		DAED(I50 + 16) = XKGS(I)	
000210		DAED(I50 + 17) = XKGTL(I)	
000211		DAED(I50+18) = XKGUCR(I)*2000./2,20462	12/12/69
000212		DAED(I50 + 19) = XKGSCR(I)	
000213		DAED(I50 + 20) = XKGTLC(I)	
000214		DAED(I50 + 21) = PRDCTA(I,1)	
000215		DAED(I50 + 22) = 0	
000216		DAED(I50 + 23) = PRDCTA(I,3) + PRDCTA(I,2)	
000217		DAED(I50 + 24) = PRDCTA(I,4)	
000218		DAED(I50 + 25) = PRDCTA(I,5)	
000219		DAED(I50 + 26) = PRDCTA(I,6)	
000220		DAED(I50 + 27) = PRDCTA(I,7)	
000221		DAED(I50 + 28) = PRDCTA(I,8)	
000222		DAED(I50 + 29) = PRDCTA(I,9)	
000223		DAED(I50 + 30) = PRDCTA(I,10)	
000224		DAED(I50 + 31) = PRDCTA(I,11)	
000225		DAED(I50 + 32) = PRDCTA(I,13)	
000226		DAED(I50 + 34) = PRDCTA(I,14)	
000227		DAED(I50 + 35) = PRDCTA(I,15)	
000228		DAED(I50 + 36) = PRDCTA(I,16)	
000229		DAED(I50 + 37) = PRDCTA(I,17)	
000230		DAED(I50 + 38) = PRDCTA(I,18)	
000231		DAED(I50 + 39) = PRDCTA(I,19)	
000232		DAED(I50 + 40) = PRDCTA(I,20)	
000233		DAED(I50 + 41) = PRDN3A(I,1)	
000234		DAED(I50 + 42) = 0	
000235		DAED(I50 + 43) = PRDN3A(I,3) + PRDN3A(I,2)	
000236		DAED(I50 + 44) = PRDN3A(I,4)	
000237		DAED(I50 + 45) = PRDN3A(I,5)	
000238		DAED(I50 + 46) = PRDN3A(I,6)	
000239		DAED(I50 + 47) = PRDN3A(I,7)	
000240		DAED(I50 + 48) = PRDN3A(I,8)	

```

000241      DAED(I50 + 49) = PRDN3A(I,9)
000242      DAED(I50 + 50) = PRDN3A(I,10)
000243      DAED(I50 + 51) = PRDN3A(I,11)
000244      DAED(I50 + 52) = PRDN3A(I,12)
000245      DAED(I50 + 53) = PRDN3A(I,13)
000246      DAED(I50 + 54) = PRDN3A(I,14)
000247      DAED(I50 + 55) = PRDN3A(I,15)
000248      DAED(I50 + 56) = PRDN3A(I,16)
000249      DAED(I50 + 57) = PRDN3A(I,17)
000250      DAED(I50 + 58) = PRDN3A(I,18)
000251      DAED(I50 + 59) = PRDN3A(I,19)
000252      7001 DAED(I50 + 60) = PRDN3A(I,20)
000253      IPC = I50 + 60
000254      IDAED(1) = IPC
000255      420 CONTINUE
000256      C
000257      C      WRITE OUT TABLE 1, PAGE 2 OF REPORT
000258      CALL PHDG
000259      NTBL = 1
000260      WRITE (LTR,960)   NTBL
000261      WRITE (LTR,920)
000262      AV23 = 0
000263      AVPU = 0
000264      AVFAB = DFAB + DSHP
000265      AVREP = 0
000266      AVOAM = 0
000267      DO 430 I = 1,NY
000268      TIMX = TSTART + FLOAT(I-1)
000269      IYR = IFIX(TIMX)
000270      WRITE(LTR,930)IYR,XXLDF(I),FPURC(I),FCRED(I),FABCH(I),REPCCH(I),
000271      1 PRESHP(I),POSTSH(I),FLOSS(I),XVARFT(I),TOTAL(I)
000272      AVFAB = AVFAB + (FABCH(I) + PRESHP(I))
000273      AVREP = AVREP + (REPCCH(I) + POSTSH(I))
000274      AVOAM = AVOAM + (XVARFT(I) + CYR)
000275      430 CONTINUE
000276      IYR = NYR + IBEGIN
000277      DO 429 IN = 1,IYR
000278      AVPU = AVPU+(PRDN3(IN,8)+PRDN3(IN,10))-(PRDCT(IN,8)+PRDCT(IN,10))
000279      AV23 = AV23+(PRDN3(IN,2)+PRDN3(IN, 3))-(PRDCT(IN,2)+PRDCT(IN, 3))
000280      429 CONTINUE
000281      C
000282      IF(IPR.EQ.0) GO TO 432
000283      101 CALL PHDG
000284      NTBL = 1
000285      WRITE (LTR,960)   NTBL
000286      WRITE (LTR,919)
000287      WRITE (LTR,920)
000288      DO 431 I = 1,NY
000289      YFLOSS = YABLSS (I) + YEPLSS(I)

```

12/12/69

12/12/69

CFTB 380

CFTB 395

CFTB 396

CFTB 400

CFTB 402

CFTB 415

CFTB 417

CFTB 430

12/12/69

12/12/69

CFTB 470

```

000290      YRESHP(I) = YSHP1(I) + YSHP2(I)
000291      YOSTSH(I) = YSHP3(I) + YSHP4(I)
000292      YTOTAL = YPURCH(I)-YFCRED(I)+YFABCH(I)+YREPC(I)+YRESHP(I)+
000293      1 YOSTSH(I)+ YFLOSS
000294      TIMX = TSTART + FLOAT(I-1)
000295      IYR = IFIX(TIMX)
000296      XVARFT(I) = CVARYR*XLDF(I)
000297      WRITE (LTR,930) IYR,XXLDF(I),YPURCH(I),YFCRED(I),YFABCH(I),YREPC(I)
000298      1(I),YRESHP(I),YOSTSH(I),YFLOSS,XVARFT(I),YTOTAL
000299  431 CONTINUE
000300  432 CONTINUE
000301  C      WRITE OUT TABLE 2, PAGE 3 OF REPORT
000302      CALL PHDG
000303      NTBL = 2
000304      WRITE (LTR,960) NTBL
000305      WRITE (LTR,940)
000306      NY = NY. + IFIX(TCONST)
000307      DO 580 K = 1,NY
000308      TIMX = AINT(TSTART + FLOAT(K-1) - TCONST)
000309      CALL TIMLIB
000310      BLKFAB(K) = VLIB(4)
000311      CORFAB(K) = VLIB(3)
000312      PRATO(K) = VLIB(9)
000313      PU233(K) = VLIB(7)
000314      CFX(K) = VLIB(6)
000315      DELFAB(K) = VLIB(2)
000316      IYR = IFIX(TIMX)
000317      U23PRC = PU233(K)*PISO(1)
000318      PUPRIC = PRATO(K)* PISO(3)
000319      IF (IPU.GT.0) PUPRIC = PRATO(K)*U90PR(K)
000320      IF (TIMX.LT.TSTART) GO TO 540
000321      I = K - IFIX(TCONST)
000322      WRITE (LTR,950) IYR,BLREP(I),COREP(I),BLTIM(I),COTIM(I),
000323      1 BLKFAB(K),CORFAB(K),DELFAB(K),PUPRIC,U23PRC,CFX(K)
000324      GO TO 580
000325  540 WRITE (LTR,955) IYR,BLKFAB(K),CORFAB(K),DELFAB(K),PUPRIC,U23PRC,CFX
000326      1(K)
000327  580 CONTINUE
000328  C      URANIUM PURCHASES AND CREDITS
000329      IF (IMFOS.NE. 0) GO TO 990
000330      CALL PHDG
000331      NTBL = 3
000332      WRITE (LTR,960) NTBL
000333      WRITE (LTR,956)
000334      DO 585 K = 1,NY
000335      TIMX = TSTART + FLOAT (K-1)-TCONST
000336      IYR = IFIX(TIMX)
000337  585 WRITE (LTR,957) IYR,CFX(K),
000338      1XXT(K),U90PR(K),XKGU(K),XKGS(K),XKGT(L),XKGUCR(K),XKGSCR(K),XKGT(L)

```

CFTB 480
CFTB 490
CFTB 496
CFTB 497
CFTB 500
CFTB 502
CFTB 503
12/12/69
CFTB 507
CFTB 509
CFTB 510
CFTB 511

CFTB 512

CFTB 514

CFTB 515
CFTB 519
CFTB 520

CFTB 530

CFTB 580
12/12/69

```

000339      1C(K)
000340      C
000341      C
000342      630 FORMAT (12X,19HREACTOR DESCRIPTION,46X,19HFIXED PROCESS TIMES )
000343      640 FORMAT ( 21H REACTOR STARTUP DATE, 15X, F9.1 )
000344      641 FORMAT(1H+,65X,32HURANIUM ENRICHMENT AND LEAD TIME ,3X,F10.1,3X,
000345      14HDAYS)
000346      650 FORMAT ( 14H REACTOR POWER, 22X          F9.1, 3X, 6HMW(TH) )
000347      660 FORMAT ( 21H ELECTRICAL CONV. EFF, 15X,2PF9.1,3X, 3HPCT)
000348      670 FORMAT ( 24H TONS OF FUEL IN REACTOR,12X,F9.1, 3X, 5HTONNE )
000349      680 FORMAT ( 17H REACTOR LIFETIME, 19X,          F9.1, 3X, 3HYRS )
000350      690 FORMAT ( 18H PLANT LOAD FACTOR, 18X,          F9.1, 3X, 3HPCT)
000351      700 FORMAT ( 1H )
000352      701 FORMAT (1H0)
000353      710 FORMAT ( 14X, 13HPLANT CHARGES )
000354      712 FORMAT ( 20H BOND INTEREST RATE , 16X,2PF9.1,3X,3HPCT)
000355      714 FORMAT (35H EARNING RATE ON EQUITY (AFTER TAX),1X,2PF9.1,3X,3HPCT)
000356      715 FORMAT (32H NUCLEAR LIABILITY COST PER YEAR, 4X,F9.1,3X,4H$/YR )
000357      716 FORMAT ( ' NUCLEAR LIABILITY COST PER MWYE ' ,F9.1, ' $/MWY ' )
000358      717 FORMAT (26H PLANT BASE OPERATING COST, 10X,F9.1,3X,5H$/YR )
000359      718 FORMAT (24H FEDERAL INCOME TAX RATE, 12X,2PF9.1,3X,4HPCT )
000360      719 FORMAT (18H PROPERTY TAX RATE, 18X,2PF9.1,3X,6HPCT/YR)
000361      720 FORMAT (14X,'CAPITAL COSTS')
000362      722 FORMAT ( 18H CONSTRUCTION TIME, 18X, F9.1, 3X, 3HYRS)
000363      724 FORMAT ( ' SPECIAL MATERIALS, NON-DEPRECIABLE',F11.1,3X,'$')
000364      725 FORMAT ( ' SPECIAL MATERIALS, DEPRECIABLE ' ,F11.1,3X,'$')
000365      728 FORMAT ( ' REACTOR PLANT EQUIPMENT ' ,F11.1,3X,'$')
000366      730 FORMAT ( ' ELECTRIC PLANT EQUIPMENT ' ,F11.1,3X,'$')
000367      732 FORMAT ( ' TURBINE PLANT EQUIPMENT ' ,F11.1,3X,'$')
000368      734 FORMAT ( ' MISCELLANEOUS PLANT EQUIPMENT ' ,F11.1,3X,'$')
000369      735 FORMAT (27H NET SALVAGE VALUE OF PLANT, 9X, F9.1, 3X, 1H$ )
000370      736 FORMAT ( ' INDIRECT COSTS ' ,F11.1,3X,'$')
000371      737 FORMAT ( ' LAND AND LAND RIGHTS ' ,F11.1,3X,'$')
000372      738 FORMAT ( 24H OTHER CAPITAL COSTS , 9X, F12.1, 3X, 1H$ )
000373      750 FORMAT (1H+,70X,41HURANIUM CASCADE PRICE SCHEDULE PARAMETERS )
000374      752 FORMAT (1H+,65X,26HCOST OF FEED (SEE TABLE 2) )
000375      753 FORMAT(1H+,65X,15HCONVERSION COST,20X,F10.2,2X,4H$/KG)
000376      754 FORMAT (1H+,65X,16HFEED COMPOSITION, 19X,2PF11.4,4H PCT)
000377      756 FORMAT (1H+,65X,23HCOST OF SEPARATIVE DUTY,12X,F10.2,2X,4H$/KG )
000378      758 FORMAT (1H+,65X, 11HTAILS VALUE, 24X,F10.2,2X,4H$/KG )
000379      761 FORMAT (19H PROPERTY INSURANCE, 17X,2PF9.1,3X,6HPCT/YR)
000380      762 FORMAT (22H STATE INCOME TAX RATE, 14X,2PF9.1,3X,3HPCT )
000381      763 FORMAT (29H STATE GROSS REVENUE TAX RATE, 7X,2PF9.1,3X,3HPCT )
000382      764 FORMAT (31H COMBINED STATE AND LOCAL TAXES, 5X,F9.1,3X,4H$/YR )
000383      765 FORMAT (29H INTERIM CAPITAL REPLACEMENTS, 7X,2PF9.1,3X,6HPCT/YR)
000384      C
000385      C
000386      800 FORMAT (1H+,65X,29HPRE-FABRICATION SHIPPING TIME, 7X, F9.1, 3X,
000387      1 4HDAYS)

```

```

CFTB 610
CFTB 620
CFTB 630
CFTB 640
CFTB 650
CFTB 660
CFTB 670
CFTB 680
CFTB 690
CFTB 700
08/09/67
CFTB 710
CFTB 712
4/05/67R
3/16/67
12/12/69
3/16/67
4/14/67
3/16/67
12/12/69
CFTB 722
12/12/69
12/12/69
12/12/69
12/12/69
12/12/69
12/12/69
08/09/67
12/12/69
12/12/69
CFTB 738
08/09/67
08/09/67
08/09/67
4/13/67R
4/21/67R
4/21/67R
4/13/67R
4/13/67R
CFTB 797
CFTB 798
CFTB 800
CFTB 801

```



```

000388      802 FORMAT (1H+,65X,19H"TIME IN FABRICATION,"      17X,F9.1,3X,4HDAYS) CFTB 802
000389      804 FORMAT (1H+,65X,36H"SHIP FROM FABRICATOR TO REACT SITE ", F9.1,3X, CFTB 804
000390      1 4HDAYS ) CFTB 805
000391      806 FORMAT (1H+,65X,26H"PRE REACTOR INVENTORY TIME,10X,F9.1,3X,4HDAYS) CFTB 806
000392      808 FORMAT (1H+,65X,20H"POST REACTOR COOLING,"      16X,F9.1,3X,4HDAYS) CFTB 808
000393      810 FORMAT (1H+,65X,36H"TIME TO SHIP FUEL TO REPROCESS SITE ", F9.1,3X, CFTB 810
000394      1 4HDAYS ) CFTB 811
000395      814 FORMAT (1H+,67X,47H"(REPROCESSING TIME DETERMINED BY SIZE OF BATCH) CFTB 814
000396      1 ) CFTB 815
000397      816 FORMAT (1H+,65X,26H"SHIP TO FINAL DESTINATION ,10X,F9.1,3X,4HDAYS) CFTB 816
000398      825 FORMAT (1H+,78X,16H"SHIPPING CHARGES ) CFTB 825
000399      828 FORMAT (1H+65X,33H"PRE-FABRICATION SHIPPING COST,(U),3X,F9.1, 3X,
000400      1 4H$/KG) CFTB 829
000401      829 FORMAT (1H+65X,36H"PRE-FABRICATION SHIPPING COST(RECYC) , F9.1,
000402      1 3X, 4H$/KG)
000403      830 FORMAT (1H+,65X,29H"FABRICATOR TO REACTOR SITE(U),7X, F9.1, 3X
000404      1 4H$/KG) CFTB 831
000405      831 FORMAT (1H+,65X,36H"FABRICATOR TO REACTOR SITE(RECYC) , F9.1, 3
000406      1X, 4H$/KG)
000407      832 FORMAT (1H+,65X,36H"REACTOR SITE TO REPROCESSING PLANT , F9.1,3X, CFTB 832
000408      1 4H$/KG ) CFTB 833
000409      836 FORMAT (1H+,65X,36H"COST TO SHIP TO FINAL DESTINATION , F9.1,3X, CFTB 836
000410      1 4H$/KG ) CFTB 837
000411      860 FORMAT (1H+,78X,20H"REPROCESSING CHARGES) CFTB 860
000412      862 FORMAT (1H+,65X,29H"REPROCESSING PLANT THROUGHPUT 7X, F9.1, 3X, CFTB 862
000413      1 6HKG/DAY) CFTB 863
000414      864 FORMAT (1H+,65X,36H"REPROCESSING PLANT OPERATING COST , F9.1,3X, CFTB 864
000415      1 5H$/DAY) CFTB 865
000416      890 FORMAT (1H+,78X,20H"FIRST CORE PURCHASE ) CFTB 890
000417      892 FORMAT (1H+,65X,18H"FABRICATION CHARGE, 14X,F13.1, 3X, 1H$ ) CFTB 892
000418      894 FORMAT (1H+,65X,18H"SHIPPING CHARGE , 14X,F13.1, 3X, 1H$ ) CFTB 894
000419      896 FORMAT (1H+,65X,13H"FUEL PURCHASE, 18X,F14.1, 3X, 1H$ ) CFTB 896
000420      897 FORMAT (1H+,65X,23H"FUEL FABRICATION LOSSES, 10X,F12.1,3X, 1H$) CFTB 897
000421      898 FORMAT (1H+,65X,"INTEREST CHARGES",15X,F14.1," $") 12/12/69
000422      C OUTPUT FORMATS ---- ISOTOPE PRICES CFTB 899
000423      900 FORMAT ( 53X,15H"ISOTOPE PRICES 5(/2X,A6,F8.1,2X, 08/09/67
000424      1 4H$/GM, 3(11X,A6,F8.1,2X, 4H$/GM) ) ) 08/09/67
000425      C CFTB 917
000426      C OUTPUT FORMATS ---- PAGES 2 AND 3 CFTB 918
000427      919 FORMAT(42X,34H"COSTS WITH INTEREST TO END OF YEAR/)
000428      920 FORMAT ( 42X, 35H"YEARLY COSTS IN MILLIONS OF DOLLARS // CFTB 920
000429      1 105H YEAR CAPACITY FUEL FUEL FABRICATION REPCFTB 921
000430      2ROCESSING PRE-REACTOR POST-REACTOR FUEL,5X,13H VARIABLE ,2
000431      2X ,5HTOTAL / 9X,
000432      3 19HFACTOR PURCHASE,6X,6HCREDIT,2(7X,6HCHARGE,1X), 6X, CFTB 923
000433      4 2(8HSHIPPING,4X), 3X, 4HLOSS,5X,9HOPERATING/11X,3HPCT, 55X,
000434      5 2(6X,6HCHARGE), 7X,6HCHARGE,6X,6HCHARGE /)
000435      930 FORMAT ( 1X,I4,2PF9.1,-6PF13.3,5(F13.3),F13.3,2F12.3)
000436      940 FORMAT ( 49X, 21H"VARIABLE PARAMETERS // 2X,4HYEAR, 5X,

```

```

000437      1 12HREPROCESSING, 7X,12HREPROCESSING, 8X,11HFABRICATION, 4X,11H U
000438      2233 OR PU,4X, 8HPU PRICE,2X,10HU233 PRICE,4X, 6HU FEED /11X,12HCHA
000439      3RGE,$/KG,8X,10HTIME, DAYS,8X,12HCHARGE,$/KG, 4X, 11HFAB PENALTY ,6
000440      4X,4H$/GM,8X,4H$/GM,6X, 5HPRICE / 11X,
000441      53(12HBLKT CORE ,7X) ,5H,$/KG,29X,9H$/LB U308)
000442      950 FORMAT(2X,I4,1X,3(2F8.2,3X),2F11.2,1X,2F11.2) 12/12/69
000443      955 FORMAT(2X,I4,39X,2F8.2,3X,2F11.2,1X,2F11.2) 12/12/69
000444      956 FORMAT(40X,29HURANIUM PURCHASES AND CREDITS/8X,4H****,5X,7H*****
000445      1 ,3X,11H*****,4X,48H***** *****
000446      2*****3X,37H*****/106X,10HEQ
000447      3UIVALENT/42X,10H90 PCT ENR,16X,10HSEPARATIVE,15X,10HEQUIVALENT,3X,
000448      410HSEPARATIVE/17X,7HURANIUM,6X,5HTAILS,9X,7HURANIUM,6X,4HU308,10X,
000449      54HWORK,8X,5HTAILS,7X,4HU308,10X,4HWORK,8X,5HTAILS/18X,5HPRICE,4X,
000450      611HCOMPOSITION,7X,5HPRICE,5X,9HPURCHASED,4X,9HPURCHASED,5X,8HPRODU
000451      7CED,4X,8HCREDITED,5X,8HCREDITED,4X,8HCONSUMED/8X,4HYEAR,6X,5H $/LB12/12/69
000452      8,7X,4H PCT,10X,5H $/GM,7X,5H TONS,9X,5HTONNE,8X,7HTONNE U,5X,5H T012/12/69
000453      9NS,8X,5HTONNE,7X,7HTONNE U) 12/12/69
000454      957 FORMAT (8X,I4,F11.2,F11.3,F15.2,F13.1,-3P2F13.1,F11.1,-3PF13.1 12/12/69
000455      1 , -3PF14.1) 12/12/69
000456      960 FORMAT (1H , 55X, 5HTABLE,I2 ) CFTB 960
000457      1000 FORMAT(F6.0,12I10/8F10.1/I1/10F12.3/10F12.3/10F12.3/9A6)
000458      1002 FORMAT(F6.0,F10.2,11F10.0/8F10.0/I1/10F12.3/10F12.3/10F12
000459      1.3/9A6)
000460      990 RETURN CFTB 990
000461      END -

```

ELT CHNGLF,1,691212, 19617

```

000001      FUNCTION CHNGLF(XX)
000002      INCLUDE COM1
000003      COMMON / CDLF/X1(6),Y1(6),X2(6),Y2(6)
000004      X = XX
000005      A1I = 0.0
000006      A2I = 0.0
000007      AIP = 0.0
000008      DO 1008 I=1,5
000009      IF (X1(I+1) .GT. 0.0) GO TO 1005
000010      X1(I+1) = X
000011      Y1(I+1) = Y1(I)
000012 1005 CONTINUE
000013      IF (X .GT. X1(I+1) ) GO TO 1007
000014      SLOPE = (Y1(I+1) - Y1(I) )/(X1(I+1) - X1(I) )
000015      Y = Y1(I) + SLOPE*(X - X1(I) )
000016      A1I = A1I + (X - X1(I))*(Y + Y1(I))/2.0
000017      GO TO 1014
000018 1007 A1I = A1I + (X1(I+1) - X1(I))*(Y1(I+1) + Y1(I))/2.0
000019 1008 CONTINUE
000020      CALL EXIT
000021 1014 DO 1018 I=1,5
000022      ISV = I
000023      AIP = A2I
000024      IF (X2(I+1) .LT. 0.00001) GO TO 1020
000025      A2I = A2I + (X2(I+1) - X2(I))*(Y2(I+1) + Y2(I))/2.0
000026      IF (A2I .GT. A1I) GO TO 1025
000027 1018 CONTINUE
000028      I = ISV
000029      XMAX = X2(I+1)
000030      GO TO 1021
000031 1020 XMAX = X2(I)
000032 1021 IF (XMAX .LT. TLIFE) WRITE (6,1022) XMAX,X
000033 1022 FORMAT (56HOREAL-TIME VALUE LIES BEYOND MAXIMUM LOAD FACTOR TIME 0
000034      1F ,F7.3,23H FOR FULL-POWER TIME OF ,F7.3)
000035 1025 AA = A1I - AIP
000036      SLOPE = (Y2(I+1) - Y2(I))/(X2(I+1) - X2(I))
000037      Y = SQRT(Y2(I)**2 + 2.*SLOPE*AA)
000038      CHNGLF = X2(I)+2.*AA/(Y + Y2(I))
000039      IF (IPR .NE. 0) WRITE (6,1028) X,CHNGLF
000040 1028 FORMAT (10H TIME IN = F6.2,12H TIME OUT = F6.2)
000041      RETURN
000042      END

```

12/12/69
12/12/69
12/12/69
12/12/69

12/12/69
12/12/69

12/12/69

12/12/69

BNWL-1169

@ ELT CINPUT,1,691212, 19623

000001	C	ROUTINE TO READ IN PACTOLUS CARD INPUT	CINP 010
000002		SUBROUTINE CINPUT	CINP 020
000003	C		CINP 021
000004	C		037
000005	C	COMMON FOR PACTOLUS AND POWERCO PROGRAMS	040
000006		INCLUDE COM1	050
000007		INCLUDE COM2	055
000008		COMMON / CDLF / X1(6),Y1(6),X2(6),Y2(6)	
000009	C		100
000010	C	INITIALIZE PROPER VARIABLES AND COUNTERS TO ZERO	CINP 120
000011		CALL CLEAR (EEE(1),6848)	CINP 130
000012		CALL CLEAR (D(1),64)	CINP 140
000013	C		
000014	C	READ REACTOR CODE NAME AND LOAD FACTORS	
000015	C		
000016		READ (LTI,935) PPN0,(X2(I),Y2(I),I=1,6)	
000017	C		CINP 190
000018	C	READ CONTROL CARD	CINP 200
000019		READ(LTI,910) IRCVR,NCR,NBR,IHDG,IPR,NRELD,IECON,IMFOS,NCDS,I90,	12/12/69
000020		1 ITAP,ISEP,IPU,LL1,LL2,LL6,IADJ,NOP,JCASE,LCASE,ADATE	12/12/69
000021		IF (NOP.EQ. 0) NOP = 4	12/12/69
000022		IF (LCASE.GT.0) LCASE = LCASE + 1	CINP 220
000023		NREG = NCR + NBR	CINP 240
000024		NCNT = 0	CINP 250
000025	C		CINP 340
000026	C	READ FABRICATION CARD	CINP 350
000027		READ (LTI,920) FCINT,FABBLK,CORLOS,BLKLOS,SALT	12/12/69
000028	C		CINP 390
000029	C	READ REPROCESSING CARD	CINP 400
000030		READ(LTI,920) SEPCST,THRUPT,REPL0S,TSEP,THROW,THROCG	
000031	C		CINP 440
000032	C	READ SHIPPING CARD	CINP 450
000033		READ (LTI,920) CSHP1,SHPFAB,CSHP2,SHPREA,CSHP3,SHPSEP,CSHP4,	CINP 460
000034		1 SHPDES,DLSHP1,DLSHP2	
000035	C		CINP 490
000036	C	READ PLANT CONSTRUCTION COST CARD	CINP 500
000037		READ (LTI,920) CSTMOD,CML0SS,CSTCON,CSTPR,CSTTG,CSTHT,CSTRS,	CINP 510
000038		1 CSTOTH,D(24),D(23)	08/09/67
000039		D(25) = CSTMOD	12/12/69
000040	C	CALCULATE AND STORE INITIAL CAPITAL EXPENDITURES	08/09/67
000041		D(1)=CSTCON+CSTPR+CSTTG+CSTHT+CSTRS+CSTOTH	08/09/67
000042		D(1) = D(1) + SALT	12/12/69
000043	C		CINP 540
000044	C	READ REACTOR OPERATION AND FINANCING CARD	4/21/67R

A-14

BNWL-1169

000045		READ (LTI,920) EFF,CYR,CVARYR,D(18),D(3),D(4),D(5),D(6),HOLD,HOLD	08/09/67
000046	C		
000047	C	READ INSURANCE AND TAXES CARD	3/31/67R
000048		READ (LTI,920) CINS,D(21),D(19),TIMD,HOLD,D(7),D(15),D(16),D(17),	12/12/69
000049		1 D(22)	4/21/67R
000050		IF (TIMD .EQ. 0.0) TIMD = 0.50	12/12/69
000051	C		CINP 590
000052	C	READ PROCESS AND STARTUP TIMES CARD	CINP 600
000053		READ (LTI,920) TSTART,D(9),TCONST,TFAB,PRI,COOL,TLIFE	12/12/69
000054		IF (TLIFE .EQ. 0) TLIFE = 30.0	12/12/69
000055		D(14) = TSTART	
000056	C		CINP 640
000057	C	READ URANIUM CASCADE PRICE CARD	CINP 650
000058		READ(LTI,950) IXTL,CS,CW,XT,XF,UCONV,UBUYTM	
000059	C		CINP 690
000060	C	READ ISOTOPE PRICE CARDS	CINP 700
000061		READ (LTI,960) (PISO(I),I=1,11)	CINP 710
000062		READ (LTI,970) (MWT(K),PISO(K),K=12,20)	CINP 720
000063	C		CINP 740
000064	C	READ QUICK ECON PARAM CARDS	CINP 750
000065		IF(IECON.NE.0) GO TO 100	
000066		DO 780 I = 1,NCDS	CINP 755
000067		READ (LTI,940) CORFAB(I),SRATO(I),PRATO(I),XLDF(I),CFX(I),	CINP 760
000068		1 DELFAB(I),PU233(I),TIME(I),BLKFAB(I),BLKSEP(I),LL9	
000069	C	(A NUMBER IN COL 80 OF THE LAST CARD WILL CAUSE CYCLING THROUGH	2/01/67R
000070	C	PWERCO AFTER THIS CASE. PWERCO CAN BE ENTERED DIRECTLY BY	2/01/67R
000071	C	XGT POWER)	2/01/67R
000072		780 CONTINUE	CINP 780
000073		GO TO 789	
000074		100 READ(LTI,920)(TIME(I),I=1,NCDS)	
000075		READ(LTI,920)(CORFAB(I),I=1,NCDS)	
000076		READ(LTI,920)(DELFAB(I),I=1,NCDS)	
000077		READ(LTI,920)(BLKFAB(I),I=1,NCDS)	
000078		READ(LTI,920)(SRATO(I),I=1,NCDS)	
000079		READ(LTI,920)(BLKSEP(I),I=1,NCDS)	
000080		READ(LTI,920)(PRATO(I),I=1,NCDS)	
000081		READ(LTI,920)(CFX(I),I=1,NCDS)	
000082		READ(LTI,920)(PU233(I),I=1,NCDS)	
000083		READ(LTI,920)(XLDF(I),I=1,NCDS)	
000084		789 IF (Y2(1) .LT. 0.00001) GO TO 830	
000085		DO 820 I=1,NCDS	
000086		XLDF(I) = CALCLF(TIME(I) - TSTART)	
000087		820 CONTINUE	
000088	C		CINP 787
000089	C	READ HEADING CARDS	CINP 790
000090		830 IF (IHDG .EQ. 0) GO TO 850	
000091		K2 = IHDG*14	CINP 810
000092		READ (LTI,930) (XHDG(K),K=1,K2)	CINP 820
000093	C		CINP 830

000094
000095
000096
000097
000098
000099
000100
000101
000102
000103
000104
000105
000106
000107
000108
000109
000110
000111
000112
000113
000114
000115
000116
000117
000118
000119
000120

```
C          FILL TIME LIBRARIES
850 DO 890 I = 1,NCDS
      TLIB(1,I) = TIME(I)
      TLIB(2,I) = DELFAB(I)
      TLIB(3,I) = CORFAB(I)
      TLIB(4,I) = BLKFAB(I)
      TLIB(5,I) = XLDF(I)
      TLIB(6,I) = CFX(I)
      TLIB(7,I) = PU233(I)
      TLIB(8,I) = SRATO(I)
      TLIB(9,I) = PRATO(I)
      TLIB(10,I) = BLKSEP(I)
890 CONTINUE

C          INPUT FORMATS
910 FORMAT (18I3,2I4,3A6)
920 FORMAT (10F8.2)
930 FORMAT (13A6,A2)
935 FORMAT (A6,12F5.0)
940 FORMAT(12X,10F6.2,7X,I1)
950 FORMAT (I2,6X, 9F8.2)
960 FORMAT (11F5.2)
970 FORMAT (9(I3,F5.2) )

C          WRITE PROPER HEADING PAGE AND RETURN
C          RETURN
C          END
```

CINP 840
CINP 850
CINP 852
CINP 854
CINP 856
CINP 858
CINP 860
CINP 862
CINP 864
CINP 866
CINP 868

CINP 890
CINP 899
CINP 900
CINP 910
CINP 920
CINP 930

CINP 950
CINP 960
CINP 970
CINP 980
CINP 985
CINP 990
-

Q ELT CLEAR,1,691212, 19626

000001	C	SUBROUTINE CLEAR - TO CLEAR SUCCESSIVE CORE LOCATIONS TO ZERO	CLR 010
000002		SUBROUTINE CLEAR (A,N)	CLR 020
000003		DIMENSION A(2)	CLR 300
000004		DO 500 I = 1,N	CLR 400
000005	500	A(I) = 0.0	CLR 500
000006		RETURN	CLR 700
000007		END	-

Q ELT CLOTHO,1,691212, 19637

```

000001      CFAST  , A PROGRAM TO MAKE FAST REACTOR BURNUP TAPES ON THE UNIVAC 1107
000002      C                                          01/22/69
000003          COMMON /CDLF / X1(6),Y1(6),X2(6),Y2(6)          01/22/69
000004          IN = 5
000005          LOUT = 8
000006          READ (IN,208) TPR,FMAS,PWR          01/22/69
000007          READ (IN,810) (X1(I),Y1(I),I=1,6)          01/22/69
000008      C
000009      C      TPR IS A MULT. FACTOR FOR INVENTORY
000010      C      PWR IS A MULT. FACTOR FOR POWER
000011      C      FMAS IS A MULT. FACTOR FOR THRUPUT
000012          DIMENSION TITLE(12),ID(100),U(12),TREG(50),TXX(5),EXX(5)
000013          DIMENSION UU(12)
000014          1,CXX(12,5),TREGO(50),TRGST(50)
000015          XK = 1.602E11
000016          IF(PWR)163,164,163
000017      164 PWR = 1.0
000018      163 CONTINUE
000019          IF(TPR)160,160,161
000020      160 TPR = 1.0
000021      161 CONTINUE
000022          IF (FMAS)175,175,176
000023      175 FMAS = 1.0
000024      176 CONTINUE
000025          IF (IN.EQ.0) IN = 5
000026          IF (LOUT.EQ.0) LOUT = 8
000027          TIMST = 0.0
000028          TIMO = 0.0
000029          DATA(U(N),N=1,12)/72H U233 U235 PU239 PU241 TH232 U238 U234 PU
000030      1240 PA233 U236 PU242 NP237/
000031          DATA CHG/6H CHG/DISCHG/6HDISCHG/
000032          DATA(UU(I),I=1,12)/72H TH232 PA233 U233 U234 U235 U236 U238 N
000033      1P237 PU239 PU240 PU241 PU242/
000034          READ(IN,800) TSTOP,NREGN,NFUEL,IBUG,NPTS,CLF          01/22/69
000035          READ (IN,810) (X2(I),Y2(I),I=1,6)          01/22/69
000036          IF (Y1(1) + Y1(2).LT.0.000001) GO TO 178          01/22/69
000037          DO 177 I=1,6          01/22/69
000038              X2(I) = X1(I)          01/22/69
000039              Y2(I) = Y1(I)          01/22/69
000040      177 CONTINUE          01/22/69
000041          GO TO 179          01/22/69
000042      178 CONTINUE
000043          X1(1) = 0.0          01/22/69
000044          Y1(1) = 1.00          01/22/69

```



```

000045      X1(2) = 30.0                                01/22/69
000046      Y1(2) = 1.00                                01/22/69
000047      179 CONTINUE                                01/22/69
000048      IF (CLF) 1006,1006,1008
000049      1006 CLF = 1.00
000050      1008 CONTINUE
000051      IF(NPTS.EQ.0) NPTS = 2
000052      WRITE(6,3000)                                01/22/69
000053      TSTOP = 0.0                                    01/22/69
000054      DO 3120 I=1,5                                  01/22/69
000055      K = I                                           12/12/69
000056      IF (Y2(I+1).EQ. 0.0) GO TO 3150              12/12/69
000057      TSTOP = TSTOP + (X2(I+1) - X2(I))*(Y2(I+1) + Y2(I))/2. 01/22/69
000058      SLOPE = (Y2(I+1) - Y2(I))/(X2(I+1)-X2(I))      01/22/69
000059      WRITE (6,3010) Y2(I),X2(I),SLOPE                01/22/69
000060      3000 FORMAT (41H0 THE CAPACITY FACTOR VARIES AS FOLLOWS:/ ) 01/22/69
000061      3010 FORMAT (16X,2PF6.2,'% AT',0PF8.2,' YEARS, CHANGING BY',2PF7.2, 12/12/69
000062      1 ' %/YEAR TO' /)                               12/12/69
000063      3120 CONTINUE                                01/22/69
000064      K = 6                                           12/12/69
000065      3150 WRITE (6,3160) Y2(K),X2(K),NREGN           12/12/69
000066      3160 FORMAT (16X,2PF6.2,'% AT',0PF8.2,' YEARS,' 12/12/69
000067      2//11H THIS IS A,I3,15H REGION REACTOR )
000068      IF(NFUEL.NE.0) WRITE(6,1011)
000069      1011 FORMAT(23H CONTINUOUS REFUELLING)
000070      ISW = 0
000071      IROUND = 0
000072      I1 = 114
000073      I2 = 137
000074      XF = 1.0
000075      I3 = 1
000076      MH = 0
000077      ME = -1
000078      DO 99 I=1,100
000079      99 ID(I) = 0
000080      1 READ(IN,100) ITEST, RTP,ACASE,BCASE,VOL
000081      RTP = RTP*PWR
000082      IF(ITEST)5,2,5
000083      2 ICT = 1
000084      READ (IN,103) (TITLE(I),I=1,12)
000085      IF(ISW.EQ.0) WRITE(6,1012)(TITLE(I),I=1,12)
000086      1012 FORMAT(/2X,12A6//30X,21HKILOGRAMS OF ISOTOPES)
000087      IF(ISW.EQ.0) WRITE(6,1013) (UU(I),I=1,12)
000088      1013 FORMAT(10X,12(1X,A6,1X),10H TIME //)
000089      ISW = 1
000090      IROUND = 1
000091      4 READ(IN,101)C02,C13,C23,C24,C25,C26,C28,C37,C49,C40,C41,C42,
000092      1NFINAL,NR,TIME,EXP,ICOR
000093      TIME = TIME * CLF * TPR/PWR

```

03/11/69

BNWL-1169

```

000094      TIMEE = TIME*365.3
000095      RKG = C02 + C13+C23+C24+C25+C26+C28+C37+C49+C40+C41+C42
000096      FMUL = FMAS
000097      IF (TIME) 3200,3200,3201
000098 3200 FMUL = TPR
000099 3201 RKG = RKG*FMUL
000100      DENS = RKG/VOL
000101      DENS = RKG/VOL
000102      RKG = RKG/1000.
000103      TIM = CHNGLF (TIME)
000104      TIM = TIM*365.3
000105 C IROUND = 0, STARTUP DATA
000106 C      = 1, SHUTDOWN DATA
000107      IF (IROUND) 10,11,10
000108 10 YLD = CALCLF (TIM/365.3)
000109      RRTP = RTP*YLD
000110      WRITE (LOUT) I1,MH, ID(1), ACASE, BCASE, (ID(I), I=1,32), (TITLE(I)
000111      2, I=1,12), ID(1),
000112      3(U(I), I=1,12), (ID(I), I=1,33), DENS, XK, ID(1), (X2(I), Y2(I), I=1,6)
000113      4, ID(1), ID(1), RKG, RRTP, ICOR
000114      IROUND = 0
000115      TIMO = TIM
000116 51 TIMST = TIMEE
000117 11 CONTINUE
000118      TIMA = TIM*8.64E4
000119      TTIM = TIM/365.3
000120 7 CONTINUE
000121      FMUL = FMAS
000122      IF (TTIM) 3100,3100,3101
000123 3100 FMUL = TPR
000124 3101 C02 = C02*FMUL
000125      C13 = C13*FMUL
000126      C23 = C23*FMUL
000127      C24 = C24*FMUL
000128      C25 = C25*FMUL
000129      C26 = C26*FMUL
000130      C28 = C28*FMUL
000131      C37 = C37*FMUL
000132      C49 = C49*FMUL
000133      C40 = C40*FMUL
000134      C41 = C41*FMUL
000135      C42 = C42*FMUL
000136      TYP = CHG
000137      IF (NFINAL.GT.1) TYP = DISCHG
000138      WRITE (6,1002) TYP, C02, C13, C23, C24, C25, C26, C28, C37, C49
000139      1, C40, C41, C42, TTIM, ACASE, BCASE
000140 1002 FORMAT( 2X, A6, 2X, 13F8.1, 2X, I4, A1)
000141      CONST = .6023/VOL
000142      C02 = C02*CONST/232.

```

01/22/69

01/22/69

01/22/69

01/22/69

01/22/69

01/22/69

01/22/69

12/12/69

```

000143      C13 = C13*CONST/233.
000144      C23 = C23*CONST/233.
000145      C24 = C24*CONST/234.
000146      C25 = C25*CONST/235.
000147      C26 = C26*CONST/236.
000148      C28 = C28*CONST/238.
000149      C37 = C37*CONST/237.
000150      C49 = C49*CONST/239.
000151      C40 = C40*CONST/240.
000152      C41 = C41*CONST/241.
000153      C42 = C42*CONST/242.
000154      13 WRITE(LOUT) I2, NFINAL, ICT, ACASE, BCASE, C23, C25, C49, C41, C02, C28, C24
000155      1, C40, C13, C26, C42, C37, (ID(L), L=1, 34),
000156      1 (ID(L), L=1, 81), TIMA, EXP, ID(1), ID(1), ID(1
000157      2), XF
000158      ICT = ICT + 1
000159      IF(NFINAL-1) 5, 4, 280
000160      280 IF(30, -TIM/365.3) 281, 281, 279
000161      279 TREGO(NR) = TIMO
000162      TREG(NR) = TIMEE
000163      TRGST(NR) = TIMST
000164      GO TO 1
000165      C THIS IS THE BEGINNING OF THE END OF LIFE CALCULATIONS
000166      C FIRST THE REFUELING OF ALL REGIONS WILL BE PERFORMED - THIS
000167      C BRINGS THE MATERIAL BALANCE TO THE END OF LIFE - THEN
000168      C THE EQUILIBRIUM CORE WILL BE DISCHARGED IF THIS IS A CONTINUOUSLY
000169      C REFUELED REACTOR
000170      281 BACKSPACE LOU
000171      BACKSPACE LOU
000172      BACKSPACE LOU
000173      WRITE(6, 1051)
000174      IF(1BUG) 2820, 2821, 2820
000175      2820 WRITE(6, 206) TTIM
000176      2821 CONTINUE
000177      282 READ (IN, 106) IX
000178      IF(IX-1) 282, 6, 282
000179      6 TIMST = 0.
000180      DO 300 K=1, NREGN
000181      TIMEE = TREG(K)
000182      TIMO = TREGO(K)
000183      TIMST = TRGST(K)
000184      IF(1BUG) 2830, 2831, 2830
000185      2830 WRITE(6, 1000) TIMEE, TIMO, TIMST
000186      2831 CONTINUE
000187      1000 FORMAT(17H TIMEE, TIMO, TIMST /3F12.1)
000188      XXF = 1.0
000189      IROUND = 1
000190      IF(NFUEL, NE, 0) GO TO 2001
000191      READ (IN, 101) C02, C13, C23, C24, C25, C26, C28, C37, C49, C40, C41, C42,

```

```

000192      1NFINAL,NR,TIME,EXP,ICOR
000193      TIME = TIME * CLF * TPR/PWR
000194      NLP = 0
000195      CXX(1,1) = C02
000196      CXX(2,1) = C13
000197      CXX(3,1) = C23
000198      CXX(4,1) = C24
000199      CXX(5,1) = C25
000200      CXX(6,1) = C26
000201      CXX(7,1) = C28
000202      CXX(8,1) = C37
000203      CXX(9,1) = C49
000204      CXX(10,1) = C40
000205      CXX(11,1) = C41
000206      CXX(12,1) = C42
000207      TXX(1) = TIME
000208      EXX(1) = EXP
000209      TIMEE = TIMEE + TIME*365.3
000210 289 TIM = CHNGLF(TIMEE/365.3)
000211      YA = CALCLF(TIM)
000212      TTIM = TIM
000213      TIM = TIM*365.3
000214      TIMA = TIM*8.64E4
000215      TTIM = TIM/365.3
000216      IF(I,UG,NE,0) WRITE(6,1001)TIM,TIMO,YA,EXP
000217 1001 FORMAT(23H TIME AT THIS POINT IS ,F10.2,5X,36H THE STARTUP TIME FO
000218      1R THIS REGION WAS ,F10.2/52H AND THE AVERAGE LOAD FACTOR FOR THIS
000219      2INTERVAL WAS ,F8.3//17H THE EXPOSURE IS,F10.1)
000220 450 FMUL = FMAS
000221      IF(TTIM-30.)3106,3105,3105
000222 3105 FMUL = TPR
000223 3106 C02 = C02*FMUL
000224      C13 = C13*FMUL
000225      C23 = C23*FMUL
000226      C24 = C24*FMUL
000227      C25 = C25*FMUL
000228      C26 = C26*FMUL
000229      C28 = C28*FMUL
000230      C37 = C37*FMUL
000231      C49 = C49*FMUL
000232      C40 = C40*FMUL
000233      C41 = C41*FMUL
000234      C42 = C42*FMUL
000235      RKG = C02 + C13+C23+C24+C25+C26+C28+C37+C49+C40+C41+C42
000236      DENS = RKG/VOL
000237      RKG = RKG/1000.
000238      IF(ROUND)510,511,510
000239 510 YLD = CALCLF(TIM/365.3)
000240      RRTP = RTP*YLD

```

03/11/69

01/22/69

01/22/69

01/22/69

01/22/69

01/22/69

01/22/69

```

000241      WRITE(LOUT) I1, MH, ID(1), ACASE, BCASE, (ID(I), I=1, 32), (TITLE(I), I=1, 12
000242      2), ID(1),
000243      3(U(I), I=1, 12), (ID(I), I=1, 33), DENS, XK, ID(1), (X2(I), Y2(I), I=1, 6)      01/22/69
000244      4, ID(1), ID(1), RKG, RRT, ICOR      01/22/69
000245      IROUND = 0
000246      TIMO = TIM
000247      551 TIMST = TIMEE
000248      511 CONTINUE
000249      TIMA = TIM*8.64E4
000250      TTIM = TIM/365.3
000251      70 CONTINUE
000252      TYP = CHG
000253      IF(NFINAL.GT.1) TYP = DISCHG
000254      WRITE(6,1002) TYP, C02, C13, C23, C24, C25, C26, C28, C37, C49
000255      1, C40, C41, C42, TTIM, ACASE, BCASE
000256      CONST = .6023/VOL      12/12/69
000257      C02 = C02*CONST/232.
000258      C13 = C13*CONST/233.
000259      C23 = C23*CONST/233.
000260      C24 = C24*CONST/234.
000261      C25 = C25*CONST/235.
000262      C26 = C26*CONST/236.
000263      C28 = C28*CONST/238.
000264      C37 = C37*CONST/237.
000265      C49 = C49*CONST/239.
000266      C40 = C40*CONST/240.
000267      C41 = C41*CONST/241.
000268      C42 = C42*CONST/242.
000269      130 WRITE(LOUT) I2, NFINAL, ICT, ACASE, BCASE, C23, C25, C49, C41, C02, C28, C24
000270      1, C40, C13, C26, C42, C37, (ID(L), L=1, 34),
000271      1      (ID(L), L=1, 81), TIMA, EXP, ID(1), ID(1), ID(1
000272      2), XXF
000273      ICT = ICT + 1
000274      IF(NFINAL-1) 6, 290, 300
000275      C THE FOLLOWING IS THE EQUILIBRIUM DISCHARGE OF THE CORE FOR
000276      C CONTINUOUSLY REFUELED REACTORS
000277      2001 DO 2003 JXX=1, 5
000278      DO 2002 IXX=1, 12
000279      2002 CXX(IXX, JXX) = 0.
000280      2003 EXX(JXX) = 0.
000281      290 TDEL = TSTOP - TIMEE/365.3
000282      C INDEX ON J AND IA IN THE FOLLOWING STATEMENTS ARE INCREASED FOR
000283      C ADDITIONAL INTERMEDIATE DATA POINTS
000284      READ(IN, 101) ((CXX(I, J), I=1, 12), NFINAL, NR, TXX(J), EXX(J), ICOR, J=2, NP
000285      1TS)
000286      DO 291 IA = 2, NPTS
000287      II = IA
000288      TXX(IA) = TXX(IA) * CLF * TPR/PWR      03/11/69
000289      321 IF(TXX(IA)-TDEL) 291, 292, 292

```

```

000290      291 CONTINUE
000291      292 TXN = TDEL-TXX(II-1)
000292          XXF = TXN/(TXX(II)-TXX(II-1))
000293          IF (NFUEL.NE.0) XXF = TDEL/TXX(II)
000294          IF (IBUG) 2920,2921,2920
000295      2920 WRITE(6,107)XXF,TXN,C23,C25
000296      2921 CONTINUE
000297      107 FORMAT(4F12.4)
000298          C02 = (CXX(1,II) - CXX(1,II-1))*XXF + CXX(1,II-1)
000299          C13 = (CXX(2,II) - CXX(2,II-1))*XXF + CXX(2,II-1)
000300          C23 = (CXX(3,II) - CXX(3,II-1))*XXF + CXX(3,II-1)
000301          C24 = (CXX(4,II) - CXX(4,II-1))*XXF + CXX(4,II-1)
000302          C25 = (CXX(5,II) - CXX(5,II-1))*XXF + CXX(5,II-1)
000303          C26 = (CXX(6,II) - CXX(6,II-1))*XXF + CXX(6,II-1)
000304          C28 = (CXX(7,II) - CXX(7,II-1))*XXF + CXX(7,II-1)
000305          C37 = (CXX(8,II) - CXX(8,II-1))*XXF + CXX(8,II-1)
000306          C49 = (CXX(9,II) - CXX(9,II-1))*XXF + CXX(9,II-1)
000307          C40 = (CXX(10,II) - CXX(10,II-1))*XXF + CXX(10,II-1)
000308          C41 = (CXX(11,II) - CXX(11,II-1))*XXF + CXX(11,II-1)
000309          C42 = (CXX(12,II) - CXX(12,II-1))*XXF + CXX(12,II-1)
000310          EXP = EXX(II)*TDEL/TXX(II)
000311          NLP = 0
000312          IF (NFUEL) 700,322,700
000313      700 TIM = 30.*365.3
000314          TTIM = 30.0
000315          GO TO 450
000316      322 TIMEE = TSTOP*365.3
000317          IF (IBUG) 4101,4102,4101
000318      4101 WRITE(6,410)EXP,TIMEE,C02,TXN,TDEL
000319      4102 CONTINUE
000320      410 FORMAT(1X,22HEXP,TIMEE,C02,TXN,TDEL /1X,5F12.3)
000321          NFINAL = 3
000322          GO TO 249
000323      300 CONTINUE
000324          IF (NFUEL.EQ.0) GO TO 5
000325          TIM = 30.0 * 365.3
000326          XXF = 1.0
000327          IROUJID = 1
000328      2450 READ(IN,101)C02,C13,C23,C24,C25,C26,C28,C37,C49,C40,C41,C42,
000329          1NFINAL,NR,TIME,EXP,ICOR
000330          TIME = TIME * CLF * TPR/PWR
000331          READ(IN,101)((CXX(I,J),I=1,12),NFINAL,NR,TXX(J),EXX(J),ICOR,J=2,NP
000332          1TS)
000333          DO 2455 J=2,NPTS
000334      2455 TXX(J) = TXX(J) * CLF * TPR/PWR
000335          NFINAL = 1
000336          RKG = 0.
000337          DO 2520 I=1,12
000338      2520 RKG = RKG + CXX(I,2)*TPR

```

03/11/69

03/11/69

```

000339      DENS = RKG/VOL
000340      RKG = RKG/1000.
000341 2460 IF (IROUND) 2510, 2511, 2510
000342 2510 YLD = CALCLF(TIM/365.3) 01/22/69
000343      RRTP = RTP*YLD
000344      WRITE(LOUT) I1, MH, ID(1), ACASE, BCASE, (ID(1), I=1, 32), (TITLE(I), I=1, 12
000345      2), ID(1),
000346      3(U(I), I=1, 12), (ID(I), I=1, 33), DENS, XK, ID(1), (X2(I), Y2(I), I=1, 6) 01/22/69
000347      4, ID(1), ID(1), RKG, RRTP, ICOR 01/22/69
000348      IROUND = 0
000349      TIMO = TIM
000350 2551 TIMST = TIMEE
000351 2511 CONTINUE
000352      TIMA = TIM*8.64E4
000353      TTIM = TIM/365.3
000354 270 CONTINUE
000355 3109 FMUL = TPR
000356 3110 C02 = C02*FMUL
000357      C13 = C13*FMUL
000358      C23 = C23*FMUL
000359      C24 = C24*FMUL
000360      C25 = C25*FMUL
000361      C26 = C26*FMUL
000362      C28 = C28*FMUL
000363      C37 = C37*FMUL
000364      C49 = C49*FMUL
000365      C40 = C40*FMUL
000366      C41 = C41*FMUL
000367      C42 = C42*FMUL
000368      TYP = CHG 12/12/69
000369      IF (NFINAL .GT. 1) TYP = DISCHG 12/12/69
000370      WRITE(6, 1002) TYP, C02, C13, C23, C24, C25, C26, C28, C37, C49
000371      1, C40, C41, C42, TTIM, ACASE, BCASE
000372      CONST = .6023/VOL 12/12/69
000373      C02 = C02*CONST/232.
000374      C13 = C13*CONST/233.
000375      C23 = C23*CONST/233.
000376      C24 = C24*CONST/234.
000377      C25 = C25*CONST/235.
000378      C26 = C26*CONST/236.
000379      C28 = C28*CONST/238.
000380      C37 = C37*CONST/237.
000381      C49 = C49*CONST/239.
000382      C40 = C40*CONST/240.
000383      C41 = C41*CONST/241.
000384      C42 = C42*CONST/242.
000385 2130 WRITE(LOUT) I2, NFINAL, ICT, ACASE, BCASE, C23, C25, C49, C41, C02, C28, C24
000386      1, C40, C13, C26, C42, C37, (ID(L), L=1, 34),
000387      1 (ID(L), L=1, 81), TIMA, EXP, ID(1), ID(1), ID(1)

```

```

000388      2),XXF
000389      ICT = ICT + 1
000390      IF (NFINAL-1) 2160,2160,5
000391 2160 C02 = CXX(1,II)
000392      C13 = CXX(2,II)
000393      C23 = CXX(3,II)
000394      C24 = CXX(4,II)
000395      C25 = CXX(5,II)
000396      C26 = CXX(6,II)
000397      C28 = CXX(7,II)
000398      C37 = CXX(8,II)
000399      C49 = CXX(9,II)
000400      C40 = CXX(10,II)
000401      C41 = CXX(11,II)
000402      C42 = CXX(12,II)
000403      EXP = EXX(II)
000404      NFINAL = 3
000405      GO TO 2460
000406      5 WRITE(LOUT)I3,ME
000407      END FILE LOUT
000408      WRITE(6,1050)
000409 1050 FORMAT(2X,8HEND DATA)
000410 1051 FORMAT(121H THE PREVIOUS REGION WOULD HAVE GONE PAST 30 YEARS. T
000411      1HIS REGION WILL BE DELETED AND THE FOLLOWING REGIONS COMPRISE THE
000412      2,/2X,36HSHUTDOWN OF THE REACTOR AT 30 YEARS.)
000413      100 FORMAT(I1,F9.3,I4,A1,F10.4)
000414      101 FORMAT(8E10.4,4/4E10.4/2I5,2E10.4,I5)
000415      103 FORMAT(12A6)
000416      104 FORMAT (5F10.3,4I5,F5.0)
000417      105 FORMAT(5F12.2,I5)
000418      106 FORMAT(I1)
000419      200 FORMAT(20H THE BRNUP DATA FOR , 9A6,42H
000420      1 ,F8.4,3H ,A5)
000421      201 FORMAT(84H
000422      1 ,2E11.4,2F6.3,3H ,
000423      2I2/10H ,3E10.3,10H ,E10.3,10H ,E10.3,
000424      3I0H ,2E10.3,20H )
000425      202 FORMAT(132H
000426      1
000427      2 )
000428      203 FORMAT(132H XXXX
000429      1
000430      2 )
000431      204 FORMAT(80H
000432      1 ,4E10.3,10H )
000433      205 FORMAT(E10.3,20H ,E10.3,90H
000434      1
000435      2 )
000436      206 FORMAT(6HTTIM =,F10.2)

```


000437 207 FORMAT(5X,29HY1,Y2,X1,X2,TSTOP,NREGN,NFUEL)
000438 208 FORMAT(8E10.4)
000439 800 FORMAT (F10.0,4I5,F10.0)
000440 810 FORMAT (12F5.0)
000441 END

01/22/69
01/22/69

@ ELT CONSUM,1,691212, 19641

```
000001      SUBROUTINE CONSUM(NMA,ACM)
000002      C
000003      INCLUDE COM1
000004      C
000005      GO TO (1000,2000,3000,5000,5000) , NOP
000006      C
000007      LIFO OPTION
000008      C
000009      1000 DO 1500 II=NMA,1,-1
000010          JJ = NMA-II+1
000011          CONS(JJ) = AMIN1(ACM,TMA(II) )
000012          CUC(JJ) = UCM(II)
000013          TMA(II) = TMA(II) - CONS(JJ)
000014          ACM = ACM - CONS(JJ)
000015          IF (ACM .EQ. 0.0) GO TO 5000
000016      1500 CONTINUE
000017          GO TO 5000
000018      C
000019      C      FIFO OPTION
000020      C
000021      2000 IF (ACM .GT. 0.0) GO TO 2100
000022          CONS(NMA) = ACM
000023          CUC(NMA) = UCM(NMA)
000024          TMA(NMA) = TMA(NMA) - CONS(NMA)
000025          ACM = 0.0
000026          GO TO 5000
000027      2100 DO 2500 II=1,NMA
000028          CONS(II) = AMIN1(ACM,TMA(II) )
000029          CUC(II) = UCM(II)
000030          TMA(II) = TMA(II) - CONS(II)
000031          ACM = ACM - CONS(II)
000032          IF (ACM .EQ. 0.0) GO TO 5000
000033      2500 CONTINUE
000034          GO TO 5000
000035      C
000036      C      WEIGHTED-AVERAGE OPTION
000037      C
000038      3000 IF (NMA .GT. 1) GO TO 3500
000039          CUC(1) = UCM(1)
000040          CONS(1) = ACM
000041          TMA(1) = TMA(1) - ACM
000042          ACM = 0.0
000043          GO TO 5000
000044      3500 CUC(3) = (ABS(TMA(1)*UCM(1)) + ABS(TMA(2)*UCM(2))) /
```

```

000045      1 (ABS(TMA(1)) + ABS(TMA(2)))
000046      UCM(3) = CUC(3)
000047      CONS(3) = ACM
000048      TMA(3) = TMA(1) + TMA(2) - ACM
000049      TMA(1) = 0.0
000050      TMA(2) = 0.0
000051      ACM = 0.0
000052      NMA = 3
000053      GO TO 5000
000054 5000 RETURN
000055      END

```

@ ELT CONVRT,1,691212, 19646

000001	C	ROUTINE TO READ 7090 TAPE WITH NTRAN AND CONVERT INFO	CONV 010
000002		SUBROUTINE CONVRT (MARRAY)	CONV 020
000003	C		CONV 030
000004	C	COMMON FOR PACTOLUS PROGRAM	040
000005		INCLUDE COM1	050
000006		DIMENSION MARRAY(150),LARRAY(150)	CONV 090
000007	C		CONV 100
000008		CALL NTRAN (LTB,2,150,LARRAY,LSTAT)	CONV 250
000009	270	IF (LSTAT.EQ.-1) GO TO 270	CONV 270
000010		IF (LSTAT.LT.0) GO TO 870	CONV 290
000011	C		CONV 300
000012	C	PUT HEADING INFO INTO ARRAY1 OR ISOTOPE INFO INTO ARRAY	CONV 310
000013		NWDS = FLD(3,15,LARRAY(2))	CONV 315
000014		DO 330 I = 1,NWDS	CONV 320
000015	330	MARRAY(I) = LARRAY(I+2)	CONV 330
000016	C	CONVERT HEADING AND ISOTOPE INFO	CONV 340
000017		FLD(1,35,MARRAY(1)) = FLD(3,15,MARRAY(1))	CONV 350
000018		IF (NWDS.LE.1) GO TO 900	CONV 355
000019		MARRAY(2) = FLD(3,15,MARRAY(2))	CONV 360
000020		MARRAY(3) = FLD(3,15,MARRAY(3))	CONV 370
000021		CALL NCNVRT(MARRAY(4),MARRAY(4),1,3)	CONV 380
000022	C		CONV 450
000023	C	CONVERT FORTRAN II INTEGERS, ALPHAMERIC INFO, AND NEG NUMBERS	CONV 460
000024	C		CONV 470
000025	C		CONV 480
000026	C	DETERMINE IF RECORD IS HEADING OR ISOTOPE RECORD	CONV 490
000027		IF (NWDS.GT.120) GO TO 750	CONV 500
000028	C	HEADING RECORD, CONVERT THE HEADING INFO	CONV 540
000029		DO 600 I = 5,17	CONV 590
000030	600	MARRAY(I) = FLD(3,15,MARRAY(I))	CONV 600
000031		DO 620 I = 20,34	CONV 610
000032	620	MARRAY(I) = FLD(3,15,MARRAY(I))	CONV 620
000033		CALL NCNVRT(MARRAY(37),MARRAY(37),48,3)	CONV 640
000034		MARRAY(85) = FLD(3,15,MARRAY(85))	CONV 660
000035		MARRAY(86) = FLD(3,15,MARRAY(86))	CONV 661
000036		MARRAY(87) = FLD(3,15,MARRAY(87))	CONV 662
000037		MARRAY(92) = FLD(3,15,MARRAY(92))	CONV 670
000038		GO TO 900	CONV 720
000039	C		CONV 730
000040	C	ISOTOPE RECORD, CONVERT INFORMATION	CONV 740
000041	750	CONTINUE	CONV 750
000042		DO 770 I = 5,59	CONV 760
000043	770	MARRAY(I) = MAX0(MARRAY(I),0)	CONV 770
000044		GO TO 900	CONV 850

A-30

BNWL-1169

000045	C	WRITE ERROR MESSAGE -- IMPROPER READ	CONV 860
000046		870 WRITE (LTR,880) NRCD,LSTAT,MARRAY(1)	CONV 870
000047		880 FORMAT (1H0 // 25H***** IMPROPER READ AFTER,15, 8H RECORDS,5X,	CONV 880
000048		1 7HLSTAT =,I3,5X,4HM1 =,I3,5X,6H***** //)	CONV 881
000049		IEND = 1	CONV 885
000050		M = 6	CONV 887
000051	C	CONVERT ANY NEGATIVE NUMBERS	CONV 890
000052		900 IF (MARRAY(1).LT.0) MARRAY(1)=-FLD(1,35,MARRAY(1))	CONV 900
000053		RETURN	CONV 970
000054		END	-

@ ELT COSTEQ,1,691212, 19650

000001		SUBROUTINE COSTEQ	
000002	C		PC0 060
000003	C	COMMON FOR POWERCO PROGRAM	PC0 070
000004		INCLUDE COM2	4/14/67R
000005		INCLUDE COM4	12/7/67R
000006	C		PC0 090
000007		BOT=0.	
000008		IF(LL1-1)71,10,71	
000009	10	TOP=PLT+D(11)+WC*(1.-PWV(NY))-PWV(1)*D(18)-PWV(NY)*D(24)	7/26/67R
000010		DO 12 N=1,NY	
000011		TOP=TOP+PWV(N)*(EB(N)-TXR*(EBOLD(N)-EFUOLD(N)+EPOLD(N)+SYD(N))+	12/7/67R
000012	1	D(18))	12/7/67R
000013	12	BOT=BOT+PWV(N)*U(N)	
000014	15	P=TOP/(BOT*(1.-TXR-(1.-TXR)*D(16)))*1.0E+09	5/26/67R
000015		RETURN	
000016	71	TOP=(1.-BND)*(PLT+D(11))+WC*(1.-BND-PWE(NY))-PWE(1)*D(18)	5/26/67R
000017	1	-PWE(NY)*D(24)	7/26/67R
000018		DO 72 N=1,NY	
000019		TOP=TOP+PWE(N)*(EB(N)+TXR*(EFUOLD(N)-EBOLD(N)-EPOLD(N)-SYD(N)	12/7/67R
000020	1	-TAJ(N))+TAL(N)+TAJ(N)+D(18))	4/21/67R
000021	72	BOT=BOT+PWE(N)*U(N)	
000022	73	P=TOP/(BOT*(1.-TXR-(1.-TXR)*D(16)))*1.0E+09	5/26/67R
000023		RETURN	
000024		END	-

@ ELT CTOTL,1,691212, 19654

000001	C	FUNCTION TO SUM THE TOTAL CONCENTRATIONS FOR 20 ISOTOPES	CTOT 010
000002		FUNCTION CTOTL (KINC)	CTOT 020
000003	C		CTOT 025
000004	C	COMMON FOR PACTOLUS PROGRAM	040
000005		INCLUDE COM1	050
000006	C		CTOT 180
000007	C	SUM FOR KTH ISOTOPE RECORD	CTOT 190
000008		K = KINC	CTOT 200
000009		CT = C23(K)*233. + C25(K)*235. + C49(K)*239. + C41(K)*241.	CTOT 220
000010		1 + C02(K)*232. + C28(K)*238. + C24(K)*234. + C40(K)*240.	CTOT 230
000011		2 + C13(K)*233. + C26(K)*236. + C42(K)*242.	CTOT 240
000012		DO 300 I = 12,20	CTOT 280
000013		300 CT = CT + CXX(K,I-11)*FLOAT(MWT(I))	CTOT 300
000014		CTOTL = CT	CTOT 400
000015		RETURN	CTOT 900
000016		END	-

ELT DATAK,1,691212, 19659

000001		SUBROUTINE DATAK	DAT 020
000002	C		DAT 022
000003	C	COMMON FOR POWERCO PROGRAM	055
000004		INCLUDE COM2	055
000005		DATA L1/6/	DAT 060
000006	C		DAT 070
000007	C	ASSIGN PROPER VALUES FOR POWERCO USE	DAT 090
000008		PLT = D(1)	DAT 100
000009		YRS = D(2)	DAT 102
000010		WC = D(3)+D(23)+D(25)	8/07/67R
000011		BND=D(4)	3/27/67R
000012		RRB=D(5)	3/27/67R
000013		RRE=D(6)	3/27/67R
000014		TXR=D(7)*(1,-D(15))+D(15)	4/21/67R
000015		DMW = D(8)	DAT 114
000016		YRD=FLOAT(IFIX(D(9)+0.9999))+0.0000001	2/06/67R
000017		VOU = D(10)	DAT 118
000018		DO 130 K = 1,NY	DAT 125
000019		TAA(K)=0.0	2/01/67R
000020		TAB(K)=0.0	2/01/67R
000021		130 TEH(K)=VOU*PFW(K)+ELM(K)	5/01/67R
000022	C		DAT 140
000023	C	WRITE PAGE HEADINGS	DAT 150
000024		CALL PHDG	DAT 160
000025		WRITE (L1,511)	DAT 170
000026		WRITE(L1,512)	
000027		GO TO (91,92,93,94,45),LL1	
000028		91 WRITE(L1,513)	
000029		GO TO 95	
000030		92 WRITE(L1,514)	
000031		GO TO 95	
000032		93 WRITE(L1,515)	
000033		GO TO 95	
000034		94 WRITE(L1,516)	
000035		GO TO 95	
000036		45 WRITE(L1,575)LL6	3/31/67R
000037		95 IF(LL2-1)96,96,97	
000038		96 WRITE(L1,517)	
000039		GO TO 101	
000040		97 WRITE(L1,518)	
000041		101 WRITE(L1,521)	
000042		WRITE(L1,522)PLT	
000043		WRITE(L1,523)YRS	
000044		WRITE(L1,524)D(3)	3/25/67R

A-34

BNWL-1169

000045	WRITE(L1,525)BND	
000046	WRITE(L1,526)RRB	
000047	IF (BND-0.99995) 103,104,104	3/09/67R
000048	103 WRITE(L1,527)RRE	2/06/67R
000049	GO TO 105	2/06/67R
000050	104 WRITE(L1,570)RRE	3/31/67R
000051	105 WRITE(L1,528)D(7)	4/21/67R
000052	WRITE(L1,529)	
000053	WRITE(L1,530)DMW	
000054	WRITE(L1,531)YRD	
000055	HOLD=D(10)-D(21)	3/31/67R
000056	WRITE(L1,533)D(10)	5/05/67R
000057	WRITE(L1,541)D(11)	
000058	ID14=D(14)+.001	2/14/67R
000059	WRITE(L1,542)ID14	2/14/67R
000060	WRITE(L1,543)	2/14/67R
000061	IF (D(22)) 121,120,121	3/31/67R
000062	120 WRITE(L1,544)D(15)	3/31/67R
000063	WRITE(L1,545)D(16)	3/31/67R
000064	WRITE(L1,546)D(17)	3/31/67R
000065	GO TO 122	3/31/67R
000066	121 WRITE(L1,551)	3/31/67R
000067	WRITE(L1,561)	3/31/67R
000068	122 WRITE(L1,547)D(18)	3/31/67R
000069	WRITE(L1,548)D(19)	3/31/67R
000070	WRITE(L1,549)D(20)	3/31/67R
000071	HOLD=D(21)/D(8)	3/31/67R
000072	WRITE(L1,550)HOLD	3/31/67R
000073	WRITE(L1,552)	3/31/67R
000074	IF (D(22)) 123,124,123	3/31/67R
000075	123 WRITE(L1,553)D(22)	3/31/67R
000076	GO TO 125	3/31/67R
000077	124 WRITE(L1,561)	3/31/67R
000078	125 WRITE(L1,554)D(23)	3/31/67R
000079	WRITE(L1,556)D(24)	7/26/67R
000080	WRITE(L1,557)D(25)	8/07/67R
000081	WRITE(L1,555)D(26)	3/31/67R
000082	WRITE(L1,537)	
000083	WRITE (L1,800) (DES(I),I=1,8)	7/27/67R
000084	WRITE(L1,538)	
000085	INITYR=D(14)-0.99	2/14/67R
000086	DO 102 N=1,NY	
000087	NOWYR=INITYR+N	1/26/67R
000088	CVOU=VOU*PFW(N)	
000089	WRITE(L1,540)N,NOWYR,PFW(N),CURA(N),CFAB(N),CREP(N),CPLU(N),EEE(N)	5/01/67R
000090	1 ,CVOU,BRP(N)	5/01/67R
000091	102 EEE(N)=ELM(N)	5/01/67R
000092	C	DAT 480
000093	C OUTPUT FORMATS	DAT 490

000094	511 FORMAT (15H0INPUT DATA)		DAT 511
000095	512 FORMAT(7H0CARD 1)		
000096	513 FORMAT(31H BOND REPAYMENT PROPORTIONAL)		DAT 513
000097	514 FORMAT(46H BOND REPAYMENT UNIFORM PRINCIPAL REDUCTION)		DAT 514
000098	515 FORMAT(40H BOND REPAYMENT UNIFORM TOTAL PAYMENT)		DAT 515
000099	516 FORMAT(37H BOND REPAYMENT AS SCHEDULED BELOW)		DAT 516
000100	517 FORMAT(30H STRAIGHT LINE DEPRECIATION)		DAT 517
000101	518 FORMAT(36H SUM OF YEARS DIGITS DEPRECIATION)		DAT 518
000102	521 FORMAT(7H0CARD 2)		
000103	522 FORMAT(40H PLANT INVESTMENT, \$M	,F12.4,	4/21/67R
000104	1 4X,19H(INITIAL FINANCING))		4/21/67R
000105	523 FORMAT(40H PROJECT LIFE, YEARS	,F12.4)	1/26/67R
000106	524 FORMAT(40H NONFUEL WORKING CAPITAL, \$M	,F12.4,	4/21/67R
000107	1 4X,19H(INITIAL FINANCING))		4/21/67R
000108	525 FORMAT(43H FRACTION OF INITIAL INVESTMENT IN BONDS,F9.4)		2/06/67R
000109	526 FORMAT(40H BOND INTEREST RATE	,F12.4)	
000110	527 FORMAT(40H EQUITY EARNING RATE (AFTER TAXES)	,F12.4)	4/04/67R
000111	528 FORMAT(40H FEDERAL INCOME TAX RATE	,F12.4)	4/04/67R
000112	529 FORMAT(7H0CARD 3)		
000113	530 FORMAT(40H REACTOR POWER, MWE	,F12.4)	1/26/67R
000114	531 FORMAT(40H DEPRECIABLE LIFE, YEARS	,F12.4)	1/26/67R
000115	533 FORMAT (4X,'NONFUEL VARIABLE OPERATING COST, \$M/YR',	F10.4,	12/12/69
000116	1 4X,'(AT 100% PLANT FACTOR)')		12/12/69
000117	537 FORMAT(40H1ANNUAL INPUT DATA, EXPENSES IN \$M/YR//)		7/27/67R
000118	538 FORMAT(1H0,82X,4HBASE,7X,8HVARIABLE,4X,9HSPECIFIED/18X,4HLOAD,9X,		2/28/67R
000119	14HFUEL,5X,11HFABRICATION,3X,9HREPROCESS,6X,4HU-PU,7X,9HOPERATING,		2/28/67R
000120	24X,9HOPERATING,7X,4HBOND/6X,4HYEAR,7X,6HFACTOR,5X,9HPURCHASES,7X,		2/28/67R
000121	34HCOST,9X,4HCOST,7X,6HCREDIT,9X,4HCOST,9X,4HCOST,7X,8HPAYMENTS/)		2/28/67R
000122	540 FORMAT(1X,I3,I6,8F13.5)		1/26/67R
000123	541 FORMAT(40H INITIAL CORE INVESTMENT, \$M	,F12.4,	4/21/67R
000124	1 4X,19H(INITIAL FINANCING))		4/21/67R
000125	542 FORMAT(1H0/36H FIRST YEAR OF OPERATION	,I11)	2/16/67R
000126	543 FORMAT(7H0CARD 4)		2/16/67R
000127	544 FORMAT(40H STATE INCOME TAX RATE	,F12.4)	3/31/67R
000128	545 FORMAT(40H STATE GROSS REVENUE TAX RATE	,F12.4)	4/21/67R
000129	546 FORMAT(40H PROPERTY TAX RATE	,F12.4)	4/21/67R
000130	547 FORMAT(40H INTERIM CAPITAL REPLACEMENTS, \$M/YR	,F12.4)	5/05/67R
000131	548 FORMAT(40H PROPERTY INSURANCE, \$M/YR	,F12.4)	3/31/67R
000132	549 FORMAT(40H NUCLEAR LIABILITY, \$M/YR	,F12.4)	3/31/67R
000133	550 FORMAT(40H NUCLEAR LIABILITY, \$M/MWYE	,F12.4)	7/26/67R
000134	551 FORMAT (1H0)		3/31/67R
000135	552 FORMAT(7H0CARD 5)		3/31/67R
000136	553 FORMAT(40H STATE AND LOCAL TAXES, \$M/YR	,F12.4)	4/11/67R
000137	554 FORMAT(40H RECOVERABLE COST OF LAND, \$M	,F12.4,	4/21/67R
000138	1 4X,19H(INITIAL FINANCING))		4/21/67R
000139	555 FORMAT(40H REACTOR OPERATING LIFE, YEARS	,F12.4)	3/31/67R
000140	556 FORMAT(40H NET SALVAGE VALUE OF PLANT, \$M	,F12.4)	7/26/67R
000141	557 FORMAT(40H RECOVERABLE MODERATOR AND SALT, \$M	,F12.4,	8/07/67R
000142	1 4X,19H(INITIAL FINANCING))		4/21/67R

000143	561 FORMAT(1H)	3/31/67R
000144	570 FORMAT(40H SUPPLEMENTARY BOND INTEREST RATE ,F12.4)	3/31/67R
000145	575 FORMAT(46H BOND REPAYMENT UNIFORM PRINCIPAL REDUCTION,,	3/31/67R
000146	1 17H STARTING IN YEAR,2X,I2)	3/31/67R
000147	800 FORMAT (27H PROBLEM IDENTIFICATION ,BA6//)	7/27/67R
000148	RETURN	
000149	END	-

Q ELT DEPREC,1,691212, 19663

000001		SUBROUTINE DEPREC	
000002	C		DEP 022
000003	C		PCO 060
000004	C	COMMON FOR POWERCO PROGRAM	PCO 070
000005		INCLUDE COM2	055
000006	C		PCO 090
000007		DO 200 N = 1,NY	DEP 190
000008	200	SYD(N) = 0.0	DEP 200
000009		LDE=YRD+.000001	4/21/67R
000010		GO TO (5,7),LL2	
000011	5	SLD=(PLT-D(24))/YRD	7/26/67R
000012		DO 6 N=2,LDE	5/01/67R
000013	6	SYD(N)=SLD+D(18)/YRD*(YRD-FLOAT(N)+1.)	5/01/67R
000014		SYD(1)=SLD	5/01/67R
000015		SYD(LDE)=SYD(LDE)+D(18)*(YRD-1.)/2.	5/01/67R
000016		GO TO 9	4/21/67R
000017	7	ABB=(PLT-D(24))*2./ (YRD*(YRD+1.))	7/26/67R
000018		PCT=D(18)/PLT	5/01/67R
000019		DO 8 N=2,LDE	5/01/67R
000020		YR=N	5/01/67R
000021	8	SYD(N) = ABB*(1.-PCT*(N-1))*(YRD-N+1) + D(18)	12/12/69
000022		SYD(1) = ABB*YRD	12/12/69
000023		SYD(LDE)=SYD(LDE)+D(18)*(YRD-1.)/3.	5/01/67R
000024	9	RETURN	5/01/67R
000025		END	-

A-38

BNWL-1169

ELT DHDG,1,691212, 19666

000001	C	ROUTINE TO WRITE HEADING LINES FOR DOCUMENTATION LIST	DHDG 002
000002		SUBROUTINE DHDG	DHDG 005
000003	C		DHDG 007
000004	C		DHDG 020
000005		COMMON /TAPES/LTB,LTI,LTR	025
000006		COMMON /ADATE/ADATE(3),LSW,KARD(15)	030
000007		DATA NPAG/0/	DHDG 080
000008	C		DHDG 150
000009		NPAG = NPAG + 1	DHDG 160
000010		WRITE (LTR,200) ADATE,NPAG	DHDG 190
000011	200	FORMAT (1H1, 19X, 44HDOCUMENTATION OF THE PACTOLUS PROGRAM AS OF ,	DHDG 200
000012	1	3A6, 10X, 4HPAGE,I4 //)	DHDG 210
000013		LSW = 0	DHDG 300
000014		RETURN	DHDG 500
000015		END	-

000001 DECEMBER, 1969

000002
000003
000004
000005
000006
000007
000008
000009
000010
000011
000012
000013
000014
000015
000016
000017
000018
000019
000020
000021
000022
000023
000024
000025
000026
000027
000028
000029
000030
000031
000032
000033
000034
000035
000036
000037
000038
000039
000040
000041
000042
000043
000044

```

XXXXX   XX   XXXX   XXXXXXX   XXX   X   X   X   XXXX
X   X   X   X   X   X   X   X   X   X   X   X   X
X   X   X   X   X   X   X   X   X   X   X   X   X
X   X   X   X   X   X   X   X   X   X   X   X   X
XXXXXX   XXXXX   X   X   X   X   X   X   X   X   X
X   X   X   X   X   X   X   X   X   X   X   X   X
X   X   X   X   X   X   X   X   X   X   X   X   X
X   X   X   XXXX   X   XXX   XXXXXX   XXX   XXXX

```

TABLE OF CONTENTS

USERS INSTRUCTIONS FOR THE PACTOLUS PROGRAM	PAGE 3
PACTOLUS CARD FORMATS	PAGE 4
DESCRIPTION OF SUBROUTINES	PAGE 9
DESCRIPTION OF PROGRAM LOGIC	PAGE 11
DESCRIPTION OF PACTOLUS COMMON VARIABLES	PAGE 12
SAMPLE INPUT AND SAMPLE RUN WITH OUTPUT	PAGE 21

000045
 000046
 000047
 000048
 000049
 000050
 000051
 000052
 000053
 000054
 000055
 000056
 000057
 000058
 000059
 000060
 000061
 000062
 000063
 000064
 000065
 000066
 000067
 000068
 000069
 000070
 000071
 000072
 000073
 000074
 000075
 000076
 000077
 000078
 000079
 000080
 000081
 000082
 000083
 000084
 000085
 000086
 000087
 000088
 000089
 000090
 000091
 000092
 000093

USERS INSTRUCTIONS FOR THE PACTOLUS PROGRAM

THE PACTOLUS CODE MAY BE USED IN ANY ONE OF THE THREE FOLLOWING WAYS.

1

THE PACTOLUS INPUT CARDS SHOULD BE PLACED BEHIND THE CONTROL CARDS, USING AN XQT PACTLS. THIS WILL EXECUTE AND OUTPUT THE NORMAL PACTOLUS REPORTS. A BURNUP TAPE IS REQUIRED AS INPUT ON CHANNEL H.

2

THE LAST PART OF PACTOLUS, COMPRISING THE COST OF POWER (POWERCO) SUBROUTINES, MAY BE RUN SEPARATELY. THE INPUT CARDS WHICH INCLUDE THE ANNUAL CASH FLOWS SHOULD BE PLACED BEHIND THE CONTROL CARDS, USING AN XQT POWER. THIS WILL EXECUTE AND OUTPUT ONLY THE POWERCO REPORTS.

3

THE PACTOLUS DOCUMENTATION CAN BE PRODUCED USING AN XQT PDOC. PRECEDED BY A DAT DOCMNT, 2 CARD. PDOC CALLS SUBROUTINE DHDG TO WRITE PAGE HEADINGS, AND USES THE UPD PROCESSOR, DOCMNT, AS DATA. PDOC ALSO CALLS SUBROUTINE PCTLUS WHICH EXECUTES THE SAMPLE DATA AND OUTPUTS THE NORMAL PACTOLUS AND POWERCO OUTPUT. A BURNUP TAPE ON CHANNEL H IS REQUIRED AS INPUT.

PACTOLUS CARD FORMATS

COLUMNS

CARD NUMBER 1 --- IDENTIFICATION AND LOAD FACTORS (A6,12F5.0)		
PPNO	- CASE IDENTIFICATION	1-6
X2(1)	- FIRST TIME ON LOAD FACTOR CURVE, YR.	7-11
Y2(1)	- FIRST LOAD FACTOR AT TIME X2(1), FRACTION	12-16
X2(2)	- SECOND TIME ON LOAD FACTOR CURVE, YR.	17-21
Y2(2)	- SECOND LOAD FACTOR AT TIME X2(2), FRACTION	22-26
. NUMBER OF LOAD FACTOR POINTS MAY BE 6 OR LESS.		
.		
X2(6)	- SIXTH TIME ON LOAD FACTOR CURVE, YR.	57-61
Y2(6)	- SIXTH LOAD FACTOR AT TIME X2(6), FRACTION	62-66
CARD NUMBER 2 --- CONTROL CARD (18I3,2I4,3A6)		
IRCVR	- CURRENTLY NOT USED	1-3
NCR	- NUMBER OF INITIAL CORE REGIONS (I3)	4-6

000094	NBR	- NUMBER OF INITIAL BLANKET REGIONS (I3)	7-9
000095	IHDG	- HEADER SWITCH, NUMBER OF HEADING CARDS TO BE READ	10-12
000096	IPR	- DEBUG SWITCH, 0=NO DEBUG PRINTOUT, 1=SOME, 9=ALL PR OUT (I3)	13-15
000097	NRELD	- NUMBER OF BATCHES IN RELOAD	16-18
000098	IECON	- SPECIAL OPTION FOR READING ECON CARDS IN A DIFFERENT FORMAT	19-21
000099	IMFOS	- 0, NUCLEAR PLANT OPERATION	22-24
000100		- 1, FOSSIL PLANT OPERATION	
000101	NCDS	- NUMBER OF ECONOMICS PARAMETER CARDS (I3)	25-27
000102	I90	- TAPE SWITCH, 0=1108 TAPE, 90=7090 TAPE, -1=BLOCKED 1108 TAPE	28-30
000103	ITAP	- TAPE UNIT FOR DAEDALUS TAPE OUTPUT	31-33
000104	ISEP	- 0, REPROCESSING AS DESCRIBED CARD 4	34-36
000105		- 1, REPROCESSING COST BASED ON UNIT COSTS ON ECON PARAMETER CARDS (SRATO,BLKSEP)	
000106			
000107	IPU	- 0, PU PRICE IS PRODUCT OF VALUE ON CARD 11 AND PRATIO ON ECON	37-39
000108		PARAMETER CARD	
000109		- 1, PU PRICE IS PRODUCT OF CALCULATED 90% ENRICHED URANIUM	
000110		AND PRATO ON ECON PARAMETER CARD	
000111			
000112		PACTOLUS CARD FORMATS	COLUMNS
000113			
000114	LL1	- BOND REPAYMENT OPTION	40-42
000115		- 01 = PROPORTIONAL CASE	
000116		- 02 = UNIF. PRINCIPAL RED.	
000117		- 03 = UNIFORM ANNUAL PAYMENT	
000118		- 04 = PER INPUT SCHEDULE	
000119		- 05 = DELAYED UNIFORM PRINCIPAL REDUCTION	
000120	LL2	- DEPRECIATION OPTION	43-45
000121		- 01 = STRAIGHT LINE	
000122		- 02 = SUM OF - YEARS DIGITS	
000123	LL6	- DELAYED BOND REPAYMENT OPTIONS. THE NUMBER ENTERED HERE	46-48
000124		- INDICATES THE YEAR IN WHICH BOND REPAYMENT IS TO START.	
000125		- USED ONLY IF LL1 = 05	
000126	IADJ	- 0, USE ALL BATCHES ON BURNUP TAPE	49-51
000127		- 1, USE ONLY BATCHES NECESSARY TO REACH END OF REACTORS LIFETIME	
000128	NOP	- 1, LIFO INVENTORY ACCOUNTING OPTION USED	52-54
000129		- 2, FIFO INVENTORY ACCOUNTING OPTION USED	
000130		- 3, WEIGHTED-AVERAGE INVENTORY ACCOUNTING OPTION	
000131		- 4, STANDARD INVENTORY ACCOUNTING OPTION	
000132		- 5, DIRECT FUEL EXPENSE METHOD	
000133	JCASE	- FIRST BATCH OR CASE TO PROCESS FROM BURNUP TAPE(I4)	55-58
000134	LCASE	- LAST BATCH OR CASE TO PROCESS FROM BURNUP TAPE(I4)	59-62
000135	ADATE	- ALPHABETIC DATE FOR REPORT HEADINGS (3A6)	63-80
000136			
000137		CARD NUMBER 3 --- FABRICATION CARD (10F8,2)	
000138	FCINT	- FIRST CORE INTEREST RATE, FRACTION	1-8
000139	FABBLK	- CURRENTLY NOT USED	9-16
000140	CORLOS	- CORE FABRICATION LOSSES, FRACTION	17-24
000141	BLKLOS	- BLANKET FABRICATION LOSSES--SHOULD BE SAME AS CORE FOR NOW	25-32
000142	SALT	- RECOVERABLE COST OF SALT FOR MSBR OR MSCR, \$	33-40

000143		
000144	CARD NUMBER 4 --- REPROCESSING CARD (10F8.2)	
000145	SEPCST - REPROCESSING PLANT OPERATING COST, \$/DAY	1-8
000146	THRUPT - REPROCESSING PLANT THROUGHPUT, KG/DAY	9-16
000147	REPL0S - REPROCESSING LOSSES, FRACTION	17-24
000148	TSEP - REPROCESSING TIME USED IF ISEP=1 ON CARD 2, DAYS	25-32
000149	THROW - NUMBER OF YEARS BEFORE THROW-AWAY OF DISCHARGE MATERIAL	33-40
000150	THROCG - CHARGE FOR THROW-AWAY MATERIAL, \$/KG	41-48
000151		
000152	PACTOLUS CARD FORMATS	COLUMNS
000153		
000154	CARD NUMBER 5 --- SHIPPING CARD (10F8.2)	
000155	CSHP1 - SHIPPING COST, PRE-FAB, \$/KG	1-8
000156	SHPFAB - SHIPPING TIME, PRE-FAB, DAYS	9-16
000157	CSHP2 - SHIPPING COST, PRE-IRRADIATION, \$/KG	17-24
000158	SHPREA - SHIPPING TIME, PRE-IRRADIATION, DAYS	25-32
000159	CSHP3 - SHIPPING COST, POST-IRRADIATION, \$/KG	33-40
000160	SHPSEP - SHIPPING TIME, POST-IRRADIATION, DAYS	41-48
000161	CSHP4 - SHIPPING COST, POST-SEPARATION, \$/KG	49-56
000162	SHPDES - SHIPPING TIME, POST-SEPARATION, DAYS	57-64
000163	DLSHP1 - SHIPPING COST FOR RECYCLE FUEL, PRE-FAB, \$/KG	65-72
000164	DLSHP2 - SHIPPING COST FOR RECYCLE FUEL, POST-SEPARATION, \$/KG	73-80
000165		
000166	CARD NUMBER 6 --- PLANT CONSTRUCTION COST CARD (10F8.2)	
000167	CSTMOD - MODERATOR COST, \$	1-8
000168	CMLOSS - MODERATOR LOSS RATE, PCT/YR	9-16
000169	CSTCON - COST OF CONTROL SYSTEM, \$	17-24
000170	CSTPR - COST OF PRESSURE VESSEL, \$	25-32
000171	CSTITG - COST OF TURBINES, \$	33-40
000172	CSTHT - COST OF HEAT EXCHANGERS, \$	41-48
000173	CSTRS - COST OF REACTOR SITE PREPARATION, \$	49-56
000174	CSTOTH - ALL OTHER CAPITAL COSTS, INCL CONSTR AND MATRLS, \$	57-64
000175	D(24) - NET SALVAGE VALUE OF PLANT, \$	65-72
000176	D(23) - RECOVERABLE LAND COST, AS PART OF WORKING CAPITAL, \$	73-80
000177		
000178	CARD NUMBER 7 --- REACTOR OPERATION AND FINANCING (10F8.2)	
000179	EFF - THERMAL-TO-ELECTRICAL CONVERSION EFFICIENCY, FRACTION	1-8
000180	CYR - PLANT BASE OPERATING COST, \$/YR.	9-16
000181	CVARYR - VARIABLE PLANT OPERATING COST(MULTIPLY BY LOAD FACTOR TO OBTAIN	17-24
000182	YEARLY COST) \$/YR	
000183	D(18) - INTERIM CAPITAL REPLACEMENTS, FRACTION OF PLANT INVESTMENT/YR	25-32
000184	D(3) - NON-FUEL WORKING CAPITAL, \$	33-40
000185	D(4) - FRACTION OF INITIAL INVESTMENT IN BONDS	41-48
000186	D(5) - INTEREST RATE ON BONDS, FRACTIONAL	49-56
000187	D(6) - EARNING RATE ON EQUITY (AFTER TAXES), FRACTIONAL	57-64
000188	- (BLANK)	65-72
000189	- (BLANK)	73-80
000190		
000191	PACTOLUS CARD FORMATS	COLUMNS

000192			
000193		CARD NUMBER 8 --- INSURANCE AND TAXES	(10F8.2)
000194	CINS	- NUCLEAR LIABILITY INSURANCE, \$/YR	1- 8
000195	D(21)	- NUCLEAR LIABILITY INSURANCE, \$/MWEY	
000196	D(19)	- PROPERTY INSURANCE, FRACTION OF PLANT INVESTMENT/YR	17-24
000197	TIMD	- FRACTION OF YEAR TO DISCOUNT ANNUAL EXPENSES	25-32
000198		- (BLANK)	33-40
000199	D(7)	- FEDERAL INCOME TAX RATE, FRACTIONAL	41-48
000200	D(15)	- STATE INCOME TAX RATE, FRACTIONAL	49-56
000201	D(16)	- STATE GROSS REVENUE TAX RATE, FRACTIONAL	57-64
000202	D(17)	- PROPERTY TAX ON PLANT + INITIAL CORE, FRACTIONAL/YR	65-72
000203	D(22)	- TOTAL NON-FED TAXES, IF NOT STATED SEPARATELY, \$/YR	73-80
000204			
000205		CARD NUMBER 9 --- PROCESS AND STARTUP TIMES	(10F8.2)
000206	TSTART	- REACTOR STARTUP DATE, YR (19XX. OR 20XX.)	1-8
000207	D(9)	- DEPRECIABLE LIFE, YRS	9-16
000208	DCONST	- CONSTRUCTION TIME, YRS	17-24
000209	TFAB	- FABRICATION TIME, DAYS	25-32
000210	PRI	- PRE-REACTOR INVENTORY TIME, DAYS	33-40
000211	COOL	- POST-REACTOR COOLING TIME, DAYS	41-48
000212	TLIFE	- REACTOR OPERATING LIFETIME, YRS.	49-56
000213			
000214		CARD NUMBER 10 --- URANIUM CASCADE PRICES	(12,6X,9F8.2)
000215	IXTL	- 0, USE INPUT TAILS COMPOSITION	1-2
000216		1, CALCULATE OPTIMUM TAILS COMPOSITION	
000217	CS	- COST OF SEPARATIVE DUTY, \$/KG	9-16
000218	CW	- TAILS VALUE, \$/KG	17-24
000219	XT	- TAILS COMPOSITION, FRACTION	25-32
000220	XF	- FEED COMPOSITION, FRACTION	33-40
000221	UCONV	- UF6 CONVERSION CHARGE, \$/KG	41-48
000222	UBUYTM	- URANIUM CONVERSION AND ENRICHMENT TIME, DAYS	49-56
000223			
000224		CARD NUMBER 11 -- STANDARD ISOTOPE PRICE CARD	(11F5.2)
000225	PISO(1)	- U -233 PRICE, \$/GRAM	1-5
000226	PISO(2)	- U -235 PRICE, \$/GRAM	6-10
000227	PISO(3)	- PU-239 PRICE, \$/GRAM	11-15
000228	PISO(4)	- PU-241 PRICE, \$/GRAM	16-20
000229	PISO(5)	- TH-232 PRICE, \$/GRAM	21-25
000230	PISO(6)	- U -238 PRICE, \$/GRAM	26-30
000231	PISO(7)	- U -234 PRICE, \$/GRAM	31-35
000232	PISO(8)	- PU-240 PRICE, \$/GRAM	36-40
000233	PISO(9)	- PA-233 PRICE, \$/GRAM	41-45
000234	PISO(10)	- U -236 PRICE, \$/GRAM	46-50
000235	PISO(11)	- PU-242 PRICE, \$/GRAM	51-55
000236			
000237		PACTOLUS CARD FORMATS	COLUMNS
000238			
000239		CARD NUMBER 12 --- VARIABLE ISOTOPE PRICE CARD	(9(I3,F5.2))
000240	MWT (12)	- ISOTOPE ATOMIC WEIGHT	1-3

000241	PISO(12)	ISOTOPE PRICE, \$/GRAM	4-8
000242	MWT (13)	ISOTOPE ATOMIC WEIGHT	9-11
000243	PISO(13)	ISOTOPE PRICE, \$/GRAM	12-16
000244	MWT (14)	ISOTOPE ATOMIC WEIGHT	17-19
000245	PISO(14)	ISOTOPE PRICE, \$/GRAM	20-24
000246	MWT (15)	ISOTOPE ATOMIC WEIGHT	25-27
000247	PISO(15)	ISOTOPE PRICE, \$/GRAM	28-32
000248	MWT (16)	ISOTOPE ATOMIC WEIGHT	33-35
000249	PISO(16)	ISOTOPE PRICE, \$/GRAM	36-40
000250	MWT (17)	ISOTOPE ATOMIC WEIGHT	41-43
000251	PISO(17)	ISOTOPE PRICE, \$/GRAM	44-48
000252	MWT (18)	ISOTOPE ATOMIC WEIGHT	49-51
000253	PISO(18)	ISOTOPE PRICE, \$/GRAM	52-56
000254	MWT (19)	ISOTOPE ATOMIC WEIGHT	57-59
000255	PISO(19)	ISOTOPE PRICE, \$/GRAM	60-64
000256	MWT (20)	ISOTOPE ATOMIC WEIGHT	65-67
000257	PISO(20)	ISOTOPE PRICE, \$/GRAM	68-72
000258			
000259	-- VARIABLE ECONOMIC PARAMETER CARDS (2-40) (12X,10F6.2,7X,11)		
000260	(SEE NCDS ON CARD 2)		
000261	CORFAB	- CORE FABRICATION COST, \$/KG	13-18
000262	SRATO	- CORE REPROCESSING COST, \$/KG	19-24
000263	PRATO	- PU PRICE RATIO (TO THAT SHOWN ON CARD 11 OR CALCULATED 90% ENRICHED URANIUM PRICE AS DEFINED BY IPU, CARD 2), FRACTION	25-30
000264			
000265	XLDF	- LOAD FACTOR, FRACTION (CURRENTLY NOT USED)	31-36
000266	CFX	- URANIUM FEED PRICE, \$/LB U308	37-42
000267	DELFAB	- ADDITIONAL FABRICATION COST WHEN HANDLING RECYCLE FUELS, \$/KG	43-48
000268	PU233	- U-233 PRICE RATIO (TO THAT SHOWN ON CARD 11), FRACTION	49-54
000269	TIME	- CALENDAR YEAR WHEN THESE PARAMETERS APPLY (19XX. OR 20XX.)	55-60
000270	BLKFAB	- BLANKET FABRICATION COST, \$/KG	61-66
000271	BLKSEP	- BLANKET REPROCESSING COST, \$/KG	67-72
000272	LL9	- IF NON-ZERO ON LAST PARAMETER CARD, WILL CALL POWERCO AGAIN	80
000273			
000274	-- HEADING CARDS -- (SEE IHG ON CARD 1) (13A6,A2)		
000275	(WITH REACTOR IDENTIFICATION SYMBOLS IN COLUMNS 73-76)		
000276	XHDG	- ARRAY OF HEADING INFORMATION FROM HEADING CARDS	1-80
000277			
000278			
000279	DESCRIPTIONS OF SUBROUTINES USED IN PACTOLUS PROGRAM		
000280			
000281	PACTOLUS SUBROUTINES		
000282	PACTLS	- PACTOLUS MAIN PROGRAM	
000283	COM1	- COMMON FOR PACTOLUS ROUTINES	
000284	COM2	- COMMON FOR POWERCO ROUTINES	
000285	COM3	- COMMON FOR FIXED CHARGE ROUTINE IN POWERCO	
000286	COM4	- MISC. COMMON FOR POWERCO	
000287	CALCLF	- CALCULATES LOAD FACTOR AT THE GIVEN TIME	
000288	CFTABL	- WRITE COST FLOW TABLES (THREE PAGES OF PACTOLUS OUTPUT)	
000289	CHNGLF	- CHANGE TIME FROM ONE LOAD FACTOR CURVE TO ANOTHER	

000290 CINPUT - READ IN PACTOLUS INPUT CARDS
 000291 CLEAR - CLEARS N SUCCESSIVE CORE LOCATIONS TO ZERO
 000292 CLOTHO - COMMUNICATES MASS BALANCE DATA TO PACTOLUS
 000293 CONSUM - ALLOCATES CONSUMPTION OF EACH BATCH TO PROPER YEAR
 000294 CONVRT - READS 7090 CREATED TAPE WITH NTRAN AND CONVERTS INFO
 000295 CTOTL - SUM TOTAL CONCENTRATIONS FOR 20 ISOTOPES
 000296 DHOG - PRINT HEADING FOR DOCUMENTATION PRINT-OUT
 000297 FAB - CALCULATE AND STORE FABRICATION COSTS
 000298 FASTLP - SUBROUTINE FORM OF CLOTHO WHICH CALLS PCTLUS
 000299 HDG3 - WRITE SUB-HEADING LINES FOR TABLES 3 AND 4
 000300 HEADR - WRITE HEADER PAGE PRECEDING THE REPORT
 000301 INTAP - READS BURNUP TAPE FROM TAPE TO DRUM
 000302 INVACC - INVENTORY ACCOUNTING ROUTINE
 000303 LOSS - CALCULATE AND STORE LOSSES
 000304 PCTLUS - MAJOR PACTOLUS PROGRAM LOGIC IN SUBROUTINE FORM
 000305 PDOC - MAIN PROGRAM USED FOR DOCUMENTATION PRINT-OUT
 000306 PHDG - SKIP TO A NEW PAGE AND WRITE PAGE HEADINGS
 000307 PHYSIC - CALCULATES AND PRINTS CERTAIN REACTOR PERFORMANCE DATA
 000308 PRICE - CALCULATE AND STORE FUEL VALUES
 000309 PRODC - CALCULATE AND STORE KG PRODUCED AND USED FOR EACH PRODUCT
 000310 READ - READ THE BURNUP INFO FROM MAGNETIC TAPE
 000311 SEP - CALCULATE AND STORE REPROCESSING COSTS
 000312 SHIP - CALCULATE AND STORE SHIPPING COSTS
 000313 SKED - URANIUM CASCADE PRICE SCHEDULE
 000314 SUEZ - MAIN PROGRAM WHICH CALLS FASTLP
 000315 TABL3 - PRINTS QUANTITIES OF FUEL FABRICATED AND REPROCESSED
 000316 TAILS - CALCULATE THE U235 PRICE
 000317 TIMLIB - INTERPOLATE ALL TIME LIBRARIES (VARIABLES THAT VARY WITH TIME)
 000318 TMLIB - INTERPOLATE ONE TIME VARIABLE AS SPECIFIED IN CALL LIST
 000319
 000320
 000321

DESCRIPTIONS OF SUBROUTINE USED IN PACTOLUS PROGRAM

000322 POWERCO SUBROUTINES
 000323
 000324 POWER - MAIN PROGRAM TO USE POWERCO
 000325 BONDPY - CALCULATES BOND REPAYMENT SCHEDULES
 000326 COSTEQ - CALCULATES UNIT COST OF ENERGY
 000327 DATAK - PRINTS DATA INPUT TO POWERCO
 000328 DEPREC - CALCULATES DEPRECIATION
 000329 EXPENS - CALCULATES PRORATED FUEL EXPENSES
 000330 FACTRS - CALCULATES PRESENT WORTH FACTORS
 000331 FIXCHG - CALCULATES FIXED CHARGE RATES AND BREAKDOWN OF UNIT ENERGY COSTS
 000332 INPUT - READ INPUT DATA IF EXECUTING POWERCO WITHOUT PACTOLUS
 000333 OUTPUT - WRITES ANNUAL INCOME STATEMENT AND BALANCE SHEET INFORMATION
 000334 PAYOUT - CALCULATES ANNUAL INCOME STATEMENT AND BALANCE SHEET INFORMATION
 000335 POWERCO - POWERCO MAIN PROGRAM IN SUBROUTINE FORM
 000336
 000337
 000338

DESCRIPTION OF THE PACTOLUS PROGRAM

000339
 000340
 000341
 000342
 000343
 000344
 000345
 000346
 000347
 000348
 000349
 000350
 000351
 000352
 000353
 000354
 000355
 000356
 000357
 000358
 000359
 000360
 000361
 000362
 000363
 000364
 000365
 000366
 000367
 000368
 000369
 000370
 000371
 000372
 000373
 000374
 000375
 000376
 000377
 000378
 000379
 000380
 000381
 000382
 000383
 000384
 000385
 000386
 000387

PURPOSE

THE PURPOSE OF THE PACTOLUS PROGRAM IS TO CALCULATE CASH AND MATERIAL FLOWS AND NUCLEAR POWER COSTS FROM AN INPUT TAPE OF BURNUP INFORMATION AND ASSOCIATED DATA CARDS.

PROGRAM

THE PACTOLUS MAIN PROGRAM FIRST ASSIGNS TAPE UNITS TO BE USED AND THEN CALLS IN SUBROUTINE PCTLUS TO EXECUTE THE MAIN PROGRAM LOGIC FOR ONE GROUP OF INPUT CARDS. IF SUCCESSIVE CASES ARE TO BE RUN, SUBROUTINE PCTLUS IS CALLED FOR EACH CASE UNTIL ALL CASES HAVE BEEN PROCESSED.

SUBROUTINE PCTLUS FIRST CALLS SUBROUTINE CINPOT TO READ IN ALL INPUT CARDS FOR THE CASE BEING PROCESSED. THEN PROPER VARIABLES AND COUNTERS ARE INITIALIZED TO ZERO. SUBROUTINE READ IS THEN CALLED TO READ IN A BURNUP RECORD AND ALL ASSOCIATED ISOTOPE RECORDS FROM THE BURNUP TAPE AND STORE THIS INFORMATION IN THE PROPER ARRAYS. THEN SUBROUTINES FAB, SEP, SHIP, PRICE, LOSS, AND PRODCOT ARE CALLED TO CALCULATE AND STORE COST AND PRODUCT INFORMATION INTO THE REPORTING ARRAYS. THE PROGRAM THEN TRANSFERS BACK TO THE CALL TO SUBROUTINE READ AND THE PROCESS IS REPEATED UNTIL ALL RECORDS FOR THE PARTICULAR CASE HAVE BEEN READ. WHEN READING HAS TERMINATED, SUBROUTINES CFTABL AND TABL3 ARE CALLED TO WRITE THE CASH FLOW AND PRODUCT USAGE REPORTS, AND COMMON ARRAYS FOR THE POWERCO PROGRAM ARE FILLED. SUBROUTINE PWRCO IS THEN CALLED WHICH EXECUTES THE POWERCO PROGRAM LOGIC AND OUTPUTS THE NORMAL POWERCO REPORTS. SUBROUTINE PCTLUS THEN RETURNS TO THE MAIN PROGRAM.

DEBUG PRINT-OUT CAN BE OBTAINED IN VARIOUS PLACES DEPENDING ON SWITCH IPR ON THE FIRST INPUT CARD.

IPR=0 - NO DEBUG PRINT-OUT
 IPR=1 - ONE LINE PRINT-OUT FOR EACH HEADING RECORD
 IPR=2 - 31 LINES P-0 FOR EACH HDG RCD, FAB-SEP-TAILS-PRICE-LOSS INFO
 IPR=9 - ALL ABOVE INFO PLUS ADDITIONAL 60-90 LINES OF SKED INFO

DESCRIPTIONS OF PACTOLUS COMMON VARIABLES

DIM BLOCK

LTB	- LOGICAL TAPE UNIT FOR BURNUP TAPE	TAPES
LTI	- LOGICAL TAPE UNIT FOR CARD INPUT	TAPES
LTR	- LOGICAL TAPE UNIT FOR REPORT OUTPUT	TAPES
J	- COUNTER FOR ISOTOPE RECORDS READ FOR EACH HDG RECORD	XREAD
NSTEP	- NOT USED	XREAD
SUMT	- SUM OF ISOTOPE CONCENTRATIONS FOR THIS ISOTOPE RECORD	XREAD
SUMT1	- SUM OF ISOTOPE CONCENTRATIONS FOR FIRST ISOTOPE RECORD	XREAD
SMCX	- SUM OF ISOTOPE CONC FOR FIRST ISOTOPE RCD (C ARRAY)	XREAD

000388	SMDX	- SUM OF ISOTOPE CONC FOR FIRST ISOTOPE RCD (D ARRAY)		XREAD
000389	N3	- FINAL NUMBER OF ISOTOPE RECORDS FOR EACH HDG RECORD		XREAD
000390	NSW	- NOT USED		XREAD
000391	IEND	- END PROCESSING SWITCH (IEND=1, END PROCESSING)		XREAD
000392				
000393	C23	- CONCENTRATION OF U233 FOR EACH ISOTOPE RECORD	60	CXX
000394	C25	- CONCENTRATION OF U235 FOR EACH ISOTOPE RECORD	60	CXX
000395	C49	- CONCENTRATION OF PU239 FOR EACH ISOTOPE RECORD	60	CXX
000396	C41	- CONCENTRATION OF PU241 FOR EACH ISOTOPE RECORD	60	CXX
000397	C02	- CONCENTRATION OF TH232 FOR EACH ISOTOPE RECORD	60	CXX
000398	C28	- CONCENTRATION OF U238 FOR EACH ISOTOPE RECORD	60	CXX
000399	C24	- CONCENTRATION OF U234 FOR EACH ISOTOPE RECORD	60	CXX
000400	C40	- CONCENTRATION OF PU240 FOR EACH ISOTOPE RECORD	60	CXX
000401	C13	- CONCENTRATION OF PA233 FOR EACH ISOTOPE RECORD	60	CXX
000402	C26	- CONCENTRATION OF U236 FOR EACH ISOTOPE RECORD	60	CXX
000403	C42	- CONCENTRATION OF PU242 FOR EACH ISOTOPE RECORD	60	CXX
000404	CXX	- CONCENTRATIONS OF 9 ISOTOPES FOR EACH ISOTOPE RCD	60,9	CXX
000405	DXX	- FAKE CONC OF 9 ISOTOPES FOR EACH ISOTOPE RCD	60,9	CXX
000406	D23	- FAKE CONC OF U233 FOR EACH ISOTOPE RECORD	60	CXX
000407	D25	- FAKE CONC OF U235 FOR EACH ISOTOPE RECORD	60	CXX
000408	D49	- FAKE CONC OF PU239 FOR EACH ISOTOPE RECORD	60	CXX
000409	D41	- FAKE CONC OF PU241 FOR EACH ISOTOPE RECORD	60	CXX
000410	D02	- FAKE CONC OF TH232 FOR EACH ISOTOPE RECORD	60	CXX
000411	D28	- FAKE CONC OF U238 FOR EACH ISOTOPE RECORD	60	CXX
000412	D24	- FAKE CONC OF U234 FOR EACH ISOTOPE RECORD	60	CXX
000413	D40	- FAKE CONC OF PU240 FOR EACH ISOTOPE RECORD	60	CXX
000414	D13	- FAKE CONC OF PA233 FOR EACH ISOTOPE RECORD	60	CXX
000415	D26	- FAKE CONC OF U236 FOR EACH ISOTOPE RECORD	60	CXX
000416	D42	- FAKE CONC OF PU242 FOR EACH ISOTOPE RECORD	60	CXX
000417	TIM	- TIMES FOR EACH ISOTOPE RCD IN DAYS	60	CXX
000418	EX	- EXPOSURE FOR EACH ISOTOPE RCD	60	CXX
000419	VF	- MASS FRACTION ARRAY (ONLY VF(1) IS USED)	24	CXX
000420				
000421		DESCRIPTIONS OF PACTOLUS COMMON VARIABLES		DIM BLOCK
000422				
000423	M1	= CODE -- 0=GOOD HEADING RCD, -1=END OF TAPE		HED
000424	MC	- CARDS 8 + 9 FROM ALTHAEA--IDENT IS 2ND	EGV TO ARRAY1 2	35 HED
000425		- AND 3RD NO.S IN THIS ARRAY		
000426	AHGD	- ALPHABETIC HEADINGS FOR EACH PAGE - RCD		13 HED
000427	ANAM	- NAMES OF ISOTOPES - RCD		35 HED
000428	N11	- NUMBER OF ISOTOPES IN GROUP 1	EGV TO ARRAY1 85	HED
000429	N12	- NUMBER OF ISOTOPES IN GROUP 2	EGV TO ARRAY1 86	HED
000430	N13	- NUMBER OF ISOTOPES IN GROUP 3	EGV TO ARRAY1 87	HED
000431	FTEMP	- FUEL TEMP	EGV TO ARRAY1 88	HED
000432	SDPV	- DESC OF SPECTRUM -- SEE ALTHAEA INPUT	EGV TO ARRAY1 89	HED
000433	TNL	- THERMAL NON LEAKAGE FACTOR	EGV TO ARRAY1 90	HED
000434	TMOD	- MODERATOR TEMP	EGV TO ARRAY1 91	HED
000435	IE	- NO. OF ISOTOPE UNIQUELY RESPONSIBLE FOR FAST EFFECT	92	HED
000436	SCA	- EPITHERMAL EFF MACRO POTENTIAL (SCATTER X-SECT)	93	HED

000437	PWI	- POWER, MW/TON	EQV TO ARRAY1	94	HED
000438	DENS	- G4/CC OF METAL FUEL	EQV TO ARRAY1	95	HED
000439	XK	- CONV. FACTOR	EQV TO ARRAY1	96	HED
000440	TSNF	- MACRO NON-FUEL X-SECT	EQV TO ARRAY1	97	HED
000441	JASON	- NUMBERS COMMUNICATED FROM JASON	EQV TO ARRAY1	98	13 HED
000442	BMULT1	- MINIMUM K	EQV TO ARRAY1	111	HED
000443	RKG	- INITIAL TONS OF FUEL IN REGION (CONV TO KG)	EQV TO ARRAY1	112	HED
000444	RTP	- REACTOR POWER	EQV TO ARRAY1	113	HED
000445	ICOR	- DISCHARGE SWITCH, 1=BLANKET, 0=CORE			HED
000446	HDM	- DUMMY FIELDS TO FILL OUT HEADING RCD TO 150 WORDS			37 HED
000447	RKGF	- FINAL TONS OF FUEL IN REGION (CONV TO KG)			HED
000448	PPNO	- REACTOR IDENTIFICATION			HED

SUBROUTINE READ READS THE BURNUP TAPE HEADING
RECORDS INTO ARRAY1(150) EQUIVALENCED TO M1.

DESCRIPTIONS OF PACTOLUS COMMON VARIABLES

DIM BLOCK

000456	M	- RECORD IDENT SWITCH, 1=NORMAL ISOTOPE RCD, 3=LAST RCD			ISOTP
000457	NREC	- RECORD SEQUENCE NUMBER	EQV TO ARRAY	2	ISOTP
000458	ACASE	- IDENTIFICATION INTEGER	EQV TO ARRAY	3	ISOTP
000459	BCASE	- IDENTIFICATION CHARACTER	EQV TO ARRAY	4	ISOTP
000460	YC	- ISOTOPE CONC (1-35), FAKES (36-55)	EQV TO ARRAY	5	55 ISOTP
000461	XA	- MICRO ABS X-SECT	EQV TO ARRAY	60	35 ISOTP
000462	ZA	- MICRO FISSION X-SECT	EQV TO ARRAY	95	30 ISOTP
000463	XM	- INSTANTANEOUS K INFINITY	EQV TO ARRAY	115	ISOTP
000464	AM	- GRADED K INFINITY	EQV TO ARRAY	116	ISOTP
000465	RZ	- PHYSICS DATA NOT USED	EQV TO ARRAY	117	ISOTP
000466	RID	- PHYSICS DATA NOT USED	EQV TO ARRAY	118	ISOTP
000467	FFF	- PHYSICS DATA NOT USED	EQV TO ARRAY	119	ISOTP
000468	ETA	- EFF NEUTRONS PRODUCED PER FISSION	EQV TO ARRAY	120	ISOTP
000469	F	- THERMAL UTILIZATION	EQV TO ARRAY	121	ISOTP
000470	PE	- RESONANCE ESCAPE PROBABILITY	EQV TO ARRAY	122	ISOTP
000471	EPS	- FAST EFFECT	EQV TO ARRAY	123	ISOTP
000472	ABSOR	- TOTAL MACRO ABS X-SECT	EQV TO ARRAY	124	ISOTP
000473	ABFIS	- TOTAL MACRO FISSION X-SECT	EQV TO ARRAY	125	ISOTP
000474	SUMA	- N-2N X-SECT	EQV TO ARRAY	126	ISOTP
000475	PMIN	- MIN TO AVG POWER (OR FLUX)	EQV TO ARRAY	127	ISOTP
000476	PMAX	- MAX TO AVG POWER (OR FLUX)	EQV TO ARRAY	128	ISOTP
000477	TNEUT	- NEUTRON	EQV TO ARRAY	129	ISOTP
000478	THT	- FLUX	EQV TO ARRAY	130	ISOTP
000479	PWAV	- AVG FLUX FOR CONSTANT POWER	EQV TO ARRAY	131	ISOTP
000480	TIME	- TIME FOR THIS ISOTOPE RECORD	EQV TO ARRAY	132	ISOTP
000481	EXPOS	- EXPOSURE FOR THIS ISOTOPE RECORD	EQV TO ARRAY	133	ISOTP
000482	FRACT	- REGIONS MASS FRACTION OF THE CORE	EQV TO ARRAY	132	ISOTP
000483	CUREFF	- KEFF FOR PREVIOUS TIME STEP	EQV TO ARRAY	133	ISOTP
000484	CURTIM	- CURRENT AVG KEFF	EQV TO ARRAY	134	ISOTP
000485	IDM	- DUMMY FIELDS TO FILL OUT ISOTOPE RECORD TO 150 WORDS			14 ISOTP

000486
 000487
 000488
 000489
 000490
 000491
 000492
 000493
 000494
 000495
 000496
 000497
 000498
 000499
 000500
 000501
 000502
 000503
 000504
 000505
 000506
 000507
 000508
 000509
 000510
 000511
 000512
 000513
 000514
 000515
 000516
 000517
 000518
 000519
 000520
 000521
 000522
 000523
 000524
 000525
 000526
 000527
 000528
 000529
 000530
 000531
 000532
 000533
 000534

SUBROUTINE READ READS THE BURNUP TAPE ISOTOPE
 RECORDS INTO ARRAY(150) EQUIVALENCED TO M.

DESCRIPTIONS OF PACTOLUS COMMON VARIABLES		DIM	BLOCK
IRCVR	- DUMMY FOR NOW		CD1
NCR	- NUMBER OF INITIAL CORE REGIONS (I3)		CD1
NBR	- NUMBER OF INITIAL BLANKET REGIONS (I3)		CD1
IHDG	- HEADER SWITCH, 0=		CD1
IPR	- DEBUG SWITCH, 0=NO DEBUG PRINTOUT, 2=ALL PR OUT (I3)		CD1
JCASE	- FIRST CASE TO BEGIN PROCESSING (I4)		CD1
LCASE	- LAST CASE TO PROCESS (I4)		CD1
IS	- TAILS SWITCH		CD1
NCDS	- NUMBER OF QUICK ECON PARAMETER CARDS (I3)		CD1
I90	- TAPE SWITCH, 0=1108 TAPE, 90=7090 TAPE, -1=BLOCKED 1108 TAPE		CD1
ADATE	- ALPHABETIC DATE FOR REPORT HEADINGS (3A6)	3	CD1
NREG	- NUMBER OF REGIONS IN INITIAL CORE = NCR + NBR		CD1
NCNT	- COUNTER FOR REGIONS		CD1
NRCD	- COUNTER FOR NUMBER OF RECORDS READ		CD1
NYRS	- NUMBER OF YEARS IN REACTOR LIFETIME = FINAL TIM(N3)/365.3		CD1
ITAP	- DAEDALUS OUTPUT TAPE NO		CD1
ISEP	- REPROCESSING OPTIONS		CD1
NRELD	- NUMBER OF BATCHES IN RELOAD		CD1
IPU	- PU PRICE OPTION		CD1
IADJ	- LOAD FACTOR ADJUSTMENT SWITCH		CD1
NOP	- INVENTORY ACCOUNTING SWITCH		CD1
IMFOS	- FOSSIL PLANT SWITCH		CD1
FCINT	- INTEREST RATE ON FIRST CORE COSTS, FRACTION		CD2
FABBLK	- CURRENTLY NOT USED		CD2
CORLOS	- CORE FAB LOSSES, FRACTION		CD2
BLKL0S	- BLANKET FAB LOSSES, FRACTION		CD2
SALT	- SPECIAL MATERIALS, DEPRECIABLE (SALT FOR MSBR OR MSCR), \$		CD2
IECON	- SPECIAL OPTION FOR READING ECON CARDS IN DIFFERENT FORMAT		CD2
SEPCST	- REPROCESSING PLANT OPERATING COST, \$/DAY		CD3
THRUPT	- REPROCESSING PLANT THROUGHPUT, KG/DAY		CD3
REPL0S	- REPROCESSING LOSSES, FRACTION		CD3
CSHP1	- SHIPPING COST, PRE-FAB, \$/KG		CD4
SHPFAB	- SHIPPING TIME, PRE-FAB, DAYS		CD4
CSHP2	- SHIPPING COST, PRE-IRRADIATION, \$/KG		CD4
SHPREA	- SHIPPING TIME, PRE-IRRADIATION, DAYS		CD4
CSHP3	- SHIPPING COST, POST-IRRADIATION, \$/KG		CD4
SHPSEP	- SHIPPING TIME, POST-IRRADIATION, DAYS		CD4
CSHP4	- SHIPPING COST, POST-SEPARATION, \$/KG		CD4
SHPDES	- SHIPPING TIME, POST-SEPARATION, DAYS		CD4
DLSHP1	- SHIPPING COST FOR RECYCLE FUEL, PRE-IRRADIATION, \$/KG		CD4

000535	DLSHP2 - SHIPPING COST FOR RECYCLE FUEL, POST-IRRADIATION, \$/KG	CD4
000536	DESCRIPTIONS OF PACTOLUS COMMON VARIABLES	DIM BLOCK
000537		
000538	CSTMOD - SPECIAL MATERIALS, NON-DEPRECIABLE (MODERATOR COST), \$	CD5
000539	CMLOSS - MODERATOR LOSS RATE, PCT/YR	CD5
000540	CSTCON - REACTOR PLANT EQUIPMENT (CONSTROL SYSTEM COST), \$	CD5
000541	CSTPR - ELECTRIC PLANT EQUIPMENT (PRESSURE VESSEL COST), \$	CD5
000542	CSTTG - TURBINE PLANT EQUIPMENT, \$	CD5
000543	CSTHT - MISCELLANEOUS PLANT EQUIPMENT (HEAT EXCHANGER COSTS), \$	CD5
000544	CSTRS - INDIRECT COSTS (REACTOR SITE COSTS), \$	CD5
000545	CSTOTH - ALL OTHER CAPITAL COSTS, INCL CONSTR AND MATRLS, \$	CD5
000546		
000547	EFF - THERMAL TO ELECTRICAL CONVERSION EFFICIENCY, FRACTION	CD6
000548	CYR - PLANT OPERATING COST, \$/YR	CD6
000549	CINS - INSURANCE, \$/YR	CD6
000550	CVARYR - VARIABLE OPERATING COST, LOAD FACTOR TIMES \$/YR	CD6
000551	TIMD - FRACTION OF YEAR TO DISCOUNT ANNUAL EXPENSES	CD6
000552		
000553	TSTART - REACTOR STARTUP DATE, YR	CD7
000554	TLIFE - REACTOR OPERATING LIFETIME, YRS.	CD7
000555	TCONST - CONSTRUCTION TIME, YRS	CD7
000556	TFAB - FABRICATION TIME, DAYS	CD7
000557	PRI - PRE-REACTOR INVENTORY TIME, DAYS	CD7
000558	COOL - POST-REACTOR INVENTORY TIME, DAYS	CD7
000559		
000560	XF - FEED COMPOSITION, FRACTION	CD8
000561	CS - COST OF SEPARATIVE DUTY, \$/KG	CD8
000562	CW - TAILS VALUE, \$/KG	CD8
000563	XT - TAILS COMPOSITION, FRACTION	CD8
000564	UONV - U308 CONVERSION COST, \$/KG	CD8
000565	IXTL - TAILS SWITCH	CD8
000566		
000567	PISO - PRICES FOR EACH OF 20 ISOTOPES, \$/GM	20 CD9
000568	MWT - ATOMIC WTS FOR EACH OF 20 ISOTOPES	20 CD9
000569	XHDG - ARRAY OF HEADING INFORMATION FROM HEADING CARDS	60 CD9
000570		
000571	CORFAB = CORE FABRICATION COST, \$/KG	40 CD10
000572	SRATO = SEPARATIVE COST RATIO	40 CD10
000573	PRATO = PU PRICE RATIO	40 CD10
000574	XLDF = LOAD FACTOR	40 CD10
000575	CFX = URANIUM FEED COST, \$/LB	40 CD10
000576	PU233 = PRICE RATIO OF U233	40 CD10
000577	TIME = TIME (19XX OR 20XX)	40 CD10
000578	BLKFAB = BLANKET FABRICATION COST, \$/KG	40 CD10
000579	BLKSEP = BLANKET REPROCESSING COST, \$/KG	40 CD10
000580		
000581		
000582	DESCRIPTIONS OF PACTOLUS COMMON VARIABLES	DIM BLOCK
000583		

000584	FPURC = FUEL PURCHASE, \$	TABLE 1	40	YCOSTS
000585	FCRED = FUEL CREDIT, \$	TABLE 1	40	YCOSTS
000586	FABCH = FABRICATION CHARGE, \$	TABLE 1	40	YCOSTS
000587	REPCH = REPROCESSING CHARGE, \$	TABLE 1	40	YCOSTS
000588	PRESHP = PRE-REACTOR SHIPPING CHARGE, \$	TABLE 1	40	YCOSTS
000589	POSTSH = POST-REACTOR SHIPPING CHARGE, \$	TABLE 1	40	YCOSTS
000590	FLOSS = FUEL LOSS CHARGE, \$	TABLE 1	40	YCOSTS
000591	TOTAL = TOTAL CHARGES, \$	TABLE 1	40	YCOSTS
000592	FABLSS = FABRICATION LOSSES, \$		40	YCOSTS
000593	REPLSS = REPROCESSING LOSSES, \$		40	YCOSTS
000594	SHP1 = PRE-FABRICATION SHIPPING CHARGES, \$		40	YCOSTS
000595	SHP2 = POST-FABRICATION SHIPPING CHARGES, \$		40	YCOSTS
000596	SHP3 = PRE-REPROCESSING SHIPPING CHARGES, \$		40	YCOSTS
000597	SHP4 = POST-REPROCESSING SHIPPING CHARGES, \$		40	YCOSTS
000598				
000599	BLREP = BLANKET REPROCESSING CHARGE, \$/KG	TABLE 2	40	CRATES
000600	COREP = CORE REPROCESSING CHARGE, \$/KG	TABLE 2	40	CRATES
000601	BLTIM = BLANKET REPROCESSING TIME, DAYS	TABLE 2	40	CRATES
000602	COTIM = CORE REPROCESSING TIME, DAYS	TABLE 2	40	CRATES
000603	XKGU = TONS OF U308 PURCHASED	TABLE 2	40	CRATES
000604	XKGS = KG SEPARATIVE DUTY	TABLE 2	40	CRATES
000605	XKGUCR = TONS OF U308 CREDIT IN DISCHARGE		40	CRATES
000606	XKGSCR = SEPARATIVE DUTY CREDIT IN DISCHARGE, KG		40	CRATES
000607	XXT = TAILS COMPOSITION, PCT		40	CRATES
000608				
000609	RTONS = TOTAL TONS OF FUEL IN REACTOR			REACT
000610	TSEP = TIME IN SEPARATIONS, DAYS			REACT
000611	VI = TOTAL VALUE OF ALL PURCHASES			REACT
000612	VFF = TOTAL VALUE OF ALL SALES OR CREDITS			REACT
000613	VFR = TOTAL VALUE OF ALL DUMMY FUEL SALES OR CREDITS			REACT
000614	SXM = XM FOR FIRST ISOTOPE GROUP			REACT
000615	CT1 = TOTAL AMOUNT OF ALL ISOTOPES FOR FIRST ISOTOPE RECORD			REACT
000616	CTN3 = TOTAL AMOUNT OF ALL ISOTOPES FOR LAST ISOTOPE RECORD			REACT
000617	DFAB = FIRST CORE FABRICATION CHARGE			REACT
000618	DSHP = FIRST CORE SHIPPING CHARGE			REACT
000619	DPUR = FIRST CORE FUEL PURCHASE COST			REACT
000620	DLOS = FIRST CORE FUEL FABRICATION LOSSES			REACT
000621	DINT = INTEREST CHARGE ON FIRST CORE COST, \$			REACT
000622	VIX = FUEL PURCHASE COST FOR PARTICULAR DISCHARGE			REACT
000623	VFX = VALUE OF DUMMY SALES OR CREDITS FOR THIS DISCHARGE			REACT
000624	VFY = VALUE OF SALES OR CREDITS FOR THIS DISCHARGE			REACT
000625	RFIS = TOTAL KGS OF FISSIONABLE MATERIAL IN REACTOR BEFORE LOSSES			REACT
000626	DESCRIPTIONS OF PACTOLUS COMMON VARIABLES		DIM	BLOCK
000627				
000628	TLIB = TIME LIBRARIES, TABLES OF ITEMS THAT VARY WITH TIME		10,40	TLIB
000629	VLIB = INTERPOLATED VALUES FROM TIME LIBRARIES			TLIB
000630	TIMX = TIME TO USE IN INTERPOLATING TIME LIBRARIES			TLIB
000631				
000632	PRDCT = KG CHARGED		40,20	PRDCT

000633	PRDN3 - KG DISCHARGED	40,20	PRDCT
000634	PFISS - FISSILE PCT		PRDCT
000635	PRDN3A - KG DISCHARGED (DAEDALUS LAG TIME)	40,20	PRDCT
000636	PRDCTA - KG CHARGED (DAEDALUS LEAD TIME)	40,20	PRDCT
000637			
000638	IL - FUEL BATCH COUNTER		TBL3
000639	T8 - DRUM ADDRESS TABLE FOR READING BLOCKED BURNUP TAPES	7	TBL3
000640			
000641	RFTM - RESIDENCE TIME, YRS		TBL5
000642	TMWD - TOTAL MEGAWATT-DAYS FOR LIFETIME		TBL5
000643	AVLDF - AVG. LOAD FACTOR OVER REACTORS OPERATING LIFETIME, FRACTION		TBL5
000644	TU308 - TOTAL U308 CONSUMED, TONS		TBL5
000645	SPAVG - AVERAGE SPECIFIC POWER, MWTH/TONNE		TBL5
000646	SPFP - INITIAL SPECIFIC POWER, MWTH/TONNE		TBL5
000647	SPINV - SPECIFIC INVENTORY, FISSILE KGS/MWE		TBL5
000648	DTEXP - CURRENTLY NOT USED		TBL5
000649	DTLIN - CURRENTLY NOT USED		TBL5
000650	WEPT - TONS OF U308 MINED PER MWE-YR		TBL5
000651	WTHPT - TONS OF U308 MINED PER MWTH-YR		TBL5
000652	GFPT - KGS FISSIONED / TON OF U308 MINED		TBL5
000653	XFT - POSSIBLE FRACTION OF YEAR REACTOR COULD BE OPERATED	40	TBL5
000654	YILDY - YIELD, FISSILE KGS / MWE-YR		TBL5
000655	YILDPU - YIELD, KGS OF PU / MWE-YR		TBL5
000656	YILD23 - YIELD, KGS OF U233 / MWE-YR		TBL5
000657	YILD25 - YIELD, KGS OF U235 / MWE-YR		TBL5
000658	SRKG - TOTAL TONNE OF MATERIAL CHARGED IN REACTOR LIFETIME		TBL5
000659	TSEPD - TOTAL TONNE OF SEPARATIVE DUTY CONSUMED		TBL5
000660	GFAB - KGS FABRICATED / MWE-YR		TBL5
000661	GSDPY - KGS OF SEPARATIVE DUTY / MWE-YR		TBL5
000662	DESCRIPTIONS OF PACTOLUS COMMON VARIABLES		DIM BLOCK
000663			
000664	RATE - DISCOUNT RATE, FRACTION		CALCN
000665	XXLDF - AVERAGE LOAD FACTOR IN EACH YEAR, FRACTION	40	CALCN
000666	UBUYTM - URANIUM ENRICHMENT AND LEAD TIME, DAYS		CALCN
000667	U90PR - PRICE OF 90% ENRICHED URANIUM, \$/KG	40	CALCN
000668	XKGTLC - KGS OF TAILS MATERIAL PURCHASED	40	CALCN
000669	RRK6 - TAIL CREDIT AT DISCHARGE, KGS	40	CALCN
000670	RRKG - MATERIAL CHARGED IN GIVEN YEAR, TONNE	40	CALCN
000671	RRKGF - MATERIAL DISCHARGED IN GIVEN YEAR, TONNE	40	CALCN
000672	PU41IN - PU-241 PRICE USED FOR LOSS CALCULATION ON CHARGES		CALCN
000673	PU41OT - PU-241 PRICE USED FOR LOSS CALCULATION ON DISCHARGES		CALCN
000674			
000675	THROW - NUMBER OF YEARS BEFORE THROW-AWAY OF DISCHARGE MATERIAL		THROWA
000676	THROCG - CHARGE FOR THROW-AWAY MATERIAL, \$/KG		THROWA
000677	FRKG - THROW-AWAY MATERIAL DISCHARGED, KGS		THROWA
000678			
000679	DAED - YEARLY INFORMATION FOR DAEDALUS	2200	DAEDLS
000680	DAED1 - SYSTEMS LIFETIME CHARACTERISTICS FOR DAEDALUS	60	DAEDLS
000681	AVFAB - AVERAGE ANNUAL FABRICATION COST(INCLUDES PRESIPPING), \$/YR		DAEDLS

000682	AVREP - AVERAGE ANNUAL REPROCESSING COST(INCLUDES POSTSHIPPING),\$/YR	DAEDLS
000683	AVOAM - AVERAGE ANNUAL OPERATING AND MAINTENANCE COST, \$/YR	DAEDLS
000684	AVPU - AVERAGE ANNUAL FISSION PU PRODUCTION, KG/YR	DAEDLS
000685	AV23 - AVERAGE ANNUAL U-233 PRODUCTION, KG/YR	DAEDLS
000686	AVU308 - AVERAGE ANNUAL U308 COST, \$/YR	DAEDLS
000687	AVSEPD - AVERAGE ANNUAL SEPARATIVE DUTY COST, \$/YR	DAEDLS
000688	U308PR - U308 PRICE, \$/KG	DAEDLS
000689	IBEGIN - YEARS OF DAEDALUS INFORMATION BEFORE STARTUP	DAEDLS
000690	NYR - YEARS OF DAEDALUS INFORMATION AFTER STARTUP	DAEDL
000691	TCYR - YEAR FOR DAEDALUS	40 DAEDLS
000692	IPCT - CURRENTLY NOT USED	DAEDLS
000693	IZ - TOTAL WORDS OF INFORMATION IN DAED1 ARRAY	DAEDLS
000694	SRKGF - TOTAL TONNE OF MATERIAL DISCHARGED IN REACTOR LIFETIME	DAEDLS
000695	IENDCK - END-OF-LIFE SWITCH FOR READING BURNUP TAPE	DAEDLS
000696	IPC - TOTAL WORDS OF INFORMATION IN DAED ARRAY	DAEDLS
000697	ACVERS - ALTHAEA OR CLOTHO VERSION	DAEDLS
000698	PVERS - PACTOLUS VERSION	DAEDLS

DESCRIPTIONS OF PACTOLUS COMMON VARIABLES

DIM BLOCK

000701		
000702	ACU308 - CONSUMPTION OF U308 BY YEAR, KGS	40 INVCOM
000703	ACSW - CONSUMPTION OF SEPARATIVE WORK BY YEAR, KGS	40 INVCOM
000704	ACFAB - CONSUMPTION OF FABRICATION MATERIAL BY YEAR, KGS	40 INVCOM
000705	ACREP - CONSUMPTION OF SEPARATIONS MATERIAL BY YEAR, KGS	40 INVCOM
000706	ACFPU - CONSUMPTION OF FISSION PLUTONIUM BY YEAR, KGS	40 INVCOM
000707	ACU233 - CONSUMPTION OF U-233 BY YEAR, KGS	40 INVCOM
000708	BINV - INVENTORY BALANCE AT BEGINNING OF YEAR, KGS	30 INVCOM
000709	EINV - INVENTORY BALANCE AT END OF YEAR, KGS	30 INVCOM
000710	TMA - TOTAL MATERIAL AVAILABLE BY UNIT COST, KGS	30 INVCOM
000711	UCM - UNIT COST OF MATERIALS AVAILABLE, \$/KG	30 INVCOM
000712	CONS - NET CONSUMPTION BY UNIT COST, KGS	30 INVCOM
000713	CUC - UNIT COST OF MATERIAL CONSUMED, \$/KG	30 INVCOM
000714	TBINV - TOTAL FUEL INVENTORY VALUE AT BEGINNING OF YEAR, \$	40 INVCOM
000715	TPURCH - TOTAL FUEL PURCHASES DURING YEAR, \$	40 INVCOM
000716	TCONS - TOTAL FUEL CONSUMPTION DURING YEAR, \$	40 INVCOM
000717	TSALES - TOTAL FUEL SALES OR CREDIT DURING YEAR, \$	40 INVCOM
000718	TADJ - TOTAL FUEL INVENTORY ADJUSTMENTS DURING YEAR, \$	40 INVCOM
000719	TEINV - TOTAL FUEL INVENTORY VALUE AT END OF YEAR, \$	40 INVCOM
000720	INVOPT - NUMBER OF FUEL INVENTORY ADJUSTMENTS DURING LIFETIME	INVCOM

SAMPLE INPUT

COLUMNS

```
0000000001111111112222222222333333333344444444445555555555666666666677777777778
1234567890123456789012345678901234567890123456789012345678901234567890
```

NOTE: THE SYMBOL (Δ) IN COL. 1 REPRESENTS A 7-8 PUNCH.

000721				
000722				
000723				
000724				
000725				
000726				
000727				
000728				
000729	Δ RUN	5,CUS550,2,100	D. R. HAFFNER	SAMPLE RUN
000730	ΔRX ASG	A=U2780		

000731
000732
000733
000734
000735
000736
000737
000738
000739
000740
000741
000742
000743
000744
000745
000746
000747
000748
000749
000750
000751
000752
000753
000754
000755
000756
000757
000758
000759
000760
000761
000762
000763
000764
000765
000766
000767
000768
000769
000770
000771
000772
000773
000774
000775
000776
000777

```

ΔRX ASG H=U9302
Δ XQT CUR
IN A
IN A
TRI A
Δ XQT PACTLS
WU3H 0.0 .80 15. .80 30. .55
0 3 0 2 0 2 -1 0 1 0 01 02 0 1 4 STANDARD COST
.07 .0045 .0045 0
.0045 30.
32. .55 10. 3.59 32. 30. .45
1.684E8
.325 1.003 E6 .810E6 .0035 .52 .0423 0.10
332000. .0025 .50 .03 .04 .032
1970. 30. 3.0 25. 30. 150. 30.0
1 26.00 0. .00711 2.50 162.
14.0 10.0 10.0.0125
237 241 243 242 242 243 244 238
91.67 42.50 .917 6.25 16.0 1.0 1965.
39.67 23.00 .917 12.60 16.0 1.0 2004.
HEADING CARD NUMBER ONE
HEADING CARD NUMBER TWO

Δ XQT CUR
TRI H
Δ FIN

A RUN USING THE ABOVE SAMPLE DATA WILL BE EXECUTED (XQT PACTLS), AND THE
NORMAL PACTOLUS OUTPUT WILL FOLLOW.
END OF PRINTED DATA
WU3H 0.0 .80 15. .80 30. .55
0 3 0 2 0 2 -1 0 1 0 01 02 0 1 4 STANDARD COST
.07 .0045 .0045 0
.0045 30.
32. .55 10. 3.59 32. 30. .45
1.684E8
.325 1.003 E6 .810E6 .0035 .52 .0423 0.10
332000. .0025 .50 .03 .04 .032
1970. 30. 3.0 25. 30. 150. 30.0
1 26.00 0. .00711 2.50 162.
14.0 10.0 10.0.0125
237 241 243 242 242 243 244 238
91.67 42.50 .917 6.25 16.0 1.0 1965.
39.67 23.00 .917 12.60 16.0 1.0 2004.
HEADING CARD NUMBER ONE
HEADING CARD NUMBER TWO

END

```

ELT EXPENS,1,691212, 19677

000001		SUBROUTINE EXPENS	EXP 020
000002	C		EXP 022
000003		INCLUDE COM1	12/12/69
000004		INCLUDE COM2	11/7/67R
000005		INCLUDE COM4	11/7/67R
000006		INCLUDE COM5	11/7/67R
000007	C		PCO 090
000008		I=0	11/7/67R
000009	1	I=I+1	11/7/67R
000010		WEX = 0.0	EXP 100
000011		WRX = D(11)	EXP 110
000012		DO 4 M=1,NY	
000013		EB(M)=CURA(M)+CFAB(M)+CREP(M)+TEH(M)-CPLU(M)	
000014		EFU(M)=EB(M)-TEH(M)	
000015		ELM(M)=TEH(M)	
000016		U(M) = PFW(M)*DMW*1000.*24.*365.3	12/12/69
000017		Z(M)=U(M)*1.0E-09	
000018		WRX=WRX+EFU(M)	
000019	4	WEX=WEX+PFW(M)	
000020		DO 3 M=1,NY	
000021		II = TCONST + M + .0000001	12/12/69
000022		IF (NOP ,LE. 3) EP(M) = (TCONS(II) - TADJ(II)	12/12/69
000023	1	+ PRESHP(M) + POSTSH(M) + FLOSS(M))/1.0E6	12/12/69
000024		IF (NOP ,EQ. 4) EP(M) = (WRX/WEX)*PFW(M)	12/12/69
000025		IF (NOP ,EQ. 5) EP(M) = EFU(M)	12/12/69
000026	3	CONTINUE	12/12/69
000027		GO TO (6,9), I	11/7/67R
000028	6	DO 7 K=1,40	11/7/67R
000029		EXCURA(K)=CURA(K)	12/7/67R
000030		EXCFAB(K)=CFAB(K)	12/7/67R
000031		EXCREP(K)=CREP(K)	12/7/67R
000032		EXCPLU(K)=CPLU(K)	12/7/67R
000033		CURA(K)=YPURCH(K)	11/7/67R
000034		CFAB(K)=YFABCH(K)	11/7/67R
000035		CREP(K)=YREPCCH(K)	11/7/67R
000036		CPLU(K)=YFCRED(K)	11/7/67R
000037		EBOLD(K)=EB(K)	11/7/67R
000038		EFUOLD(K)=EFU(K)	11/7/67R
000039	7	EPOLD(K)=EP(K)	11/7/67R
000040		GO TO 1	11/7/67R
000041	9	RETURN	11/7/67R
000042		END	

@ ELT FAB,1,691212, 19681

000001	C	ROUTINE TO CALCULATE AND STORE FABRICATION COSTS	FAB	010
000002		SUBROUTINE FAB	FAB	020
000003	C			037
000004	C	COMMON FOR PACTOLUS AND POWERCO PROGRAMS		040
000005		INCLUDE COM1		050
000006		INCLUDE COM2		055
000007		INCLUDE COM5		
000008	C			100
000009	C		FAB	280
000010	C	CALCULATE TOTAL ENRICHMENT TIMES DENSITY	FAB	290
000011		ENR1 = C25(1)*235. + C49(1)*239. + C41(1)*241. + C23(1)*233.	FAB	300
000012		CT1 = CTOTL(1)	FAB	305
000013		ENR = ENR1/CT1*DENS		
000014	C	CALCULATE TIME TO BUY FABRICATION	FAB	390
000015		TIM1 = ((TIM(1)-SHPREA-PRI-TFAB/2.)/365.3) + 1.0		12/12/69
000016		TIM2 = TIM1 - 1.0		
000017		TIMX = TSTART + TIM1 - 1.0		
000018	C	INTERPOLATE IN THE TIME LIBRARY	FAB	430
000019		CALL TIMLIB	FAB	440
000020		IF (CT1) 650,650,600		
000021		600 CONTINUE		
000022	C		FAB	580
000023	C	DETERMINE IF THIS IS A CORE OR BLANKET DISCHARGE	FAB	590
000024		IF(I90.EQ.0) GO TO 601		
000025		GFIS = 0.04		
000026		ICOR = 0		
000027		IF(ENR.LT.GFIS) ICOR = 1		
000028		601 CONTINUE		
000029		IF(ICOR.EQ.0) GO TO 650		
000030	C	BLANKET DISCHARGE --- SET BLANKET SWITCH (ICOR = 1)	FAB	610
000031		FABCST = VLIB(4)	FAB	620
000032		DELFBI = 0.0	FAB	630
000033		GO TO 700	FAB	635
000034	C	CORE DISCHARGE	FAB	640
000035		650 DELFBI = VLIB(2)	FAB	650
000036		FABCST = VLIB(3)	FAB	670
000037	C		FAB	680
000038	C	CALCULATE FABRICATION COST, CONVERT FROM TONS TO KG	FAB	690
000039		700 CFACTR = 1000.0	FAB	700
000040		IF (XK.LT.1.60 E+11) CFACTR = 907.185		
000041		RKG = RKG * CFACTR	FAB	720
000042		RKGF = RKGF * CFACTR		
000043		FABC = FABCST*RKG		
000044		XENR =(C49(1)*239.+C40(1)*240.+C41(1)*241.+C42(1)*242.+C23(1)*233.		

A-57

BNWL-1169

```

000045      1)/CT1
000046      IF(XENR-.0001)702,701,701
000047      701 FABC = (DELFB1 + FABCST)*RKG
000048      702 CONTINUE
000049      C      DETERMINE IF DEBUG PRINTOUT IS WANTED          FAB 760
000050      IF (IPR.GE.2) WRITE (LTR,770) FABC,RKG,INDX,ICOR      FAB 765
000051      770 FORMAT (5X, 9HFAB DEBUG, 3X, 2E12.5,2I3 )          FAB 770
000052      C
000053      C      DETERMINE IF THIS IS FABRICATION COST OR CAPITAL EXPENSE      FAB 780
000054      800 IF (TIM(1) .GT. 0.0) GO TO 900                      FAB 790
000055      DFAB = DFAB + FABC                                          12/12/69
000056      GO TO 950                                                  FAB 820
000057      C      DETERMINE THE PROPER INDEX AND FILL FABCH ARRAY          FAB 840
000058      900 INDX = MAX1(TIM1,1.0)                                  FAB 890
000059      YINDX = INDX
000060      RNT = RATE*(YINDX - TIM2) + 1.0
000061      FABCH(INDX) = FABCH(INDX) + FABC                          FAB 920
000062      YFABCH(INDX) = YFABCH(INDX) + FABC*RNT
000063      IF(IPR.NE.0)WRITE(6,1000) YFABCH(INDX),INDX,FABCH(INDX),RNT,TIM2,Y
000064      1INDX
000065      1000 FORMAT(8H YFAB,I,-6PF10.3,I5,F10.3,0PF10.4,2F10.1)
000066      C
000067      950 CONTINUE
000068      TI5 = TIM1 + TCONST
000069      INDX = MAX1(TI5,1.0)
000070      RRKG(INDX) = RRKG(INDX) + RKG
000071      RETURN
000072      END

```


ELT FACTRS,1,691212, 19686

000001		SUBROUTINE FACTRS	FAC 020
000002	C		PCO 060
000003		INCLUDE COM1	12/12/69
000004		INCLUDE COM2	
000005	C		PCO 090
000006		RRW=BND*RRB+(1.-BND)*RRE	
000007	3	RRV=BND*RRB*(1.-TXR)+(1.-BND)*RRE	
000008		DO 100 N=1,NY	12/12/69
000009		SMY = -(FLOAT(N-1) + TIMD)	12/12/69
000010		PWE(N) = (1.0 + RRE)**SMY	12/12/69
000011		PWV(N) = (1.0 + RRV)**SMY	12/12/69
000012	100	CONTINUE	12/12/69
000013		PWV(1) = 1./(1. + RRV/2.)	12/12/69
000014		RETURN	
000015		END	-

@ ELT FASTLP,1,691212, 19696

```

000001      CFAST      , A PROGRAM TO MAKE FAST REACTOR BURNUP TAPES ON THE UNIVAC 1107
000002      SUBROUTINE FASTLP (IN,LOUT,TPR,FMAS,PWR)                                01/22/69
000003      C                                                    01/22/69
000004      COMMON /CDLF / X1(6),Y1(6),X2(6),Y2(6)                                01/22/69
000005      WRITE (6,8000) TPR,FMAS
000006      8000 FORMAT (9H TPR,FMAS/2F12.4)
000007      C
000008      C      TPR IS A MULTIPLIER FOR THERMAL POWER
000009      C      FMAS IS A MULTIPLIER FOR REACTOR INVENTORY
000010      C      PWR IS THE POWER MULTIPLIER
000011      DIMENSION TITLE(12),ID(100),U(12),TREG(50),TXX(5),EXX(5)
000012      DIMENSION UU(12)
000013      1,CXX(12,5),TREGO(50),TRGST(50)
000014      XK = 1.602E11
000015      IF (PWR)163,164,163
000016      164 PWR = 1.0
000017      163 CONTINUE
000018      IF (TPR)160,160,161
000019      160 TPR = 1.0
000020      161 CONTINUE
000021      IF (FMAS)175,175,176
000022      175 FMAS = 1.0
000023      176 CONTINUE
000024      IF (IN.EQ.0) IN = 5
000025      IF (LOUT.EQ.0) LOUT = 8
000026      TIMST = 0.0
000027      TIMO = 0.0
000028      DATA(U(N),N=1,12)/72H U233 U235 PU239 PU241 TH232 U238 U234 PU
000029      1240 PA233 U236 PU242 NP237/
000030      DATA CHG/6H CHG/DISCHG/6HDISCHG/
000031      DATA(UU(I),I=1,12)/72H TH232 PA233 U233 U234 U235 U236 U238 N
000032      1P237 PU239 PU240 PU241 PU242/
000033      READ(IN,800) TSTOP,NREGN,NFUEL,IBUG,NPTS,CLF                                01/22/69
000034      READ (IN,810) (X2(I),Y2(I),I=1,6)                                01/22/69
000035      IF (Y1(1) + Y1(2),LT.0.000001) GO TO 178                                01/22/69
000036      DO 177 I=1,6                                01/22/69
000037      X2(I) = X1(I)                                01/22/69
000038      Y2(I) = Y1(I)                                01/22/69
000039      177 CONTINUE                                01/22/69
000040      GO TO 179                                01/22/69
000041      178 CONTINUE
000042      X1(1) = 0.0                                01/22/69
000043      Y1(1) = 1.00                                01/22/69
000044      X1(2) = 30.0                                01/22/69

```

A-60

BNWL-1169

```

000045      Y1(2) = 1.00                                01/22/69
000046      179 CONTINUE                                01/22/69
000047      IF (CLF) 1006,1006,1008
000048      1006 CLF = 1.00
000049      1008 CONTINUE
000050      IF(NPTS,EQ.0) NPTS = 2
000051      WRITE(6,3000)                                01/22/69
000052      TSTOP = 0.0                                  01/22/69
000053      DO 3120 I=1,5                                  01/22/69
000054      K = I                                          12/12/69
000055      IF (Y2(I+1) .EQ. 0.0) GO TO 3150             12/12/69
000056      TSTOP = TSTOP + (X2(I+1) - X2(I))*(Y2(I+1) + Y2(I))/2. 01/22/69
000057      SLOPE = (Y2(I+1) - Y2(I))/(X2(I+1)-X2(I))    01/22/69
000058      WRITE (6,3010) Y2(I),X2(I),SLOPE             01/22/69
000059      3000 FORMAT (41H0 THE CAPACITY FACTOR VARIES AS FOLLOWS:/ ) 01/22/69
000060      3010 FORMAT (16X,2PF6.2,'% AT',0PF8.2,' YEARS, CHANGING BY',2PF7.2, 12/12/69
000061      1 ' %/YEAR TO' /)                             12/12/69
000062      3120 CONTINUE                                01/22/69
000063      K = 6                                          12/12/69
000064      3150 WRITE (6,3160) Y2(K),X2(K),NREGN         12/12/69
000065      3160 FORMAT (16X,2PF6.2,'% AT',0PF8.2,' YEARS,' 12/12/69
000066      2//11H THIS IS A,I3,15H REGION REACTOR )
000067      IF(NFUEL,NE.0) WRITE(6,1011)
000068      1011 FORMAT(23H CONTINUOUS REFUELLING)
000069      ISW = 0
000070      IROUND = 0
000071      I1 = 114
000072      I2 = 137
000073      XF = 1.0
000074      I3 = 1
000075      MH = 0
000076      ME = -1
000077      DO 99 I=1,100
000078      99 ID(I) = 0
000079      1 READ(IN,100) ITEST, RTP,ACASE,BCASE,VOL
000080      RTP = RTP*PWR
000081      IF(ITEST)5,2,5
000082      2 ICT = 1
000083      READ (IN,103) (TITLE(I),I=1,12)
000084      IF(ISW,EQ.0) WRITE(6,1012)(TITLE(I),I=1,12)
000085      1012 FORMAT(/2X,12A6//30X,21HKILOGRAMS OF ISOTOPES)
000086      IF(ISW,EQ.0) WRITE(6,1013) (UU(I),I=1,12)
000087      1013 FORMAT(10X,12(1X,A6,1X),10H TIME //)
000088      ISW = 1
000089      IROUND = 1
000090      4 READ(IN,101)C02,C13,C23,C24,C25,C26,C28,C37,C49,C40,C41,C42,
000091      1NFINAL,IR,TIME,EXP,ICOR
000092      TIME = TIME * CLF * TPR/PWR                    03/11/69
000093      TIMEE = TIME*365.3

```

```

000094      RKG = C02 + C13+C23+C24+C25+C26+C28+C37+C49+C40+C41+C42
000095      FMUL = FMAS
000096      IF (TIME) 3200,3200,3201
000097      3200 FMUL = TPR
000098      3201 RKG = RKG*FMUL
000099      DENS = RKG/VOL
000100      RKG = RKG/1000.
000101      TIM = CHNGLF (TIME)
000102      TIM = TIM*365.3
000103      C IROUND = 0, STARTUP DATA
000104      C      = 1, SHUTDOWN DATA
000105      IF (IROUND) 10,11,10
000106      10 YLD = CALCLF (TIM/365.3)
000107      RRTP = RTP*YLD
000108      WRITE (LOUT) I1,MH, ID(1), ACASE, BCASE, (ID(I), I=1,32), (TITLE(I)
000109      2, I=1,12), ID(1),
000110      3(U(I), I=1,12), (ID(I), I=1,33), DENS, XK, ID(1), (X2(I), Y2(I), I=1,6)
000111      4, ID(1), ID(1), RKG, RRTP, ICOR
000112      IROUND = 0
000113      TIMO = TIM
000114      51 TIMST = TIMEE
000115      11 CONTINUE
000116      TIMA = TIM*8.64E4
000117      TTIM = TIM/365.3
000118      7 CONTINUE
000119      FMUL = FMAS
000120      IF (TTIM) 3100,3100,3101
000121      3100 FMUL = TPR
000122      3101 C02 = C02*FMUL
000123      C13 = C13*FMUL
000124      C23 = C23*FMUL
000125      C24 = C24*FMUL
000126      C25 = C25*FMUL
000127      C26 = C26*FMUL
000128      C28 = C28*FMUL
000129      C37 = C37*FMUL
000130      C49 = C49*FMUL
000131      C40 = C40*FMUL
000132      C41 = C41*FMUL
000133      C42 = C42*FMUL
000134      TYP = CHG
000135      IF (NFIN4L.GT.1) TYP = DISCHG
000136      WRITE (6,1002) TYP, C02, C13, C23, C24, C25, C26, C28, C37, C49
000137      1, C40, C41, C42, TTIM, ACASE, BCASE
000138      1002 FORMAT( 2X, A6, 2X, 13F8.1, 2X, I4, A1)
000139      CONST = .6023/VOL
000140      C02 = C02*CONST/232.
000141      C13 = C13*CONST/233.
000142      C23 = C23*CONST/233.

```

01/22/69

01/22/69

01/22/69

01/22/69

01/22/69

01/22/69

01/22/69

12/12/69

BNWL-1169

```

000143      C24 = C24*CONST/234.
000144      C25 = C25*CONST/235.
000145      C26 = C26*CONST/236.
000146      C28 = C28*CONST/238.
000147      C37 = C37*CONST/237.
000148      C49 = C49*CONST/239.
000149      C40 = C40*CONST/240.
000150      C41 = C41*CONST/241.
000151      C42 = C42*CONST/242.
000152      13 WRITE(LOUT) I2,NFINAL,ICT,ACASE,BCASE,C23,C25,C49,C41,C02,C28,C24
000153      1,C40,C13,C26,C42,C37,(ID(L),L=1,34),
000154      1      (ID(L),L=1,81),TIMA,EXP,ID(1),ID(1),ID(1
000155      2),XF
000156      ICT = ICT + 1
000157      IF(NFINAL-1)5,4,280
000158      280 IF(30.-TIM/365.3)281,281,279
000159      279 TREGO(NR) = TIMO
000160      TREG(NR) = TIMEE
000161      TRGST(NR) = TIMST
000162      GO TO 1
000163      C THIS IS THE BEGINNING OF THE END OF LIFE CALCULATIONS
000164      C FIRST THE REFUELING OF ALL REGIONS WILL BE PERFORMED - THIS
000165      C BRINGS THE MATERIAL BALANCE TO THE END OF LIFE - THEN
000166      C THE EQUILIBRIUM CORE WILL BE DISCHARGED IF THIS IS A CONTINUOUSLY
000167      C REFUELED REACTOR
000168      281 BACKSPACE LOU
000169      BACKSPACE LOU
000170      BACKSPACE LOU
000171      WRITE(6,1051)
000172      IF(IBUG)2820,2821,2820
000173      2820 WRITE(6,206)TTIM
000174      2821 CONTINUE
000175      282 READ (IN,106)IX
000176      IF(IX-1)282,6,282
000177      6 TIMST = 0.
000178      DO 300 K=1,NREGN
000179      TIMEE = TREG(K)
000180      TIMO = TREGO(K)
000181      TIMST = TRGST(K)
000182      IF(IBUG)2830,2831,2830
000183      2830 WRITE(6,1000)TIMEE,TIMO,TIMST
000184      2831 CONTINUE
000185      1000 FORMAT(17H TIMEE,TIMO,TIMST /3F12.1)
000186      XXF = 1.0
000187      IROUND = 1
000188      IF(NFUEL,NE,0) GO TO 2001
000189      READ (IN,101)C02,C13,C23,C24,C25,C26,C28,C37,C49,C40,C41,C42,
000190      1NFINAL,NR,TIME,EXP,ICOR
000191      TIME=TIME*CLF*TPR/PWR

```

03/11/69

```

000192      NLP = 0
000193      CXX(1,1) = C02
000194      CXX(2,1) = C13
000195      CXX(3,1) = C23
000196      CXX(4,1) = C24
000197      CXX(5,1) = C25
000198      CXX(6,1) = C26
000199      CXX(7,1) = C28
000200      CXX(8,1) = C37
000201      CXX(9,1) = C49
000202      CXX(10,1) = C40
000203      CXX(11,1) = C41
000204      CXX(12,1) = C42
000205      TXX(1) = TIME
000206      EXX(1) = EXP
000207      TIMEE = TIMEE + TIME*365.3
000208 289 TIM = CHNGLF(TIMEE/365.3)                                01/22/69
000209      YA = CALCLF(TIM)                                          01/22/69
000210      TTIM = TIM                                                 01/22/69
000211      TIM = TIM*365.3                                           01/22/69
000212      TIMA = TIM*8.64E4
000213      TTIM = TIM/365.3
000214      IF(I3UG.NE.0) WRITE(6,1001)TIM,TIMO,YA,EXP
000215 1001 FORMAT(23H  TIME AT THIS POINT IS ,F10.2,5X,36HTHE STARTUP TIME FO
000216      1R THIS REGION WAS ,F10.2/52H  AND THE AVERAGE LOAD FACTOR FOR THIS01/22/69
000217      2INTERVAL WAS ,F8.3//17H  THE EXPOSURE IS,F10.1)
000218 450 FMUL = FMAS
000219      IF(TTIM-30.)3106,3105,3105
000220 3105 FMUL = TPR
000221 3106 C02 = C02*FMUL
000222      C13 = C13*FMUL
000223      C23 = C23*FMUL
000224      C24 = C24*FMUL
000225      C25 = C25*FMUL
000226      C26 = C26*FMUL
000227      C28 = C28*FMUL
000228      C37 = C37*FMUL
000229      C49 = C49*FMUL
000230      C40 = C40*FMUL
000231      C41 = C41*FMUL
000232      C42 = C42*FMUL
000233      RKG = C02 + C13+C23+C24+C25+C26+C28+C37+C49+C40+C41+C42
000234      DENS = RKG/VOL
000235      RKG = RKG/1000.
000236      IF(ROUND)510,511,510
000237 510 YLD = CALCLF(TIM/365.3)                                01/22/69
000238      RRTP = RTP*YLD
000239      WRITE(LOUT)I1,MH, ID(1),ACASE,BCASE,(ID(I),I=1,32),(TITLE(I),I=1,12
000240      2),ID(1),

```

```

000241      3(U(I),I=1,12),(ID(I),I=1,33),DENS,XK,ID(1),(X2(I),Y2(I),I=1,6)      01/22/69
000242      4,ID(1),ID(1),RK6,RRTP,ICOR      01/22/69
000243      IROUND = 0
000244      TIMO = TIM
000245      551 TIMST = TIMEE
000246      511 CONTINUE
000247      TIMA = TIM*8.64E4
000248      TTIM = TIM/365.3
000249      70 CONTINUE
000250      TYP = CHG
000251      IF(NFINAL.GT.1) TYP = DISCHG
000252      WRITE(6,1002) TYP,C02,C13,C23,C24,C25,C26,C28,C37,C49
000253      1,C40,C41,C42,TTIM,ACASE,BCASE
000254      CONST= .6023/VOL      12/12/69
000255      C02 = C02*CONST/232.
000256      C13 = C13*CONST/233.
000257      C23 = C23*CONST/233.
000258      C24 = C24*CONST/234.
000259      C25 = C25*CONST/235.
000260      C26 = C26*CONST/236.
000261      C28 = C28*CONST/238.
000262      C37 = C37*CONST/237.
000263      C49 = C49*CONST/239.
000264      C40 = C40*CONST/240.
000265      C41 = C41*CONST/241.
000266      C42 = C42*CONST/242.
000267      130 WRITE(LOUT)I2,NFINAL,ICT,ACASE,BCASE,C23,C25,C49,C41,C02,C28,C24
000268      1,C40,C13,C26,C42,C37,(ID(L),L=1,34),
000269      1 (ID(L),L=1,81),TIMA,EXP,ID(1),ID(1),ID(1
000270      2),XXF
000271      ICT = ICT + 1
000272      IF(NFINAL-1)6,290,300
000273      C THE FOLLOWING IS THE EQUILIBRIUM DISCHARGE OF THE CORE FOR
000274      C CONTINUOUSLY REFUELED REACTORS
000275      2001 DO 2003 JXX=1,5
000276      DO 2002 IXX=1,12
000277      2002 CXX(IXX,JXX) = 0.
000278      2003 EXX(JXX) = 0.
000279      290 TDEL = TSTOP - TIMEE/365.3
000280      C INDEX ON J AND IA IN THE FOLLOWING STATEMENTS ARE INCREASED FOR
000281      C ADDITIONAL INTERMEDIATE DATA POINTS
000282      READ(IN,101)((CXX(I,J),I=1,12),NFINAL,NR,TXX(J),EXX(J),ICOR,J=2,NP
000283      1TS)
000284      DO 291 IA = 2,NPTS
000285      II = IA
000286      TXX(IA) = TXX(IA) * CLF * TPR/PWR      03/11/69
000287      321 IF(TXX(IA)-TDEL)291,292,292
000288      291 CONTINUE
000289      292 TXN = TDEL-TXX(II-1)

```

```

000290      XXF = TXN/(TXX(II)-TXX(II-1))
000291      IF(NFUEL.NE.0) XXF = TDEL/TXX(II)
000292      IF(IGUG)2920,2921,2920
000293 2920 WRITE(6,107)XXF,TXN,C23,C25
000294 2921 CONTINUE
000295      107 FORMAT(4F12.4)
000296      C02 = (CXX(1,II) - CXX(1,II-1))*XXF + CXX(1,II-1)
000297      C13 = (CXX(2,II) - CXX(2,II-1))*XXF + CXX(2,II-1)
000298      C23 = (CXX(3,II) - CXX(3,II-1))*XXF + CXX(3,II-1)
000299      C24 = (CXX(4,II) - CXX(4,II-1))*XXF + CXX(4,II-1)
000300      C25 = (CXX(5,II) - CXX(5,II-1))*XXF + CXX(5,II-1)
000301      C26 = (CXX(6,II) - CXX(6,II-1))*XXF + CXX(6,II-1)
000302      C28 = (CXX(7,II) - CXX(7,II-1))*XXF + CXX(7,II-1)
000303      C37 = (CXX(8,II) - CXX(8,II-1))*XXF + CXX(8,II-1)
000304      C49 = (CXX(9,II) - CXX(9,II-1))*XXF + CXX(9,II-1)
000305      C40 = (CXX(10,II) - CXX(10,II-1))*XXF + CXX(10,II-1)
000306      C41 = (CXX(11,II) - CXX(11,II-1))*XXF + CXX(11,II-1)
000307      C42 = (CXX(12,II) - CXX(12,II-1))*XXF + CXX(12,II-1)
000308      EXP = EXX(II)*TDEL/TXX(II)
000309      NLP = 0
000310      IF (NFUEL) 700,322,700
000311 700 TIM = 30.*365.3
000312      TTIM = 30.0
000313      GO TO 450
000314 322 TIMEE = TSTOP*365.3
000315      IF(IGUG)4101,4102,4101
000316 4101 WRITE(6,410)EXP,TIMEE,C02,TXN,TDEL
000317 4102 CONTINUE
000318      410 FORMAT(1X,22HEXP,TIMEE,C02,TXN,TDEL /1X,5F12.3)
000319      NFINAL = 3
000320      GO TO 289
000321 300 CONTINUE
000322      IF (NFUEL .EQ. 0) GO TO 5
000323      TIM = 30.0 * 365.3
000324      XXF = 1.0
000325      IROUND = 1
000326 2450 READ(IN,101)C02,C13,C23,C24,C25,C26,C28,C37,C49,C40,C41,C42,
000327      1NFINAL,NR,TIME,EXP,ICOR
000328      TIME = TIME * CLF * TPR/PWR
000329      READ(IN,101)((CXX(I,J),I=1,12),NFINAL,NR,TXX(J),EXX(J),ICOR,J=2,NP
000330      1TS)
000331      DO 2455 J=2,NPTS
000332 2455 TXX(J) = TXX(J) * CLF * TPR/PWR
000333      NFINAL = 1
000334      RKG = 0.
000335      DO 2520 I=1,12
000336 2520 RKG = RKG + CXX(I,2)*TPR
000337      DENS = RKG/VOL
000338      RKG = RKG/1000.

```

03/11/69

03/11/69


```

000339      2460 IF (IROUND) 2510, 2511, 2510
000340      2510 YLD = CALCLF (TIM/365.3)
000341          RRTP = RTP*YLD
000342          WRITE (LOUT) I1, MH, ID(1), ACASE, BCASE, (ID(1), I=1, 32), (TITLE(I), I=1, 12
000343              2), ID(1),
000344              3(U(I), I=1, 12), (ID(I), I=1, 33), DENS, XK, ID(1), (X2(I), Y2(I), I=1, 6)
000345              4, ID(1), ID(1), RKG, RRTP, ICOR
000346          IROUND = 0
000347          TIMO = TIM
000348      2551 TIMST = TIMEE
000349      2511 CONTINUE
000350          TIMA = TIM*8.64E4
000351          TTIM = TIM/365.3
000352      270 CONTINUE
000353      3109 FMUL = TPR
000354      3110 C02 = C02*FMUL
000355          C13 = C13*FMUL
000356          C23 = C23*FMUL
000357          C24 = C24*FMUL
000358          C25 = C25*FMUL
000359          C26 = C26*FMUL
000360          C28 = C28*FMUL
000361          C37 = C37*FMUL
000362          C49 = C49*FMUL
000363          C40 = C40*FMUL
000364          C41 = C41*FMUL
000365          C42 = C42*FMUL
000366          TYP = CHG
000367          IF (NFINAL .GT. 1) TYP = DISCHG
000368          WRITE (6, 1002) TYP, C02, C13, C23, C24, C25, C26, C28, C37, C49
000369      1, C40, C41, C42, TTIM, ACASE, BCASE
000370          CONST = .6023/VOL
000371          C02 = C02*CONST/232.
000372          C13 = C13*CONST/233.
000373          C23 = C23*CONST/233.
000374          C24 = C24*CONST/234.
000375          C25 = C25*CONST/235.
000376          C26 = C26*CONST/236.
000377          C28 = C28*CONST/238.
000378          C37 = C37*CONST/237.
000379          C49 = C49*CONST/239.
000380          C40 = C40*CONST/240.
000381          C41 = C41*CONST/241.
000382          C42 = C42*CONST/242.
000383      2130 WRITE (LOUT) I2, NFINAL, ICT, ACASE, BCASE, C23, C25, C49, C41, C02, C28, C24
000384          1, C40, C13, C26, C42, C37, (ID(L), L=1, 34),
000385          1 (ID(L), L=1, 81), TIMA, EXP, ID(1), ID(1), ID(1
000386          2), XXF
000387          ICT = ICT + 1

```

01/22/69

01/22/69

01/22/69

12/12/69

12/12/69

12/12/69

```

000388      IF (NFINAL-1) 2160,2160,5
000389 2160 C02 = CXX(1,II)
000390      C13 = CXX(2,II)
000391      C23 = CXX(3,II)
000392      C24 = CXX(4,II)
000393      C25 = CXX(5,II)
000394      C26 = CXX(6,II)
000395      C28 = CXX(7,II)
000396      C37 = CXX(8,II)
000397      C49 = CXX(9,II)
000398      C40 = CXX(10,II)
000399      C41 = CXX(11,II)
000400      C42 = CXX(12,II)
000401      EXP = EXX(II)
000402      NFINAL = 3
000403      GO TO 2460
000404      5 WRITE(LOUT)I3,ME
000405      END FILE LOUT
000406      WRITE(6,1050)
000407 1050 FORMAT(2X,8HEND DATA)
000408 1051 FORMAT(121H THE PREVIOUS REGION WOULD HAVE GONE PAST 30 YEARS. T
000409      1HIS REGION WILL BE DELETED AND THE FOLLOWING REGIONS COMPRISE THE
000410      2,/2X,36HSHUTDOWN OF THE REACTOR AT 30 YEARS.)
000411      100 FORMAT(I1,F9.3,I4,A1,F10.4)
000412      101 FORMAT(8E10.4/4E10.4/2I5,2E10.4,I5)
000413      103 FORMAT(12A6)
000414      104 FORMAT (5F10.3,4I5,F5.0)
000415      105 FORMAT(5F12.2,I5)
000416      106 FORMAT(I1)
000417      200 FORMAT(20H THE BRNUP DATA FOR , 9A6,42H
000418      1 ,F8.4,3H ,A5)
000419      201 FORMAT(84H
000420      1 ,2E11.4,2F6.3,3H
000421      2I2/10H ,3E10.3,10H ,E10.3,10H ,E10.3,
000422      310H ,2E10.3,20H )
000423      202 FORMAT(132H
000424      1
000425      2 )
000426      203 FORMAT(132H XXXX
000427      1
000428      2 )
000429      204 FORMAT(80H
000430      1 ,4E10.3,10H )
000431      205 FORMAT(E10.3,20H ,E10.3,90H
000432      1
000433      2 )
000434      206 FORMAT(6HTTIM =,F10.2)
000435      207 FORMAT(5X,29HY1,Y2,X1,X2,TSTOP,NREGN,NFUEL )
000436      800 FORMAT (F10.0,4I5,F10.0)

```

01/22/69

000437
000438
000439

810 FORMAT (12F5.0)
RETURN
END

01/22/69

A-69

BNWL-1169

Q ELT FIXCHG,1,691212, 19711

000001		SUBROUTINE FIXCHG	
000002	C		FIX 022
000003	C	COMMON FOR POWERCO PROGRAM	055
000004		INCLUDE COM1	6/14/67R
000005		INCLUDE COM2	055
000006		INCLUDE COM3	
000007		INCLUDE COM4	12/7/67R
000008		INCLUDE COM5	12/7/67R
000009	C		FIX 057
000010		DIMENSION IDAED1(175)	12/12/69:
000011		EQUIVALENCE (DAED1,IDAED1)	12/12/69:
000012		DATA L1/6/	FIX 060
000013	C		FIX 110
000014		PP=P	10/20/7R
000015		SALCOR=CPLU(NY)-CPLU(NY-1)	2/28/67R
000016		REPCOR=CREP(NY)-CREP(NY-1)	8/07/67R
000017		XTUT = 0.0	FIX 120
000018		XEPT = 0.0	FIX 130
000019		XTAT = 0.0	FIX 140
000020		XTALI=0.0	2/10/67R
000021		XTALP=0.0	2/10/67R
000022		XTALN=0.0	4/26/67R
000023		XREP=0.0	5/29/67R
000024		FABI =0.0	2/09/67R
000025		REPI =0.0	2/09/67R
000026		PURI =0.0	2/09/67R
000027		RECI =0.0	2/09/67R
000028		FABT=0.0	2/13/67R
000029		REPT=0.0	2/13/67R
000030		PUT=0.0	2/13/67R
000031		RECT=0.0	2/13/67R
000032		WCI =0.0	2/06/67R
000033		COREI=0.0	2/09/67R
000034		TAXEFU=0.0	
000035		TAXEP =0.0	
000036		TAXSYD=0.0	
000037		TOTINS=0.0	3/16/67R
000038		COREXP=0.0	8/07/67R
000039		PLTEXP=0.0	8/07/67R
000040		PVCORE=0.0	8/07/67R
000041		PVPExp=0.0	8/07/67R
000042		PVLOAD=0.0	3/16/67R
000043		PVINS=0.0	3/07/67R
000044		IF (RRE-1.E-34) 10,10,11	3/19/67R

000045	10 FNYE=NY	3/19/67R
000046	GO TO 12	3/19/67R
000047	11 FNYE=(1.-PWE(NY))/RRE	3/19/67R
000048	12 IF (RRV-1.E-34) 13,13,14	3/19/67R
000049	13 VFV=NY	3/19/67R
000050	GO TO 15	3/19/67R
000051	14 VFV=(1.-PWV(NY))/RRV	3/19/67R
000052	15 WEX=0.0	3/19/67R
000053	POWER=0.0	
000054	TOTELM=0.0	
000055	FABCS=0.0	2/06/67R
000056	REPCS=-REPCOR	8/07/67R
000057	PURCS=0.0	2/06/67R
000058	RECCS=SALCOR	2/28/67R
000059	DO 20 N=1,NY	2/06/67R
000060	WEX=WEX+PFW(N)	
000061	POWER=POWER+Z(N)	2/09/67R
000062	REPCS=REPCS+EXCREP(N)	12/7/67R
000063	FABCS=FABCS+EXCFAB(N)	12/7/67R
000064	PURCS=PURCS+EXCURA(N)	12/7/67R
000065	20 RECCS=RECCS-EXCPLU(N)	12/7/67R
000066	SUMFAC=D(26)+1.0	8/07/67R
000067	DO 36 N=1,NY	11/1/67R
000068	YR=N	8/07/67R
000069	PFWFAC=AMAX1(0.,AMIN1(1.,D(26)-FLOAT(N)+1))	8/07/67R
000070	SUMFAC=SUMFAC-PFWFAC	8/07/67R
000071	CORTAX=D(17)*D(11)*SUMFAC/D(26)	8/07/67R
000072	EXP=D(19)*PFWFAC+D(17)*(D(1)*(1.-(YR-1.)/D(9))*(1.-D(18)/	8/07/67R
000073	1 D(1)*YR*.5)))	8/07/67R
000074	C (ELM(N) INCLUDES D(19) PROPERTY INSURANCE, D(20-21) NUCLEAR	11/2/67R
000075	C LIABILITY, D(22) OPTIONAL TOTAL STATE TAXES, D(17)*D(1).. PLANT	11/2/67R
000076	C PROPERTY TAX, D(17)*D(11).. CORE PROPERTY TAX)	11/2/67R
000077	ELM(N)=ELM(N)-EXP	10/24/7R
000078	PROPER(N)=CORTAX+EXP	10/5/67R
000079	COREXP=COREXP+CORTAX	8/07/67R
000080	PLTEXP=PLTEXP+EXP	8/07/67R
000081	IF(LL1-1)30,32,30	
000082	30 ADZ=PWE(N)	
000083	GO TO 34	2/01/67R
000084	32 ADZ=PWV(N)	2/01/67R
000085	34 XTALI=XTALI+(1.-TXR)*TAJ(N)*ADZ	2/01/67R
000086	XTALP=XTALP+TAL(N) *ADZ	2/01/67R
000087	XTALN=XTALN+TAL(N)	4/26/67R
000088	IF (N.EQ. 1) GO TO 35	5/29/67R
000089	XREP=XREP+D(18)*ADZ	5/29/67R
000090	35 TAXEFU=TAXEFU+ADZ *TXR*EFU(N)	5/29/67R
000091	TAXEP =TAXEP -ADZ *TXR*EP (N)	2/01/67R
000092	TAXSYD=TAXSYD-ADZ *TXR*SYD(N)	2/01/67R
000093	XTAT=XTAT+ADZ*(SYD(N)+EXP)	11/11/67

000094	XEP(N)=ELM(N)+EPOLD(N)	12/7/67R
000095	XEPW(N)=ADZ*XEP(N)	
000096	XEPT=XEPT+XEPW(N)	
000097	FABT=FABT+CFAB(N)*ADZ	2/13/67R
000098	REPT=REPT+CREP(N)*ADZ	2/13/67R
000099	PURT=PURT+CURA(N)*ADZ	2/13/67R
000100	RECT=RECT-CPLU(N)*ADZ	2/13/67R
000101	FABI =FABI +FABCS *PFW(N)/WEX*ADZ	2/09/67R
000102	REPI =REPI +REPCS *PFW(N)/WEX*ADZ	2/09/67R
000103	PURI =PURI +PURCS *PFW(N)/WEX*ADZ	2/09/67R
000104	RECI =RECI +RECCS *PFW(N)/WEX*ADZ	2/09/67R
000105	TOTELM=TOTELM+ELM(N)-CORTAX	11/1/67R
000106	WCI =WCI +(ELM(N)-CORTAX) *ADZ	11/1/67R
000107	PVPEXP=PVPEXP+EXP*ADZ	11/1/67R
000108	PVCORE=PVCORE+CORTAX*ADZ	11/1/67R
000109	COREI=COREI+((D(11)+REPCOR-SALCOR)*PFW(N)/WEX+CORTAX)*ADZ	11/1/67R
000110	PVLOAD=PVLOAD+PFW(N)*ADZ	3/16/67R
000111	TOTINS=TOTINS+PFWFAC	3/16/67R
000112	PVINS=PVINS+ADZ*PFWFAC	3/16/67R
000113	XTU(N)=EFU(N)-EPOLD(N)	12/7/67R
000114	XTUW(N)=ADZ*XTU(N)	
000115	36 XTUT=XTUT+XTUW(N)	11/1/67R
000116	XTAL=XTALI+XTALP	2/13/67R
000117	PVSAL=SALCOR*ADZ	2/28/67R
000118	PVREP=REPCOR*ADZ	8/07/67R
000119	RECT=RECT+PVSAL	11/1/67R
000120	REPT=REPT-PVREP	11/1/67R
000121	COMTAX=(1.-TXR)*(1.-D(16))	5/29/67R
000122	IF (LL1 .EQ. 1) GO TO 38	11/1/67R
000123	FCRD=(1.-BND+XTAL+(XREP+PVPEXP-TXR*XTAT-PWE(NY)*D(24))/PLT)/	11/1/67R
000124	1 (FNYE*COMTAX)	11/1/67R
000125	FCRN=(1.-BND-PWE(NY)+XTAL)/(FNYE*COMTAX)	5/29/67R
000126	EXPW=XEPT/(FNYE*(1.-D(16)))	6/01/67R
000127	EXPWT=EXPW+(PVPEXP+XTAT)/FNYE	
000128	FWC=((D(11)+D(25))*(1.-BND+XTAL)+XTUT-PWE(NY)*D(25))/(FNYE*COMTAX*11/2/67R	11/2/67R
000129	1 FCRN)	11/2/67R
000130	PPW=BOT/FNYE*1.0E-9	2/06/67R
000131	PRTZ=TXR*XTAT/PLT	
000132	PNTZ=1.-BND+XTAL-PRTZ	
000133	GO TO 40	
000134	38 FCRD=(PLT+XREP+PVPEXP-TXR*XTAT-PWV(NY)*D(24))/(PLT*COMTAX*VFV)	11/16/7R
000135	FCRN=RRV/COMTAX	5/29/67R
000136	EXPW=XEPT/(VFV *(1.-D(16)))	6/01/67R
000137	EXPWT=EXPW+(PVPEXP+XTAT)/VFV	
000138	IF (RRV-1.E-34) 24,24,25	3/19/67R
000139	24 FWC=0.	3/19/67R
000140	GO TO 26	3/19/67R
000141	25 FWC=(D(11)+XTUT+(1.-PWV(NY))*D(25))/(RRV*VFV)	11/2/67R
000142	26 PPW=BOT/VFV*1.0E-9	3/19/67R

000143	XTAL=BND	2/01/67R
000144	XTALP=XTAL-XTALI	2/01/67R
000145	40 PRTZ=TXR*XTAT/PLT	
000146	C (WC INCLUDES D(3),D(23),D(25))	11/1/67R
000147	WC=WC-D(25)	8/07/67R
000148	TERM1=FCRD*PLT	
000149	TERM2=FCRN*WC	
000150	TERM3=FCRN*FWC	11/2/67R
000151	TERM4 = EXPW	
000152	A=TERM1+TERM2+TERM3+TERM4	
000153	P=A/PPW	2/06/67R
000154	SPLU = A	FIX 330
000155	DELA=(PLT-D(12))*FCRD +(WC-D(13))*FCRN	
000156	ACHK=A-DELA	
000157	WRITE(L1,510)	
000158	WRITE(L1,800)(DES(I),I=1,8)	
000159	WRITE(L1,512)FCRD	
000160	WRITE(L1,513)FCRN	
000161	WRITE(L1,515)A	2/01/67R
000162	WRITE(L1,517)EXPWT	11/1/67R
000163	IF (RRV) 43,43,42	4/18/67R
000164	42 WRITE(L1,514)FWC	4/18/67R
000165	43 WRITE(L1,516) PP	10/20/7R
000166	FACTOR=1.0E+9/(COMTAX*BOT)	10/20/7R
000167	TOTAX=(TXR+D(16))*(1.-D(7))*(1.-D(15))*FACTOR	6/30/67R
000168	POSTAX=1.0E+9/BOT	2/10/67R
000169	C (FACTOR=BEFORE ALL TAXES, TOTAX=FEDERAL INCOME, STATE INCOME, AND	6/30/67R
000170	C STATE GROSS REVENUE TAXES BEFORE DEDUCTIONS,	6/30/67R
000171	C POSTAX=AFTER ALL TAXES)	6/20/67R
000172	WCC(1)=TOTELM/POWER	3/27/67R
000173	WCC(7)=FCRN*WC/PPW+WCI*(1.-TXR)*FACTOR	6/12/67R
000174	FABC(1)=FABCS/POWER	2/10/67R
000175	REPC(1)=REPCS/POWER	2/10/67R
000176	PURC(1)=PURCS/POWER	2/10/67R
000177	RECC(1)=RECCS/POWER	2/10/67R
000178	FUELC(1) = FABC(1) + REPC(1) + PURC(1) + RECC(1)	12/12/69
000179	FUELC(7) = FABC(7) + REPC(7) + PURC(7) + RECC(7)	12/12/69
000180	FABC(7)=(FABT-FABI*TXR)*FACTOR	3/07/67R
000181	REPC(7)=(REPT-REPI*TXR)*FACTOR	3/07/67R
000182	PURC(7)=(PURT-PURI*TXR)*FACTOR	3/07/67R
000183	RECC(7)=(RECT-RECI*TXR)*FACTOR	3/07/67R
000184	DO 44 I=1,7	3/07/67R
000185	44 FUELC(I)=FABC(I)+REPC(I)+PURC(I)+RECC(I)	2/09/67R
000186	D20(1)=0.0	8/07/67R
000187	D20(7)=FCRN*D(25)/PPW	8/07/67R
000188	PLANTC(1)=(PLT+D(18))*(D(9)-1.)+PLTEXP-D(24))/POWER	8/07/67R
000189	PLANTC(7)=FCRD*PLT/PPW	11/1/67R
000190	COREC(1)=(D(11)+REPCOR+COREXP-SALCOR)/POWER	8/07/67R
000191	FUELT(1) = FUELC(1) + COREC(1) + D20(1)	12/12/69

```

000192 COREC(7)=((1.-BND+XTAL)*D(11)+PVREP+PVCORE-PVSAL-TXR*COREI)*FACTOR11/1/67R
000193 FUELT(7) = FUELC(7) + COREC(7) + D20(7) 12/12/69
000194 PURRAT=DPUR*1.0E-6/D(11) 6/14/67R
000195 WRITE(L1,801) 2/06/67R
000196 WRITE(L1,800)(DES(I),I=1,8) 1/30/67R
000197 WRITE(L1,516) P 1/30/67R
000198 PLANT1 = PLANTC(1) 12/12/69
000199 PLANT7 = PLANTC(7) 12/12/69
000200 PLANT8 = PLANT1 - PLT/POWER + (D(16)/(1.+D(16)))*PLANT7 12/12/69
000201 PLNT10 = (PLT/POWER)*(RRW*(1.+RRW)**D(9))/((1.+RRW)**D(9)-1.)*D(9) 12/12/69
000202 PLANT9 = PLANT7 - PLANT8 - PLNT10 12/12/69
000203 WCC1 = WCC(1) 12/12/69
000204 WCC7 = WCC(7) 12/12/69
000205 EGREC = RRW 12/12/69
000206 TAXINC = RRW/(1.-TXR) - EGREC 12/12/69
000207 REVTAH = FCEN - EGREC - TAXINC 12/12/69
000208 AJ = (D(20) + D(21)*D(8) + CYR/1.0E6)*D(26)/POWER 12/12/69
000209 WCC8 = WCI*1.0E9/BOT - AJ 12/12/69
000210 WCC9 = (1. + D(16))*WCC8 12/12/69
000211 WCC10 = 0.0 12/12/69
000212 WCC11 = 0.0 12/12/69
000213 WCC12 = WCC9 12/12/69
000214 WCC13 = WCC1 - WCC8 12/12/69
000215 WCC14 = REVTAH*WCC*D(26)/POWER+AJ*(1.+D(16)) 12/12/69
000216 WCC15 = TAXINC*WCC*D(26)/POWER 12/12/69
000217 WCC16 = EGREC*WCC*D(26)/POWER 12/12/69
000218 WCC17 = WCC14 + WCC15 + WCC16 12/12/69
000219 FUEL11 = FUELT(1) 12/12/69
000220 FUEL17 = FUELT(7) 12/12/69
000221 FUEL18 = (FABI + REPI + PURI + RECI)*1.0E9/BOT 12/12/69
000222 FUEL19 = (1.+D(16))*FUEL18 12/12/69
000223 FUEL10 = 0.0 12/12/69
000224 FUEL11 = 0.0 12/12/69
000225 FUEL12 = FUEL19 12/12/69
000226 FUEL13 = FUEL1 - FUEL18 12/12/69
000227 FUEL14 = (FUEL17 - FUEL12)/FCEN*REVTAH 12/12/69
000228 FUEL15 = (FUEL17 - FUEL12)/FCEN*TAXINC 12/12/69
000229 FUEL16 = (FUEL17 - FUEL12)/FCEN*EGREC 12/12/69
000230 FUEL17 = FUEL17 - FUEL12 12/12/69
000231 WRITE (L1,1002) 12/12/69
000232 WRITE (L1,808) PLANT1,PLANT8,PLANT9,PLNT10,PLANT7 12/12/69
000233 WRITE (L1,807) WCC13,WCC14,WCC15,WCC16,WCC17,WCC8,WCC9,WCC10,WCC11 12/12/69
000234 1,WCC12 12/12/69
000235 WRITE (L1,802) FUEL13,FUEL14,FUEL15,FUEL16,FUEL17,FUEL18,FUEL19, 12/12/69
000236 2 FUEL10,FUEL11,FUEL12 12/12/69
000237 ADDED(1) = PLANT1 + WCC13 + WCC8 + FUEL13 + FUEL18 12/12/69
000238 ADDED(2) = PLANT8 + WCC14 + WCC9 + FUEL14 + FUEL19 12/12/69
000239 ADDED(3) = PLANT9 + WCC15 + WCC10 + FUEL15 + FUEL10 12/12/69
000240 ADDED(4) = PLNT10 + WCC16 + WCC11 + FUEL16 + FUEL11 12/12/69

```


000241	ADDED(5) = PLANT7 + WCC17 + WCC12+ FUEL17 + FUEL12	12/12/69
000242	WRITE (L1,810) (ADDED(I),I=1,5)	12/12/69
000243	D207 = FCRN*D(25)/PPW	12/12/69
000244	D208 = 0.0	12/12/69
000245	D209 = 0.0	12/12/69
000246	D2010 = D207*(D(16)/(1.+D(16)))	12/12/69
000247	D2011 = D207 -D2010 - D209	12/12/69
000248	D2012 = D2011*RRW/FCRN*(1.+D(16))	12/12/69
000249	D2013 = D2011*(1.+D(16))*(FCRN/(1.+D(16))-RRW)/FCRN	12/12/69
000250	D2014 = D209 +D2010 +D2012 +D2013	12/12/69
000251	ASUR7 = (PVINS*D(20)+PVLOAD*D(21))*(1.-TXR)*FACTOR	12/12/69
000252	ASUR8 = (D(20)*TOTINS+D(21)*WEX)/POWER	12/12/69
000253	ASUR9 = ASUR8	12/12/69
000254	ASUR10 = ASUR7*(D(16)/(1.+D(16)))	12/12/69
000255	ASUR11 = ASUR7 - ASUR10 - ASUR9	12/12/69
000256	ASUR12 = ASUR11*RRW/FCRN*(1.+D(16))	12/12/69
000257	ASUR13 = ASUR11*(1.+D(16))*(FCRN/(1.+D(16))-RRW)/FCRN	12/12/69
000258	ASUR14 = ASUR9 + ASUR10 + ASUR12 + ASUR13	12/12/69
000259	ERTH7 = D(23)*FCRN/PPW	12/12/69
000260	ERTH8 = 0.0	12/12/69
000261	ERTH9 = 0.0	12/12/69
000262	ERTH10 = ERTH7*(D(16)/(1.+D(16)))	12/12/69
000263	ERTH11 = ERTH7 - ERTH10 - ERTH9	12/12/69
000264	ERTH12 = ERTH11*RRW/FCRN*(1.+D(16))	12/12/69
000265	ERTH13 = ERTH11*(1.+D(16))*(FCRN/(1.+D(16))-RRW)/FCRN	12/12/69
000266	ERTH14 = ERTH9 + ERTH10 + ERTH12 + ERTH13	12/12/69
000267	OTHR7 = (WC-D(23))*FCRN/PPW+WCI*(1.-TXR)*FACTOR-ASUR7	12/12/69
000268	OTHR8 = TOTELM/POWER - ASUR8 - ERTH8	12/12/69
000269	OTHR9 = WCC8 + AJ	12/12/69
000270	OTHR10 = OTHR7*(D(16)/(1.+D(16)))	12/12/69
000271	OTHR11 = OTHR7 - OTHR10 - OTHR9	12/12/69
000272	OTHR12 = OTHR11*RRW/FCRN*(1.+D(16))	12/12/69
000273	OTHR13 = OTHR11*(1.+D(16))*(FCRN/(1.+D(16))-RRW)/FCRN	12/12/69
000274	OTHR14 = OTHR9 + OTHR10 + OTHR12 + OTHR13	12/12/69
000275	WRITE (L1,821)	12/12/69
000276	WRITE (L1,812) OTHR8,OTHR9,OTHR10,OTHR11,OTHR12,OTHR13,OTHR14	12/12/69
000277	WRITE (L1,813) ERTH8,ERTH9,ERTH10,ERTH11,ERTH12,ERTH13,ERTH14	12/12/69
000278	WRITE (L1,814) ASUR8,ASUR9,ASUR10,ASUR11,ASUR12,ASUR13,ASUR14	12/12/69
000279	WRITE(L1,822)	6/14/67R
000280	COL1A=COREXP/POWER	9/30/68R
000281	FABCI(1)=D(11)/POWER	9/30/68
000282	PURCI(1) = FABCI(1)*PURRAT	12/12/69
000283	FABCI(7)=COREC(7)+(PVSAL-PVREP)*FACTOR	10/5/67R
000284	PURCI(7) = FABCI(7)*PURRAT	12/12/69
000285	FABCI(1) = FABCI(1) - PURCI(1)	12/12/69
000286	FABCI(7) = FABCI(7) - PURCI(7)	12/12/69
000287	REPCI(1)=REPCOR/POWER	10/5/67R
000288	REPCI(7)=PVREP*FACTOR	10/5/67R
000289	RECCI(1)=-SALCOR/POWER	10/5/67R

000290	RECCI(7)=-PVSAL*FACTOR	10/5/67R
000291	COL1 = COL1A*PURRAT	12/12/69
000292	PURCI7 = PURCI(7)	12/12/69
000293	PURCI8 = PURCI(1)	12/12/69
000294	PURCI9 = COL1	12/12/69
000295	PURI10 = PURCI7*(D(16)/(1.+D(16)))	12/12/69
000296	PURI11 = PURCI7 - PURI10 - PURCI9	12/12/69
000297	PURI12 = PURI11*RRW/FCRN*(1.+D(16))	12/12/69
000298	PURI13 = PURI11*(1.+D(16))*(FCRN/(1.+D(16))-RRW)/FCRN	12/12/69
000299	PURI14 = PURCI9 + PURI10 + PURI12 + PURI13	12/12/69
000300	PURC7 = PURC(7)	12/12/69
000301	PURC8 = PURC(1)	12/12/69
000302	PURC9 = PURI*1.0E9/BOT	12/12/69
000303	PURC10 = PURC7*D(16)/(1.+D(16))	12/12/69
000304	PURC11 = PURC7 - PURC10 - PURC9	12/12/69
000305	PURC12 = PURC11*RRW/FCRN*(1. + D(16))	12/12/69
000306	PURC13 = PURC11*(1.+D(16))*(FCRN/(1.+D(16)) - RRW)/FCRN	12/12/69
000307	PURC14 = PURC9 + PURC10 + PURC12 + PURC13	12/12/69
000308	SUM = PURCI7 + PURC7	12/12/69
000309	WRITE (L1,805) SUM	12/12/69
000310	WRITE (L1,816) COL1,PURCI8,PURCI9,PURI10,PURI11,PURI12,PURI13	12/12/69
000311	1, PURI14	12/12/69
000312	WRITE (L1,811) PURC8,PURC9,PURC10,PURC11,PURC12,PURC13,PURC14	12/12/69
000313	COL1 = COL1A - COL1	12/12/69
000314	FABCI7 = FABCI(7)	12/12/69
000315	FABCI8 = FABCI(1)	12/12/69
000316	FABCI9 = COL1	12/12/69
000317	FABI10 = FABCI7*(D(16)/(1.+D(16)))	12/12/69
000318	FABI11 = FABCI7 - FABI10 - FABCI9	12/12/69
000319	FABI12 = FABI11*RRW/FCRN*(1.+D(16))	12/12/69
000320	FABI13 = FABI11*(1.+D(16))*(FCRN/(1.+D(16))-RRW)/FCRN	12/12/69
000321	FABI14 = FABCI9 + FABI10 + FABI12 + FABI13	12/12/69
000322	FABC1 = FABC(1)	12/12/69
000323	FABC7 = FABC(7)	12/12/69
000324	FABC8 = FABC(1)	12/12/69
000325	FABC9 = FABI*1.0E9/BOT	12/12/69
000326	FABC10 = FABC7*D(16)/(1.+D(16))	12/12/69
000327	FABC11 = FABC7 - FABC10 - FABC9	12/12/69
000328	FABC12 = FABC11*RRW/FCRN*(1. + D(16))	12/12/69
000329	FABC13 = FABC11*(1.+D(16))*(FCRN/(1.+D(16)) - RRW)/FCRN	12/12/69
000330	FABC14 = FABC9 + FABC10 + FABC12 + FABC13	12/12/69
000331	SUM = FABCI7 + FABC7	12/12/69
000332	WRITE (L1,803) SUM	12/12/69
000333	WRITE(L1,816) COL1,FABCI8,FABCI9,FABI10,FABI11,FABI12,FABI13	12/12/69
000334	1, FABI14	12/12/69
000335	WRITE (L1,811) FABC8,FABC9,FABC10,FABC11,FABC12,FABC13,FABC14	12/12/69
000336	REPCI7 = REPCI(7)	12/12/69
000337	REPCI8 = REPCI(1)	12/12/69
000338	REPCI9 = 0.00	12/12/69

000339	REPI10 = REPCI7*(D(16)/(1.+D(16)))	12/12/69
000340	REPI11 = REPCI7 - REPI10 - REPCI9	12/12/69
000341	REPI12 = REPI11*RRW/FCRN*(1.+D(16))	12/12/69
000342	REPI13 = REPI11*(1.+D(16))*(FCRN/(1.+D(16)) - RRW)/FCRN	12/12/69
000343	REPI14 = REPCI9 + REPI10 + REPI12 + REPI13	12/12/69
000344	REPC7 = REPC(7)	12/12/69
000345	REPC8 = REPC(1)	12/12/69
000346	REPC9 = REPI*1.0E9/BOT	12/12/69
000347	REPC10 = REPC7*D(16)/(1.+D(16))	12/12/69
000348	REPC11 = REPC7 - REPC10 - REPC9	12/12/69
000349	REPC12 = REPC11*RRW/FCRN*(1. + D(16))	12/12/69
000350	REPC13 = REPC11*(1.+D(16))*(FCRN/(1.+D(16)) - RRW)/FCRN	12/12/69
000351	REPC14 = REPC9 + REPC10 + REPC12 + REPC13	12/12/69
000352	SUM = REPCI7 + REPC7	12/12/69
000353	WRITE (L1,804) SUM	12/12/69
000354	WRITE(L1,809) REPCI8,REPCI9,REPI10,REPI11,REPI12,REPI13,REPI14	12/12/69
000355	WRITE (L1,811) REPC8,REPC9,REPC10,REPC11,REPC12,REPC13,REPC14	12/12/69
000356	RECCI7 = RECCI(7)	12/12/69
000357	RECCI8 = RECCI(1)	12/12/69
000358	RECCI9 = 0.00	12/12/69
000359	RECI10 = RECCI7*(D(16)/(1.+D(16)))	12/12/69
000360	RECI11 = RECCI7 - RECI10 - RECCI9	12/12/69
000361	RECI12 = RECI11*RRW/FCRN*(1.+D(16))	12/12/69
000362	RECI13 = RECI11*(1.+D(16))*(FCRN/(1.+D(16)) - RRW)/FCRN	12/12/69
000363	RECI14 = RECCI9 + RECI10 + RECI12 + RECI13	12/12/69
000364	RECC1 = RECC(1)	12/12/69
000365	RECC7 = RECC(7)	12/12/69
000366	RECC8 = RECC(1)	12/12/69
000367	RECC9 = RECI*1.0E9/BOT	12/12/69
000368	RECC10 = RECC7*D(16)/(1.+D(16))	12/12/69
000369	RECC11 = RECC7 - RECC10 - RECC9	12/12/69
000370	RECC12 = RECC11*RRW/FCRN*(1. + D(16))	12/12/69
000371	RECC13 = RECC11*(1.+D(16))*(FCRN/(1.+D(16)) - RRW)/FCRN	12/12/69
000372	RECC14 = RECC9 + RECC10 + RECC12 + RECC13	12/12/69
000373	SUM = RECCI7 + RECC7	12/12/69
000374	WRITE (L1,806) SUM	12/12/69
000375	WRITE(L1,809) RECCI8,RECCI9,RECI10,RECI11,RECI12,RECI13,RECI14	12/12/69
000376	WRITE (L1,811) RECC8,RECC9,RECC10,RECC11,RECC12,RECC13,RECC14	12/12/69
000377	WRITE (L1,815) D208,D209,D2010,D2011,D2012,D2013,D2014	12/12/69
000378	WRITE(L1,823)	12/12/69
000379	DEPPLT = PLANT7/(1.+D(16))*POWER*1000./ (D(8)*D(9))	12/12/69
000380	WCAPNF = WCC17/(1.+D(16))*POWER*1000./D(8)/D(9)	12/12/69
000381	WCAPF = FUEL17/(1.+D(16))*POWER*1000./ (D(8)*D(9))	12/12/69
000382	ANFXOP = D(20) + D(21)*D(8) + CYR/1.0E6	12/12/69
000383	OAM = WCC8	12/12/69
000384	FULCYC = FUEL78	12/12/69
000385	REVTAX = D(16)/(1.+D(16))*(PLANT7 + WCC7 + FUEL77)	12/12/69
000386	FIXCST = DEPPLT + WCAPNF + WCAPF	12/12/69
000387	OPRCST = FULCYC + OAM	12/12/69

000388	WRITE (L1,900)	12/12/69
000389	WRITE (L1,800) (DES(I),I=1,8)	12/12/69
000390	WRITE (L1,516) P	12/12/69
000391	WRITE (L1,1500) FIXCST	12/12/69
000392	WRITE (L1,1510) DEPPLT	12/12/69
000393	WRITE (L1,1520) WCAPNF,ANFXOP	12/12/69
000394	WRITE (L1,1530) WCAPF	12/12/69
000395	WRITE (L1,1600) OPRCST	12/12/69
000396	WRITE (L1,1610) OAM	12/12/69
000397	WRITE (L1,1620) FULCYC	12/12/69
000398	WRITE (L1,909) REV TAX	12/12/69
000399	WC=WC+D(25)	11/7/67R
000400		12/12/69
000401	C STORE FIXED CHARGE CALCULATIONS TO	12/12/69
000402	C SECOND BINARY DAEDALUS ARRAY	12/12/69
000403	C	12/12/69
000404	DO 60 I=28,39	12/12/69
000405	DAED1(I) = 0.0	12/12/69
000406	60 CONTINUE	12/12/69
000407	DAED1(40) = PLANT1	12/12/69
000408	DAED1(41) = PLANT8	12/12/69
000409	DAED1(42) = PLANT9	12/12/69
000410	DAED1(43) = PLNT10	12/12/69
000411	DAED1(44) = 0.0	12/12/69
000412	DAED1(45) = 0.0	12/12/69
000413	DAED1(46) = PLANT7	12/12/69
000414	DAED1(47) = WCC13	12/12/69
000415	DAED1(48) = WCC14	12/12/69
000416	DAED1(49) = WCC15	12/12/69
000417	DAED1(50) = WCC16	12/12/69
000418	DAED1(51) = 0.0	12/12/69
000419	DAED1(52) = 0.0	12/12/69
000420	DAED1(53) = WCC17	12/12/69
000421	DAED1(54) = WCC8	12/12/69
000422	DAED1(55) = WCC9	12/12/69
000423	DAED1(56) = WCC10	12/12/69
000424	DAED1(57) = WCC11	12/12/69
000425	DAED1(58) = 0.0	12/12/69
000426	DAED1(59) = 0.0	12/12/69
000427	DAED1(60) = WCC12	12/12/69
000428	DAED1(61) = FUEL13	12/12/69
000429	DAED1(62) = FUEL14	12/12/69
000430	DAED1(63) = FUEL15	12/12/69
000431	DAED1(64) = FUEL16	12/12/69
000432	DAED1(65) = 0.0	12/12/69
000433	DAED1(66) = 0.0	12/12/69
000434	DAED1(67) = FUEL17	12/12/69
000435	DAED1(68) = FUEL18	12/12/69
000436	DAED1(69) = FUEL19	12/12/69

000437	DAED1(70) = FUEL10	12/12/69
000438	DAED1(71) = FUEL11	12/12/69
000439	DAED1(72) = 0.0	12/12/69
000440	DAED1(73) = 0.0	12/12/69
000441	DAED1(74) = FUEL12	12/12/69
000442	DAED1(75) = ADDED(1)	12/12/69
000443	DAED1(76) = ADDED(2)	12/12/69
000444	DAED1(77) = ADDED(3)	12/12/69
000445	DAED1(78) = ADDED(4)	12/12/69
000446	DAED1(79) = 0.0	12/12/69
000447	DAED1(80) = 0.0	12/12/69
000448	DAED1(81) = ADDED(5)	12/12/69
000449	DAED1(82) = OTHR8	12/12/69
000450	DAED1(83) = OTHR9	12/12/69
000451	DAED1(84) = OTHR10	12/12/69
000452	DAED1(85) = OTHR11	12/12/69
000453	DAED1(86) = OTHR12	12/12/69
000454	DAED1(87) = OTHR13	12/12/69
000455	DAED1(88) = OTHR14	12/12/69
000456	DAED1(89) = ERT8	12/12/69
000457	DAED1(90) = ERT9	12/12/69
000458	DAED1(91) = ERT10	12/12/69
000459	DAED1(92) = ERT11	12/12/69
000460	DAED1(93) = ERT12	12/12/69
000461	DAED1(94) = ERT13	12/12/69
000462	DAED1(95) = ERT14	12/12/69
000463	DAED1(96) = ASUR8	12/12/69
000464	DAED1(97) = ASUR9	12/12/69
000465	DAED1(98) = ASUR10	12/12/69
000466	DAED1(99) = ASUR11	12/12/69
000467	DAED1(100) = ASUR12	12/12/69
000468	DAED1(101) = ASUR13	12/12/69
000469	DAED1(102) = ASUR14	12/12/69
000470	DAED1(103) = PURC18	12/12/69
000471	DAED1(104) = PURC19	12/12/69
000472	DAED1(105) = PURI10	12/12/69
000473	DAED1(106) = PURI11	12/12/69
000474	DAED1(107) = PURI12	12/12/69
000475	DAED1(108) = PURI13	12/12/69
000476	DAED1(109) = PURI14	12/12/69
000477	DAED1(110) = PURC8	12/12/69
000478	DAED1(111) = PURC9	12/12/69
000479	DAED1(112) = PURC10	12/12/69
000480	DAED1(113) = PURC11	12/12/69
000481	DAED1(114) = PURC12	12/12/69
000482	DAED1(115) = PURC13	12/12/69
000483	DAED1(116) = PURC14	12/12/69
000484	DAED1(117) = FABC18	12/12/69
000485	DAED1(118) = FABC19	12/12/69

000486	DAED1(119)=	FABI10	12/12/69
000487	DAED1(120)=	FABI11	12/12/69
000488	DAED1(121)=	FABI12	12/12/69
000489	DAED1(122)=	FABI13	12/12/69
000490	DAED1(123)=	FABI14	12/12/69
000491	DAED1(124)=	FABC8	12/12/69
000492	DAED1(125)=	FABC9	12/12/69
000493	DAED1(126)=	FABC10	12/12/69
000494	DAED1(127)=	FABC11	12/12/69
000495	DAED1(128)=	FABC12	12/12/69
000496	DAED1(129)=	FABC13	12/12/69
000497	DAED1(130)=	FABC14	12/12/69
000498	DAED1(131)=	REPCI8	12/12/69
000499	DAED1(132)=	REPCI9	12/12/69
000500	DAED1(133)=	REPI10	12/12/69
000501	DAED1(134)=	REPI11	12/12/69
000502	DAED1(135)=	REPI12	12/12/69
000503	DAED1(136)=	REPI13	12/12/69
000504	DAED1(137)=	REPI14	12/12/69
000505	DAED1(138)=	REPC8	12/12/69
000506	DAED1(139)=	REPC9	12/12/69
000507	DAED1(140)=	REPC10	12/12/69
000508	DAED1(141)=	REPC11	12/12/69
000509	DAED1(142)=	REPC12	12/12/69
000510	DAED1(143)=	REPC13	12/12/69
000511	DAED1(144)=	REPC14	12/12/69
000512	DAED1(145)=	RECCI8	12/12/69
000513	DAED1(146)=	RECCI9	12/12/69
000514	DAED1(147)=	RECI10	12/12/69
000515	DAED1(148)=	RECI11	12/12/69
000516	DAED1(149)=	RECI12	12/12/69
000517	DAED1(150)=	RECI13	12/12/69
000518	DAED1(151)=	RECI14	12/12/69
000519	DAED1(152)=	RECC8	12/12/69
000520	DAED1(153)=	RECC9	12/12/69
000521	DAED1(154)=	RECC10	12/12/69
000522	DAED1(155)=	RECC11	12/12/69
000523	DAED1(156)=	RECC12	12/12/69
000524	DAED1(157)=	RECC13	12/12/69
000525	DAED1(158)=	RECC14	12/12/69
000526	DAED1(159)=	D208	12/12/69
000527	DAED1(160)=	D209	12/12/69
000528	DAED1(161)=	D2010	12/12/69
000529	DAED1(162)=	D2011	12/12/69
000530	DAED1(163)=	D2012	12/12/69
000531	DAED1(164)=	D2013	12/12/69
000532	DAED1(165)=	D2014	12/12/69
000533	IZ =	165	12/12/69
000534	IDAED1(1) =	IZ	12/12/69

000535	C		FIX 480
000536	C	OUTPUT FORMATS	FIX 490
000537		510 FORMAT(26H1FIXED CHARGE CALCULATIONS/)	FIX 510
000538		512 FORMAT(41H0FIXED CHARGE RATE ON DEPRECIABLE CAPITAL,F14.4,	10/20/7R
000539		1 2X,63H(INCLUDES PLANT PROPERTY TAX, INSURANCE, REPLACEMENTS, SALV	11/2/67R
000540		2AGE))	11/2/67R
000541		513 FORMAT(44H FIXED CHG RATE ON NONDEPRECIABLE INVESTMENTF11.4)	8/24/67R
000542		514 FORMAT(41H0FUEL WORKING CAPITAL, \$M , F14.4,	11/1/67R
000543		1 2X,61H(EXCESS OF FUEL COST OVER AMORTIZED, RECOVERABLE D20 OR SAL	11/2/67R
000544		1T))	11/2/67R
000545		515 FORMAT(41H0CONSTANT ANNUAL INCOME REQUIRED, \$M , F14.4)	2/01/67R
000546		516 FORMAT (1H0/24H POWER COST, MILLS/KWHE , 3X,F14.4/1H0)	10/20/7R
000547		517 FORMAT(41H0TOTAL TAX-DEDUCTIBLE EXPENSES, \$M , F14.4)	11/1/67R
000548		800 FORMAT(27H0PROBLEM IDENTIFICATION ,8A6/)	FIX 800
000549		801 FORMAT(26H1COST OF POWER CALCULATION,75X,19HFUEL CYCLE ANALYSIS)	1/30/67R
000550		802 FORMAT ('0 FUEL CYCLE COSTS (2) FIXED'	12/12/69
000551		1 ,F8.4,3X,4F10.4	12/12/69
000552		2 /'	VARIABLE'
000553		3 ,F8.4,3X,4F10.4)	12/12/69
000554		803 FORMAT (8X,11HFABRICATION,89X, , F12.4)	11/1/67R
000555		804 FORMAT (8X,12HREPROCESSING,88X, , F12.4)	11/1/67R
000556		805 FORMAT (8X,14HFUEL PURCHASES,86X, , F12.4)	11/1/67R
000557		806 FORMAT (8X,11HFUEL CREDIT,89X, , F12.4)	11/1/67R
000558		807 FORMAT ('0 OPERATING AND MAINTENANCE COSTS (1) FIXED'	12/12/69
000559		1 ,F8.4,3X,4F10.4	12/12/69
000560		2 /'	VARIABLE'
000561		3 ,F8.4,3X,4F10.4)	12/12/69
000562		808 FORMAT (1H0,4X,18HDEPRECIABLE PLANT ,24X,	8/07/67R
000563		1 F8.4,3X,4F10.4)	12/12/69
000564		809 FORMAT (11X,12HINITIAL CORE,24X,	6/15/67R
000565		1 F8.4,8X,5F9.4,F12.4)	3/07/67R
000566		810 FORMAT ('0 TOTAL',37X,F8.4,3X,4F10.4)	12/12/69
000567		811 FORMAT (11X,16HREPLACEMENT FUEL,20X,	6/14/67R
000568		1 F8.4,8X,5F9.4,F12.4)	6/14/67R
000569		812 FORMAT (8X,18HOPERATING EXPENSES,21X,	8/07/67R
000570		1 F8.4,8X,5F9.4,F12.4)	6/15/67R
000571		813 FORMAT (8X,22HRECOVERABLE LAND COSTS,17X,	6/15/67R
000572		1 F8.4,8X,5F9.4,F12.4)	6/15/67R
000573		814 FORMAT (8X,17HNUCLEAR LIABILITY,22X,	6/15/67R
000574		1 F8.4,8X,5F9.4,F12.4)	6/15/67R
000575		815 FORMAT (8X,35HMODERATOR AND FUEL CARRIER RECOVERY,4X,	8/07/67R
000576		1 F8.4,8X,5F9.4,F12.4)	6/15/67R
000577		816 FORMAT (11X,12HINITIAL CORE,16X,2F8.4,8X,5F9.4,F12.4)	9/30/68R
000578		821 FORMAT (/// 47X,' CASH ',20X,'REVENUE FIXED CAPITAL INCOME	12/12/69
000579		1 TOTAL',47X,' PER KWH',10X,'EXPENSES TAXES CHARGES RECOVE	12/12/69
000580		2RY TAXES CHARGES'/' (1) DETAILS OF OPERATING AND MAINTENANC	12/12/69
000581		3E COSTS')	12/12/69
000582		822 FORMAT (1H0,1X,31H(2) DETAILS OF FUEL CYCLE COSTS,7X,	9/30/68R
000583		1 15HINDIRECT DIRECT)	9/30/68R

000584	823	FORMAT ('0 (3) INCLUDES REVENUE TAXES.')	12/12/69
000585	900	FORMAT(26H1COST OF POWER CALCULATION,78X,16HUTILITY ANALYSIS)	1/31/67R
000586	909	FORMAT ('0 REVENUE TAXES ',31X,F14.4)	12/12/69
000587	1002	FORMAT (47X,' CASH ANNUAL INCOME CAPITAL TOTAL '	12/12/69
000588	1	/ 47X,' PER KWH EXPENSES(3) TAXES RECOVERY CHARGES'	12/12/69
000589	2	/)	12/12/69
000590	1500	FORMAT ('0 ANNUAL FIXED COSTS, \$/KWE',21X,F14.4)	12/12/69
000591	1510	FORMAT ('0 DEPRECIABLE PLANT',32X,F14.4)	12/12/69
000592	1520	FORMAT (' NON-FUEL WORKING CAPITAL',25X,F14.4	12/12/69
000593	1	,2X,'(INCLUDES ANNUAL FIXED OPERATING COSTS OF 'F7.4,' \$M/YR)')	12/12/69
000594	1530	FORMAT (' FUEL WORKING CAPITAL',29X,F14.4)	12/12/69
000595	1600	FORMAT ('0 OPERATING COSTS, MILLS/KWHE',21X,F14.4)	12/12/69
000596	1610	FORMAT ('0 OPERATION AND MAINTENANCE',24X,F14.4)	12/12/69
000597	1620	FORMAT (' FUEL CYCLE',39X,F14.4)	12/12/69
000598		RETURN	
000599		END	

@ ELT HDG3,1,691212, 19715

000001	C	ROUTINE TO WRITE SUB-HEADING LINES FOR TABLES 3 AND 4	HDG3 010
000002		SUBROUTINE HDG3(K)	HDG3 020
000003	C		HDG3 030
000004	C	COMMON FOR PACTOLUS PROGRAM	040
000005		INCLUDE COM1	050
000006	C		HDG3 150
000007	C	WRITE PAGE HEADINGS	HDG3 160
000008		CALL PHDG	HDG3 170
000009	C		HDG3 180
000010	C		HDG3 190
000011		IF (K.LE.2) WRITE (LTR,600)	HDG3 200
000012		IF (K.GT.2) WRITE (LTR,610)	HDG3 210
000013		IF ((K.EQ.2).OR.(K.EQ.4)) GO TO 400	HDG3 230
000014		WRITE (LTR,620)	HDG3 300
000015		GO TO 800	HDG3 370
000016	C	WRITE HEADING LINE FOR SECOND GROUP OF ISOTOPES	HDG3 390
000017		400 WRITE (LTR,630) (ANAM(I),I=12,20)	HDG3 400
000018	C		HDG3 570
000019	C	OUTPUT FORMATS	HDG3 590
000020		600 FORMAT (1H0,54X,7HTABLE 5/ 45X,30HKILOGRAMS FABRICATED EACH YEAR/5	
000021		20X,20H (BEFORE LOSSES) /)	
000022		610 FORMAT (1H0,54X,7HTABLE 6/ 44X,31HKILOGRAMS REPROCESSED EACH YE	
000023		2AR / 51X,17H(AFTER LOSSES)/)	
000024		620 FORMAT (2X,4HYEAR,5X,105HTH232 PA233 U233 U234	HDG3 620
000025		1 U235 U236 U238 PU239 PU240 PU241 PU242	HDG3 621
000026		2 /)	HDG3 622
000027		630 FORMAT (2X,4HYEAR, 9(4X,A6), 4X,17HFISS PRD TOTAL /)	HDG3 630
000028	C		HDG3 700
000029		800 RETURN	HDG3 800
000030		END	-

ELT HEADR,1,691212, 19719

```

000001      C      ROUTINE TO WRITE HEADER PAGE PRECEDING THE REPORT      HEAD 010
000002      SUBROUTINE HEADR      HEAD 020
000003      C      HEAD 021
000004      C      037
000005      C      COMMON FOR PACTOLUS PROGRAM      040
000006      INCLUDE COM1      050
000007      C      100
000008      C      HEAD 160
000009      C      HEAD 190
000010      WRITE (LTR,300) ADATE      HEAD 260
000011      300 FORMAT (1H1 /// 50X,19HNUCLEAR POWER COSTS / 53X,14HAS CALCULATHEAD 300
000012      1ED / 57X, 7HBY THE // 53X,14HPACTOLUS CODE / 59X,2HON / 50X, HEAD 310
000013      2 3A6 // )      HEAD 320
000014      C      HEAD 340
000015      C      DETERMINE IF EXTRA HEADING LINES SHOULD BE WRITTEN      HEAD 350
000016      IF (IHDG.EQ.0) GO TO 600      HEAD 360
000017      K2 = IHDG*14      HEAD 370
000018      WRITE (LTR,400) (XHDG(K),K=1,K2)      HEAD 390
000019      400 FORMAT (20X,13A6,A2 )      HEAD 400
000020      C      HEAD 570
000021      C      WRITE REMAINDER OF HEADING LINES      HEAD 580
000022      600 WRITE (LTR,620)      HEAD 600
000023      620 FORMAT( 1H0 // 41X,38H ENGINEERING ECONOMICS SECTION //
000024      1 46X,27HBATTELLE MEMORIAL INSTITUTE / 45X,30HPACIFIC NORTHWEST LABHEAD 630
000025      2ORATORIES // 50X,19HPOST OFFICE BOX 999 / 46X,27HRICHLAND, WASHINHEAD 640
000026      3GTON 99352 // 32X,44H TELEPHONE. AREA CODE 509 946-24712/12/69
000027      45 / 46X,27HCABLE ADDRESS. BAT NOR LAB )
000028      C      HEAD 850
000029      RETURN      HEAD 900
000030      END      -

```

A-84

BNWL-1169

@ ELT INPUT,1,691212, 19725

```

000001      SUBROUTINE INPUT
000002      C
000003      C          COMMON FOR PACTOLUS AND POWERCO PROGRAMS
000004      INCLUDE COM1
000005      INCLUDE COM2
000006      INCLUDE COM5
000007      C
000008      DATA LI,BLNK/5,1H /
000009      C
000010      LTR = 6
000011      1 READ(LI,401)LL1,LL2,LL3,LL4,LL5,LL6,LL7,LL8,
000012      1LL9,LL10,(DES(I),I=1,8)
000013      SUMFAC=D(26)+1.0
000014      DO 3 K=1,NY
000015      YR=K
000016      ELM(K)=EEE(K)
000017      PFWFAC=AMAX1(0.,AMIN1(1.,D(26)-YR+1.))
000018      SUMFAC=SUMFAC-PFWFAC
000019      3 EEE(K)=EEE(K)-(D(19)+D(20)+D(21)+D(22))*PFWFAC-D(17)*
000020      1(D(1)*(1.-(YR-1.)/D(9))*(1.-D(18)/D(1)*YR*0.5))+D(11)*SUMFAC/D(26))
000021      IF(LL3-1) 150,90,200
000022      90 IF(LL4)97,97,92
000023      92 DO 89 N=1,LL4
000024      READ(LI,404)J,D(J)
000025      IF ((J.LE. 0) .OR. (J.GT. 35)) GO TO 130
000026      GO TO (82,89,89,89,89,89,89,89,81,89,89,82,89,89,89,89,89,82,82,82,
000027      1 82,81,82,89,89,89,82,89,89,89,89,89,89,89,89,89,89), J
000028      81 D(21)=D(21)*D(8)
000029      82 SUMFAC=D(26)+1.0
000030      DO 83 I=1,NY
000031      YR=I
000032      PFWFAC=AMAX1(0.,AMIN1(1.,D(26)-YR+1.))
000033      SUMFAC=SUMFAC-PFWFAC
000034      83 ELM(I)=EEE(I)+(D(19)+D(20)+D(21)+D(22))*PFWFAC+D(17)*
000035      1(D(1)*(1.-(YR-1.)/D(9))*(1.-D(18)/D(1)*YR*0.5))+D(11)*SUMFAC/D(26))
000036      GO TO 89
000037      89 CONTINUE
000038      IF (LL5.LE.0) GO TO 200
000039      97 DO 120 N=1,LL5
000040      READ(LI,405)M,K,AD
000041      IF ((M.LE. 0) .OR. (M.GT. 180)) GO TO 131
000042      GO TO (101,102,103,104,105,106,107),K
000043      101 PFW (M) = AD
000044      GO TO 120

```

```

INP 030
040
050
055
11/7/67R
INP 059
INP 060
INP 070
INP 075
INP 080
5/01/67R
5/01/67R
5/02/67R
11/10/7R
5/02/67R
5/01/67R
5/16/67R
5/16/67R
5/02/67R
3/19/67R
4/04/67R
5/01/67R
5/01/67R
4/21/67R
4/21/67R
5/02/67R
5/02/67R
4/21/67R
5/16/67R
5/16/67R
3/19/67R
3/19/67R
INP 095
INP 098
4/04/67R
INP 101
INP 101

```

BWNL-1169

000045	102 CURA(M) = AD	INP 102
000046	GO TO 120	INP 102
000047	103 CFAB(M) = AD	INP 103
000048	GO TO 120	INP 103
000049	104 CREP(M) = AD	INP 104
000050	GO TO 120	INP 104
000051	105 CPLU(M) = AD	INP 105
000052	GO TO 120	INP 105
000053	106 EEE(M)=AD	
000054	YR=M	5/02/67R
000055	ELM(M)=AD+(D(19)+D(20)+D(21)+D(22))*AMAX1(0.,AMIN1(1.,D(26)-	5/01/67R
000056	1 YR+1.0))+D(17)*(D(1)*(1.-(YR-1.)/D(9))*(1.-D(18)/D(1)*	5/16/67R
000057	2 YR*0.5))+D(11)*(D(26)+1.-YR)/D(26))	5/16/67R
000058	GO TO 120	INP 106
000059	107 BRP(M)=AD	
000060	120 CONTINUE	INP 120
000061	GO TO 200	INP 130
000062	130 WRITE (6,406) D(J),J	4/04/67R
000063	GO TO 120	12/12/69
000064	131 WRITE (6,406) AD,M	4/04/67R
000065	GO TO 120	4/04/67R
000066	C	INP 140
000067	150 READ(LI,402) (D(N),N=1,35)	INP 150
000068	D(21)=D(21)*D(8)	3/31/67R
000069	IF (D(26)) 95,95,96	3/31/67R
000070	95 D(26)=D(2)	3/31/67R
000071	96 NY=D(2)+0.999	2/01/67R
000072	SUMFAC=D(26)+1.0	4/21/67R
000073	DO 170 K = 1,NY	INP 165
000074	YR=K	5/02/67R
000075	READ(LI,402)PFW(K),CURA(K),CFAB(K),CREP(K),CPLU(K),EEE(K),BRP(K)	2/01/67R
000076	PFWFAC=AMAX1(0.,AMIN1(1.,D(26)-YR+1.))	5/02/67R
000077	SUMFAC=SUMFAC-PFWFAC	4/21/67R
000078	170 ELM(K)=EEE(K)+(D(19)+D(20)+D(21)+D(22))*PFWFAC+D(17)*	5/15/67R
000079	1(D(1)*(1.-(YR-1.)/D(9))*(1.-D(18)/D(1)*YR*0.5))+D(11)*SUMFAC/D(26))	5/15/67R
000080	C	INP 180
000081	C ASSIGN VALUES FOR PAGE HEADING ROUTINE	INP 190
000082	200 ADATE(1) = BLNK	INP 200
000083	ADATE(2) = BLNK	INP 202
000084	ADATE(3) = BLNK	INP 204
000085	DO 250 I = 1,8	INP 240
000086	250 AHOG(I) = DES(I)	INP 250
000087	DO 270 I = 9,13	INP 260
000088	270 AHOG(I) = BLNK	INP 270
000089	J=MIN0(NY,40)	11/10/7R
000090	DO 290 K=1,J	11/10/7R
000091	YPURCH(K)=CURA(K)	11/7/67R
000092	YFABCH(K)=CFAB(K)	11/7/67R
000093	YREPCH(K)=CREP(K)	11/7/67R

000094	290 YFCRED(K)=CPLU(K)	11/10/7R
000095	C	INP 380
000096	C INPUT FORMATS	INP 390
000097	401 FORMAT(10I2,8A6)	
000098	402 FORMAT(7E10.0)	
000099	403 FORMAT(I4,E16.0,5E10.0)	
000100	404 FORMAT(I4,E20.0)	
000101	405 FORMAT(2I4,E12.0)	
000102	406 FORMAT(22H0***** A VALUE OF, 1PE14.5,49H HAS BEEN ENTERED	ER4/04/67R
000103	1RONEOUSLY WITH A SUBSCRIPT OF, I6)	4/04/67R
000104	C	INP 450
000105	RETURN	INP 900
000106	END	-

```

000143      TEINV(I) = TEINV(I) + ADJINV
000144 350 NRMA = 0
000145      DO 400 II=1,NMA
000146      IF (TMA(II) .EQ. 0.0) GO TO 400
000147      NRMA = NRMA + 1
000148      TMA(NRMA) = TMA(II)
000149      UCM(NRMA) = UCM(II)
000150      EINV(NRMA) = EINV(II)
000151 400 CONTINUE
000152      NZA = NRMA + 1
000153      DO 420 II=NZA,NMA
000154      TMA(II) = 0.0
000155      UCM(II) = 0.0
000156      BINV(II) = 0.0
000157      EINV(II) = 0.0
000158 420 CONTINUE
000159 500 CONTINUE
000160 1000 CONTINUE
000161      CALL PHDG
000162      WRITE (LTR,6000)
000163      DO 1500 I=1,NYR
000164      ITIMX = TSTART + FLOAT(I-1) - TCONST + .000001
000165      WRITE (LTR,6010) ITIMX,TBINV(I),TPURCH(I),TCONS(I),TSALES(I)
000166      1 ,TADJ(I),TEINV(I)
000167 1500 CONTINUE
000168      RETURN
000169 4000 FORMAT ( 30X,' I N V E N T O R Y   A C C O U N T I N G   O F '2A6
000170 1// 9X,'UNIT COST   BEGINNING INVENTORY   PURCHASES
000171 2 CONSUMPTION      SALES      ENDING INVENTORY   '
000172 3/  ' YEAR      $/KG (HM)',5('      TONNE      $ M ') //)
000173 5000 FORMAT (15,F12.2, 5(-3PF13.3,-6PF8.3) )
000174 5001 FORMAT (1H )
000175 5010 FORMAT ( 91X,'INVENTORY ADJUSTMENT--',-6PF9.3
000176 1 /      99X,'ENDING INVENTORY-----',-6PF9.3      /)
000177 6000 FORMAT (40X,'INVENTORY ACCOUNTING OF FUEL EXPENSES   '
000178 1 /  48X,'IN MILLIONS OF DOLLARS'
000179 2 //' YEAR',4X,'BEGINNING INVENTORY',4X,'PURCHASES',8X,'CONSUMPTION
000180 3',9X,'SALES',8X,'ADJUSTMENTS',4X,'ENDING INVENTORY'//)
000181 6010 FORMAT (15,2X,-6P7F17.5)
000182      END

```

@ ELT LOSS,1,691212, 19741

```

000001      C          ROUTINE TO CALCULATE AND STORE LOSSES          LOS  010
000002      SUBROUTINE LOSS          LOS  020
000003      C          LOS  030
000004      C          COMMON FOR PACTOLUS PROGRAM          040
000005      INCLUDE COM1          050
000006      INCLUDE COM5
000007      C          LOS  190
000008      C          CALCULATE INDEXES FOR LOSS VARIABLES          LOS  200
000009      A1 = (TIM(1) - SHPREA - PRI)/365.3 + 1.0          12/12/69
000010      A2 = (TIM(N3) + COOL + SHPSEP + TSEP)/365.3 + 1.0          12/12/69
000011      K1 = MAX1(A1,1.0)
000012      K2 = MAX1(A2,1.0)
000013      B1 = K1
000014      B2 = K2
000015      AB1 = B1 - A1 - 1.
000016      AB2 = B2 - A2 - 1.
000017      C          FILL UP LOSS ARRAYS          LOS  340
000018      XLOSS = CORLOS          LOS  350
000019      IF (ICOR.GT.0)          XLOSS = BLKLOS          LOS  370
000020      XL = XLOSS*VIX          LOS  390
000021      TDECY = SHPREA + PRI          12/12/69
000022      PUDEC1 = (C41(1)*(1.-EXP(-1.438E-4*(SHPFAB+TFAB))) + C41(1)*(1.-XLOS
000023      1S)*(1.-EXP(-1.438E-4* TDECY)))*PU41IN
000024      IF (TIM(1) .GT. 0.0) FABLSS(K1) = FABLSS(K1) + XL + PUDEC1          12/12/69
000025      TDECY = COOL + SHPSEP + TSEP
000026      PUDEC2 = (C41(N3)*(1.-EXP(-1.438E-4*TDECY)) + C41(N3)*(1.-REPLS)*(
000027      11.-EXP(-1.438E-4*SHPDES))) *PU41OT
000028      IF (IPR.NE.0) WRITE(LTR,1010) PUDEC1,PUDEC2
000029      1010 FORMAT(/15H PU DECAY DEBUG //2F12.3//)
000030      IF (TIM(1) .GT. 0.0) FLOSS(K1) = FLOSS(K1) + XL + PUDEC1          12/12/69
000031      IF (TIM(1) .LE. 0.0) DLOS = DLOS + XL + PUDEC1          12/12/69
000032      FLOSS(K2) = FLOSS(K2) + REPLS*VFY + PUDEC2
000033      REPLSS(K2) = REPLSS(K2) + REPLS*VFY + PUDEC2
000034      RNT1 = 1.0 + RATE*AB1
000035      RNT2 = 1.0 + RATE*AB2
000036      IF (TIM(1) .GT. 0.0) YABLSS(K1) = YABLSS(K1) + XL*RNT1 + PUDEC1          12/12/69
000037      YEPLSS(K2) = YEPLSS(K2) + REPLS * VFY*RNT2 + PUDEC2
000038      IF (IPR.NE.0) WRITE(6,1000) YABLSS(K1),K1,YEPLSS(K2),K2,RNT1,RNT2,AB
000039      11,AB2
000040      1000 FORMAT(21H YABLSS,K1,YEPLSS,K2,-6PF10.3,I5,F10.3,I5,0P2F10.4,2F10
000041      1.1)
000042      C          LOS  580
000043      C          DETERMINE IF DEBUG PRINTOUT IS NEEDED          LOS  590
000044      IF (IPR.GE.2) WRITE (LTR,700) XL,VFY,DLOS,XLOSS,ICOR          LOS  600

```

A-93

BNWL-1169

000045
000046
000047

700 FORMAT (5X,12HLOSS DEBUG , 4E12.5,I3)
RETURN
END

LOS 700
LOS 970
-

Q ELT OUTPUT,1,691212, 19745

000001		SUBROUTINE OUTPUT(RED,RAD)	
000002	C		OUT 022
000003	C	COMMON FOR POWERCO PROGRAM	055
000004		INCLUDE COM2	055
000005		INCLUDE COM4	4/21/67R
000006	C		PCO 090
000007		DATA LTR/6/	
000008	C		OUT 040
000009		DATA L1/6/	OUT 060
000010		IF (RAD) 400,20,399	1/26/67R
000011	20	WRITE(L1,505)	
000012		WRITE(L1,800)(DES(I),I=1,8)	
000013		PCT=RRR	5/02/67R
000014		IF (LL1,NE. 1) GO TO 15	5/02/67R
000015		PCT=RRV	5/02/67R
000016	15	WRITE (LTR,541) PCT	12/12/69
000017		INITYR=D(14)-0.99	2/14/67R
000018		DO 16 N = 1,NY	OUT 180
000019		NOWYR=INITYR+N	1/26/67R
000020		PWF=PWE(N)	5/02/67R
000021		IF (LL1,NE. 1) GO TO 16	5/02/67R
000022		PWF=PWV(N)	5/02/67R
000023	16	WRITE(L1,543)N,NOWYR,PWF,EFUOLD(N),EPOLD(N),ELM(N),SYD(N),TAJ(N),	11/7/67R
000024	1	TAX(N)	11/7/67R
000025		WRITE(L1,508)	
000026		WRITE(L1,800)(DES(I),I=1,8)	
000027		WRITE (LTR,544)	OUT 220
000028	12	DO 13 N=1,NY	
000029		NOWYR=INITYR+N	1/26/67R
000030		WRITE(L1,543)N,NOWYR,Z(N),TAD(N),TAC(N),TEB(N),TEA(N),TEQ(N),	10/5/67R
000031		1TAG(N)	4/21/67R
000032	13	FSLTAX(N)=TAX(N)+TEA(N)	11/17/7R
000033		GO TO 400	OUT 290
000034	399	WRITE(LTR,507)	1/26/67R
000035		GO TO 401	1/26/67R
000036	400	WRITE (LTR,506)	OUT 400
000037	401	WRITE(LTR,800)(DES(I),I=1,8)	1/31/67R
000038		IF (RAD) 413,403,413	4/26/67R
000039	403	IF (BND-.99995) 405,404,404	3/07/67R
000040	404	WRITE(LTR,545)	3/07/67R
000041		GO TO 406	3/07/67R
000042	405	WRITE(LTR,546)	3/07/67R
000043	406	DO 18 N=1,NY	3/07/67R
000044		NOWYR=INITYR+N	1/26/67R

A-95

BNWL-1169

Q ELT PCTLUS,1,691212, 19762

000001	C	MAIN PROGRAM LOGIC OF THE PACTOLUS PROGRAM	PAC	005
000002		SUBROUTINE PCTLUS	PAC	010
000003	C		PAC	030
000004	C	COMMON FOR PACTOLUS AND POWERCO PROGRAMS		040
000005		INCLUDE COM1		050
000006		INCLUDE COM2		055
000007		INCLUDE COM4		10/5/67R
000008		INCLUDE COM5		
000009		INCLUDE COM3		4/17/67R
000010	C		PAC	140
000011		DATA SMIL/1.0E+6/	PAC	150
000012	C		PAC	190
000013	C			
000014	C	READ NECESSARY INPUT CARDS		
000015		CALL CINPOT		
000016		RATE = D(16)		
000017		IF (LL1.EQ. 1)		
000018		1RATE = D(4)*D(5)*(1.-D(7)*(1.-D(15))-D(15))+(1.-D(4))*D(6)		
000019		IF (IPR.NE.0)WRITE(6,1003) RATE		
000020	1003	FORMAT(/2X,13HINTEREST RATE,F10.4//)		
000021		RATE = 0.		
000022	C	LOAD TAPE H ON THE DRUM		
000023	C			
000024		IF (I90)100,110,110		
000025	100	CALL SETDR(8,430720,880000,T8)		
000026		CALL INTAP(8,16)		
000027	110	CONTINUE		
000028	C		PAC	290
000029	C	READ BURNUP INFO FOR ONE CASE	PAC	300
000030		SRKG = 0.0		
000031		SRKGF = 0.0		
000032		IL = 0		
000033	310	CALL READ	PAC	310
000034		IF (IEND.EQ.1) GO TO 770		
000035		IL = IL + 1		
000036		IF (NCNT.LT.NREG) GO TO 311		
000037		NNREG = NREG + NRELD		
000038		IF (IMFOS.EQ. 0) GO TO 320		12/12/69
000039		FOSFAC = CXX(N3,1)*237./(DENS*.6023)		12/12/69
000040		RKGF = RKGF*FOSFAC		12/12/69
000041		CXX(N3,1) = CXX(N3,1)/FOSFAC		12/12/69
000042	320	CONTINUE		12/12/69
000043		IF (NCNT.EQ. NREG) RFTM = (TIM(N3) - TIM(1))/365.3		01/22/69
000044	311	CONTINUE		

A-100

BNWL-1169

```

000045      SRKG = SRKG + RKG
000046      SRKGF = SRKGF + RKGF
000047      C      ARE WE AT END OF THIS GROUP OF CASES          PAC 320
000048      C      ADD UP TOTAL TONS OF FUEL IN REACTOR          PAC 332
000049      IF (TIM(1).LE. 0.0) RTONS = RTONS + RKG          12/12/69
000050      C      DETERMINE IF DEBUG PRINTOUT IS WANTED          PAC 335
000051      IF (IPR.LE.0) GO TO 400          PAC 340
000052      IF (MOD(NCNT,40).EQ.0) CALL PHDG          PAC 345
000053      TM = TIM(N3)/365.3 + 1.0          01/22/69
000054      WRITE (LTR,360) MC(2),MC(3),M1,TM,RKG, EX(N3),N3          PAC 350
000055      360 FORMAT ( 5X,8HCASE NO.,I5,A1, 8X,3HM =,I2, 8X,6HTIME =,F5.1, 8X,          PAC 360
000056      1 SHRKG =,F6.1,8X,5HEXP =,F9.1,8X,I2,9H ISOTOPES )          PAC 361
000057      C          PAC 380
000058      C      UPDATE DISCHARGE COUNTER AND CALC AND STORE FAB COSTS          PAC 390
000059      400 NCNT = NCNT + 1          PAC 400
000060      FRKG = 0
000061      IF(((TIM(N3) + COOL)/365.3-THROW)*THROW)101,101,102
000062      102 FRKG = RKGF
000063      RKGF = 0
000064      101 CONTINUE
000065      CALL FAB          PAC 410
000066      BFABN = RKG          12/12/69
000067      C      CALCULATE AND STORE REPROCESSING COSTS          PAC 440
000068      CALL SEP          PAC 450
000069      BREPN = RKGF          12/12/69
000070      C      CALCULATE AND STORE SHIPPING COSTS          PAC 490
000071      CALL SHIP          PAC 500
000072      C      CALCULATE INITIAL AND FINAL FUEL VALUES          PAC 540
000073      K1 = MAX1((TIM(1)-PRI-SHPREA-TFAB-SHPFAB-UBUYTM/2.)/365.3          12/12/69
000074      1 + TCONST + 1.0,1.0)          12/12/69
000075      K2 = MAX1((TIM(N3)+COOL+SHPSEP+TSEP+SHPDES)/365.3+TCONST+1.0,1.0)          12/12/69
000076      BU308 = XKGU(K1) - XKGUCR(K2)          12/12/69
000077      BSW = XKGS(K1) - XKGSCR(K2)          12/12/69
000078      CALL PRICE          PAC 550
000079      BU308N = (XKGU(K1) - XKGUCR(K2)) - BU308          12/12/69
000080      BSWN = (XKGS(K1)-XKGSCR(K2)) - BSW          12/12/69
000081      C      CALCULATE AND STORE LOSSES          PAC 590
000082      CALL LOSS          PAC 600
000083      C          PAC 639
000084      C      CALCULATE AND STORE KG OF EACH PRODUCT CHARGED          PAC 640
000085      K1 = MAX1((TIM(1)-SHPREA-TFAB-PRI)/365.3+TCONST+1.0,1.0)          12/12/69
000086      K2 = MAX1((TIM(N3)+COOL+SHPSEP)/365.3+TCONST+1.0,1.0)          12/12/69
000087      BFPUN = (PRDCT(K1,8)+PRDCT(K1,10))-(PRDN3(K2,8)+PRDN3(K2,10))          12/12/69
000088      BU233 = PRDCT(K1,3) - PRDN3(K2,3)          12/12/69
000089      CALL PRODT          PAC 650
000090      BFPUN = (PRDCT(K1,8)+PRDCT(K1,10)-(PRDN3(K2,8)+PRDN3(K2,10)))-BFPUN          12/12/69
000091      BU233N = (PRDCT(K1,3)-PRDN3(K2,3)) - BU233          12/12/69
000092      IF(NCNT.NE.NREG) GO TO 402
000093      ICONST = TCONST/1.00001 + 1.0

```

000094	DO 401 ITI=1,ICONST	
000095	RFIS = PRDCT(ITI,3)+PRDCT(ITI,5)+PRDCT(ITI,8)+PRDCT(ITI,10)	
000096	IF(RFIS)401,401,402	
000097	401 CONTINUE	
000098	402 CONTINUE	
000099	IF (NOP .GT. 3) GO TO 310	12/12/69
000100	C	12/12/69
000101	C DISTRIBUTE MATERIAL CONSUMPTIONS BY YEAR FOR INVENTORY VALUATION	12/12/69
000102	C	12/12/69
000103	TIMI = TIM(1)/365.3	12/12/69
000104	TIMFNL = TIM(N3)/365.3	12/12/69
000105	RESTIM = TIMFNL - TIMI	12/12/69
000106	500 TIMF = INT(TIMI + 1.0)	12/12/69
000107	IF (TIMF .GT. TIMFNL) TIMF = TIMFNL	12/12/69
000108	FRA = (TIMF - TIMI)/RESTIM	12/12/69
000109	KK = TIMI + TCONST + 1.0	12/12/69
000110	ACU308(KK) = ACU308(KK) + FRA*BU308N	12/12/69
000111	ACSW(KK) = ACSW(KK) + FRA*BSWN	12/12/69
000112	ACFAB(KK) = ACFAB(KK) + FRA*BFABN	12/12/69
000113	ACREP(KK) = ACREP(KK) + FRA*BRPN	12/12/69
000114	ACFPU(KK) = ACFPU(KK) + FRA*BFPU	12/12/69
000115	ACU233(KK) = ACU233(KK) + FRA*BU233N	12/12/69
000116	TIMI = TIMF	12/12/69
000117	IF (TIMF .LT. TIMFNL) GO TO 500	12/12/69
000118	C	PAC 690
000119	C CALCULATE MASS BALANCE TABLES AND SUMMARY PHYSICS INFO	PAC 700
000120	GO TO 310	PAC 750
000121	C	PAC 755
000122	C WRITE CASH FLOW REPORT	PAC 760
000123	770 D(2) = (TIM(N3) + COOL + SHPSEP + TSEP + SHPDES)/365.30001	01/22/69
000124	CALL HEADR	
000125	CALL CFTABL	PAC 780
000126	IF (ITAP .GT. 0) CALL NTRAN(ITAP,1,IPC,DAED,LS01)	12/12/69
000127	CALL INVACC	12/12/69
000128	CALL PHYSIC	
000129	CALL TABL3	PAC 790
000130	C FILL POWERCO COMMON WITH NECESSARY INFO	PAC 800
000131	D(1) = D(1) / SMIL	PAC 801
000132	D(3) = D(3) / SMIL	PAC 803
000133	D(8) = RTP * EFF	PAC 810
000134	D(10) = (CVARYR+D(21)*D(8))/SMIL	3/31/67R
000135	DPUR = DPUR + DINT	12/12/69
000136	D(11) = (DFAB + DSHP + DPUR + DLOS) / SMIL	PAC 813
000137	D(18)=D(18)*D(1)	5/01/67R
000138	D(19)=D(19)*D(1)	5/01/67R
000139	D(20)=CINS/SMIL	3/31/67R
000140	D(21)=D(21)*D(8)/SMIL	3/31/67R
000141	D(22)=D(22)/SMIL	3/31/67R
000142	D(23)=D(23)/SMIL	3/31/67R

000143	D(24)=D(24)/SMIL	8/01/67R
000144	D(25)=D(25)/SMIL	8/07/67R
000145	D(26)=TLIFE	3/31/67R
000146	NY = D(2) + .999999	
000147	SUMFAC=D(26)+1.0	4/21/67R
000148	DO 870 I = 1, NY	PAC 830
000149	YR=I	5/02/67R
000150	SUMFAC=SUMFAC-XFT(I)	4/21/67R
000151	PRESHP(I) = SHP1(I) + SHP2(I)	
000152	POSTSH (I) = SHP3(I) + SHP4(I)	
000153	YRESHP(I) = YSHP1(I) + YSHP2(I)	
000154	YOSTSH(I) = YSHP3(I) + YSHP4(I)	
000155	IF(I*PR.NE.0)WRITE(6,1010)YRESHP(I),YOSTSH(I),I,PRESHP(I),POSTSH(I)	
000156	1010 FORMAT(17H YRESHP,YOSTSH,I,-6P2F10.3,I5,2F10.3)	
000157	YPURCH(I)=YPURCH(I)/SMIL	11/14/7R
000158	YFABCH(I)=(YFABCH(I)+YRESHP(I)+YABLSS(I))/SMIL	11/14/7R
000159	YREPC(I)=(YREPC(I)+YOSTSH(I)+YEPLSS(I))/SMIL	11/14/7R
000160	YFCRED(I)=YFCRED(I)/SMIL	11/14/7R
000161	PFW(I) = XXLDF(I)	
000162	CURA(I) = FPURC(I)/SMIL	PAC 842
000163	CFAB(I) = (FABCH(I) + PRESHP(I) + FABLSS(I))/ SMIL	PAC 844
000164	CREP(I) = (REPC(I) + POSTSH(I) + REPLSS(I))/ SMIL	PAC 846
000165	CPLU(I) = FCRED(I)/SMIL	PAC 848
000166	EEE(I)=CYR*XFT(I)/SMIL	5/02/67R
000167	ELM(I)=EEE(I)+(D(19)+D(20)+D(21)+D(22))*XFT(I)+D(17)*	5/16/67R
000168	1(D(1)*(1,-(YR-1.)/D(9)*(1.-D(18)/D(1)*YR*0.5))+D(11)*SUMFAC/D(26))	5/16/67R
000169	870 CONTINUE	PAC 870
000170	C PUT IN HEADING INFORMATION	PAC 872
000171	DO 880 I = 1,8	PAC 875
000172	880 DES(I) = AHDG(I)	PAC 880
000173	C	PAC 890
000174	C RUN POWERCO PROGRAM	PAC 900
000175	CALL PWRCO	PAC 910
000176	IF (ITAP .LE. 0) GO TO 999	4/12/67R
000177	AVFAB = AVFAB/D(2)	
000178	AVOAM = AVOAM/D(2)	
000179	AVPU = AVPU/D(2)	
000180	AVREP = AVREP/D(2)	
000181	AV23 = AV23/D(2)	
000182	AVLBU = 0	
000183	AVGU23 = 0	
000184	AVGPU = 0	
000185	TBACK = (TFAB+SHPFAB+SHPREA+PRI+UBUYTM)/365.3	
000186	IBACK = TBACK + 1	
000187	LSTART = TSTART	
000188	DO 882 IK=1,IBACK	
000189	AIK = IK	
000190	TIMX = LSTART-IBACK + IK - 1	
000191	CALL TIMLIB	

```

000192      AVLBU = AVLBU + VLIB(6)
000193      AVGU23 = AVGU23 + VLIB(7)*PISO(1)
000194 882  AVGPU = AVGPU + VLIB(9)*PISO(3)
000195      DO 881 IK=1,NY
000196      AIK = IK
000197      TIMX = AIK + TSTART
000198      CALL TIMLIB
000199      AVLBU = AVLBU + VLIB(6)
000200      AVGU23 = AVGU23 + VLIB(7)*PISO(1)
000201 881  AVGPU = AVGPU + VLIB(9)*PISO(3)
000202      BACK = IBACK
000203      AIK = AIK + BACK
000204      AVLBU = AVLBU/AIK
000205      AVGU23 = AVGU23/AIK
000206      AVGPU = AVGPU/AIK
000207      AVU308 = AVU308/D(2)
000208      AVSEPD = AVSEPD/D(2)
000209      AVKFAB = AVFAB *D(2)/SRKG
000210      AVKREP = AVREP*D(2)/SRKGF
000211      DAED1( 2) = SPFP
000212      DAED1( 3) = YILD1
000213      DAED1( 4) = YILDPU
000214      DAED1( 5) = YILD25
000215      DAED1( 6) = YILD23
000216      DAED1( 7) = SPINV
000217      DAED1( 8) = WEPT
000218      DAED1( 9) = WTHPT
000219      DAED1(10) = GFPT
000220      DAED1(11) = GSDPY
000221      DAED1(12) = TU308
000222      DAED1(13) = TSEPD
000223      DAED1(14) = GFAB
000224      DAED1(15) = AVFAB
000225      DAED1(16) = AVREP
000226      DAED1(17) = AV0AM
000227      DAED1(18) = AVPU
000228      DAED1(19) = AV23
000229      DAED1(20) = AVU308
000230      DAED1(21) = AVLDF
000231      DAED1(22) = AVKFAB
000232      DAED1(23) = AVKREP
000233      DAED1(24) = AVLBU
000234      DAED1(25) = AVGPU
000235      DAED1(26) = AVGU23
000236      YEARS=NY
000237      DAED1(27) = YEARS
000238      CALL NTRAN (ITAP,1,IZ,DAED1,LSD4)
000239 957  LSD1 = LSD1
000240 955  LSD4 = LSD4

```

```

10/5/67R**-1
**-1
*-56

```

000241	IF (LSD1 .GT. 0 .OR. LSD4 .GT. 0) GO TO 997	12/12/69
000242	IF(LSD1.GT.-2.OR.LSD4.GT.-2) GO TO 957	
000243	WRITE (6,1006) LSD1,LSD4	
000244	RETURN 0	
000245	1006 FORMAT(32H ERROR IN NTRAN WRITING, LSD1 =,I4,1X,6HLSD4 =,I4)	
000246	997 CALL NTRAN (ITAP,9)	12/12/69
000247	999 RETURN	4/12/67R
000248	END	-

Q ELT PDOC,1,691212, 19766

000001	C		PD0C 002
000002	C	PROGRAM TO LIST OUT DOCUMENTATION CARDS	PD0C 005
000003	C		PD0C 007
000004	C	COMMON FOR PACTOLUS PROGRAM	010
000005		COMMON /TAPES/LTB, LTI, LTR	025
000006		COMMON /ADATE/ADATE(3), LSW, KARD(15)	030
000007	C		PD0C 035
000008		DIMENSION ITB(7)	PD0C 040
000009		DATA MINUS/1H-/, KBLNK/1H /	PD0C 050
000010	C		PD0C 120
000011	C	ASSIGN TAPE UNITS	PD0C 130
000012		LTB = 8	PD0C 135
000013		LTI = 25	PD0C 140
000014		LTR = 6	PD0C 150
000015	C		PD0C 150
000016	C	SET UP DRUM FOR READING INPUT CARDS	PD0C 160
000017		CALL SETDAR (LTI, 2, ITB)	PD0C 170
000018	C		PD0C 350
000019	C	READ THE DATE CARD AND WRITE PAGE HEADING	PD0C 360
000020		READ (LTI, 700) (ADATE(I), I=1, 3)	PD0C 380
000021		CALL DHDG	PD0C 400
000022		IEND = 1	PD0C 420
000023	C		PD0C 440
000024	C	READ ANOTHER INPUT CARD	PD0C 450
000025		460 READ (LTI, 700) KARD	PD0C 460
000026	C	DETERMINE IF PAGE HEADING SHOULD BE WRITTEN	PD0C 490
000027		IF (KARD(15).NE.MINUS) GO TO 600	PD0C 500
000028		IF (KARD(14).EQ.MINUS) GO TO 750	PD0C 520
000029		LSW = 1	PD0C 550
000030		KARD(15) = KBLNK	PD0C 570
000031	C	WRITE OUT THE CARD	PD0C 590
000032		600 WRITE (LTR, 620) KARD	PD0C 600
000033		620 FORMAT (20X, 13A6, 2A1)	PD0C 620
000034		IF (LSW.GT.0) CALL DHDG	PD0C 640
000035		GO TO 460	PD0C 660
000036	C		PD0C 670
000037	C	INPUT FORMATS	PD0C 680
000038		700 FORMAT (13A6, 2A1)	PD0C 700
000039	C		PD0C 730
000040	C	EXECUTE THE PACTOLUS PROGRAM WITH THE SAMPLE INPUT	PD0C 740
000041		750 CALL PCTLUS	PD0C 750
000042		STOP	PD0C 900
000043		END	-

A-106

BNWL-1169

Q ELT PHDG,1,691212, 19770

000001	C	ROUTINE TO WRITE PAGE HEADINGS FOR EACH PAGE OF REPORT	PHDG 010
000002		SUBROUTINE PHDG	PHDG 020
000003	C		PHDG 022
000004	C		037
000005	C	COMMON FOR PACTOLUS PROGRAM	040
000006		INCLUDE COM1	050
000007		DATA NPAGE/0/, BLANK/1H /	3/31/67R
000008		FLD(0,36,AHDG(13)) = FLD(0,36,PPNO)	12/12/69
000009	C		PHDG 180
000010	C		PHDG 190
000011		NPAGE = NPAGE + 1	PHDG 240
000012		WRITE (LTR,300) ADATE,NPAGE,(AHDG(I),I=1,13)	PHDG 270
000013		300 FORMAT(1H1,3A6,23X,37HPACTOLUS CASH FLOW AND POWER COSTS ,33X	2/26/69
000014		1 4HPAGE,I4 // 40X,13A6 /)	PHDG 310
000015		RETURN	PHDG 900
000016		END	-

Q ELT PHYSIC,1,691212, 19776

```

000001      SUBROUTINE PHYSIC
000002      INCLUDE COM1
000003      INCLUDE COM2
000004      COMMON /CDLF / X1(6),Y1(6),X2(6),Y2(6)
000005      C
000006      YRS = (TIM(N3) + COOL + SHPSEP + TSEP + SHPDES)/365.30001
000007      NYR = YRS + 1.0
000008      NNYR = YRS + TCONST + 1.
000009      DO 1 I=1,NNYR
000010      1 AVLDF = AVLDF + XXLDF(I)
000011      AVLDF = AVLDF/(TIM(N3)/365.3)
000012      TMWEY = RTP*EFF*AVLDF*TIM(N3)/365.3
000013      NCONS = TCONST/1.00001 + 1.0
000014      NYR = NYR + NCONS
000015      TU308 = 0.
000016      TSEPD = 0.
000017      DO 2 I=1,NNYR
000018      TSEPD = TSEPD + (XKGS(I)-XK6SCR(I))
000019      2 TU308 = TU308 + (XKGU(I) - XK6UCR(I) )
000020      PTM =(COOL + SHPSEP + TSEP + SHPDES + SHPFAB + TFAB + SHPREA + PRI
000021      1)/365.3
000022      C RFTM IS GENERATED IN READ
000023      C TMWD IS GENERATED IN READ
000024      C GMPMWD IS INPUT
000025      C EU IS INPUT
000026      C ETH IS INPUT
000027      SPAVG = RTP*AVLDF/RTONS
000028      SPFP = RTP/RTONS
000029      PU239 = 0.
000030      YILDPU=0.0
000031      YILD23=0.0
000032      YILD25=0.0
000033      YILDT =0.0
000034      DO 3 I=1,NNYR
000035      YILDPU = YILDPU + ((PRDN3(I,8)+PRDN3(I,10)) - (PRDCT(I,8)+PRDCT(I,
000036      1 10)))/TMWEY
000037      YILD23 = YILD23 + (PRDN3(I,3) - (PRDCT(I,3)+PRDCT(I,2)))/TMWEY
000038      YILD25 = YILD25 + (PRDN3(I,5) - PRDCT(I,5))/TMWEY
000039      3 CONTINUE
000040      YILDT = YILDPU + YILD25 + YILD23
000041      C
000042      SPINV = RFIS/(RTP*EFF)
000043      WEPT = TU308/TMWEY
000044      WTHPT = WEPT*EFF

```

01/22/69

01/22/69

12/12/69

12/12/69

12/12/69

12/12/69

12/12/69

4/07/67R

4/07/67R

4/07/67R

4/07/67R

12/12/69

12/12/69

12/12/69

12/12/69

```

000045      GFAB = SRKG*1000./TMWEY      12/12/69
000046      GFPT = RTP*AVLDF*TIM(N3)*1.05/TU308/1000.      12/12/69
000047      GSDPY = TSEPD/TMWEY      12/12/69
000048      TSEP0 = TSEPD/1000.
000049
C      CALL PHDG
000050      WRITE(LTR,99)
000051      WRITE(LTR,101)SPFP
000052      WRITE(LTR,102) YILDY
000053      WRITE(LTR,103) YILDPY
000054      WRITE(LTR,104) YILD25
000055      WRITE(LTR,109) YILD23
000056      WRITE(LTR,108)SPINV
000057      WRITE (LTR,105) WEPT
000058      WRITE (LTR,106) WTHPT
000059      WRITE(LTR,107) GFPT
000060      WRITE(LTR,110) GSDPY
000061      WRITE(LTR,111)TU308
000062      WRITE(LTR,112)TSEPD
000063      WRITE(LTR,113) GFAB
000064      WRITE (LTR,100) AVLDF      01/22/69
000065      WRITE(LTR,120)      01/22/69
000066      DO 10 I=1,5      01/22/69
000067      K = I      12/12/69
000068      IF (Y2(I+1) .EQ. 0.0) GO TO 20      12/12/69
000069      SLOPE = (Y2(I+1) - Y2(I))/(X2(I+1)-X2(I))      01/22/69
000070      WRITE (LTR,130) Y2(I),X2(I),SLOPE      01/22/69
000071      10 CONTINUE      01/22/69
000072      K = 6      12/12/69
000073      20 WRITE (LTR,140) Y2(K),X2(K)      12/12/69
000074
C      WTHP=SPINV      4/14/67R
000075
C
000076      99 FORMAT( ///52X,7HTABLE 4/48X,24HREACTOR PROPERTIES TABLE)
000077      100 FORMAT(1H0,9X,38HAVERAGE PLANT CAPACITY FACTOR,PER-CENT,42X,2PF10.
000078      11)
000079      101 FORMAT(1H0,9X,54HINITIAL FULL POWER SPECIFIC POWER,MW/TONNE HEAVY
000080      1METAL ,26X,F10.1)
000081      102 FORMAT(1H0,9X,30HYIELD, FISSILE KG PER MWE-YEAR ,50X,F10.3)
000082      103 FORMAT(1H0,9X,26HYIELD, KG PU PER MWE-YEAR , 54X,F10.3)
000083      104 FORMAT(1H0,9X,27HYIELD, KG U235 PER MWE-YEAR ,53X,F10.3)
000084      105 FORMAT(1H0,9X,27HYIELD, KG U233 PER MWE-YEAR ,53X,F10.3)
000085      106 FORMAT (1H0,9X,31HTONS OF U308 MINED PER MWE-YEAR,39X,F20.3)      12/12/69
000086      107 FORMAT (1H0,9X,32HTONS OF U308 MINED PER MWTH-YEAR,38X,F20.3)      12/12/69
000087      108 FORMAT (1H0,9X,41HKILOGRAMS FISSIONED PER TON OF U308 MINED,F49.2)12/12/69
000088      109 FORMAT(1H0,9X,66HSPECIFIC INVENTORY, KG OF FISSILE MATERIAL PER ME
000089      1GAWATT ELECTRICAL ,14X,F10.2)
000090      110 FORMAT(1H0,9X,29HKG SEPARATIVE DUTY PER MWE-YR, 41X,F20.2)
000091      111 FORMAT(1H0,8X,22H TONS OF U308 CONSUMED,49X,F20.1)
000092
000093

```

000094	112	FORMAT (1H0,9X,34HTONNES OF SEPARATIVE DUTY CONSUMED,36X,F20.1)	12/12/69
000095	113	FORMAT(1H0,8X,25H KG FABRICATED PER MWE-YR ,56X,F10.1)	
000096	120	FORMAT (/7X,41H THE CAPACITY FACTOR VARIES AS FOLLOWS:/)	01/22/69
000097	130	FORMAT (16X,2PF6.2,'% AT',0PF8.2,' YEARS, CHANGING BY',2PF7.2,	12/12/69
000098	1	' %/YEAR TO' /)	12/12/69
000099	140	FORMAT (16X,2PF6.2,'% AT',0PF8.2,' YEARS.')	12/12/69
000100		RETURN	
000101		END	

Q ELT POWER,1.691212, 19779

```
000001      C   PROGRAM TO CALL AND CYCLE THROUGH PWERCO
000002      CALL PWERCO
000003      STOP
000004      END
```

A-111

BNWL-1169

ELT PRICE,1,691212, 19786

000001	C	ROUTINE TO CALCULATE AND STORE FUEL VALUES	PRC	010
000002		SUBROUTINE PRICE	PRC	020
000003	C			037
000004	C	COMMON FOR PACTOLUS PROGRAM		040
000005		INCLUDE COM1		050
000006		INCLUDE COM5		
000007	C		PRC	060
000008		DIMENSION PRC(20)	PRC	090
000009	C		PRC	120
000010	C	OUTPUT FORMATS	PRC	130
000011		150 FORMAT (5X, 7HPRICE , 5X, 8E12.5)	PRC	150
000012	C		PRC	168
000013	C		PRC	169
000014	C	PERFORM PRICE CALCULATIONS AS FOLLOWS -- BY ISOTOPE NUMBER	PRC	170
000015	C	1 U233 INPUT CARDS C23	PRC	171
000016	C	2 U235 BUY AND SELL -- PRICE SCHEDULE C25	PRC	172
000017	C	3 PU239 BUY+SELL - CARD*PU PRICE RATIOS C49	PRC	173
000018	C	4 PU241 BUY+SELL - CARD*PU PRICE RATIOS C41	PRC	174
000019	C	5 TH232 INPUT CARDS C02	PRC	175
000020	C	6 U238 INPUT CARDS C28	PRC	176
000021	C	7 U234 INPUT CARDS C24	PRC	177
000022	C	8 PU240 BUY+SELL - CARD*PU PRICE RATIOS C40	PRC	178
000023	C	9 PU233 INPUT CARDS C13	PRC	179
000024	C	10 U236 INPUT CARDS C26	PRC	180
000025	C	11 PU242 BUY+SELL - CARD*PU PRICE RATIOS C42	PRC	181
000026	C	12 INPUT CARDS - VARIABLE ISOTOPES CXX	PRC	182
000027	C	INPUT CARDS - VARIABLE ISOTOPES CXX	PRC	184
000028	C	INPUT CARDS - VARIABLE ISOTOPES CXX	PRC	185
000029	C	20 INPUT CARDS - VARIABLE ISOTOPES CXX	PRC	190
000030	C		PRC	191
000031	C		PRC	197
000032	C	UPDATE TIME LIBRARIES FOR BUYING TIME	PRC	198
000033		TIM1 = (TIM(1)-PRI-SHPREA-TFAB-SHPFAB)/365.3 + 1.0		12/12/69
000034		TIM2 = TIM1 -1.0		
000035		TIMX = TSTART + TIM1 - 1.0		
000036		CALL TIMLIB	PRC	210
000037		PRATIO = VLIR(9)		
000038		URATIO = VLIR(7)		
000039		K1 = MAX1(TIM1,1.0)	PRC	230
000040		THPR = 0.0		
000041		TK1 = K1		
000042		RNT = RATE*(TK1 - TIM2) + 1.0		
000043		TIM3 = TIM1 - UBUYTM/365.3		12/12/69
000044		TIM4 = TIM3 - 1.0		

A-112

BNWL-1169

```

000045      K3 = MAX1 (TIM3,1.0)
000046      TK4 = K3
000047      CU1 = C25(1)+C23(1)+C28(1)+C26(1)
000048      CUN3 = C23(N3)+C25(N3)+C26(N3)+C28(N3)
000049
000050      C          CALCULATE CONVERSION CONSTANT AND ALL ISOTOPE PRICES TO BUY
000051      BCAF = 1./6023
000052      CCONV = ( BCAF / DENS ) * RKG*1000.0
000053      PRC(1) = C23(1)*PISO(1)*URATIO*233.
000054      ZMLT = 1.0
000055      IF (C23(1)/(C23(1) + C25(1) + C28(1)) .LT. 0.0001) GO TO 250
000056      225 PRC(2) = C25(1)*PISO(2)*URATIO*235.
000057      GO TO 260
000058      C          CALC U235 PRICE IN TAILS ROUTINE
000059      250 IF(CU1)251,251,252
000060      251 PRC(2) = 0.
000061      GO TO 260
000062      252 PRC(2) = TAILS(1)/BCAF
000063      ZMLT = 0.
000064      260 CONTINUE
000065      PRC(3) = C49(1) * PISO(3)*PRATIO * 239.
000066      PRC(4) = C41(1) * PISO(4)*PRATIO * 241.
000067      PU41IN = PRC(4)*CCONV/C41(1)
000068      PRC(5) = C02(1) * PISO(5) * 232.
000069      PRC(6) = C28(1) * PISO(6) * 238.*ZMLT
000070      PRC(7) = C24(1) * PISO(7) * 234.
000071      PRC(8) = C40(1) * PISO(8)*PRATIO * 240.
000072      PRC(9) = C13(1)*PISO(9)*233.*PRATIO
000073      PRC(10) = C26(1) * PISO(10) * 236.*ZMLT
000074      PRC(11) = C42(1) * PISO(11)*PRATIO * 242.
000075      DO 350 I = 12,20
000076      PRC(I) = CXX(1,I-11) * PISO(I) * FLOAT(MWT(I))
000077      350 CONTINUE
000078      C          CALCULATE INITIAL COST
000079      VIX = 0.0
000080      DO 400 I = 1,20
000081      400 VIX = VIX + PRC(I)
000082      VIX = VIX*CCONV
000083      VI = VI + VIX
000084      VJX = (PRC(6) + PRC(10) + PRC(2))*CCONV
000085      IF (TIM(1) .GT. 0.0) FPURC(K1) = FPURC(K1) + VIX - VJX
000086      IF (TIM(1) .EQ. 0.0) DPUR = DPUR + VIX
000087      IF (TIM(1) .GT. 0.0) YPURCH(K1) = YPURCH(K1) + (VIX-VJX)*RNT
000088      IF(IPR.NE.0)WRITE(6,1000)YPURCH(K1),K1,FPURC(K1),RNT,TK1,TIM2
000089      1000 FORMAT(11H YPURCH,K1,-6PF10.3,I5,F10.3,0PF10.4,2F10.1)
000090      RNT = RATE*(TK4-TIM4)+1.0
000091      IF (TIM(1) .EQ. 0.0) GO TO 410
000092      FPURC(K3) = FPURC(K3) + VJX
000093      YPURCH(K3) = YPURCH(K3) + VJX*RNT

```

PRC 240

PRC 250

12/12/69

PRC 260

12/12/69

PRC 281

PRC 285

PRC 286

12/12/69

PRC 288

PRC 292

PRC 294

PRC 300

PRC 310

PRC 340

PRC 350

PRC 380

PRC 385

PRC 390

PRC 400

PRC 405

PRC 410

12/12/69

12/12/69

12/12/69

12/12/69

12/12/69

12/12/69

```

000094      410 CONTINUE
000095      C      DETERMINE IF DEBUG PRINTOUT IS WANTED
000096          TIM2 = TIM1 -1.0
000097          TK1 = K1
000098          RNT = RATE*(TK1 - TIM2) + 1.0
000099          IF (IPR.GE.2) WRITE (LTR,150) CCONV,(PRC(I),I=1,20)
000100      C
000101      C
000102      C      UPDATE TIME LIBRARIES FOR SELLING TIME
000103          TIM1 = (TIM(N3)+COOL+SHPSEP+TSEP+SHPDES)/365.3 + 1.0
000104          TIMX = TSTART + TIM1
000105          CALL TIMLIB
000106          PRATIO = VLIR(9)
000107          URATIO = VLIR(7)
000108          K1 = MAX1(TIM1,1.0)
000109      C      CALCULATE FINAL COST
000110          N = N3
000111          CCONV = (BCAV/DENS) * RKGF * 1000.
000112          PRC(1) = C23(N)*PISO(1)*URATIO*233.
000113          ZMLT = 1.0
000114          IF(C23(N)/(C23(N)+C25(N)+C28(N))-.10)450,425,425
000115      425 PRC(2) = C25(N)*PISO(2)*URATIO*235.
000116          GO TO 460
000117      450 IF(CUN3)451,451,452
000118      451 PRC(2) = 0.
000119          GO TO 460
000120      452 PRC(2) = TAILS(N)/BCAV
000121          ZMLT = 0.
000122      460 CONTINUE
000123          PRC(3) = C49(N) * PISO(3)*PRATIO * 239.
000124          PRC(4) = C41(N) * PISO(4)*PRATIO * 241.
000125          PU410T = PRC(4)*CCONV/C41(N)
000126          PRC(5) = C02(N)*PISO(5)*232.*THPR
000127          PRC(6) = C28(N) * PISO(6) * 238.
000128          PRC(6) = C28(N) * PISO(6) * 238.*ZMLT
000129          PRC(8) = C40(N) * PISO(8)*PRATIO * 240.
000130          PRC(9) = C13(N)*PISO(9)*233.*PRATIO
000131          PRC(10) = C26(N) * PISO(10) * 236.
000132          PRC(10) = C26(N) * PISO(10) * 236.*ZMLT
000133          DO 550 I = 12,20
000134          PRC(I) = CXX(N,I-11) * PISO(I) * FLOAT(MWT(I))
000135      550 CONTINUE
000136          VFX = 0.0
000137          DO 600 I = 1,20
000138      600 VFX = VFX + PRC(I)
000139          VFY = VFX*CCONV
000140          VFF = VFF + VFY
000141          IF (IPR.GE.2) WRITE (LTR,150) CCONV,(PRC(I),I=1,20)
000142      C

```

12/12/69
PRC 425

PRC 426
PRC 430
PRC 439
PRC 440
12/12/69
PRC 455
PRC 460

PRC 480
PRC 490
PRC 500

PRC 506
PRC 508
12/12/69

PRC 512

PRC 516

PRC 520

PRC 530

PRC 540

PRC 550

PRC 580

PRC 590

PRC 600

PRC 610

PRC 620

PRC 630

PRC 670

000143	C	CALCULATE VALUE OF REMAINING FUEL	PRC	680
000144		PRC(1) = D23(N)*PISO(1)*233.*PRATIO		
000145	C	TAILS(N) REMOVED DED	PRC	700
000146		PRC(3) = D49(N) * PISO(3)*PRATIO * 239.	PRC	710
000147		PRC(4) = D41(N) * PISO(4)*PRATIO * 241.	PRC	712
000148		PRC(5) = D02(N) * PISO(5) * 232.	PRC	714
000149		PRC(6) = D28(N) * PISO(6) * 238.	PRC	716
000150		PRC(7) = D24(N) * PISO(7) * 234.	PRC	718
000151		PRC(8) = D40(N) * PISO(8)*PRATIO * 240.	PRC	720
000152		PRC(9) = D13(N)*PISO(9)*233.*PRATIO		
000153		PRC(10) = D26(N) * PISO(10) * 236.	PRC	724
000154		PRC(11) = D42(N) * PISO(11)*PRATIO * 242.	PRC	726
000155		DO 750 I = 12,20	PRC	730
000156		PRC(I) = DXX(N,I-11) * PISO(I) * FLOAT(MWT(I))	PRC	740
000157	750	CONTINUE	PRC	750
000158		VFX = 0.0	PRC	757
000159		DO 770 I = 1,20	PRC	760
000160	770	VFX = VFX + PRC(I)	PRC	770
000161		VFX = VFX*CCONV	PRC	775
000162		VFR = VFR + VFX	PRC	780
000163	C		PRC	790
000164	C	CALCULATE BRED FUEL CREDIT	PRC	820
000165		FCRED(K1) = FCRED(K1) + VFY	PRC	850
000166		YFCRED(K1) = YFCRED(K1) + VFY*RNT		
000167		IF(IPR.NE.0)WRITE(6,1001)YFCRED(K1),K1,FCRED(K1),RNT,TK1,TIM2		
000168	1001	FORMAT(11H YFCRED,K1,-6PF10.3,I5,F10.3,0PF10.4,2F10.1)		
000169		RETURN	PRC	970
000170		END		-

@ ELT PRODC T,1,691212, 19792

```
000001      C      ROUTINE TO CALCULATE AND STORE KG OF EACH PRODUCT      PROD 010
000002      SUBROUTINE PRODC T      PROD 020
000003      C      PROD 030
000004      C      COMMON FOR PACTOLUS PROGRAM      040
000005      INCLUDE COM1      050
000006      C      PROD 180
000007      C      COMPUTE ARRAY INDEXES FOR STORING INFO      PROD 190
000008      TC = TCONST + 1.0      PROD 195
000009      K1 = MAX1((TIM(1)-SHPREA-TFAB-PRI)/365.3 + TC,1.0)      12/12/69
000010      K2 = MAX1((TIM(N3)+COOL+SHPSEP)/365.3 + TC,1.0)      12/12/69
000011      TK1 = TFAB + SHPREA + PRI
000012      TK2 = SHPFAB + TFAB + SHPREA + PRI
000013      TK3 = COOL + SHPSEP
000014      TK4 = TK3 + TSEP + SHPDES
000015      K3 = MAX1((TIM(N3)+COOL+SHPSEP+TSEP+SHPDES)/365.3+TC,1.0)      12/12/69
000016      K4 = MAX1((TIM(N3)+COOL+SHPSEP+TSEP+SHPDES+UBUYTM)/365.3+TC,1.0)      12/12/69
000017      K5 = MAX1((TIM(1)-TK2)/365.3+TC,1.0)      12/12/69
000018      K6 = MAX1((TIM(1)-TK2-UBUYTM)/365.3+TC,1.0)      12/12/69
000019      FBLO = 1.-CORLOS
000020      RPL0 = 1. - REPL0S
000021      DECLSS = EXP(-1.438E-4*TK1)*FBLO      12/12/69
000022      CT1 = DENS * .6023      12/12/69
000023      C      FILL IN PROPER ARRAYS      PROD 290
000024      K = K1      PROD 300
000025      PRDCT(K,1) = PRDCT(K,1) + ((C02(1)*232.)/CT1)*RKGF/FBLO
000026      PRDCT(K,2) = PRDCT(K,2) + ((C13(1)*233.)/CT1)*RKGF/FBLO
000027      PRDCT(K,3) = PRDCT(K,3) + ((C23(1)*233.)/CT1)*RKGF/FBLO
000028      PRDCT(K,4) = PRDCT(K,4) + ((C24(1)*234.)/CT1)*RKGF/FBLO
000029      PRDCT(K,5) = PRDCT(K,5) + ((C25(1)*235.)/CT1)*RKGF/FBLO
000030      PRDCT(K,6) = PRDCT(K,6) + ((C26(1)*236.)/CT1)*RKGF/FBLO
000031      PRDCT(K,7) = PRDCT(K,7) + ((C28(1)*238.)/CT1)*RKGF/FBLO
000032      PRDCT(K,8) = PRDCT(K,8) + ((C49(1)*239.)/CT1)*RKGF/FBLO
000033      PRDCT(K,9) = PRDCT(K,9) + ((C40(1)*240.)/CT1)*RKGF/FBLO
000034      PRDCT(K,10) = PRDCT(K,10) + ((C41(1)*241.)/CT1)*RKGF/DECLSS
000035      PRDCT(K,11) = PRDCT(K,11) + ((C42(1)*242.)/CT1)*RKGF/FBLO
000036      DO 380 I = 12,20
000037      380 PRDCT(K,I) = PRDCT(K,I) + ((CXX(1,I-11)*FLOAT(MWT(I))/CT1)*RKGF)
000038      1/FBLO
000039      DECLSS = EXP(-1.438E-4*TK2)*FBLO      12/12/69
000040      K = K5
000041      PRDCTA(K,1) = PRDCTA(K,1) + ((C02(1)*232.)/CT1)*RKGF/FBLO
000042      PRDCTA(K,2) = PRDCTA(K,2) + ((C13(1)*233.)/CT1)*RKGF/FBLO
000043      PRDCTA(K,3) = PRDCTA(K,3) + ((C23(1)*233.)/CT1)*RKGF/FBLO
000044      PRDCTA(K,4) = PRDCTA(K,4) + ((C24(1)*234.)/CT1)*RKGF/FBLO
```

A-116

BNWL-1169

```

000045      K = K6
000046      PRDCTA(K,5) = PRDCTA(K,5) + ((C25(1)*235.)/CT1)*RKGF/FBLO
000047      PRDCTA(K,6) = PRDCTA(K,6) + ((C26(1)*236.)/CT1)*RKGF/FBLO
000048      PRDCTA(K,7) = PRDCTA(K,7) + ((C28(1)*238.)/CT1)*RKGF/FBLO
000049      K = K5
000050      PRDCTA(K,8) = PRDCTA(K,8) + ((C49(1)*239.)/CT1)*RKGF/FBLO
000051      PRDCTA(K,9) = PRDCTA(K,9) + ((C40(1)*240.)/CT1)*RKGF/FBLO
000052      PRDCTA(K,10) = PRDCTA(K,10) + ((C41(1)*241.)/CT1)*RKGF/DECLSS
000053      PRDCTA(K,11) = PRDCTA(K,11) + ((C42(1)*242.)/CT1)*RKGF/FBLO
000054      DO 381 I=12,20
000055      381 PRDCTA(K,I) = PRDCTA(K,I) + ((CXX(1,I-11)*FLOAT(MWT(I))/CT1)*RKGF)
000056      1/FBLO
000057      C      FILL IN ARRAYS FOR DISCHARGE                                PROD 390
000058      K = K2                                                                PROD 400
000059      N = N3                                                                PROD 410
000060      DECLSS = EXP(-1.438E-4*TK3)*RPLO                                     12/12/69
000061      PRDN3(K,1) = PRDN3(K,1) + ((C02(N)*232.)/CT1)*RKGF*RPLO
000062      PRDN3(K,2) = PRDN3(K,2) + ((C13(N)*233.)/CT1)*RKGF*RPLO
000063      PRDN3(K,3) = PRDN3(K,3) + ((C23(N)*233.)/CT1)*RKGF*RPLO
000064      PRDN3(K,4) = PRDN3(K,4) + ((C24(N)*234.)/CT1)*RKGF*RPLO
000065      PRDN3(K,5) = PRDN3(K,5) + ((C25(N)*235.)/CT1)*RKGF*RPLO
000066      PRDN3(K,6) = PRDN3(K,6) + ((C26(N)*236.)/CT1)*RKGF*RPLO
000067      PRDN3(K,7) = PRDN3(K,7) + ((C28(N)*238.)/CT1)*RKGF*RPLO
000068      PRDN3(K,8) = PRDN3(K,8) + ((C49(N)*239.)/CT1)*RKGF*RPLO
000069      PRDN3(K,9) = PRDN3(K,9) + ((C40(N)*240.)/CT1)*RKGF*RPLO
000070      PRDN3(K,10) = PRDN3(K,10) + ((C41(N)*241.)/CT1)*RKGF*DECLSS
000071      PRDN3(K,11) = PRDN3(K,11) + ((C42(N)*242.)/CT1)*RKGF*RPLO
000072      DO 470 I = 12,20
000073      470 PRDN3(K,I) = PRDN3(K,I) + ((CXX(N,I-11)*FLOAT(MWT(I))/CT1)*RKGF) PROD 460
000074      1*RPLO                                                                PROD 470
000075      C      FILL IN ARRAYS FOR 30 YR TAPE (AT DISCHARGE)                PROD 500
000076      K = K3                                                                PROD 501
000077      N = N3                                                                PROD 502
000078      DECLSS = EXP(-1.438E-4*TK4)*RPLO                                     12/12/69
000079      PRDN3A(K,1) = PRDN3A(K,1) + ((C02(N)*232.)/CT1)*RKGF*RPLO
000080      PRDN3A(K,2) = PRDN3A(K,2) + ((C13(N)*233.)/CT1)*RKGF*RPLO
000081      PRDN3A(K,3) = PRDN3A(K,3) + ((C23(N)*233.)/CT1)*RKGF*RPLO
000082      PRDN3A(K,4) = PRDN3A(K,4) + ((C24(N)*234.)/CT1)*RKGF*RPLO
000083      PRDN3A(K,5) = PRDN3A(K,5) + ((C25(N)*235.)/CT1)*RKGF*RPLO
000084      PRDN3A(K,6) = PRDN3A(K,6) + ((C26(N)*236.)/CT1)*RKGF*RPLO
000085      PRDN3A(K,7) = PRDN3A(K,7) + ((C28(N)*238.)/CT1)*RKGF*RPLO
000086      PRDN3A(K,8) = PRDN3A(K,8) + ((C49(N)*239.)/CT1)*RKGF*RPLO
000087      PRDN3A(K,9) = PRDN3A(K,9) + ((C40(N)*240.)/CT1)*RKGF*RPLO
000088      PRDN3A(K,10) = PRDN3A(K,10) + ((C41(N)*241.)/CT1)*RKGF*DECLSS
000089      PRDN3A(K,11) = PRDN3A(K,11) + ((C42(N)*242.)/CT1)*RKGF*RPLO
000090      DO 471 I = 12,20
000091      471 PRDN3A(K,I) = PRDN3A(K,I) + ((CXX(N,I-11)*FLOAT(MWT(I))/CT1) PROD 514
000092      1*RKGF)*RPLO                                                         PROD 515
000093      RETURN                                                                PROD 900

```

000094

END

Q ELT PWERC0,1,691212, 19795

```
000001      C      POWERCO PROGRAM -- TO GENERATE TABLES OF COSTS AND EXPENSES
000002      C
000003      C
000004      C      READ IN ONE GROUP OF POWERCO INPUT CARDS
000005      SUBROUTINE PWERC0
000006      200 CALL INPUT
000007      CALL DATAK
000008      CALL FACTRS
000009      CALL DEPREC
000010      CALL EXPENS
000011      CALL BONDPY
000012      CALL COSTEQ
000013      CALL PAYOUT(1.,0.)
000014      CALL OUTPUT(1.,0.)
000015      CALL FIXCHG
000016      CALL PAYOUT(0.,1.)
000017      CALL OUTPUT(0.,1.)
000018      GO TO 200
000019      END
```

A-118

BNWL-1169

@ ELT PWRCO,1,691212, 19800

000001	C	POWERCO PROGRAM -- TO GENERATE TABLES OF COSTS AND EXPENSES	PCO	010
000002		SUBROUTINE PWRCO	PCO	020
000003	C		PCO	030
000004	C		PCO	180
000005		CALL DATAK	PCO	300
000006		CALL FACTRS	PCO	320
000007		CALL DEPREC		
000008		CALL EXPENS	PCO	360
000009		CALL BONDPY	PCO	380
000010		CALL COSTEQ		
000011		CALL PAYOUT(1.,0.)		
000012		CALL OUTPUT(1.,0.)		
000013		CALL FIXCHG		
000014		RETURN	PCO	900
000015		END		-

ELT READ,1,691212, 19807

000001	C	ROUTINE TO READ BURNUP INFO FROM TAPE	READ 010
000002		SUBROUTINE READ	READ 020
000003	C		READ 021
000004	C		037
000005	C	COMMON FOR PACTOLUS PROGRAM	040
000006		INCLUDE COM1	050
000007		COMMON / CDLF / X1(6),Y1(6),X2(6),Y2(6)	
000008	C		078
000009		DIMENSION ARRAY(150),ARRAY1(150)	095
000010		EQUIVALENCE (ARRAY,M),(ARRAY1,M1)	097
000011		DATA CHG/6H CHG/DISCHG/6HDISCHG/	
000012		DIMENSION UU(14)	12/12/69
000013		DATA UU/84H TH232 PA233 U233 U234 U235 U236 U238 NP237 PU239	12/12/69
000014		1PU240 PU241 PU242 TIME EXPOS/	12/12/69
000015	C		100
000016	C		105
000017		IEND = 0	READ 120
000018		IF (IENDCK.EQ. 99) GO TO 1290	
000019	C	DETERMINE IF INPUT TAPE WAS CREATED ON 7090 OR 1107	READ 150
000020		160 IF (I90.LE.0) GO TO 210	READ 160
000021	C	CONVERT 7090 TAPE	READ 169
000022		CALL CONVRT (ARRAY1)	READ 170
000023		GO TO 220	READ 185
000024	C		READ 190
000025	C	READ HEADING RECORD	READ 200
000026		210 READ (LTB) L,(ARRAY1(I),I=1,L)	READ 210
000027		220 NRCD = NRCD + 1	READ 220
000028		KCASE = MC(2)	READ 230
000029	C	DETERMINE IF END TAPE HAS BEEN REACHED, IF SO GO TO 940	READ 250
000030		IF (M1) 940,280,160	READ 260
000031	C	COMPARE PRESENT CASE WITH PREVIOUS	READ 270
000032	C	TEST FOR FIRST AND LAST CASE NEEDED FOR PROCESSING	READ 270
000033		280 IF (JCASE.EQ.0) GO TO 300	READ 280
000034		IF (KCASE.NE.JCASE) GO TO 160	READ 285
000035		JCASE = 0	READ 290
000036		300 IF (KCASE.EQ.LCASE) IEND = 1	READ 300
000037	C	STORE VARIABLE ISOTOPES AND SUM THE CONCENTRATIONS	READ 775
000038	C	STORE INFO FOR THIS HEADING RECORD	READ 360
000039		370 J = 0	READ 370
000040	C		READ 430
000041	C	SET INDEX INFO AND READ ISOTOPE RECORDS	READ 440
000042		450 J = J + 1	READ 450
000043	C	TEST FOR INPUT FROM 7090 OR 1107	READ 460
000044		470 IF (I90.LE.0) GO TO 500	READ 470

A-120

BNWL-1169

000045	CALL CONVRT (ARRAY)	READ 480
000046	GO TO 540	READ 485
000047	C READ 1107 CREATED TAPE	READ 495
000048	500 READ (LTB) L,(ARRAY(I),I=1,L)	READ 500
000049	540 NRCD = NRCD + 1	READ 540
000050	C DETERMINE IF THIS A PROPER ISOTOPE RECORD	READ 570
000051	IF (M.GT.0) IF (M=6) 750,750,700	READ 580
000052	C NOT AN ISOTOPE RECORD, BACKSPACE TAPE AND RETURN	READ 590
000053	J = J - 1	READ 600
000054	BACKSPACE LTB	READ 610
000055	GO TO 970	READ 690
000056	C	READ 692
000057	C M EXCEEDS 6, WRITE ERROR MESSAGE	READ 697
000058	700 WRITE (LTR,710) M	READ 700
000059	710 FORMAT (1H0 // 20X,32H***** AN IMPROPER VALUE OF M =,I2,25H WAS	READ 710
000060	1ENCOUNTERED ***** //	READ 711
000061	STOP	READ 730
000062	C	READ 740
000063	C GOOD ISOTOPE RECORD, STORE INFO FROM CARD	READ 745
000064	750 C23(J) = ARRAY(5)	READ 750
000065	C25(J) = ARRAY(6)	READ 752
000066	C49(J) = ARRAY(7)	READ 754
000067	C41(J) = ARRAY(8)	READ 756
000068	C02(J) = ARRAY(9)	READ 758
000069	C28(J) = ARRAY(10)	READ 760
000070	C24(J) = ARRAY(11)	READ 762
000071	C40(J) = ARRAY(12)	READ 764
000072	C13(J) = ARRAY(13)	READ 766
000073	C26(J) = ARRAY(14)	READ 768
000074	C42(J) = ARRAY(15)	READ 770
000075	SUMC = 0.0	READ 777
000076	SUMD = 0.0	READ 778
000077	DO 790 I = 1,9	READ 780
000078	CXX(J,I) = ARRAY(I+15)	READ 785
000079	DXX(J,I) = ARRAY(I+50)	READ 786
000080	SUMC = SUMC + ARRAY(I+15)	READ 788
000081	SUMD = SUMD + ARRAY(I+50)	READ 789
000082	790 CONTINUE	READ 790
000083	C STORE THE FAKE INFO	READ 797
000084	D23(J) = ARRAY(40)	READ 800
000085	D25(J) = ARRAY(41)	READ 802
000086	D49(J) = ARRAY(42)	READ 804
000087	D41(J) = ARRAY(43)	READ 806
000088	D28(J) = ARRAY(45)	READ 808
000089	D24(J) = ARRAY(46)	READ 810
000090	D40(J) = ARRAY(47)	READ 812
000091	D13(J) = ARRAY(48)	READ 814
000092	D26(J) = ARRAY(49)	READ 816
000093	D42(J) = ARRAY(50)	READ 818

```

000094      C          CONVERT TIME IN SECONDS TO TIME IN DAYS          READ 829
000095      TIM(J) = ARRAY(132)/86400.          READ 830
000096      EX (J) = ARRAY(133)          READ 832
000097      IF(J,NE,1) GO TO 782
000098      TIMX = TIM(J)/365.3 + TSTART
000099      CALL TIMLIB
000100      XLDP = VLIB(5)
000101      DO 779 I=1,6
000102      X1(I) = ARRAY1(2*I+96)
000103      Y1(I) = ARRAY1(2*I+97)
000104      779 CONTINUE
000105      IF (Y1(1)) 780,780,781
000106      780 Y1(1) = .80
000107      Y1(2) = .80
000108      X1(1) = 0.0
000109      X1(2) = 30.
000110      781 X = TIM(J)/365.3
000111      DO 7810 I=1,5
000112      IF (X1(I+1) .GT. 0.00001) GO TO 7804
000113      XLFI = Y1(I)
000114      GO TO 7814
000115      7804 IF (X .LT. X1(I+1) ) GO TO 7812
000116      7810 CONTINUE
000117      7812 SLOPE = (Y1(I+1) - Y1(I) )/(X1(I+1) - X1(I) )
000118      XLFI = Y1(I) + SLOPE*(X - X1(I) )
000119      7814 CONTINUE
000120      RTP = RTP/XLFI
000121      782 CONTINUE
000122      C          ASSIGN VF=MASS FRACTION          READ 839
000123      VF(1) = ARRAY(134)          READ 840
000124      C          SUM THE TOTAL CONCENTRATION OF FUEL          READ 864
000125      SMCS = C23(J)+C25(J)+C49(J)+C41(J)+C02(J)+C28(J)+C24(J)+C40(J)+
000126      1 C13(J)+C26(J)+C42(J) + SUMC          READ 865
000127      IF(J,EQ,1) SUM1 = SMCS          READ 866
000128      SMDS = D23(J)+D25(J)+D49(J)+D41(J)+D24(J)+D40(J)+D13(J)+D26(J)+
000129      1 D42(J) + SUMD          READ 866
000130      SUMT = SMCS + SMDS          READ 867
000131      IF (J-1) 907,900,907          READ 868
000132      900 IF (CTOTL(1)) 903,903,905
000133      903 RKGf = RKG
000134      RKG = 0.
000135      GO TO 907
000136      905 RKGf = RKG
000137      907 CONTINUE
000138      C
000139      C          DETERMINE IF WE ARE AT THE END OF ISOTOPE RECORDS
000140      910 IF (J,GE,60) GO TO 970
000141      IF (M-3) 450,970,970
000142      C

```


000143	C		READ 938
000144	C	END TAPE, SET PROPER SWITCHES, REWIND TAPE, AND RETURN	READ 939
000145	940	IEND = 1	READ 940
000146	C	SET N3 EQUAL TO NUMBER OF ISOTOPE RECORDS READ	READ 960
000147		RETURN	
000148	970	N3 = J	READ 970
000149		IF (CTOTL(N3)) 980,980,990	
000150	980	RKGF = 0.	
000151	990	CONTINUE	
000152		IF(IADJ.EQ.0) GO TO 1299	
000153		ACTIME = TLIFE*365.3	12/12/69
000154		IF(IL.EQ.0) IREG = -1	
000155		JJ = 1	
000156	1005	X = CHNGLF(TIM(JJ)/365.3)	
000157		TIM(JJ) = X	
000158		TIM(JJ) = TIM(JJ)*365.3	
000159	1030	IF (JJ-1) 1040,1040,1050	
000160	1040	JJ = N3	
000161		IF(N3-1) 1280,1060,1005	
000162	1050	CONTINUE	
000163		IF(TIM(N3) - ACTIME)1060,1060,1070	
000164	1070	N3 = N3 - 1	
000165		IF(IREG.GT.0) GO TO 1040	
000166		IREG = 0	
000167		GO TO 1040	
000168	1060	IF(IREG.LT.0) GO TO 1299	
000169		IREG = IREG + 1	
000170		DELTA = ACTIME - TIM(N3)	
000171		TINCR = TIM(N3+1) - TIM(N3)	
000172		TMLT = DELTA/TINCR	
000173		C23(N3+1) = (C23(N3+1)-C23(N3))*TMLT + C23(N3)	
000174		C25(N3+1) = (C25(N3+1)-C25(N3))*TMLT + C25(N3)	
000175		C26(N3+1) = (C26(N3+1)-C26(N3))*TMLT + C26(N3)	
000176		C49(N3+1) = (C49(N3+1)-C49(N3))*TMLT + C49(N3)	
000177		C41(N3+1) = (C41(N3+1)-C41(N3))*TMLT + C41(N3)	
000178		C40(N3+1) = (C40(N3+1)-C40(N3))*TMLT + C40(N3)	
000179		C02(N3+1) = (C02(N3+1)-C02(N3))*TMLT + C02(N3)	
000180		C28(N3+1) = (C28(N3+1)-C28(N3))*TMLT + C28(N3)	
000181		C24(N3+1) = (C24(N3+1)-C24(N3))*TMLT + C24(N3)	
000182		C13(N3+1) = (C13(N3+1)-C13(N3))*TMLT + C13(N3)	
000183		C42(N3+1) = (C42(N3+1)-C42(N3))*TMLT + C42(N3)	
000184		DO 1291 JK = 1,9	
000185	1291	CXX(N3+1,JK) = (CXX(N3+1,JK) - CXX(N3,JK))*TMLT + CXX(N3,JK)	
000186		TIM(N3+1) = (TIM(N3+1) - TIM(N3))*TMLT + TIM(N3)	
000187		EX(N3+1) = (EX(N3+1) - EX(N3))*TMLT + EX(N3)	
000188		N3 = N3 + 1	
000189		IF(IREG.LT.NREG) GO TO 1299	
000190	1280	IENDCK = 98	
000191		GO TO 1299	

```

000192      1290 IEND = 1
000193      1299 IF(I90.EQ. 0 .OR. IENDCK .GT. 98) GO TO 1300
000194          TYP = CHG
000195          CT1 = DENS * .6023
000196          G23 = C23( 1)*232.*RKG/CT1*1000.
000197          G25 = C25( 1)*235.*RKG/CT1*1000.
000198          G26 = C26(1)*236.*RKG/CT1*1000.
000199          G49 = C49( 1)*239.*RKG/CT1*1000.
000200          G41 = C41( 1)*241.*RKG/CT1*1000.
000201          G40 = C40( 1)*240.*RKG/CT1*1000.
000202          G42 = C42( 1)*242.*RKG/CT1*1000.
000203          G28 = C28( 1)*238.*RKG/CT1*1000.
000204          G24 = C24( 1)*234.*RKG/CT1*1000.
000205          G13 = C13( 1)*233.*RKG/CT1*1000.
000206          G02 = C02( 1)*232.*RKG/CT1*1000.
000207          G27 = CXX( 1,1)*237.*RKG/CT1*1000.
000208          TIMM = TIM(1)/365.3
000209          IF (MOD(NL,20) .NE. 0)      GO TO 1305
000210          CALL PHDG
000211          WRITE (6,3000)  (UU(I),I=1,14)
000212      1305 CONTINUE
000213          WRITE (6,3001) TYP,G02,G13,G23,G24,G25,G26,G28,G27,G49,G40,G41,
000214          1G42,TIMM
000215          TYP = DISCHG
000216          CT1 = DENS * .6023
000217          G23 = C23(N3)*232.*RKG/CT1*1000.
000218          G25 = C25(N3)*235.*RKG/CT1*1000.
000219          G26 = C26(N3)*236.*RKG/CT1*1000.
000220          G49 = C49(N3)*239.*RKG/CT1*1000.
000221          G41 = C41(N3)*241.*RKG/CT1*1000.
000222          G40 = C40(N3)*240.*RKG/CT1*1000.
000223          G42 = C42(N3)*242.*RKG/CT1*1000.
000224          G28 = C28(N3)*238.*RKG/CT1*1000.
000225          G24 = C24(N3)*234.*RKG/CT1*1000.
000226          G13 = C13(N3)*233.*RKG/CT1*1000.
000227          G02 = C02(N3)*232.*RKG/CT1*1000.
000228          G27 = CXX(N3,1)*237.*RKG/CT1*1000.
000229          TIMM = TIM(N3)/365.3
000230          WRITE (6,3002) TYP,G02,G13,G23,G24,G25,G26,G28,G27,G49,G40,G41,
000231          1G42,TIMM ,EX(N3)
000232      3000 FORMAT (11X,14(1X,A6,1X)/)
000233      3001 FORMAT (2X,A6,2X,12F8.1,F8.2)
000234      3002 FORMAT (3X,A6,2X,12F8.1,F8.2,F9.1)
000235      1300 IF(IENDCK .EQ. 98) IENDCK = 99
000236          TMWD = TMWD + EX(N3)*RKG
000237          NL = IL + 1
000238          RETURN
000239          END

```

12/12/69

12/12/69

12/12/69

12/12/69

12/12/69

12/12/69

12/12/69

12/12/69

12/12/69

12/12/69

READ 990

BNWL-1169

Q ELT SEP,1,691212, 19813

000001	C	ROUTINE TO CALCULATE AND STORE REPROCESSING COSTS	SEP 010
000002		SUBROUTINE SEP	SEP 020
000003	C		SEP 030
000004	C	COMMON FOR PACTOLUS PROGRAM	040
000005		INCLUDE COM1	050
000006		INCLUDE COM5	
000007	C		SEP 270
000008	C	INTERPOLATE IN TIME LIBRARY	SEP 280
000009		TIM1 = (TIM(N3)+COOL+SHPSEP)/365.3 + 1.0	12/12/69
000010		TIM2 =TIM1 - 1.0	
000011		INDX = TIM1 + TCONST	
000012		RRKGF(INDX) = RRKGF(INDX) + RKGF	
000013		TIMX = TSTART + TIM1 - 1.0	
000014		CALL TIMLIB	SEP 300
000015		SRATIO = VLIB(8)	SEP 320
000016		BCOST = VLIB(10)	
000017		TCLEAN = 0.	
000018		IF(ISEP)10,20,10	
000019	10	SCOST = SRATIO	
000020		SRATIO = 1.0	
000021	20	CONTINUE	
000022		K1 = MAX1(TIM1,1.0)	SEP 330
000023		TK1 = K1	
000024		RNT = RATE*(TK1 - TIM2) +1.0	
000025		IF (IMFOS.EQ. 0) GO TO 5	12/12/69
000026		REPCH(K1) = REPCH(K1) - VLIB(3)*RKGF	12/12/69
000027		YREPCH(K1) = YREPCH(K1) - VLIB(3)*RKGF*RNT	12/12/69
000028		RETURN	12/12/69
000029	5	CONTINUE	12/12/69
000030		IF(ISEP,NE.0) GO TO 759	
000031	C	CALCULATE CLEANUP TIME	SEP 400
000032		XCL = RKGF/THRUPT	SEP 410
000033		TCLEAN = 8.0	SEP 420
000034		IF (XCL.GT.24.) TCLEAN = XCL/3.0	SEP 430
000035	C		SEP 440
000036	C	CALCULATE ENRICHMENT	SEP 450
000037		ENR = 0.0	SEP 460
000038		DO 530 I = 1,N3	SEP 470
000039		ENR1 = C25(I)+C49(I)+C41(I)+C23(I)	SEP 480
000040		CXSM = 0.0	SEP 482
000041		DO 485 K = 1,9	SEP 483
000042	485	CXSM = CXSM + CXX(I,K)	SEP 485
000043		ENRT = ENR1 + C02(I)+C28(I)+C24(I)+C40(I)+C13(I)+C26(I)+C42(I) +	SEP 490
000044	1	CXSM	SEP 491

A-125

BNWL-1169

000045	ENR1 = (ENR1/ENRT)	SEP	510
000046	ENR = A*AX1(ENR,ENR1)	SEP	520
000047	530 CONTINUE	SEP	530
000048	C	SEP	540
000049	C CALCULATE THRU X VARIABLE, DEPENDING ON ENR	SEP	600
000050	X = ENR * 100.0	SEP	610
000051	X2 = X*X	SEP	611
000052	X3 = X2*X	SEP	612
000053	X4 = X3*X	SEP	613
000054	TX = THRUPT/1000.0	SEP	620
000055	IF (X.GT.3.0) IF (X-9.) 660,660,700	SEP	625
000056	THRU X = THRUPT	SEP	630
000057	GO TO 750	SEP	640
000058	660 THRU X = (829.3 + 354.6*X - 148.4*X2 + 18.81*X3 - 0.7954*X4) * TX	SEP	660
000059	GO TO 750	SEP	680
000060	700 IF (X.GT.20) GO TO 730	SEP	700
000061	THRU X = (1408. - 151.4*X + 6.885*X2 - .1172*X3) * TX	SEP	710
000062	GO TO 750	SEP	720
000063	730 THRU X = (682.1 - 44.42*X + 1.382*X2 - .0222*X3 + 1.776E-4*X4		
000064	1 - 5.585E-7*X**5)*TX		
000065	C	SEP	738
000066	C IF FUEL CONTAINS THORIUM, TAKE HALF OF CALCULATED VALUE	SEP	740
000067	750 IF (C02(1).GT.1.0E-20) THRU X = THRU X/2.0	SEP	750
000068	C CALCULATE SEPARATIONS TIME	SEP	755
000069	TSEP = (RKGF/THRU X)	SEP	760
000070	ENR = (C25(N3)/ENRT) * 100.0	SEP	780
000071	C1 = C25(N3)*235. + C26(N3)*236. + C28(N3)*238.	SEP	782
000072	CTN3 = CTOTL(N3)	SEP	790
000073	C2 = (C1/CTN3) * 1000.0*RKGF	SEP	800
000074	CPR = .0056	SEP	810
000075	IF (ENR.GT.5.0) CPR = .032	SEP	820
000076	RCOST = SEPCST*TSEP*SRATIO + C2*CPR	SEP	840
000077	RCOST1 = RCOST/RKGF	SEP	850
000078	C DETERMINE IF THIS IS A CORE OR BLANKET DISCHARGE	SEP	845
000079	759 IF (ICOR.LE.0) GO TO 890		
000080	IF (ISEP)760,770,760		
000081	760 RCOST = BCOST*RKGF		
000082	RCOST1 = BCOST		
000083	770 CONTINUE		
000084	BLREP(K1) = RCOST1		
000085	BLTIM(K1) = TSEP + TCLEAN	SEP	875
000086	GO TO 920	SEP	880
000087	890 IF (ISEP)891,771,891		
000088	891 RCOST = SCOST*RKGF		
000089	RCOST1 = SCOST		
000090	771 CONTINUE		
000091	COREP(K1) = RCOST1		
000092	COTIM(K1) = TSEP + TCLEAN	SEP	895
000093	C ADD UP REPROCESSING CHARGES	SEP	900

000094	920	REPCH(K1) = REPCH(K1) + RCOST	SEP	920
000095		YREPCH(K1) = YREPCH(K1) + RCOST*RNT		
000096		IF (IPR.NE.0) WRITE (6,1010) YREPCH(K1), K1, REPCH(K1), RNT, TK1, TIM2		
000097	1010	FORMAT(11H YREPCH,K1,-6PF10.3,I1,F10.3,0PF10.4,2F10.1)		
000098	C	DETERMINE IF DEBUG PRINTOUT IS WANTED	SEP	930
000099		IF (IPR.GE.2) WRITE (LTR,950) X,ENR,TSEP,K1,RCOST,C2,ICOR,RKGF	SEP	940
000100	1	, THRUX,TCLEAN	SEP	941
000101	950	FORMAT (5X, 9HSEP DEBUG, 3X, 3E12.5,2(I3,2E12.5),E12.5)	SEP	950
000102		RETURN	SEP	970
000103		END		-

ELT SHIP,1,691212, 19817

```

000001      C          ROUTINE TO CALCULATE AND STORE SHIPPING COSTS          SHP  010
000002      SUBROUTINE SHIP          SHP  020
000003      C          SHP  037
000004      C          COMMON FOR PACTOLUS PROGRAM          SHP  040
000005      INCLUDE COM1          SHP  050
000006      INCLUDE COM5
000007      C          SHP  120
000008      C          SHP  190
000009      C          CALCULATE INDEXES FOR SHIPPING VARIABLES          SHP  200
000010      K1 = (TIM(1) - SHPREA-TFAB-PRI)/365.3 + 1.0          12/12/69
000011      K2 = MAX1((TIM(1) - PRI)/365.3 + 1.0,1.0)          12/12/69
000012      K3 = MAX1((TIM(N3)+COOL+SHPSEP)/365.3 + 1.0,1.0)          12/12/69
000013      K4 = MAX1((TIM(N3)+COOL+SHPSEP+TSEP+SHPDDES)/365.3 + 1.0,1.0)          12/12/69
000014      K5 = MAX1((TIM(N3)+COOL)/365.3 + 1.0,1.0)          12/12/69
000015      TK1 = K1
000016      TK2 = K2
000017      TK3 = K3
000018      TK4 = K4
000019      TK5 = K5
000020      CSH1 = CSHP1
000021      CSH2 = CSHP2
000022      XENR = (C49(1)*239.+C40(1)*240.+C41(1)*241.+C42(1)*242.+C23(1)*233.
000023      1)/CT1
000024      IF(XENR-.0001)101,100,100
000025      100 CSH1 = DLSHP1          12/12/69
000026      CSH2 = DLSHP2          12/12/69
000027      101 TIM1 = MAX1((TIM(1)-SHPREA-TFAB-PRI)/365.3+1.0,1.0)          12/12/69
000028      TIM2 = MAX1((TIM(1) - PRI)/365.3+1.0,1.0)          12/12/69
000029      TIM3 = MAX1((TIM(N3)+COOL+SHPSEP)/365.3+1.0,1.0)          12/12/69
000030      TIM4 = MAX1((TIM(N3)+COOL+SHPSEP+TSEP+SHPDDES)/365.3+1.0,1.0)          12/12/69
000031      TIM5 = MAX1((TIM(N3)+COOL)/365.3+1.0,1.0)          12/12/69
000032      C          IF CHARGE TIME EQUALS 0., COST IS PART OF INITIAL CORE          12/12/69
000033      IF (TIM(1) .GT. 0.0) GO TO 400          12/12/69
000034      DSHP = DSHP + (CSH1 + CSH2)*RK6
000035      GO TO 420          SHP  380
000036      C          SHP  385
000037      C          SHP  390
000038      C          FILL IN PROPER SHIPPING COST ARRAYS
000039      400 SHP1(K1) = SHP1(K1) + CSH1*RKG
000040      SHP2(K2) = SHP2(K2) + CSH2*RKG
000041      RNT1 = 1.0 + RATE*(TK1-TIM1)
000042      RNT2 = 1.0 + RATE*(TK2-TIM2)
000043      YSHP1(K1) = YSHP1(K1) + CSH1*RKG*RNT1
000044      YSHP2(K2) = YSHP2(K2) + CSH2*RKG*RNT2
000045      420 SHP3(K3) = SHP3(K3) + CSH3*RKG + FRKG*THROCG*1000.

```

A-128

BNWL-1169

```

000045      SHP4(K4) = SHP4(K4) + CSHP4*RKGF          SHP  460
000046      RNT3 = 1.0 + RATE*(TK3-TIM3)
000047      RNT4 = 1.0 + RATE*(TK4-TIM4)
000048      RNT5 = 1.0 + RATE*(TK5-TIM5)
000049      YSHP3(K3) = YSHP3(K3) + CSHP3*RKGF*RNT3 + THROCG*FRKG*RNT5*1000.
000050      YSHP4(K4) = YSHP4(K4) + CSHP4*RKGF*RNT4
000051      IF(IPR,NE,0)WRITE(6,1000)YSHP1(K1),YSHP2(K2),YSHP3(K3),YSHP4(K4),K
000052      11,K2,K3,K4,RNT1,RNT2,RNT3,RNT4
000053 1000  FORMAT(2X,4HSHIP,-6P4F10.3,4I5,0P4F10.4)
000054      RETURN          SHP  970
000055      END              -

```

Q ELT SKED,1,691212, 19823

000001	C	URANIUM CASCADE PRICE SCHEDULE	SKED 010
000002		SUBROUTINE SKED(NX)	SKED 020
000003	C		SKED 022
000004	C	COMMON FOR PACTOLUS PROGRAM	040
000005		INCLUDE COM1	050
000006		COMMON /TALS/VXT,VPXT,VXF,ISS,N8,CF,VA(60),VT(60),UFISS(60),VTH	060
000007		1 ,FBF(60),VU233,TH(60),BF(60)	061
000008	C		SKED 069
000009		DIMENSION C1(60),C2(60),C3(60)	SKED 070
000010		EQUIVALENCE (C1,C25),(C2,C26),(C3,C28)	SKED 075
000011	C		SKED 079
000012	C		
000013		CMLT = 1./(.6023 * 1000.)	12/12/69
000014		TVAL = 3.00	
000015		VAMIN = TVAL/(1000.*0.6023)	
000016		CT2 = C25(1)*235. + C28(1)*238. + C26(1)*236.	SKED 096
000017		CT3 = C25(N3)*235. + C26(N3)*236. + C28(N3)*238.	SKED 097
000018	C		SKED 098
000019	C	CALC KG U308 PURCHASED AND KG OF SEPARATIVE DUTY	SKED 099
000020		TIMX = (TIM(1)-PRI-SHPREA-TFAB-SHPFAB-UBUYTM/2.)/365.3	12/12/69
000021		K1 = MAX1(TIMX+TCONST+1.0,1.0)	SKED 101
000022		TIMX = (TIM(N3)+COOL+SHPSEP+TSEP+SHPDES)/365.3	12/12/69
000023		K2 = MAX1(TIMX+TCONST+1.0,1.0)	
000024		X25 = C25(1)*235./CT2	SKED 102
000025		X26 = C26(1)*236./CT2	SKED 103
000026		X28 = C28(1)*238./CT2	SKED 104
000027		FPR = (X25-X2)/(X2-X2)	SKED 106
000028		U = X25*235. + X26*236. + X28*238.	SKED 108
000029		U308 = 3.0*U + 128.0	SKED 110
000030		UF6 = 3.0*U	SKED 111
000031		UKG = RKG*CT2/CTOTL(1)*(1.0+CORLOS)	
000032		X25F = C25(N3)*235./CT3	
000033		X26F = C26(N3)*236./CT3	
000034		X28F = C28(N3)*238./CT3	
000035		FPRF = (X25F-X2)/(X2-X2)	
000036		UF = X25F*235. + X26F*236. + X28F*238.	
000037		U308F=3.0*UF + 128.0	
000038		UF6F = 3.0*UF	SKED 125
000039		UKGF = RKG*CT3/CTOTL(N3)*(1.0-REPL0S)	
000040	C		SKED 127
000041	C		
000042	C	CALCULATION OF URANIUM ENRICHMENTS FROM THE ISOTOPIC CONC.	
000043		J = NX	SKED 140
000044	C		

A-130

BNWL-1169


```

000045      YT = (C1(J)*235.)/(C1(J)*235.+C2(J)*236.+C3(J)*238.)      12/12/69
000046      IF(XT-YT)55,55,50
000047      50 VA(J) = VAMIN
000048      GO TO 310
000049      55 YT1 = YT
000050      YT = AMAX1(YT,XT)      SKED 170
000051  C
000052  C      CALCULATION OF URANIUM CASCADE COSTS FOR CALCULATED ENRICHMENTS
000053  C
000054      60 VX=(2.0*YT-1.0)*ALOG(YT/(1.0-YT))
000055      IF (J.EQ.1)      VX1 = VX      SKED 210
000056  C      BRANCH ON ISS SWITCH, 1=NORMAL, 2=CW,GT,CF, 3=SEPDUTY,LE,0      SKED 220
000057      IF(ISS.LE.2) IF(IXTL)250,250,270
000058      VA(J) = (YT * (CF-CW) / XF + CW) * CMLT      SKED 240
000059      GO TO 300      SKED 245
000060      250 VA(J) = (CS*(VX+(VXT*(YT-XF) - VXF*(YT-XT)) / (XF-XT)) + CF *
000061      1 (YT-XT) / (XF-XT) - CW*(YT-XF) / (XF-XT)) * CMLT      SKED 250
000062      GO TO 300      SKED 260
000063      270 VA(J) = (CS*(VX-VXT-(YT-XT) * VPXT) + CW) * CMLT      SKED 270
000064  C      SET PRICE TO MAXIMUM OF PRICE CALCULATED AND VAMIN      12/12/69
000065      300 VA(J) = AMAX1(VA(J),VAMIN)      12/12/69
000066      310 VT(J) = VA(J)*(C1(J)*235.+C2(J)*236.+C3(J)*238.)      12/12/69
000067  C      SKED 380
000068  C      DETERMINE IF DEBUG PRINTOUT IS WANTED.      SKED 390
000069      IF (IPR.LT.6)      GO TO 800      SKED 400
000070  C      WRITE DEBUG PRINT OUT      SKED 420
000071      WRITE (LTR,700)      SKED 430
000072      WRITE (LTR,710) VT(J),VA(J),UFISS(J),VU233,TH(J),VTH, C1(J),
000073      1 C2(J),C3(J)      SKED 450
000074      WRITE (LTR,720)      SKED 490
000075      WRITE (LTR,710) TIM(J),BF(J),FBF(J)      SKED 510
000076      WRITE (LTR,730) CF,XF,IS,CS,XT,VAMIN,ISS,CW,YT,VXF,VX,VXT      SKED 540
000077  C      SKED 670
000078  C      OUTPUT FORMATS      SKED 690
000079      700 FORMAT (54H0 SKED DEBUG, VT(J),VA(J),UFISS,VU233,TH,VTH,C1,C2,C3)      SKED 700
000080      710 FORMAT ( 1H0,1P9E11.3)      SKED 710
000081      720 FORMAT (32H0 TIM(J), BF(J), FBF(J) )      SKED 720
000082      730 FORMAT ( 5H0CF =,1PE11.4, 8H XF =,E11.4, 22X, 9H      SKED 730
000083      1 IS =,I4/5H CS =,E11.4,8H XT =,E11.4,11H VAMIN =,E11.4,9H
000084      2 ISS =,I4/5H CW =,E11.4,8H YT =,E11.4,11H VXF =,E11.4/
000085      35H VX =,E11.4,8H VXT =,E11.4)
000086  C      SKED 790
000087      800 CONTINUE      SKED 800
000088  C      SKED 810
000089  C      STORE CALCULATED QUANTITIES FOR REPORTING ROUTINE      SKED 820
000090      IF(NX-1)810,810,830      SKED 820
000091      810 IF(YT-.0031) 812,812,811
000092      811 XKGU(K1) = XKGU(K1) + FPR*UKG*U308/UF6*2.20462/2000.      12/12/69
000093      AVU308 = AVU308 + FPR*UKG*U308/UF6*U308PR

```

```

000094      AVSEPD = AVSEPD + (VX-VXT+FPR*(VXT-VXF))*UKG*CS
000095      XKGS(K1) = XKGS(K1) + (VX-VXT+FPR*(VXT-VXF))*UKG
000096      XXT(K1) = XT*100.
000097      XKGTL(K1) = XKGTL(K1) + (YT-XF)/(XF-XT)*UKG
000098      GO TO 813
000099  812 XKGTL(K1) = XKGTL(K1) -UKG
000100  813 CONTINUE
000101      YS = .9
000102      VX = (2.0*YS-1.0)*ALOG(YS/(1.0-YS))
000103      IF(ISS.LE.2) IF(IXTL)350,350,370
000104      U90PR(K1) = (YS * (CF-CW) / XF + CW) * CMLT
000105      GO TO 400
000106  350 U90PR(K1) = (CS*(VX+(VXT*(YS-XF) - VXF*(YS-XT)) / (XF-XT)) +CF *
000107      1 (YS-XT) / (XF-XT) -CW*(YS-XF) / (XF-XT)) * CMLT
000108      GO TO 400
000109  370 U90PR(K1) = (CS*(VX-VXT-(YS-XT) * VPXT) + CW) * CMLT
000110  400 U90PR(K1) = U90PR(K1)/(CMLT*1000.*YS)
000111      RETURN
000112
000113  830 IF(YT-.0031)832,832,831
000114  831 XKGUCR(K2) = XKGUCR(K2) + FPRF*UKGF*U308F/UF6F*2.20462/2000.
000115      AVU308 = AVU308 - FPRF*UKGF*U308F/UF6F*U308PR
000116      AVSEPD = AVSEPD -(VX-VXT+FPRF*(VXT-VXF))*UKGF*CS
000117      XKGSCR(K2) = XKGSCR(K2) + (VX-VXT+FPRF*(VXT-VXF))*UKGF
000118      XKGTLK(K2) = XKGTLK(K2) + (YT-XF)/(XF-XT)*UKGF
000119      XXT(K2) = XT*100.
000120      GO TO 833
000121  832 XKGTLK(K2) = XKGTLK(K2) - UKGF
000122  833 CONTINUE
000123      YS = .9
000124      VX = (2.0*YS-1.0)*ALOG(YS/(1.0-YS))
000125      IF(ISS.LE.2) IF(IXTL)450,450,470
000126      U90PR(K2) = (YS * (CF-CW) / XF + CW) * CMLT
000127      GO TO 500
000128  450 U90PR(K2) = (CS*(VX+(VXT*(YS-XF) - VXF*(YS-XT)) / (XF-XT)) +CF *
000129      1 (YS-XT) / (XF-XT) -CW*(YS-XF) / (XF-XT)) * CMLT
000130      GO TO 500
000131  470 U90PR(K2) = (CS*(VX-VXT-(YS-XT) * VPXT) + CW) * CMLT
000132  500 U90PR(K2) = U90PR(K2)/(CMLT*1000.*YS)
000133  C 900 RETURN
000134      END

```

SKED 240
SKED 245
SKED 250
SKED 251
SKED 260
SKED 270
SKED 850

12/12/69
12/12/69

SKED 250
SKED 890
SKED 900
-

@ ELT SUEZ,1,691212, 19828

```

000001      DIMENSION FZ(7),FLT(7)
000002      INCLUDE COM1
000003      COMMON / CDLF/ X1(6),Y1(6),X2(6),Y2(6)
000004      CALL ETIME
000005      LC = 5
000006  C   IN IS THE TAPE UNIT THAT CONTAINS THE INPUT TO FAST AND PACTOLUS
000007  C   LC IS UNIT WHICH SUPPLIES THE LIST OR REACTORS (NORMALLY THE
000008  C   CARD READER, 5) LATER THIS WILL BE REPLACED BY LP SUPPLIED DATA FOR
000009  C   THE LOAD FACTOR ITERATION
000010  C   TPR IS THE REACTOR INVENTORY MULTIPLIER
000011  C   FMAS IS THE THROUGHPUT MULTIPLIER
000012  C   PWR IS THE POWER MULTIPLIER
000013      DATA IZRO/4H 0/
000014      CALL SETDR(8,800000,500000,FZ)
000015      CALL SETDAR(16,0,FLT)
000016      LTB = 8
000017      LTR = 6
000018      LTI = 16
000019 10 READ (LC,1000) IDNT,I7090,IN,TPR,FMAS,PWR,(X1(I),Y1(I),I=1,6)
000020      IF(IN.NE.0) LTI = IN
000021      IF(IDNT.EQ.IZRO) GO TO 90
000022 20 READ (LTI,1001) IZHK
000023      IF (IDNT.NE.IZHK) GO TO 20
000024      WRITE(6,1004) IZHK
000025      IF(I7090.NE.0) GO TO 21
000026      WRITE(6,1002)
000027      CALL FASTLP(LTI,LTB,TPR,FMAS,PWR)
000028      CALL ETIMEF(SEC)
000029      WRITE(LTR,1006) SEC
000030      REWIND LTB
000031      WRITE(6,1003) LTB
000032 21 CALL PCTLUS
000033      REWIND LTB
000034      GO TO 10
000035      900 FORMAT(2I5)
000036      1000 FORMAT (A4,2I3,3F5.0/12F5.0)
000037      1001 FORMAT(A4)
000038      1002 FORMAT(//2X,12HCALLING FAST)
000039      1003 FORMAT (//' TAPE',I3,' IS REWOUND, CALL PACTOLUS')
000040      1004 FORMAT(1H1,2X,7HREACTOR,2X,A4)
000041      1005 FORMAT(18H1 TIME IN SUEZ WAS,F12.3,8H SECONDS)
000042      1006 FORMAT(20H0 TIME IN CLOTHO WAS,F12.3,8H SECONDS)
000043      90 CALL ETIMEF(SEC)
000044      WRITE(LTR,1005) SEC

```

12/12/69

12/12/69

BNWL-1169

000045
000046
000047

CALL EXIT
STOP
END

12/12/69

A-134

BNWL-1169

@ ELT TABL3,1,691212, 19833

000001	C	ROUTINE TO WRITE TABLES 3 AND 4	TAB3 010
000002		SUBROUTINE TABL3	TAB3 020
000003	C		TAB3 030
000004	C	COMMON FOR PACTOLUS AND POWERCO PROGRAMS	040
000005		INCLUDE COM1	050
000006		INCLUDE COM2	055
000007	C		TAB3 180
000008	C	WRITE APPROPRIATE SUB-HEADING LINES	TAB3 240
000009		TSTRT = TSTART - TCONST	12/12/69
000010		NYRS = IFIX(TIM(N3)/365,30001 + TCONST) + 1	12/12/69
000011		IF (IMFOS .NE. 0) GO TO 340	12/12/69
000012		CALL HDG3 (1)	TAB3 250
000013		DO 320 I = 1, NYRS	TAB3 270
000014		I1 = TSTRT + FLOAT(I-1)	TAB3 280
000015		WRITE (LTR,800) I1, (PRDCT(I,K),K=1,11)	TAB3 300
000016		320 CONTINUE	TAB3 320
000017	C		TAB3 330
000018	C	WRITE ISOTOPES 12 TO 20	TAB3 340
000019		340 CONTINUE	12/12/69
000020		CALL HDG3(2)	TAB3 350
000021		DO 450 I = 1, NYRS	TAB3 360
000022		I1 = TSTRT + FLOAT(I-1)	TAB3 370
000023		TOTL = 0.0	TAB3 380
000024		DO 400 L = 1, 20	TAB3 390
000025		400 TOTL = TOTL + PRDCT(I,L)	TAB3 400
000026		WRITE (LTR,800) I1, (PRDCT(I,K),K=12,20), PFISS, TOTL	TAB3 410
000027		450 CONTINUE	TAB3 450
000028	C		TAB3 460
000029	C	WRITE TABLE OF KILOGRAMS DISCHARGED EACH YEAR	TAB3 490
000030		IF (IMFOS .NE. 0) GO TO 900	12/12/69
000031		CALL HDG3(3)	TAB3 500
000032		DO 620 I = 1, NY	TAB3 520
000033		I1 = TSTRT + FLOAT(I-1)	TAB3 530
000034		WRITE (LTR,800) I1, (PRDN3(I,K),K=1,11)	TAB3 540
000035		620 CONTINUE	TAB3 620
000036	C		TAB3 630
000037		CALL HDG3(4)	TAB3 670
000038		DO 750 I = 1, NY	TAB3 680
000039		I1 = TSTRT + FLOAT(I-1)	TAB3 690
000040		TOTL = 0.0	TAB3 700
000041		DO 720 L = 1, 20	TAB3 710
000042		720 TOTL = TOTL + PRDN3(I,L)	TAB3 720
000043		WRITE (LTR,800) I1, (PRDN3(I,K),K=12,20), PFISS, TOTL	TAB3 730
000044		750 CONTINUE	TAB3 750

000045
000046
000047
000048
000049
000050

C
C
C

 OUTPUT FORMATS
800 FORMAT (2X,I4, 11(F10.1))
900 RETURN
 END

TAB3 760
TAB3 780
TAB3 790
TAB3 800
TAB3 900
 -

Q ELT TAILS,1,691212, 19839

000001	C	ROUTINE TO CALCULATE U235 PRICE	TAIL 010
000002		FUNCTION TAILS (NX)	TAIL 020
000003	C		TAIL 022
000004	C	COMMON FOR PACTOLUS PROGRAM	040
000005		INCLUDE COM1	050
000006		COMMON /TALS/VPXT,VXF,ISS,N8,CF,VA(60),VT(60),UFISS(60),VTH	060
000007		1 ,FBF(60),VU233,TH(60),BF(60)	061
000008	C		TAIL 090
000009		TIMX = (TIM(1)-PRI-SHPREA-TFAB-SHPFAB-UBUYTM/2.)/365.3+TSTART	12/12/69
000010		IF(NX.GT.1)TIMX=(TIM(N3)+COOL+SHPSEP+TSEP+SHPDES)/365.3+TSTART	12/12/69
000011		CALL TIMLIB	
000012		CF = VLIB(6)*2.20462*(238.*3.+16.*8.)/(238.*3.) + UCONV	12/12/69
000013		U308PR = VLIB(6)*2.20462	12/12/69
000014		N = IXTL	
000015		VXF=(2.0*XF-1.0)*ALOG(XF/(1.0-XF))	TAIL 99
000016		IF (N.NE.0) GO TO 200	TAIL 098
000017	C		TAIL 099
000018	C		TAIL 101
000019		100 XTLOG=ALOG(XT/(1.0-XT))	TAIL 100
000020		VXT=(2.0*XT-1.0)*XTLOG	TAIL 101
000021		VPXT=(2.0*XT-1.0)/(XT*(1.0-XT))+2.0*XTLOG	TAIL 102
000022		IS = 1	TAIL 103
000023		GO TO 300	TAIL 104
000024	C		TAIL 105
000025		200 IF (CS) 270,270,201	TAIL 200
000026		201 IF (CF-CW) 280,280,202	TAIL 201
000027		202 S=CS/(CF-CW)	TAIL 202
000028	C		TAIL 203
000029		AM=0.0	TAIL 204
000030		IS=1	TAIL 205
000031		AN=0.0	TAIL 206
000032		IM=0	TAIL 207
000033		IN=0	TAIL 208
000034		IF (S-5.0) 207,207,206	TAIL 209
000035		206 XT=XF*0.7	TAIL 206
000036		GO TO 210	TAIL 207
000037		207 IF (S-0.010) 209,208,208	TAIL 207
000038		208 E=.0143+.5562*S-.3349*S**2+.1075*S**3-.0161*S**4+.00096*S**5	TAIL 208
000039		1 -.000014*S**6	TAIL 209
000040		XT=XF*E	TAIL 210
000041		GO TO 210	TAIL 211
000042		209 XT=1.5*S	TAIL 209
000043	C		TAIL 210
000044		210 XTLOG=ALOG(XT/(1.0-XT))	TAIL 210

000045	VXT=(2.0*XT-1.0)*XTLOG	TAIL 211
000046	VPXT=(2.0*XT-1.0)/(XT*(1.0-XT))+2.0*XTLOG	TAIL 212
000047	RFS=VXF-VXT-(XF-XT)*VPXT	TAIL 213
000048	Y=S*RFS	TAIL 214
000049		TAIL 215
000050	215 IF (Y-1.0) 220,300,225	TAIL 215
000051	220 IF (Y-0.999999) 230,230,300	TAIL 220
000052	225 IF (Y-1.000001) 300,235,235	TAIL 225
000053		TAIL 226
000054	C 230 AN=-1.0	TAIL 230
000055	GO TO 240	TAIL 231
000056	235 AN=1.0	TAIL 235
000057	240 IF (IN) 245,245,250	TAIL 240
000058	245 AM=AN	TAIL 245
000059	IN=1	TAIL 246
000060		TAIL 247
000061	C 250 IF (AM-AN) 255,260,255	TAIL 250
000062	255 IM=IM+1	TAIL 255
000063	AM=0.0	TAIL 256
000064	IF (IM.GT.100) GO TO 310	TAIL 257
000065	260 XT=XT+0.0001*AN/(2.0**IM)	TAIL 260
000066	GO TO 210	TAIL 261
000067		TAIL 262
000068	C	TAIL 263
000069	C 270 IS=3	TAIL 270
000070	XT=0.0	TAIL 271
000071	VXT=0.0	TAIL 272
000072	VPXT=0.0	TAIL 273
000073	GO TO 300	TAIL 274
000074		TAIL 275
000075	C 280 IS=2	TAIL 280
000076	XT=XF	TAIL 281
000077	VXT=VXF	TAIL 282
000078	VPXT=(2.0*XF-1.0)/(XF*(1.0-XF))+2.0*ALOG(XF/(1.0-XF))	TAIL 283
000079	WXT=VPXT	TAIL 284
000080		TAIL 285
000081	C 300 ISS = IS	TAIL 300
000082	IF (IPR-2) 400,320,320	TAIL 302
000083	310 WRITE (LTR,315) IM	TAIL 310
000084	315 FORMAT (23H0IMPROPER VALUE OF IM =,I4)	TAIL 315
000085	320 WRITE (LTR,330) XF,XTLOG,S,XT,VXF,Y,CS,VXT,WXT,CF,VPXT,ISS,CW,	TAIL 320
000086	1 RFS,N	TAIL 321
000087	330 FORMAT(12H0TAILS DEBUG/5H XF =,E11.4,5X,7HXTLOG =,E11.4,5X,5HS	TAIL 330
000088	1 =,E11.4/5H XT =,E11.4,5X,7HVXF =,E11.4,5X,5HY =,E11.4/5H CS =,E11.4/5H	TAIL3001
000089	2,E11.4,5X,7HVXT =,E11.4,5X,5HWXT =,E11.4/5H CF =,E11.4,5X,7HVPXT	TAIL3002
000090	3 =,E11.4,5X,5HISS =,I4/5H CW =,E11.4,5X,7HRFS =,E11.4,5X,5HIS	TAIL3003
000091	4=,I4)	TAIL3004
000092	C	TAIL 370
000093	C GET PROPER PRICES FROM SUBROUTINE SKED	TAIL 390

000094
000095
000096
000097

400 CALL SKED(NX)
TAILS = VT(NX)
RETURN
END

TAIL 400
TAIL 950
TAIL 970
-

@ ELT TIMLIB,1,691212, 19843

000001		SUBROUTINE TIMLIB	TLIB 010
000002	C	INTERPOLATE IN THE TIME LIBRARIES	TLIB 002
000003	C		TLIB 005
000004		INCLUDE COM1	050
000005	C		TLIB 075
000006	C	DETERMINE IF TIME EXCEEDS LIBRARY VALUES	TLIB 076
000007		IF (TIMX.GT.TLIB(1,NCDS)) GO TO 120	TLIB 077
000008	C	LOOP FOR EACH LIBRARY ENTRY	TLIB 079
000009		DO 90 K = 1,NCDS	TLIB 080
000010		IF (K.LE.1) IF (TLIB(1,1)-TIMX) 82,82,120	TLIB 081
000011		82 IF (TLIB(1,K)-TIMX) 90,200,300	TLIB 082
000012		90 CONTINUE	TLIB 090
000013		GO TO 150	TLIB 096
000014	C		TLIB 098
000015	C	WRITE ERROR MESSAGE AND END PROCESSING	TLIB 119
000016		120 WRITE (LTR,130) TIMX,TLIB(1,1),TLIB(1,NCDS)	TLIB 120
000017		130 FORMAT (1H0 // 20X,15H***** THE TIME,F10.2, 41H FALLS OUTSIDE OF	TLIB 130
000018		1THE TIME LIBRARY VALUES,F10.2, 4H AND,F10.2, 7H ***** //	TLIB 131
000019		150 K = NCDS	TLIB 150
000020	C	EXACT MATCH, FILL VLIB ARRAY WITH LIBRARY VALUES	TLIB 190
000021		200 DO 220 I = 2,10	TLIB 200
000022		220 VLIB(I) = TLIB(I,K)	TLIB 220
000023		GO TO 500	TLIB 240
000024	C	INTERPOLATE TO GET VALUES FOR TIME LIBRARIES	TLIB 290
000025		300 FRAC = (TIMX-TLIB(1,K-1))/ (TLIB(1,K)-TLIB(1,K-1))	TLIB 300
000026		DO 330 I = 2,10	TLIB 310
000027		330 VLIB(I) = TLIB(I,K-1)+FRAC*(TLIB(I,K)-TLIB(I,K-1))	TLIB 330
000028	C	FILL TIME PORTION OF LIBRARY	TLIB 490
000029		500 VLIB(1) = TIMX	TLIB 500
000030		RETURN	TLIB 600
000031		END	-

A-140

@ ELT TMLIB,1,691212, 19847

000001	C	INTERPOLATE IN THE TIME LIBRARIES	TLIB 002
000002		FUNCTION TMLIB(I)	TLIB 010
000003	C		TLIB 005
000004	C	COMMON FOR PACTOLUS PROGRAM	040
000005		INCLUDE COM1	050
000006		COMMON / CDLF / X1(6),Y1(6),X2(6),Y2(6)	
000007	C		TLIB 075
000008	C	DETERMINE IF TIME EXCEEDS LIBRARY VALUES	TLIB 076
000009		IF (TIMX.GT.TLIB(1,NCDS)) GO TO 120	TLIB 077
000010	C	LOOP FOR EACH LIBRARY ENTRY	TLIB 079
000011		IF(I.EQ.5) GO TO 501	
000012		DO 90 K = 1,NCDS	TLIB 080
000013		IF (K.LE.1) IF (TLIB(1,1)-TIMX) 82,82,120	TLIB 081
000014	82	IF (TLIB(1,K)-TIMX) 90,200,300	TLIB 082
000015	90	CONTINUE	TLIB 090
000016		GO TO 150	TLIB 096
000017	C		TLIB 098
000018	C	WRITE ERROR MESSAGE AND END PROCESSING	TLIB 119
000019	120	WRITE (LTR,130) TIMX,TLIB(1,1),TLIB(1,NCDS)	TLIB 120
000020	130	FORMAT (1H0 // 20X,15H***** THE TIME,F10.2, 41H FALLS OUTSIDE OF	TLIB 130
000021		1THE TIME LIBRARY VALUES,F10.2, 4H AND,F10.2, 7H ***** //)	TLIB 131
000022	150	K = NCDS	TLIB 150
000023	C	EXACT MATCH, FILL VLIB ARRAY WITH LIBRARY VALUES	TLIB 190
000024	200	VLB = TLIB(I,K)	TLIB 200
000025		GO TO 500	TLIB 240
000026	C	INTERPOLATE TO GET VALUES FOR TIME LIBRARIES	TLIB 290
000027	300	FRAC = (TIMX-TLIB(1,K-1))/ (TLIB(1,K)-TLIB(1,K-1))	TLIB 300
000028		VLB = TLIB(I,K-1)+FRAC*(TLIB(I,K)-TLIB(I,K-1))	TLIB 330
000029	C	ASSIGN VALUE TO FUNCTION	TLIB 490
000030	500	TMLIB = VLB	TLIB 500
000031		RETURN	TLIB 600
000032	501	TMLF = TIMX - TSTART	
000033		VLB = CALCLF(TMLF)	
000034		GO TO 500	
000035		END	

A-141

BNWL-1169

APPENDIX B

EXAMPLE CALCULATION FOR LIGHT WATER REACTOR

The input data is contained in the subroutine
DOCMNT of the main program listing contained
in Appendix A.

	TP232	PA233	UP33	U234	U235	U236	U238	NP237	PU239	PU240	PU241	PU242	TIME	EXPOS
CHG	.0	.0	.0	.0	647.3	.0	28776.7	.0	.0	.0	.0	.0	.00	
DISCHG	.0	.0	.0	.0	345.6	52.0	28441.7	4.1	119.1	31.5	12.3	1.9	1.28	12418.0
CHG	.0	.0	.0	.0	785.7	.0	28639.0	.0	.0	.0	.0	.0	.00	
DISCHG	.0	.0	.0	.0	217.5	92.4	28609.3	12.2	147.8	66.2	31.0	10.6	3.00	27655.9
CHG	.0	.0	.0	.0	717.9	.0	28706.1	.0	.0	.0	.0	.0	.00	
DISCHG	.0	.0	.0	.0	276.4	74.1	28241.0	7.9	139.0	50.9	22.5	5.6	2.07	20041.7
CHG	.0	.0	.0	.0	938.8	.0	28464.5	.0	.0	.0	.0	.0	1.28	
DISCHG	.0	.0	.0	.0	295.4	106.4	27872.0	13.4	154.1	63.5	30.8	9.5	4.07	28968.2
CHG	.0	.0	.0	.0	938.8	.0	28484.5	.0	.0	.0	.0	.0	2.07	
DISCHG	.0	.0	.0	.0	280.6	108.3	27843.4	14.1	154.9	66.1	32.2	10.4	5.04	30115.8
CHG	.0	.0	.0	.0	938.8	.0	28484.5	.0	.0	.0	.0	.0	3.00	
DISCHG	.0	.0	.0	.0	275.3	109.1	27333.6	14.3	155.0	66.9	32.6	10.7	6.03	30523.9
CHG	.0	.0	.0	.0	938.8	.0	28484.5	.0	.0	.0	.0	.0	4.07	
DISCHG	.0	.0	.0	.0	283.0	108.1	27847.7	14.0	154.7	65.7	32.0	10.3	7.01	29940.2
CHG	.0	.0	.0	.0	938.0	.0	28485.3	.0	.0	.0	.0	.0	5.04	
DISCHG	.0	.0	.0	.0	225.9	107.6	27655.0	13.8	154.3	65.1	31.7	10.1	7.95	29675.1
CHG	.0	.0	.0	.0	918.6	.0	28504.9	.0	.0	.0	.0	.0	6.03	
DISCHG	.0	.0	.0	.0	285.3	104.6	27890.2	13.2	152.9	64.0	30.8	9.6	8.86	28794.5
CHG	.0	.0	.0	.0	899.6	.0	28524.2	.0	.0	.0	.0	.0	7.01	
DISCHG	.0	.0	.0	.0	286.8	101.4	27928.7	12.5	151.5	62.5	29.8	9.1	9.74	27764.2
CHG	.0	.0	.0	.0	881.3	.0	28542.7	.0	.0	.0	.0	.0	7.95	
DISCHG	.0	.0	.0	.0	285.9	98.6	27961.2	12.0	150.1	61.3	29.1	8.7	10.60	26964.6
CHG	.0	.0	.0	.0	863.6	.0	28560.7	.0	.0	.0	.0	.0	8.86	
DISCHG	.0	.0	.0	.0	286.4	95.7	27945.8	11.4	148.6	60.0	28.1	8.2	11.42	26071.0
CHG	.0	.0	.0	.0	846.5	.0	28578.0	.0	.0	.0	.0	.0	9.74	
DISCHG	.0	.0	.0	.0	286.7	93.0	28029.1	10.9	147.2	58.6	27.3	7.8	12.21	25219.8
CHG	.0	.0	.0	.0	824.7	.0	28595.0	.0	.0	.0	.0	.0	10.60	
DISCHG	.0	.0	.0	.0	208.2	90.1	28063.4	10.3	145.7	57.0	26.4	7.3	12.98	24310.0
CHG	.0	.0	.0	.0	813.7	.0	28611.2	.0	.0	.0	.0	.0	11.42	
DISCHG	.0	.0	.0	.0	288.7	87.5	28094.4	9.8	144.2	55.7	25.5	6.9	13.73	23515.6
CHG	.0	.0	.0	.0	798.3	.0	28626.6	.0	.0	.0	.0	.0	12.21	
DISCHG	.0	.0	.0	.0	288.7	85.0	28124.2	9.4	142.7	54.4	24.7	6.6	14.45	22767.8
CHG	.0	.0	.0	.0	783.3	.0	28642.0	.0	.0	.0	.0	.0	12.98	
DISCHG	.0	.0	.0	.0	288.5	82.6	28152.9	9.0	141.2	53.2	23.9	6.2	15.15	22053.5
CHG	.0	.0	.0	.0	768.8	.0	28656.7	.0	.0	.0	.0	.0	13.73	
DISCHG	.0	.0	.0	.0	288.0	80.3	28140.0	8.6	139.8	52.1	23.2	5.9	15.83	21391.8
CHG	.0	.0	.0	.0	754.8	.0	28677.9	.0	.0	.0	.0	.0	14.45	
DISCHG	.0	.0	.0	.0	257.6	78.1	28206.0	8.2	138.6	51.0	22.5	5.6	16.51	20748.4
CHG	.0	.0	.0	.0	744.0	.0	28681.7	.0	.0	.0	.0	.0	15.15	
DISCHG	.0	.0	.0	.0	284.9	76.8	28222.0	8.0	137.9	50.5	22.2	5.5	17.22	20424.3

	TH232	PA233	U233	U234	U235	U236	U238	NP237	PU239	PU240	PU241	PU242	TIME	EXPOS
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	15.83	
DISCHG	.0	.0	.0	.0	285.0	76.7 28222.4	8.0	137.8	50.4	22.1	5.5	17.93	20407.8	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	16.51	
DISCHG	.0	.0	.0	.0	283.6	76.9 28220.3	8.1	137.9	50.7	22.3	5.5	18.65	20497.3	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	17.22	
DISCHG	.0	.0	.0	.0	284.7	76.8 28221.9	8.0	137.9	50.5	22.2	5.5	19.38	20430.5	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	17.93	
DISCHG	.0	.0	.0	.0	284.4	76.8 28221.6	8.0	137.8	50.5	22.2	5.5	20.13	20445.5	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	18.65	
DISCHG	.0	.0	.0	.0	284.3	76.8 28221.5	8.0	137.9	50.6	22.2	5.5	20.89	20452.8	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	19.38	
DISCHG	.0	.0	.0	.0	284.8	76.8 28222.0	8.0	137.8	50.5	22.2	5.5	21.65	20427.5	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	20.13	
DISCHG	.0	.0	.0	.0	284.6	76.8 28221.9	8.0	137.8	50.5	22.2	5.5	22.45	20436.1	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	20.89	
DISCHG	.0	.0	.0	.0	284.4	76.8 28221.8	8.0	137.8	50.6	22.2	5.5	23.25	20441.2	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	21.65	
DISCHG	.0	.0	.0	.0	284.7	76.8 28222.0	8.0	137.8	50.5	22.2	5.5	24.06	20425.0	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	22.45	
DISCHG	.0	.0	.0	.0	284.6	76.8 28221.9	8.0	137.8	50.5	22.2	5.5	24.90	20435.7	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	23.25	
DISCHG	.0	.0	.0	.0	284.5	76.8 28221.8	8.0	137.8	50.5	22.2	5.5	25.76	20439.0	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	24.06	
DISCHG	.0	.0	.0	.0	235.1	76.7 28222.6	8.0	137.8	50.5	22.2	5.5	26.63	20399.7	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	24.90	
DISCHG	.0	.0	.0	.0	285.0	76.7 28222.5	8.0	137.8	50.4	22.2	5.5	27.53	20411.1	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	25.76	
DISCHG	.0	.0	.0	.0	284.8	76.8 28222.2	8.0	137.8	50.5	22.2	5.5	28.45	20421.8	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	26.63	
DISCHG	.0	.0	.0	.0	285.1	76.7 28222.7	8.0	137.8	50.4	22.2	5.5	29.38	20398.4	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	27.53	
DISCHG	.0	.0	.0	.0	319.3	71.7 28275.8	6.8	134.0	44.3	19.2	4.1	30.00	18192.3	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	28.45	
DISCHG	.0	.0	.0	.0	432.3	53.9 28422.7	3.7	114.0	26.4	10.2	1.3	30.00	11931.3	
CHG	.0	.0	.0	.0	744.0	.0 28681.7	.0	.0	.0	.0	.0	.0	29.38	
DISCHG	.0	.0	.0	.0	596.6	26.0 28578.2	1.0	65.5	7.6	1.9	.1	30.00	4907.7	

REACTOR DESCRIPTION			
REACTOR STARTUP DATE	1970.0		
REACTOR POWER	3077.0	MW(TH)	
ELECTRICAL CONV. EFF	32.5	PCT	
TONS OF FUEL IN REACTOR	88.2	TONNE	
REACTOR LIFETIME	30.0	YRS	

PLANT CHARGES			
BOND INTEREST RATE	4.2	PCT	
EARNING RATE ON EQUITY (AFTER TAX)	10.0	PCT	
NUCLEAR LIABILITY COST PER YEAR	332000.0	\$/YR	
NUCLEAR LIABILITY COST PER MWYE	-0.0	\$/MWY	
PROPERTY INSURANCE	.3	PCT/YR	
PLANT BASE OPERATING COST	1003000.0	\$/YR	
FEDERAL INCOME TAX RATE	50.0	PCT	
STATE INCOME TAX RATE	3.0	PCT	
PROPERTY TAX RATE	3.2	PCT/YR	
STATE GROSS REVENUE TAX RATE	4.0	PCT	
COMBINED STATE AND LOCAL TAXES	-0.0	\$/YR	
INTERIM CAPITAL REPLACEMENTS	.4	PCT/YR	

CAPITAL COSTS			
CONSTRUCTION TIME	3.0	YRS	
SPECIAL MATERIALS, NON-DEPRECIABLE	-0.0	\$	
SPECIAL MATERIALS, DEPRECIABLE	.0	\$	
REACTOR PLANT EQUIPMENT	-0.0	\$	
TURBINE PLANT EQUIPMENT	-0.0	\$	
ELECTRIC PLANT EQUIPMENT	-0.0	\$	
MISCELLANEOUS PLANT EQUIPMENT	-0.0	\$	
INDIRECT COSTS	-0.0	\$	
OTHER CAPITAL COSTS	168400000.0	\$	
NET SALVAGE VALUE OF PLANT	-0.0	\$	
LAND AND LAND RIGHTS	-0.0	\$	

FIXED PROCESS TIMES			
URANIUM ENRICHMENT AND LEAD TIME	162.0	DAYS	
PRE-FABRICATION SHIPPING TIME	32.0	DAYS	
TIME IN FABRICATION	25.0	DAYS	
SHIP FROM FABRICATOR TO REACTOR SITE	10.0	DAYS	
PRE REACTOR INVENTORY TIME	30.0	DAYS	
POST REACTOR COOLING	150.0	DAYS	
TIME TO SHIP FUEL TO REPROCESS SITE	32.0	DAYS	
(REPROCESSING TIME DETERMINED BY SIZE OF BATCH)			
SHIP TO FINAL DESTINATION	30.0	DAYS	

SHIPPING CHARGES			
PRE-FABRICATION SHIPPING COST, (U)	-0.0	\$/KG	
FABRICATOR TO REACTOR SITE (U)	.5	\$/KG	
PRE-FABRICATION SHIPPING COST (RECYC)	-0.0	\$/KG	
FABRICATOR TO REACTOR SITE (RECYC)	.5	\$/KG	
REACTOR SITE TO REPROCESSING PLANT	3.6	\$/KG	
COST TO SHIP TO FINAL DESTINATION	-0.0	\$/KG	

REPROCESSING CHARGES			
REPROCESSING PLANT THROUGHPUT	-0.0	KG/DAY	
REPROCESSING PLANT OPERATING COST	-0.0	\$/DAY	

FIRST CORE PURCHASE			
FABRICATION CHARGE	7517971.3	\$	
SHIPPING CHARGE	48534.4	\$	
FUEL PURCHASE	14904623.3	\$	
FUEL FABRICATION LOSSES	67070.8	\$	
INTEREST CHARGES	1577673.9	\$	
URANIUM CASCADE PRICE SCHEDULE PARAMETERS			
COST OF FEED (SEE TABLE 2)			
CONVERSION COST	2.50	\$/KG	
FEED COMPOSITION	.7110	PCT	
COST OF SEPARATIVE DUTY	26.00	\$/KG	
TAILS VALUE	.00	\$/KG	

ISOTOPE PRICES											
U233W	14.0	\$/GM	U235W	-0.0	\$/GM	PU239W	10.0	\$/GM	PU241Z	10.0	\$/GM
TH232	.0	\$/GM	U238	-0.0	\$/GM	U234	-0.0	\$/GM	PU240	-0.0	\$/GM
PA233	-0.0	\$/GM	U236	-0.0	\$/GM	PU242	-0.0	\$/GM	NP237	-0.0	\$/GM
AM241	-0.0	\$/GM	AM243	-0.0	\$/GM	AM242M	-0.0	\$/GM	CM242	-0.0	\$/GM
CM243	-0.0	\$/GM	CM244	-0.0	\$/GM	PU238	-0.0	\$/GM	POISON	-0.0	\$/GM

TABLE 1
YEARLY COSTS IN MILLIONS OF DOLLARS

YEAR	CAPACITY FACTOR PCT	FUEL PURCHASE	FUEL CREDIT	FABRICATION CHARGE	REPROCESSING CHARGE	PRE-REACTOR SHIPPING CHARGE	POST-REACTOR SHIPPING CHARGE	FUEL LOSS CHARGE	VARIABLE OPERATING CHARGE	TOTAL
1970	40.0	7.184	.000	.000	.000	.000	.000	.000	.648	7.184
1971	40.0	7.247	2.932	4.880	1.150	.052	.106	.082	.648	10.565
1972	40.0	7.320	2.664	2.388	1.139	.016	.106	.052	.648	8.357
1973	40.0	7.404	2.391	2.346	1.125	.016	.106	.054	.648	8.660
1974	40.0	7.472	3.087	2.308	1.109	.016	.106	.057	.648	7.982
1975	40.0	7.352	3.003	2.269	1.095	.016	.106	.057	.648	7.892
1976	40.0	7.230	2.983	2.231	1.081	.016	.106	.056	.648	7.737
1977	40.0	7.111	3.058	2.194	1.060	.016	.106	.056	.648	7.491
1978	40.0	6.992	3.093	2.158	1.052	.016	.106	.055	.648	7.287
1979	40.0	13.633	3.084	2.124	1.039	.016	.106	.055	.648	13.889
1980	40.0	6.644	3.091	2.090	1.020	.016	.106	.054	.648	6.845
1981	40.0	6.532	3.078	2.058	1.015	.016	.211	.053	.648	7.807
1982	40.0	6.421	6.148	4.024	.990	.052	.106	.103	.648	5.528
1983	40.0	12.518	3.077	1.968	.976	.016	.106	.051	.648	12.559
1984	40.0	6.132	3.074	1.939	1.924	.016	.211	.050	.648	7.198
1985	79.2	12.384	6.121	3.797	.940	.052	.106	.098	.641	11.242
1986	77.5	6.253	3.043	1.858	.930	.016	.106	.049	.628	6.175
1987	75.8	12.631	6.047	3.634	1.842	.052	.211	.098	.614	12.401
1988	74.2	6.379	3.026	1.774	.900	.016	.106	.049	.601	6.204
1989	72.5	6.423	3.029	3.463	1.779	.016	.211	.070	.587	8.932
1990	70.8	12.973	6.115	1.687	.873	.052	.106	.079	.574	9.640
1991	69.2	6.557	3.076	1.657	.862	.016	.106	.050	.560	6.171
1992	67.5	6.603	3.096	1.626	1.890	.016	.211	.050	.547	7.101
1993	65.8	6.650	6.230	3.156	.827	.052	.106	.102	.533	4.643
1994	64.2	6.693	3.141	1.529	.815	.016	.106	.051	.520	6.075
1995	62.5	13.545	3.155	1.496	.800	.016	.106	.052	.506	12.862
1996	60.8	6.849	3.170	1.462	.790	.016	.106	.052	.493	6.104
1997	59.2	6.902	3.192	1.426	.770	.016	.106	.052	.479	6.087
1998	57.5	6.955	3.208	1.390	1.515	.016	.211	.052	.466	6.931
1999	55.8	.000	3.224	1.354	.737	.016	.106	.074	.452	-.937
2000	.0	.000	17.249	.000	2.184	.000	.317	.073	.000	-14.676

B-4

BNWL-1169

TABLE 2
VARIABLE PARAMETERS

YEAR	REPROCESSING CHARGE, \$/KG,		REPROCESSING TIME, DAYS		FABRICATION CHARGE, \$/KG,		U233 OR PU FAB PENALTY	PU PRICE	U233 PRICE	U FEED PRICE
	BLKT	CORE	BLKT	CORE	BLKT	CORE	, \$/KG	\$/GM	\$/GM	\$/LB U308
1967					.00	89.00	16.00	9.17	14.00	6.58
1968					.00	87.67	16.00	9.17	14.00	6.74
1969					.00	86.34	16.00	9.17	14.00	6.90
1970	.00	.00	.00	.00	.00	85.00	16.00	9.17	14.00	7.06
1971	.00	39.11	.00	30.00	.00	83.67	16.00	9.17	14.00	7.23
1972	.00	38.71	.00	30.00	.00	82.34	16.00	9.17	14.00	7.39
1973	.00	38.25	.00	30.00	.00	81.00	16.00	9.17	14.00	7.55
1974	.00	37.72	.00	30.00	.00	79.67	16.00	9.17	14.00	7.72
1975	.00	37.23	.00	30.00	.00	78.34	16.00	9.17	14.00	7.88
1976	.00	36.73	.00	30.00	.00	77.00	16.00	9.17	14.00	8.04
1977	.00	36.24	.00	30.00	.00	75.67	16.00	9.17	14.00	8.20
1978	.00	35.78	.00	30.00	.00	74.34	16.00	9.17	14.00	8.37
1979	.00	35.32	.00	30.00	.00	73.00	16.00	9.17	14.00	8.53
1980	.00	34.88	.00	30.00	.00	71.67	16.00	9.17	14.00	8.69
1981	.00	34.04	.00	30.00	.00	70.34	16.00	9.17	14.00	8.86
1982	.00	33.64	.00	30.00	.00	69.00	16.00	9.17	14.00	9.02
1983	.00	33.26	.00	30.00	.00	67.67	16.00	9.17	14.00	9.18
1984	.00	32.53	.00	30.00	.00	66.34	16.00	9.17	14.00	9.34
1985	.00	32.18	.00	30.00	.00	65.00	16.00	9.17	14.00	9.51
1986	.00	31.83	.00	30.00	.00	63.67	16.00	9.17	14.00	9.67
1987	.00	31.14	.00	30.00	.00	62.34	16.00	9.17	14.00	9.83
1988	.00	30.79	.00	30.00	.00	61.00	16.00	9.17	14.00	9.99
1989	.00	30.06	.00	30.00	.00	59.67	16.00	9.17	14.00	10.16
1990	.00	29.69	.00	30.00	.00	58.34	16.00	9.17	14.00	10.32
1991	.00	29.31	.00	30.00	.00	57.00	16.00	9.17	14.00	10.48
1992	.00	28.53	.00	30.00	.00	55.67	16.00	9.17	14.00	10.65
1993	.00	28.13	.00	30.00	.00	54.34	16.00	9.17	14.00	10.81
1994	.00	27.72	.00	30.00	.00	53.00	16.00	9.17	14.00	10.97
1995	.00	27.30	.00	30.00	.00	51.67	16.00	9.17	14.00	11.13
1996	.00	26.87	.00	30.00	.00	50.34	16.00	9.17	14.00	11.30
1997	.00	26.44	.00	30.00	.00	49.00	16.00	9.17	14.00	11.46
1998	.00	25.52	.00	30.00	.00	47.67	16.00	9.17	14.00	11.62
1999	.00	25.06	.00	30.00	.00	46.34	16.00	9.17	14.00	11.79
2000	.00	24.75	.00	30.00	.00	45.00	16.00	9.17	14.00	11.95

B-5

BNWL-1169

TABLE 3
URANIUM PURCHASES AND CREDITS

YEAR	URANIUM PRICE \$/LB	TAILS COMPOSITION PCT	90 PCT ENR URANIUM PRICE \$/GM	U308 PURCHASED TONS	SEPARATIVE WORK PURCHASED TONNE	TAILS PRODUCED TONNE U	EQUIVALENT U308 CREDITED TONS	EQUIVALENT SEPARATIVE WORK CREDITED TONNE	TAILS CONSUMED TONNE U
1967	6.58	.000	.00	.0	.0	.0	.0	.0	.0
1968	6.74	.000	.00	.0	.0	.0	.0	.0	.0
1969	6.90	.251	10.48	547.8	240.8	332.8	.0	.0	.0
1970	7.06	.249	10.60	244.4	124.2	158.4	.0	.0	.0
1971	7.23	.247	10.67	243.6	124.7	157.8	.1	17.3	30.4
1972	7.39	.245	10.75	242.7	125.2	157.2	.1	8.2	15.9
1973	7.55	.243	10.85	241.8	125.8	156.4	.0	1.6	3.5
1974	7.72	.241	10.94	240.7	126.3	155.6	.1	11.3	20.6
1975	7.88	.239	11.03	234.5	122.9	150.9	.1	9.4	17.4
1976	8.04	.237	11.11	228.5	119.5	146.2	.1	8.7	16.2
1977	8.20	.235	11.20	222.8	116.3	141.8	.1	9.8	17.7
1978	8.37	.233	11.28	217.3	113.1	137.6	.1	10.3	18.3
1979	8.53	.232	11.35	212.0	110.1	133.5	.1	10.2	18.0
1980	8.69	.229	11.50	408.0	211.3	255.5	.1	10.4	18.2
1981	8.86	.227	11.57	197.4	101.4	122.3	.1	10.3	17.9
1982	9.02	.226	11.64	192.0	98.7	118.9	.1	20.8	35.7
1983	9.18	.224	11.77	373.2	189.5	228.0	.1	10.6	18.0
1984	9.34	.222	11.83	181.3	91.6	109.9	.1	10.7	18.0
1985	9.51	.221	11.89	181.0	91.9	109.7	.1	21.4	35.7
1986	9.67	.219	12.00	361.0	184.5	218.6	.1	10.6	17.6
1987	9.83	.218	12.07	180.0	92.6	108.9	.1	20.8	34.2
1988	9.99	.216	12.19	359.1	186.1	217.1	.1	10.3	16.8
1989	10.16	.215	12.25	179.1	93.5	108.2	.1	10.1	16.5
1990	10.32	.213	12.32	178.7	93.7	107.9	.1	20.6	33.2
1991	10.48	.211	12.45	356.5	188.3	215.1	.1	10.3	16.5
1992	10.65	.210	12.52	177.8	94.6	107.2	.1	10.5	16.6
1993	10.81	.209	12.59	177.4	94.9	107.0	.1	21.0	32.9
1994	10.97	.208	12.66	177.1	95.2	106.7	.1	10.6	16.4
1995	11.13	.207	12.73	176.9	95.5	106.5	.1	10.6	16.4
1996	11.30	.205	12.80	176.5	95.8	106.2	.1	10.6	16.3
1997	11.46	.203	12.95	352.0	192.5	211.6	.1	10.8	16.4
1998	11.62	.202	13.03	175.5	96.7	105.4	.1	10.8	16.3
1999	11.79	.201	13.05	.0	.0	.0	.1	10.8	16.3
2000	11.95	.199	13.18	.0	.0	.0	.4	129.4	159.9

BNWL-1169

TABLE 4
REACTOR PROPERTIES TABLE

INITIAL FULL POWER SPECIFIC POWER, MW/TONNE HEAVY METAL	34.9
YIELD, FISSILE KG PER MWE-YEAR	-.581
YIELD, KG PU PER MWE-YEAR	.278
YIELD, KG U235 PER MWE-YEAR	-.859
YIELD, KG U233 PER MWE-YEAR	.000
SPECIFIC INVENTORY, KG OF FISSILE MATERIAL PER MEGAWATT ELECTRICAL	2.16
TONS OF U308 MINED PER MWE-YEAR	.228
TONS OF U308 MINED PER MWTY-YEAR	.074
KILOGRAMS FISSIONED PER TON OF U308 MINED	5.18
KG SEPARATIVE DUTY PER MWE-YR	151.79
TONS OF U308 CONSUMED	5036.6
TONNES OF SEPARATIVE DUTY CONSUMED	3358.4
KG FABRICATED PER MWE-YR	50.5
AVERAGE PLANT CAPACITY FACTOR, PER-CENT	73.7

THE CAPACITY FACTOR VARIES AS FOLLOWS:

80.00% AT 0.00 YEARS, CHANGING BY -1.00 %/YEAR TO
 80.00% AT 15.00 YEARS, CHANGING BY -1.67 %/YEAR TO
 55.00% AT 30.00 YEARS.

BNWL-1169

TABLE 5
KILOGRAMS FABRICATED EACH YEAR
(BEFORE LOSSES)

YEAR	PH232	PA233	U233	U234	U235	U236	U238	PU239	PU240	PU241	PU242
1967	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1968	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1969	.0	.0	.0	.0	2160.7	.0	86511.6	.0	.0	.0	.0
1970	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1971	.0	.0	.0	.0	1886.0	.0	57226.6	.0	.0	.0	.0
1972	.0	.0	.0	.0	943.0	.0	28613.3	.0	.0	.0	.0
1973	.0	.0	.0	.0	943.0	.0	28613.3	.0	.0	.0	.0
1974	.0	.0	.0	.0	942.2	.0	28614.1	.0	.0	.0	.0
1975	.0	.0	.0	.0	922.8	.0	28633.8	.0	.0	.0	.0
1976	.0	.0	.0	.0	903.6	.0	28653.2	.0	.0	.0	.0
1977	.0	.0	.0	.0	885.3	.0	28671.7	.0	.0	.0	.0
1978	.0	.0	.0	.0	867.5	.0	28689.8	.0	.0	.0	.0
1979	.0	.0	.0	.0	850.3	.0	28707.2	.0	.0	.0	.0
1980	.0	.0	.0	.0	833.5	.0	28724.2	.0	.0	.0	.0
1981	.0	.0	.0	.0	817.4	.0	28740.5	.0	.0	.0	.0
1982	.0	.0	.0	.0	1588.7	.0	57527.7	.0	.0	.0	.0
1983	.0	.0	.0	.0	772.3	.0	28786.2	.0	.0	.0	.0
1984	.0	.0	.0	.0	1505.6	.0	57611.9	.0	.0	.0	.0
1985	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1986	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1987	.0	.0	.0	.0	1494.8	.0	57622.8	.0	.0	.0	.0
1988	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1989	.0	.0	.0	.0	1494.8	.0	57622.8	.0	.0	.0	.0
1990	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1991	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1992	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1993	.0	.0	.0	.0	1494.8	.0	57622.8	.0	.0	.0	.0
1994	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1995	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1996	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1997	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1998	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0
1999	.0	.0	.0	.0	747.4	.0	28811.4	.0	.0	.0	.0

TABLE 5
KILOGRAMS FABRICATED EACH YEAR
(BEFORE LOSSES)

YEAR	NP237	AM241	AM243	AM242M	CM242	CM243	CM244	PU238	POISON	FISS PRD	TOTAL
1967	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1968	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1969	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	88672.3
1970	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1971	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	59112.6
1972	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29556.3
1973	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29556.3
1974	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29556.3
1975	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29556.6
1976	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29556.8
1977	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29557.0
1978	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29557.3
1979	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29557.5
1980	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29557.7
1981	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29557.9
1982	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	59116.4
1983	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.5
1984	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	59117.5
1985	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1986	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1987	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	59117.6
1988	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1989	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	59117.6
1990	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1991	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1992	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1993	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	59117.6
1994	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1995	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1996	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1997	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1998	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8
1999	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29558.8

B-9

BNWL-1169

TABLE 6
KILOGRAMS REPROCESSED EACH YEAR
(AFTER LOSSES)

YEAR	TH232	PA233	U233	U234	U235	U236	U238	PU239	PU240	PU241	PU242
1967	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1968	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1969	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1970	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1971	.0	.0	.0	.0	344.0	51.7	26353.6	118.6	31.4	11.9	1.9
1972	.0	.0	.0	.0	275.1	73.8	28113.9	138.3	50.7	21.8	5.6
1973	.0	.0	.0	.0	216.5	92.0	27883.3	147.1	65.9	30.0	10.6
1974	.0	.0	.0	.0	294.1	105.9	27746.6	153.4	63.3	29.9	9.4
1975	.0	.0	.0	.0	279.4	107.9	27718.1	154.2	65.8	31.2	10.4
1976	.0	.0	.0	.0	274.1	108.6	27708.4	154.3	66.6	31.6	10.7
1977	.0	.0	.0	.0	281.7	107.5	27722.4	154.0	65.4	31.0	10.2
1978	.0	.0	.0	.0	284.6	107.1	27729.7	153.6	64.9	30.7	10.0
1979	.0	.0	.0	.0	284.0	104.1	27764.7	152.2	63.7	29.9	9.6
1980	.0	.0	.0	.0	285.5	100.9	27803.1	150.6	62.2	28.9	9.0
1981	.0	.0	.0	.0	569.7	193.5	55705.2	297.3	120.8	55.5	16.8
1982	.0	.0	.0	.0	285.4	92.0	27903.0	146.5	58.3	26.5	7.7
1983	.0	.0	.0	.0	286.9	86.7	27937.1	145.0	56.8	25.6	7.3
1984	.0	.0	.0	.0	574.8	171.0	55965.6	285.7	109.6	48.7	13.4
1985	.0	.0	.0	.0	287.2	82.2	28026.3	140.6	53.0	23.2	6.2
1986	.0	.0	.0	.0	286.7	81.0	28053.2	139.2	51.9	22.5	5.9
1987	.0	.0	.0	.0	569.9	154.2	56174.1	275.2	101.0	43.4	11.0
1988	.0	.0	.0	.0	283.7	76.4	28095.4	137.2	50.2	21.5	5.5
1989	.0	.0	.0	.0	565.4	153.0	56188.3	274.5	100.7	43.2	11.0
1990	.0	.0	.0	.0	283.1	76.5	28094.6	137.2	50.3	21.5	5.5
1991	.0	.0	.0	.0	283.0	76.5	28094.5	137.2	50.4	21.5	5.5
1992	.0	.0	.0	.0	566.8	152.9	56189.9	274.4	100.6	43.0	10.9
1993	.0	.0	.0	.0	283.1	76.5	28094.8	137.2	50.3	21.5	5.5
1994	.0	.0	.0	.0	283.5	76.4	28095.0	137.2	50.3	21.5	5.5
1995	.0	.0	.0	.0	283.3	76.5	28094.9	137.2	50.3	21.5	5.5
1996	.0	.0	.0	.0	283.2	76.5	28094.8	137.2	50.3	21.5	5.5
1997	.0	.0	.0	.0	283.8	76.4	28095.6	137.2	50.2	21.5	5.4
1998	.0	.0	.0	.0	567.2	152.8	56190.7	274.4	100.5	43.0	10.9
1999	.0	.0	.0	.0	283.2	76.4	28095.7	137.2	50.2	21.5	5.4
2000	.0	.0	.0	.0	1342.2	156.9	64893.0	312.1	77.9	30.3	5.5

TABLE 6
KILOGRAMS REPROCESSED EACH YEAR
(AFTER LOSSES)

YEAR	LP237	AM241	AM243	AM242M	CM242	CM243	CM244	PU238	POISON	FISS PRD	TOTAL
1967	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1968	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1969	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1970	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1971	4.0	.2	.1	.0	.0	.0	.0	.4	.0	.0	28918.0
1972	7.9	.6	.7	.0	.2	.0	.1	1.3	.0	.0	28690.1
1973	12.2	1.2	1.8	.0	.3	.0	.4	2.8	.0	.0	28464.1
1974	13.3	1.2	1.6	.0	.3	.0	.4	2.8	.0	.0	28422.1
1975	14.0	1.3	1.8	.0	.3	.0	.4	3.1	.0	.0	28387.9
1976	14.3	1.3	1.9	.0	.4	.0	.5	3.2	.0	.0	28375.7
1977	13.9	1.2	1.8	.0	.3	.0	.4	3.1	.0	.0	28393.1
1978	13.7	1.2	1.7	.0	.3	.0	.4	3.0	.0	.0	28401.0
1979	13.1	1.1	1.6	.0	.3	.0	.4	2.8	.0	.0	28427.6
1980	12.5	1.1	1.5	.0	.3	.0	.3	2.6	.0	.0	28458.7
1981	23.3	2.0	2.6	.0	.5	.0	.6	4.7	.0	.0	56992.6
1982	10.8	.9	1.2	.0	.2	.0	.2	2.1	.0	.0	28535.5
1983	10.3	.9	1.1	.0	.2	.0	.2	1.9	.0	.0	28562.9
1984	19.2	1.6	1.9	.0	.4	.0	.3	3.5	.0	.0	57196.3
1985	8.9	.7	.8	.0	.2	.0	.1	1.6	.0	.0	28631.0
1986	8.5	.7	.8	.0	.2	.0	.1	1.4	.0	.0	28651.0
1987	16.2	1.3	1.4	.0	.3	.0	.2	2.7	.0	.0	57350.8
1988	8.0	.6	.7	.0	.2	.0	.1	1.3	.0	.0	28680.7
1989	16.0	1.2	1.4	.0	.3	.0	.2	2.6	.0	.0	57358.3
1990	8.0	.6	.7	.0	.2	.0	.1	1.3	.0	.0	28679.6
1991	8.0	.6	.7	.0	.2	.0	.1	1.3	.0	.0	28679.5
1992	16.0	1.2	1.4	.0	.3	.0	.2	2.6	.0	.0	57360.2
1993	8.0	.6	.7	.0	.2	.0	.1	1.3	.0	.0	28679.8
1994	8.0	.6	.7	.0	.2	.0	.1	1.3	.0	.0	28680.3
1995	8.0	.6	.7	.0	.2	.0	.1	1.3	.0	.0	28680.0
1996	8.0	.6	.7	.0	.2	.0	.1	1.3	.0	.0	28679.8
1997	8.0	.6	.7	.0	.2	.0	.1	1.3	.0	.0	28681.0
1998	16.0	1.2	1.4	.0	.3	.0	.2	2.6	.0	.0	57361.2
1999	8.0	.6	.7	.0	.2	.0	.1	1.3	.0	.0	28681.1
2000	11.5	.7	.6	.0	.1	.0	.1	1.4	.0	.0	86826.2

INPUT DATA

CARD 1

BOND REPAYMENT PROPORTIONAL
SUM OF YEARS DIGITS DEPRECIATION

CARD 2

PLANT INVESTMENT, \$M	168.4000	(INITIAL FINANCING)
PROJECT LIFE, YEARS	30.6625	
NONFUEL WORKING CAPITAL, \$M	.0000	(INITIAL FINANCING)
FRACTION OF INITIAL INVESTMENT IN BONDS	.5200	
BOND INTEREST RATE	.0423	
EQUITY EARNING RATE (AFTER TAXES)	.1000	
FEDERAL INCOME TAX RATE	.5000	

CARD 3

REACTOR POWER, MWE	1000.0250	
DEPRECIABLE LIFE, YEARS	30.0000	
NONFUEL VARIABLE OPERATING COST, \$M/YR	.8100	(AT 100% PLANT FACTOR)
INITIAL CORE INVESTMENT, \$M	24.1159	(INITIAL FINANCING)

FIRST YEAR OF OPERATION 1970

CARD 4

STATE INCOME TAX RATE	.0300
STATE GROSS REVENUE TAX RATE	.0400
PROPERTY TAX RATE	.0320
INTERIM CAPITAL REPLACEMENTS, \$M/YR	.5894
PROPERTY INSURANCE, \$M/YR	.4210
NUCLEAR LIABILITY, \$M/YR	.3320
NUCLEAR LIABILITY, \$M/MWYE	.0000

CARD 5

RECOVERABLE COST OF LAND, \$M	.0000	(INITIAL FINANCING)
NET SALVAGE VALUE OF PLANT, \$M	.0000	
RECOVERABLE MODERATOR AND SALT, \$M	.0000	(INITIAL FINANCING)
REACTOR OPERATING LIFE, YEARS	30.0000	

EXPENSES IN \$M/YR

PROBLEM IDENTIFICATION PWR 1970 30 YR U

YEAR	LOAD FACTOR	FUEL PURCHASES	FABRICATION COST	REPROCESS COST	U-PU CREDIT	BASE OPERATING COST	VARIABLE OPERATING COST	SPECIFIED BOND PAYMENTS
1 1970	.80000	7.18420	.00000	.00000	.00000	1.00300	.64800	.00000
2 1971	.80000	7.24665	4.97758	1.27306	2.93232	1.00300	.64800	.00000
3 1972	.80000	7.31950	2.43754	1.26345	2.66390	1.00300	.64800	.00000
4 1973	.80000	7.40358	2.39595	1.25127	2.39067	1.00300	.64800	.00000
5 1974	.80000	7.47131	2.35809	1.23362	3.08656	1.00300	.64800	.00000
6 1975	.80000	7.35178	2.31858	1.22435	3.00284	1.00300	.64800	.00000
7 1976	.80000	7.23028	2.27964	1.20979	2.98286	1.00300	.64800	.00000
8 1977	.80000	7.11105	2.24238	1.19553	3.05775	1.00300	.64800	.00000
9 1978	.80000	6.99213	2.20608	1.18182	3.09333	1.00300	.64800	.00000
10 1979	.80000	13.63342	2.17117	1.16800	3.08405	1.00300	.64800	.00000
11 1980	.80000	6.64410	2.13688	1.15493	3.09117	1.00300	.64800	.00000
12 1981	.80000	6.53191	2.10415	2.24885	3.07816	1.00300	.64800	.00000
13 1982	.80000	6.42128	4.11434	1.14032	6.14755	1.00300	.64800	.00000
14 1983	.80000	12.51815	2.01215	1.10603	3.07734	1.00300	.64800	.00000
15 1984	.80000	6.13166	1.98339	2.15716	3.07411	1.00300	.64800	.00000
16 1985	.79167	12.38387	3.88453	1.09490	6.12147	1.00300	.64125	.00000
17 1986	.77500	6.25291	1.90243	1.06294	3.04335	1.00300	.62775	.00000
18 1987	.75833	12.63129	3.72243	2.09492	6.04726	1.00300	.61425	.00000
19 1988	.74167	6.37905	1.81915	1.03176	3.02614	1.00300	.60075	.00000
20 1989	.72500	6.42259	3.50743	2.03175	3.02929	1.00300	.58725	.00000
21 1990	.70833	12.97787	1.77704	.99950	6.11490	1.00300	.57375	.00000
22 1991	.69167	6.55680	1.70219	.98845	3.07636	1.00300	.56025	.00000
23 1992	.67500	6.60334	1.67136	1.92204	3.09553	1.00300	.54675	.00000
24 1993	.65833	6.65004	3.24829	.97487	6.23050	1.00300	.53325	.00000
25 1994	.64167	6.69840	1.57558	.94207	3.14100	1.00300	.51975	.00000
26 1995	.62500	13.54488	1.54210	.92976	3.15504	1.00300	.50625	.00000
27 1996	.60833	6.84879	1.50846	.91719	3.17006	1.00300	.49275	.00000
28 1997	.59167	6.90157	1.47329	.90450	3.19241	1.00300	.47925	.00000
29 1998	.57500	6.95460	1.43725	1.74774	3.20835	1.00300	.46575	.00000
30 1999	.55833	.00000	1.40098	.88573	3.22371	1.00300	.45225	.00000
31 2000	.00000	.00000	.00000	2.57374	17.24948	.00000	.00000	.00000

B-13

BNWL-1169

EXPENSES BEFORE FEDERAL INCOME TAX, \$M

PROBLEM IDENTIFICATION PWR 1970 30 YR U

YEAR	5.867 PCT PRESENT WORTH FACTOR	FUEL OPERATING EXPENSES	ANNUAL FUEL EXPENSES	NON-FUEL OPERATING EXPENSES	DEPRECIATION	BOND INTEREST	TOTAL STATE INCOME AND REVENUE TAXES
1 1970	.97150	7.18420	8.89678	8.56451	10.86452	2.11729	1.68272
2 1971	.91804	10.56497	8.89678	8.35979	11.05501	3.99548	1.62680
3 1972	.86716	8.35659	8.89678	8.15569	10.65863	3.95197	1.64612
4 1973	.81911	8.66012	8.89678	7.95223	10.26479	3.85965	1.66681
5 1974	.77371	7.98195	8.89678	7.74939	9.87349	3.77088	1.68729
6 1975	.73084	7.89188	8.89678	7.54719	9.48472	3.66426	1.70822
7 1976	.69034	7.73686	8.89678	7.34561	9.09849	3.55164	1.72923
8 1977	.65208	7.49121	8.89678	7.14466	8.71479	3.43124	1.75039
9 1978	.61594	7.28669	8.89678	6.94434	8.33363	3.30057	1.77175
10 1979	.58181	13.88864	8.89678	6.74465	7.95500	3.15991	1.79332
11 1980	.54957	6.84475	8.89678	6.54558	7.57891	3.15838	1.81062
12 1981	.51911	7.80675	8.89678	6.34715	7.20535	3.00396	1.83241
13 1982	.49035	5.52838	8.89678	6.14934	6.83432	2.86375	1.85368
14 1983	.46317	12.55899	8.89678	5.95217	6.46584	2.66729	1.87655
15 1984	.43750	7.19809	8.89678	5.75562	6.09988	2.61603	1.89496
16 1985	.41326	11.24183	8.80411	5.55295	5.73646	2.44588	1.89279
17 1986	.39036	6.17493	8.61876	5.34416	5.37558	2.36174	1.86388
18 1987	.36873	12.40138	8.43341	5.13599	5.01723	2.17321	1.83801
19 1988	.34829	6.20382	8.24806	4.92846	4.66142	2.12257	1.80790
20 1989	.32899	8.93247	8.06271	4.72155	4.30814	1.94460	1.78152
21 1990	.31076	9.63961	7.87736	4.51528	3.95740	1.82816	1.75320
22 1991	.29354	6.17109	7.69201	4.30963	3.60919	1.73237	1.72417
23 1992	.27727	7.10121	7.50666	4.10461	3.26352	1.56656	1.69714
24 1993	.26191	4.64271	7.32131	3.90022	2.92038	1.42336	1.66934
25 1994	.24739	6.07506	7.13596	3.69646	2.57978	1.22954	1.64296
26 1995	.23368	12.86170	6.95061	3.49333	2.24171	1.06768	1.61553
27 1996	.22073	6.10438	6.76526	3.29082	1.90618	1.05743	1.58346
28 1997	.20850	6.08703	6.57991	3.08895	1.57318	.90973	1.55541
29 1998	.19695	6.93125	6.39456	2.88770	1.24272	.76475	1.52719
30 1999	.18603	-.93700	6.20921	2.68708	6.61233	.64159	1.32729
31 2000	.17572	-14.67574	.00000	.31807	.00000	.28531	-.01810

B-14

BNWL-1169

CALCULATION OF FEDERAL INCOME TAX, \$M

PROBLEM IDENTIFICATION PWR 1970 30 YR U

YEAR	POWER UNITS (M MWH)	TOTAL POWER SALES	TOTAL TAX DEDUCTIBLE EXPENSES	TAXABLE INCOME (FEDERAL)	FEDERAL INCOME TAX	TOTAL CASH EXPENDITURES	TOTAL CASH RECEIPTS
1 1970	7.01393	37.73270	32.12581	5.60688	2.80344	20.23486	37.73270
2 1971	7.01393	37.73270	33.93385	3.79885	1.89942	23.04037	37.73270
3 1972	7.01393	37.73270	33.30920	4.42350	2.21175	20.95955	37.73270
4 1973	7.01393	37.73270	32.64027	5.09243	2.54622	21.41477	37.73270
5 1974	7.01393	37.73270	31.97784	5.75485	2.87743	20.88546	37.73270
6 1975	7.01393	37.73270	31.30117	6.43152	3.21576	20.95245	37.73270
7 1976	7.01393	37.73270	30.62176	7.11094	3.55547	20.95657	37.73270
8 1977	7.01393	37.73270	29.93786	7.79484	3.89742	20.87308	37.73270
9 1978	7.01393	37.73270	29.24706	8.48563	4.24282	20.83500	37.73270
10 1979	7.01393	37.73270	28.54966	9.18304	4.59152	27.60752	37.73270
11 1980	7.01393	37.73270	27.99027	9.74243	4.87121	20.66156	37.73270
12 1981	7.01393	37.73270	27.28565	10.44705	5.22353	21.79923	37.73270
13 1982	7.01393	37.73270	26.59788	11.13482	5.56741	19.68821	37.73270
14 1983	7.01393	37.73270	25.85862	11.87407	5.93704	26.91414	37.73270
15 1984	7.01393	37.73270	25.26327	12.46943	6.23471	21.67278	37.73270
16 1985	6.94087	37.33965	24.43219	12.90746	6.45373	25.73069	37.33965
17 1986	6.79475	36.55355	23.56411	12.98944	6.49472	20.46708	36.55355
18 1987	6.64863	35.76745	22.59785	13.16960	6.58480	26.54958	35.76745
19 1988	6.50250	34.98136	21.76841	13.21294	6.60647	20.13605	34.98136
20 1989	6.35638	34.19526	20.81854	13.37672	6.68836	22.71331	34.19526
21 1990	6.21026	33.40916	19.93140	13.47775	6.73888	23.23637	33.40916
22 1991	6.06413	32.62306	19.06737	13.55569	6.77785	19.57214	32.62306
23 1992	5.91801	31.83696	18.13849	13.69847	6.84924	20.34160	31.83696
24 1993	5.77188	31.05087	17.23461	13.81625	6.90813	17.70980	31.05087
25 1994	5.62576	30.26477	16.28470	13.98007	6.99003	18.99391	30.26477
26 1995	5.47964	29.47867	15.36887	14.10980	7.05490	25.61486	29.47867
27 1996	5.33351	28.69257	14.60315	14.08942	7.04471	18.61277	28.69257
28 1997	5.18739	27.90647	13.70718	14.19929	7.09964	18.42043	27.90647
29 1998	5.04127	27.12038	12.81693	14.30345	7.15173	19.08726	27.12038
30 1999	4.89514	26.33426	17.47749	8.85677	4.42838	8.09516	26.33426
31 2000	.00000	.00000	.58527	-.58527	-.29264	-14.07901	.00000

B-15

BNWL-1169

PAYOUT OF INVESTMENTS, \$M

PROBLEM IDENTIFICATION PWR 1970 30 YR U

YEAR	TOTAL CASH FLOW	OUTSTANDING BONDS	EQUITY CAPITAL NOT RECOVERED	BOND INTEREST	EARNINGS ON UNRECOVERED EQUITY	BONDS REPAID	RECOVERY OF EQUITY
1 1970	17.49783	100.10825	92.40762	2.11729	4.51031	5.65252	5.21771
2 1971	14.69232	94.45573	87.18991	3.99548	8.71899	1.02849	.94937
3 1972	16.77315	93.42724	86.24054	3.95197	8.62405	2.18250	2.01462
4 1973	16.31792	91.24474	84.22592	3.85965	8.42259	2.09855	1.93713
5 1974	16.84724	89.14619	82.28879	3.77088	8.22888	2.52069	2.32679
6 1975	16.78025	86.62551	79.96201	3.66426	7.99620	2.66229	2.45750
7 1976	16.77613	83.96322	77.50451	3.55164	7.75045	2.84650	2.62754
8 1977	16.85962	81.11672	74.87698	3.43124	7.48770	3.08916	2.85153
9 1978	16.89770	78.02757	72.02545	3.30057	7.20254	3.32519	3.06940
10 1979	10.12518	74.70238	68.95605	3.15991	6.89560	.03622	.03344
11 1980	17.07113	74.66615	68.92261	3.15838	6.89226	3.65066	3.36984
12 1981	15.93346	71.01550	65.55277	3.00396	6.55528	3.31460	3.05963
13 1982	18.04448	67.70090	62.49314	2.86375	6.24931	4.64434	4.28708
14 1983	10.81855	63.05656	58.20606	2.66729	5.82061	1.21194	1.11872
15 1984	16.05992	61.84462	57.08734	2.61603	5.70873	4.02228	3.71287
16 1985	11.60895	57.82234	53.37447	2.44588	5.33745	1.98932	1.83630
17 1986	16.08647	55.83301	51.53817	2.36174	5.15382	4.45688	4.11404
18 1987	9.21788	51.37614	47.42413	2.17321	4.74241	1.19717	1.10508
19 1988	14.84530	50.17897	46.31905	2.12257	4.63190	4.20723	3.88360
20 1989	11.48195	45.97174	42.43545	1.94460	4.24355	2.75277	2.54102
21 1990	10.17279	43.21896	39.89443	1.82816	3.98944	2.26470	2.09049
22 1991	13.05092	40.95427	37.80394	1.73237	3.78039	3.91984	3.61832
23 1992	11.49536	37.03442	34.18562	1.56656	3.41856	3.38533	3.12492
24 1993	13.34107	33.64910	31.06071	1.42336	3.10607	4.58205	4.22959
25 1994	11.27085	29.06705	26.83112	1.22954	2.68311	3.82627	3.53194
26 1995	3.86381	25.24078	23.29918	1.06768	2.32992	.24243	.22378
27 1996	10.07980	24.99835	23.07540	1.05743	2.30754	3.49171	3.22312
28 1997	9.48604	21.50664	19.85228	.90973	1.98523	3.42736	3.16372
29 1998	8.03312	18.07928	16.68856	.76475	1.66886	2.91174	2.68776
30 1999	18.23910	15.16753	14.00080	.64159	1.40008	8.42267	7.77477
31 2000	14.07901	6.74487	6.22603	.28531	.62260	6.84897	6.32213

B-16

BNWL-1169

FIXED CHARGE CALCULATIONS

PROBLEM IDENTIFICATION PWR 1970 30 YR U

FIXED CHARGE RATE ON DEPRECIABLE CAPITAL	.1348	(INCLUDES PLANT PROPERTY TAX, INSURANCE, REPLACEMENTS, SALVAGE)
FIXED CHG RATE ON NONDEPRECIABLE INVESTMENT	.1260	
CONSTANT ANNUAL INCOME REQUIRED, \$M	37.0369	
TOTAL TAX-DEDUCTIBLE EXPENSES, \$M	27.6023	
FUEL WORKING CAPITAL, \$M	20.7790	(EXCESS OF FUEL COST OVER AMORTIZED, RECOVERABLE D2O OR SALT)
POWER COST, MILLS/KWHE	5.3797	

COST OF POWER CALCULATION

FUEL CYCLE ANALYSIS

PROBLEM IDENTIFICATION PWR 1970 30 YR U

POWER COST, MILLS/KWHE 5.3797

	CASH PER KWH	ANNUAL EXPENSES (3)	INCOME TAXES	CAPITAL RECOVERY	TOTAL CHARGES
DEPRECIABLE PLANT	1.4680	.7267	.4719	2.0967	3.2973
OPERATING AND MAINTENANCE COSTS (1)					
FIXED	.2146	.2147	.0000	.0000	.2147
VARIABLE	.0842	.0876	.0000	.0000	.0876
FUEL CYCLE COSTS (2)					
FIXED	.1225	.0209	.2118	.2908	.5235
VARIABLE	1.2077	1.2560	.0000	.0000	1.2560
TOTAL	3.0971	2.3060	.6837	2.3895	5.3792

	CASH PER KWH	EXPENSES	REVENUE TAXES	FIXED CHARGES	CAPITAL RECOVERY	INCOME TAXES	TOTAL CHARGES
(1) DETAILS OF OPERATING AND MAINTENANCE COSTS							
OPERATING EXPENSES	.2475	.2907	.0097	-.0489	-.0283	-.0207	.2514
RECOVERABLE LAND COSTS	.0000	.0000	.0000	-.0000	-.0000	.0000	.0000
NUCLEAR LIABILITY	.0513	.0513	.0020	-.0020	-.0011	-.0008	.0514
(2) DETAILS OF FUEL CYCLE COSTS							
FUEL PURCHASES							1.5416
INITIAL CORE	.0422 .0850	.0422	.0144	.3168	.1830	.1338	.3734
REPLACEMENT FUEL	1.2115	1.2115	.0449	-.0882	-.0509	-.0372	1.1682
FABRICATION							.5343
INITIAL CORE	.0196 .0394	.0196	.0067	.1467	.0848	.0620	.1729
REPLACEMENT FUEL	.3501	.3501	.0139	-.0026	-.0015	-.0011	.3614
REPROCESSING							.1782
INITIAL CORE	.0087	.0000	.0003	.0063	.0037	.0027	.0066
REPLACEMENT FUEL	.1971	.1971	.0066	-.0321	-.0185	-.0135	.1716
FUEL CREDIT							-.4745
INITIAL CORE	-.0723	.0000	-.0021	-.0526	-.0304	-.0222	-.0547
REPLACEMENT FUEL	-.5509	-.5509	-.0161	.1473	.0851	.0622	-.4197
MODERATOR AND FUEL CARRIER RECOVERY	.0000	.0000	.0000	-.0000	-.0000	.0000	.0000

(3) INCLUDES REVENUE TAXES.

POWER COST, MILLS/KWHE 5.3797

ANNUAL FIXED COSTS, \$/KWE

25.0897

DEPRECIABLE PLANT
NON-FUEL WORKING CAPITAL
FUEL WORKING CAPITAL

20.4999
1.3350
3.2548

(INCLUDES ANNUAL FIXED OPERATING COSTS OF 1.3350 \$M/YR)

OPERATING COSTS, MILLS/KWHE

1.2919

OPERATION AND MAINTENANCE
FUEL CYCLE

.0842
1.2077

REVENUE TAXES

.2069

DISTRIBUTION

No. of
Copies

OFFSITE

1	<u>AEC Chicago Patent Group</u> G. H. Lee
6	<u>AEC Division of Reactor Development and Technology</u> G. M. Anderson W. G. Belter G. S. Petretic S. Strauch M. J. Whitman J. G. Yevick
214	<u>AEC Division of Technical Information Extension</u>
2	<u>Argonne National Laboratory</u> P. Gast K. A. Hubb
1	<u>Atomics International</u> S. Golan
1	<u>Bechtel Corporation</u> M. P. Aronchick
1	<u>Brookhaven National Laboratory</u> C. J. Raseman
1	<u>Combustion Engineering</u> J. Dietrich
1	<u>Gulf General Atomics</u> S. Jaye
1	<u>General Electric Company, San Jose, (AEC)</u> <u>Nuclear Energy Division</u> J. H. Nail

No. of
Copies

- 3 Los Alamos Scientific Laboratory
 W. E. Crowe
- 2 Oak Ridge National Laboratory
 R. S. Carlsmith
 R. Salmon
- 1 United Engineers and Constructors, Inc.
 1401 Arch Street
 Philadelphia, Pennsylvania 19105
- 2 Westinghouse Electric Corporation (AEC)
 C. A. Anderson
 J. W. Wright

ONSITE HANFORD

- 1 AEC Chicago Patent Group
 R. K. Sharp (Richland)
- 2 AEC RDT Site Representative
 P. G. Holsted
- 1 AEC Richland Operations Office
 C. L. Robinson
- 6 Douglas United Nuclear, Inc.
 W. J. Dowis
 P. J. Gross
 H. R. Kosmata
 L. W. Lang
 R. Nilson
 DUN File

No. of
Copies

181

Battelle-Northwest

D. T. Aase
F. W. Albaugh
W. E. Anderson
E. R. Astley
J. M. Batch
W. L. Bathke
A. L. Bement
W. E. Black
C. H. Bloomster (100)
J. G. Bradley
J. B. Burnham
S. H. Bush
G. J. Busselman
D. D. Butcher
N. E. Carter
E. D. Clayton
B. M. Cole
D. L. Condotta
G. M. Dalen
F. G. Dawson
D. E. Deonigi
K. Drumheller
R. D. Ellingson
R. L. Engel
E. A. Eschbach (10)
E. A. Evans
S. R. Fields
J. F. Fletcher
J. C. Fox
S. Goldsmith
D. R. Haffner
W. L. Hampson
G. E. Hanson
H. Harty
C. M. Heeb
R. M. Hiatt
P. L. Hofmann
P. A. Horton
L. D. Jacobson
R. T. Jaske
U. P. Jenquin
W. C. Kinsel
C. E. Leach
R. C. Liikala
C. W. Lindenmeier
R. W. McKee

Battelle-Northwest (contd)

M. A. McLaughlin
E. T. Merrill
J. N. Morgan
S. E. Nunn
L. T. Pedersen
A. M. Platt
W. W. Porath
J. C. Rake
R. G. Rau
R. L. Reynolds
L. C. Schmid
R. E. Shaver
R. I. Smith
D. H. Stewart
R. E. Turley
P. C. Walkup
K. R. Wise
K. E. Yandon
J. R. Young
F. R. Zaloudek
Technical Information (5)
Technical Publications (2)