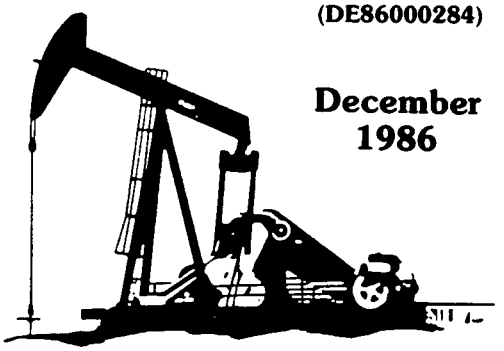
VENEZUELA-MEM/USA-DOE FOSSIL ENERGY REPORT III-3

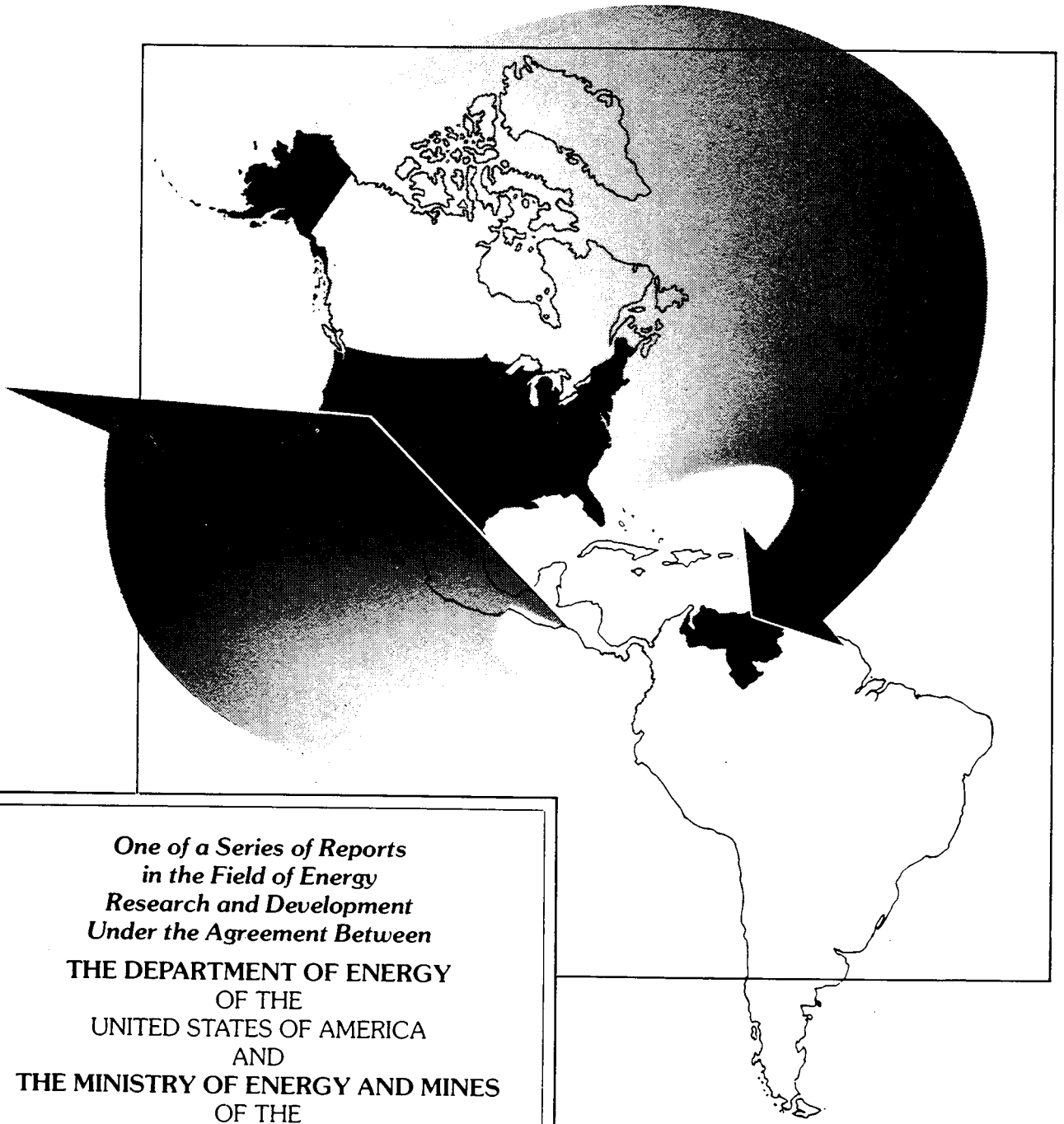
DOE/BC—86/7/SP
(DE86000284)

SUPPORTING TECHNOLOGY FOR ENHANCED OIL RECOVERY



December
1986

IN-SITU COMBUSTION PREDICTIVE MODEL



One of a Series of Reports in the Field of Energy Research and Development Under the Agreement Between

THE DEPARTMENT OF ENERGY
OF THE
UNITED STATES OF AMERICA
AND
THE MINISTRY OF ENERGY AND MINES
OF THE
REPUBLIC OF VENEZUELA

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SECOND AMENDMENT AND EXTENSION TO

Annex III—Evaluation of Past and Ongoing Enhanced Oil Recovery Projects

Implementing Agreement Between

THE DEPARTMENT OF ENERGY OF THE UNITED STATES OF AMERICA

And

THE MINISTRY OF ENERGY AND MINES OF THE REPUBLIC OF VENEZUELA

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FOREWORD

The In-situ Combustion Predictive Model (ICPM) was developed for and in conjunction with the members for the Thermal Task Group of the National Petroleum Council (NPC) for use in the 1982-1984 NPC study on enhanced oil recovery (EOR) potential. The model was designed to conform to the methodology and structure of the suite of models being used in the study. This insured that all models would calculate and report the predicted oil recovery and economics in an identical manner. As in the other models, the in-situ combustion model contains an extensive set of default equations to calculate non-critical reservoir properties, flood properties, and economic criteria. The Department of Energy, Bartlesville Project Office, supported the NPC and has maintained the models since the NPC study was completed.

The DOE, in a cooperative research program with the Ministry of Energy and Mines of Venezuela (MEMV), has made this predictive model available to Venezuela for documentation. Annex III of the cooperative research program required Venezuela to select and fund a contractor to document the five models used in the 1984 study. SSI was selected as the contractor to document the models. The documentation for ICPM is being published as a joint DOE/MEMV document.

The code listing has been added to the end of this report to provide the user maximum use of the documentation package. The user may wish to change the data input methodology to read the extensive data required for the model from a sequential file (user defined). This change will facilitate the user evaluating sensitivity runs on specific reservoir properties and in-situ combustion parameters as the user, on making an input error, is required to start at the beginning of data input.

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SECTION 1
SUMMARY OF IN-SITU COMBUSTION PREDICTIVE MODEL

1.1 INTRODUCTION

The In-Situ Combustion Predictive Model (ICPM) was developed by Scientific Software-Intercomp for the National Petroleum Council (NPC) for its 1984 survey of U.S. enhanced oil recovery potential (NPC, 1984).*

The architecture of the ICPM is similar to that of the other predictive models in the series (Paul et al, 1982; Aydelotte and Pope, 1983; Paul et al, 1984): an oil rate versus time function for a single pattern is computed, the results of which are passed to the economic calculations. Data for process costs, reservoir development costs, and operating costs, and a pattern schedule if multiple patterns are desired, allow the computation of discounted cash flow and other measures of profitability.

A brief summary of the oil recovery and economic calculations for the ICPM is given in Sections 1.2 and 1.3.

1.2 OIL RECOVERY CALCULATIONS

The ICPM oil recovery algorithm is based on the work of Brigham, et al (1980), who correlated the major variables in the combustion process to the results of 12 field pilot tests. Their correlation relates oil burned and oil produced to the amount of air injected and the reservoir volume, and is for dry combustion only. A method to predict wet combustion performance was added by NPC based on laboratory data (Garon and Wygal, 1974; Prats, 1982).

*References may be found in Section 8.

The assumptions and limitations of the ICPM are:

1. No free gas saturation
2. Empirical sweep efficiency based on pattern size
3. Constant air-to-fuel ratio of 70 MCF air burned/bbl oil burned
4. Produced water = injected water + water displaced during combustion - water remaining in burned volume
5. Water saturation in burned volume is 20% for wet combustion, 0% for dry combustion
6. Produced gas = injected nitrogen + gaseous reaction products - gas contained in burned volume
7. Amount of reaction gases is two-thirds of injected oxygen
8. Gas saturation in burned volume is 80% for wet combustion, 0% for dry combustion
9. Air injection rate based on 10 year pattern life
10. Constant air injection rate after first year of project
11. Production-to-injection well ratio is 2:1. (This value represents an inverted seven-spot pattern, or a midpoint between an inverted five-spot pattern and nine-spot pattern development)

The input parameters for the combustion model are calculated in subroutine COEF1. These are pattern area, AREAP (see Eq. 3.11, Section 3.1), number of injection wells, WELLSI (Eq. 3.12), pattern volume, PATVOL (Eq. 3.13), air requirement, AR (Eq. 3.14), water-air ratio, FWA (0.0 for dry combustion, 1.0 for wet combustion), air injection rate, ARIN (Eq. 3.15), and injection pressure, PINJ (psia):

```
PINJ = (ARIN*ALOG(626.*AREAP**0.5)/
       (2.2*10.**(-5.0-FWA)*PERM*TNET) +
       PFORM*PFORM)**0.5,                    (1.1)
```

with the restriction that if PINJ < PFORM, PINJ = PFORM + 200.

The combustion performance predictions are made in subroutine COMB. The model first calculates the compressor horsepower requirement per pattern, HPP, used to compute cost of air compressors.

```
HPP  = AIRN/1000.*48.13*PDP**0.25,           (1.2)
```

where

$$PDP = 1.2*(1.81E-6*XXL*ARIN*ARIN + PINJ*PINJ)**0.5, \quad (1.3)$$

is the compressor discharge pressure, and

$$XXL = DEPTH + 1500. \quad (1.4)$$

The cumulative air (MMSCF) and water injected (MSTB) over time-step I are, respectively

$$CUMIA(I) = CUMIA(I-1)+ARIN*DT*365.25/1000., \quad (1.5)$$

$$CUMIW(I) = CUMIW(I-1)+0.5*FWA*ARIN*DT*365.25/1000., \quad (1.6)$$

with ARIN appropriately modified until fill-up, and DT = 0.25 yr. for times less than one year, and 0.50 yr. for all other times. The cumulative oil burned as fuel is (MSTB)

$$CUMOB(I) = CUMIA(I)/AFR, \quad (1.7)$$

where AFR is the air-fuel ratio fixed at 70.0 MSCF/STB (NPC, 1984). The reservoir volume burned (ac-ft) is

$$VB = (CUMIA(I)-CUMIA(I-1))*1000./AR/43560. \quad (1.8)$$

Cumulative oil produced (MSTB) is calculated using the second correlation curve (Figure 6) of Brigham, et al (1980), with the correlation extrapolated to 100% recovery.

$$CUMOIL(I) = OIP*0.64*ATAN(Y)-CUMOB(I), \quad (1.9)$$

where the oil-in-place at the initiation of the combustion project is (MSTB)

$$OIP = 7758.*POROS*SOI*AREAP*TNET/BOI/1000., \quad (1.10)$$

and

$$Y = 0.581*X**0.82, \quad (1.11)$$

$$X = C1*C2*(CUMIA(I)+CUMIW(I))*1000., \quad (1.12)$$

$$C1 = 0.427*SOI-0.00135*TNET+2.196/VISO**0.25, \quad (1.13)$$

$$C2 = 0.95/((AREAP*TNET*7758./BOI)*(1.-POROS)), \quad (1.14)$$

where in Equation 1.14 the oxygen utilization is assumed as 95%.

Cumulative gas produced (MMSCF) is the air injected as nitrogen less gas in the burned volume, with the assumption of a burn zone temperature of 1260°F at PINJ

$$CUMGAS(I) = CUMGAS(I-1)+(0.93*ARIN*DT*365.25-(1.-SWR*FWA)*1.93*VB*PINJ*POROS)/1000., \quad (1.15)$$

where SWR, the residual water saturation after combustion, is fixed at 0.20.

Cumulative water produced (MSTB) is the water injected and displaced less water in the burned volume

$$CUMWAT(I) = CUMWAT(I-1)+(FWA*ARIN*DT*365.25+(1.-SWR*FWA-SOI)*VB*7758.*POROS/BWI)/1000. \quad (1.16)$$

The ICPM was validated against several field projects, and the results may be found in the NPC report (NPC, 1984).

1.3 ECONOMIC CALCULATIONS

The ICPM economic calculations are used to convert predicted performance data from the oil recovery algorithm into a cash flow analysis extending over the life of the project. This analysis combines forecasts of revenue, costs, expenses, and taxes into an

annual balance sheet. The model also permits an evaluation of the uncertainty of future earnings as a result of changes in key variables and thus an evaluation of project risk.

The economic calculations require three types of data:

1. Project definition (pattern development schedule, wells drilled and converted, etc). Once the performance of a single pattern has been determined, a schedule of the number of patterns per year to be initiated is used to superpose the pattern rates into an overall project performance. This procedure implicity assumes that all patterns in the project perform identically (i.e., second year oil and water rates for every pattern are the same regardless of when the pattern comes on stream). Also superposed are the capital costs of drilling and equipping wells associated with developing each pattern. From this schedule, the total multiple pattern project oil, water and gas rates are calculated as well as the total amount of fluid injected. By combining the well and pattern implementation schedules, a capital investment schedule is obtained. A fraction of this capital requirement may be borrowed and repayed over the life of the project. The fixed and variable operating costs are then calculated based upon the project performance schedule. These latter costs include such items as maintenance costs, water treating and disposal costs, etc.

2. Economic data. These include prices, costs, tax rates, discount rate, escalation (inflation) rates, and capital schedule.

3. Range of uncertainty for key variables.

Estimating Risk

The parameter method (Davidson and Cooper, 1976) is used to compute uncertainty in present value. This method deals with the parameters of the probability distributions rather than the distributions and, with reasonable assumptions about distribution

form, can estimate the probability of achieving various levels of present value.

The parameter method requires that the uncertain parameters (data) must be statistically independent. For this reason, uncertainty in performance of the reservoir is considered as a single parameter (UNCO, Card E6, Section 2.2). Other variables, such as costs, revenues and expenses, should be mutually independent. If dependence between parameters is established, the parameters should be re-arranged to minimize dependence. In the ICPM, unit prices, costs, and capital are defined as the uncertain variables, in addition to the uncertainty in oil production. Escalation, inflation and tax rates are treated as certain and constant values over the life of the project.

The mean and variance of each of the uncertain variables are then estimated. The mean is the weighted average value of all possibilities found in the probability distribution of a parameter, and the variance is the weighted average of all squares of differences from the mean. Three values of a parameter are used to calculate the mean and variance:

1. Low value - a value of the parameter small enough so that only a 10 percent chance exists of a smaller value;

2. The most-likely value; and

3. High value - a value large enough that there is only a 10 percent chance of a higher value.

Finally, the means and variances are combined into the quantities of interest, such as revenues, expenses, and costs. Once combined, the assumption of a resulting log-normal distribution is made. The mean and variance of the present value are known and estimations of present value at 10% (upside potential), 50%, and 90% (downside risk) probability are computed (see Table 4-12).

Profitability Indices

The calculated mean (50 percent) present value is presented in various formats to allow the direct comparison of costs and benefits. The present value of project revenues, costs and expenses are also reported to allow for an analysis of the components of project present value.

The final economic results are presented in terms of five measures of profitability:

1. Discounted Cash Flow (DCF), which represents the present value profit of the project;

2. Payout, which is the time required for present value profit to equal present value investment;

3. Discounted Cash Flow Rate of Return (DCFROR), which is the discount rate that reduces the DCF to zero;

4. Profit-to-Investment Ratio (P/I), which is the present value per dollar invested; and

5. Investment Efficiency, the ratio of total DCF to maximum negative DCF.

The strengths and weaknesses of these criteria are discussed in detail by Capen, et al (1976). DCF is the most widely accepted measure of project performance but it fails to recognize capital limitations and requires the specification of a discount rate. If DCF is used, a uniform discount rate should be applied to all cases considered, generally a discount rate based upon the average cost of capital.

Payout as an economic measure does provide an important measure of project performance. Since payout does not consider cash flow after the payout period ends, it is a poor ranking criteria. The advantage of including payout in the analysis allows for the recognition of minimum operating time required for a project, which can be important to operators seeking short-term returns when unstable environments make long operating periods unlikely.

DCFROR is a very popular economic criteria, and this measure obviates the need to specify a discount rate as in DCF. Problems with this criteria may result when comparing projects at different discount rates, since a project at a lesser DCFROR may have a greater present value at a company's costs of capital.

The P/I is the ratio of the project's total profit to the total investment required. The P/I recognizes capital limitations and gives a method of ranking projects in such a way as to maximize the profit per dollar invested. However, the sensitivity to cash flow timing is lost. A similar measure to the P/I ratio, the Profit-to-Expense Ratio (P/E), is also computed by the model.

Investment efficiency is defined as the ratio of the maximum cumulative discounted cash flow at economic life (T_E in Figure 1-1) to the maximum cumulative negative discounted cash flow (at time T in Figure 1-1). Investment efficiency is an excellent ranking method for enhanced oil recovery projects, which are heavily front-end loaded with high capital and operating expenses. Investment efficiency was the basis for ranking projects used in the 1984 NPC survey.

1.4 PROGRAM DIMENSIONS AND STORAGE REQUIREMENTS

Annual variables are dimensioned = 50, cumulative variables = 200. Dimensions for all variables are given in Section 5.

The ICPM requires approximately 35,000 words (base 10). This is equivalent to approximately 140,000 bytes on a 32-bit computer. I/O buffers are not included in this estimate.

1.5 SPECIFICATION OF I/O UNITS

FORTRAN I/O units are as follows:

Unit 5 - User input file
Unit 6 - Output print file
Unit 7 - Scratch file for input data processing
Unit 15 - Plot file

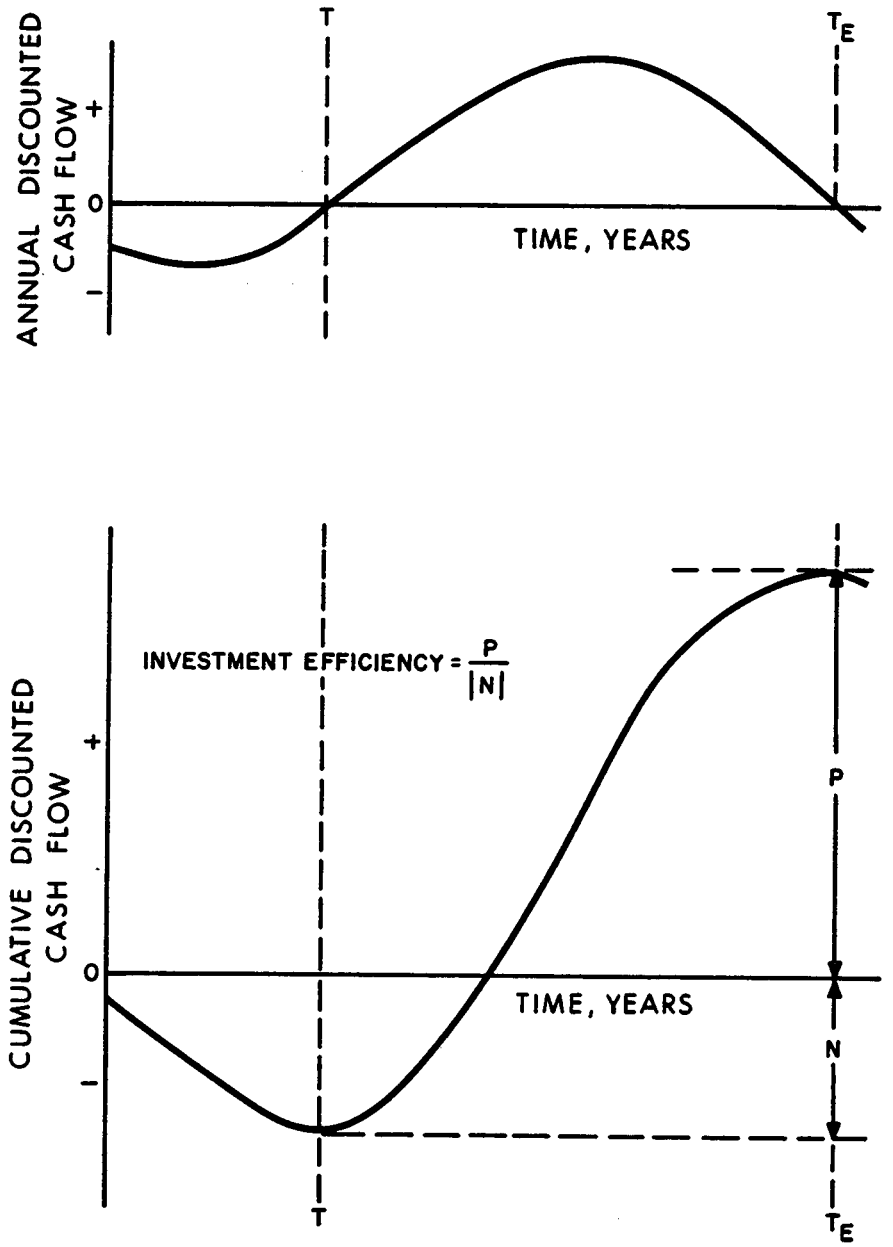

Figure 1-1. Investment Efficiency

SECTION 2
ICPM DATA ENTRY

DETAILS OF RESERVOIR AND ECONOMIC DATA ENTRY ARE GIVEN HERE. A CONDENSED SUMMARY OF THE DATA ENTRY IS GIVEN IN TABLE 2-1.

THREE TYPES OF DATA ARE INDICATED (NO BLANK DATA ALLOWED):

1. "REQUIRED" DATA - PROGRAM WILL NOT RUN UNLESS A VALUE GREATER THAN ZERO IS ENTERED.
2. "DEFAULT" DATA - IF ZERO IS ENTERED, DATA DEFAULTS TO THE VALUE INDICATED. VALUES GREATER THAN ZERO ARE USED AS SPECIFIED, UNLESS A MINIMUM VALUE IS INDICATED.
3. "NO DEFAULT" DATA - ANY VALUE ENTERED, INCLUDING ZERO, IS USED AS SPECIFIED.

2.1 RESERVOIR DATA

```
CARD R1 ***** TITLE
  READ(IR,) TITLE
    MAY BE UP TO 80 ALPHA-NUMERIC CHARACTERS

CARD R2 ***** RUN CONTROLS
  READ(IR,) IRES, IPAT, IWRIT, IECON
    IRES   - ENTER ZERO
    IPAT   - ENTER ZERO
    IWRIT  - CONTROLS PRINTING OF RESULTS OF RESERVOIR
             CALCULATIONS (NO DEFAULT, SEE TABLE 2-2)
             = 0, PRINTS ONLY FINAL RESULTS
             = 1, ALSO PRINTS CUMULATIVES
    IECON  - CONTROLS ECONOMIC ANALYSIS (NO DEFAULT)
             = 0, NO ECONOMIC CALCULATIONS, SKIP CARDS E1 TO E20
             = 1, ECONOMIC ANALYSIS OF PERFORMANCE AS PREDICTED BY THIS
                  MODEL, READ CARDS E1 TO E20

CARD R3 ***** RESERVOIR DESCRIPTION DATA
  READ(IR,) DEPTH, PFORM, TFORM
    DEPTH  - RESERVOIR DEPTH, FT (REQUIRED)
    PFORM  - RESERVOIR PRESSURE, PSIA (DEFAULT: PFORM=14.7+DEPTH*PGRAD,
             WHERE PGRAD=0.433/2.0 PSI/FT)
    TFORM  - RESERVOIR TEMPERATURE, DEG. F. VALUE ENTERED MUST BE
             .GE. 60. (DEFAULT: TFORM=70.0+DEPTH*GGRAD, WHERE
             GGRAD=0.011 DEG.F/FT)
```

```
CARD R4 ***** RESERVOIR DESCRIPTION DATA
  READ(IR,) TNET, PERM, POROS
    TNET   - TOTAL NET PAY THICKNESS, FT (REQUIRED)
    PERM   - RESERVOIR ABSOLUTE PERMEABILITY, MD (REQUIRED)
    POROS  - RESERVOIR POROSITY, FRACTION (REQUIRED)

CARD R5 ***** INITIAL CONDITION DATA
  READ(IR,) SOI, SGI, SWI
    SOI    - CURRENT OIL SATURATION IN RESERVOIR, FRACTION (REQUIRED)
    SGI    - CURRENT GAS SATURATION IN RESERVOIR, FRACTION
             (ENTER 0.0, GAS SATURATION NOT USED)
    SWI    - CURRENT WATER SATURATION IN RESERVOIR, FRACTION (REQUIRED)

CARD R6 ***** FLUID DATA
  READ(IR,) API, VISO, BOI, BWI
    API    - OIL GRAVITY, DEG.API (REQUIRED)
    VISO   - DEAD OIL VISCOSITY, CP (DEFAULT: SEE SECTION 3)
    BOI    - OIL FORMATION VOLUME FACTOR, RB/STB
             (DEFAULT: SEE SECTION 3)
    BWI    - WATER FORMATION VOLUME FACTOR, RB/STB
             (DEFAULT: SEE SECTION 3)

CARD R7 ***** CASE DATA
  READ(IR,) AREA, WELLSP, ARIN, FWA, SWEEP ,BRNMX
    AREA   - TOTAL DEVELOPED AREA, ACRES (REQUIRED)
    WELLSP - NUMBER OF PRODUCING WELLS IN DEVELOPED AREA (REQUIRED)
             NOTE: MODEL CALCULATES PATTERN AREA= AREA/WELLSP/2. ,
             WHERE NUMBER OF INJECTION WELLS = WELLSP/2.
    ARIN   - AIR INJECTION RATE, MSCF/D (DEFAULT: SEE SECTION 3)
    FWA    - WATER/AIR RATIO, STB/MSCF
           = -1.0, FOR DEFAULT: IF PERM .GE. 100. AND VISO .GE. 10.,
             WET COMBUSTION USED TO CALCULATE AIR REQUIREMENT,
             OTHERWISE DRY COMBUSTION USED
           =  0.0, FOR DRY COMBUSTION
           =  1.0, FOR WET COMBUSTION
    SWEEP  - MAXIMUM VOLUME SWEPT, FRACTION
             IF 0.0, THEN DEFAULT BASED ON PATTERN AREA AS FOLLOWS:
           = 0.40, FOR AREA .GE. 20. ACRES
           = 0.50, FOR 5.0 .LE. AREA .LT. 20. ACRES
           = 0.60, FOR AREA .LT. 5.0 ACRES

    BRNMX  - MAXIMUM THICKNESS PER BURN ZONE, FT
           = 0,  DEFAULTS TO 150. FT FOR EACH BURN ZONE
           > 0,  EQUALS THICKNESS OF EACH ZONE IN FT
           < 0,  DISABLES OPTION, AND ONE BURN ZONE
                 OF THICKNESS = TNET WILL BE USED

CARD R8 ***** END CARD (READ ONLY IF IECON = 0 ON CARD R2)
  READ (IR,) END
    END - "END" IN COLUMNS 1-4
```

2.2 ECONOMIC DATA

THE FOLLOWING CARDS ARE TO BE READ IF IECON =1 ON CARD R2.

```
CARD E1 ***** TITLE
  READ(IR,) TITLE
    MAY BE UP TO 80 ALPHA-NUMERIC CHARACTERS

CARD E2 ***** CASE CONTROLS
  READ(IR,) M,ISTATE,IDIST,IOUT,IFIT,IDAT,NCT,NCI,IDISC,
            ISO,IDEBT
    M      - NUMBER OF YEARS IN THE PROJECT (FOR ALL PATTERNS)
             M MUST BE .LE. 50
    ISTATE - STATE CODE. USED TO DEFAULT WELL CAPITAL COSTS
             (DRILLING, COMPLETION, CONVERSION, UPGRADING)
             BY REGION OF U.S. SEE SECTION 3 FOR EXPLANATION OF
             OF DEFAULTS BY REGION. TO INVOKE DEFAULTS FOR WELL
             CAPITAL COSTS, ENTER THE APPROPRIATE NUMBER 1-52 FROM THE
             TABLE BELOW, AND WPP'S AS REQUIRED ON CARD E7.
```

CODE	ALPHA	STATE	CODE	ALPHA	STATE
1	AL	ALABAMA	27	NV	NEVADA
2	AZ	ARIZONA	28	NH	NEW HAMPSHIRE
3	AR	ARKANSAS	29	NJ	NEW JERSEY
4	CA	CALIFORNIA	30	NM	NEW MEXICO
5	CO	COLORADO	31	NY	NEW YORK
6	CT	CONNECTICUT	32	NC	N.CAROLINA
7	DE	DELAWARE	33	ND	N.DAKOTA
8	DC	WASH D.C.	34	OH	OHIO
9	FL	FLORIDA	35	OK	OKLAHOMA
10	GA	GEORGIA	36	OR	OREGON
11	ID	IDAHO	37	PA	PENNSYLVANIA
12	IL	ILLINOIS	38	RI	RHODE ISLAND
13	IN	INDIANA	39	SC	S.CAROLINA
14	IA	IOWA	40	SD	S.DAKOTA
15	KS	KANSAS	41	TN	TENNESSEE
16	KY	KENTUCKY	42	TX	TEXAS
17	LA	LOUISIANA	43	UT	UTAH
18	ME	MAINE	44	VT	VERMONT
19	MD	MARYLAND	45	VA	VIRGINIA
20	MA	MASS	46	WA	WASHINGTON
21	MI	MICHIGAN	47	WV	WEST VIRGINIA
22	MN	MINNESOTA	48	WI	WISCONSIN
23	MS	MISSISSIPPI	49	WY	WYOMING
24	MO	MISSOURI	50	AK	ALASKA
25	MT	MONTANA	51	HI	HAWAII
26	NE	NEBRASKA	52	PO	OFFSHORE

TO DISABLE DEFAULTS FOR WELL COSTS, ENTER WPP1=WPP2=WPP3= WPP4=0.0 ON CARD E7. THEN WELL COSTS MAY, IF DESIRED, BE ENTERED AS PART OF CAPITAL COSTS ON CARDS E18-E19. IF WPP'S=0.0 ON CARD E7 AND ISTATE = 1-52 ON THIS CARD, THEN MODEL PENALIZES OIL PRICE BASED ON API GRAVITY AND LOCATION. SEE SECTION 3 FOR EXPLANATION OF PENALITIES. IF PROJECT IS OUTSIDE U.S. OR IT IS DESIRED TO DISABLE OIL PRICE PENALTY, ENTER WPP'S = 0.0 ON CARD E7 AND ISTATE = 53 ON THIS CARD. NOTE: IF ISTATE = 53 SELECTED, USER MUST ENTER WPP'S = 0.0 ON CARD E7.

IDIST - DISTRICT CODE (WITHIN A STATE). USED TO DEFAULT WELL COSTS. SEE SECTION 3 FOR DEFAULTS. IF OUTSIDE U.S. OR IF ISTATE= 53, ENTER IDIST=0. FOR TEXAS RAILROAD COMMISSION (RRC) DISTRICTS, ENTER (RRC NO. * 10) + Y, WHERE

Y = 1 FOR A
= 2 FOR B
= 3 FOR C

EG., FOR DISTRICT 10B ENTER 102, ETC.

IOUT - INTERMEDIATE OUTPUT CONTROL (NO DEFAULT, SEE TABLE 2-2)
= 0, MINIMUM OUTPUT GIVING RESULTS ONLY
= 1, PLUS ANNUAL CASH FLOW, PROJECT SCHEDULE, AND UNDISCOUNTED RESULTS
= 2, PLUS PROJECT MEAN RESULTS AND "DCFROR" INTERMEDIATE RESULTS

IFIT - FEDERAL INCOME TAX CREDIT OPTION (NO DEFAULT)
= 0, ALLOWS A TAX CREDIT TO OFFSET LOSSES
= 1, NO TAX CREDIT ALLOWED

IDAT - CONTROL FOR READING PRICE AND COST DATA
= 0, DEFAULT PRICES AND COSTS USED, SKIP CARDS E14-E17; SEE E14-E17 FOR DEFAULT VALUES
= 1, READ CARDS E14-E17 FOR PRICE AND COST DATA

NCT - CONTROL FOR READING TANGIBILE CAPITAL INVESTMENT PER PATTERN IN ANY GIVEN YEAR. INVESTMENTS WILL BE TIMED ACCORDING TO PATTERN SCHEDULE ON CARD E13.
= 0, DO NOT READ TANGIBLE CAPITAL INVESTMENT ON CARD E18
= 1, READ TANGIBLE CAPITAL INVESTMENT ON CARD E18

NCI - CONTROL FOR READING INTANGIBLE CAPITAL INVESTMENT PER PATTERN IN ANY GIVEN YEAR. INVESTMENTS WILL BE TIMED ACCORDING TO PATTERN SCHEDULE ON CARD E13.
= 0, DO NOT READ INTANGIBLE CAPITAL INVESTMENT ON CARD E19
= 1, READ INTANGIBLE CAPITAL INVESTMENT ON CARD E19

IDISC - CONTROL FOR DISCOUNTING METHOD (NO DEFAULT)
= 0, YEAR END DISCOUNTING FACTORS USED
= 1, MID-YEAR DISCOUNTING FACTORS USED

```
    ISO     - CONTROL FOR READING SECONDARY OIL VOLUMES (NO DEFAULT)
              = 0, DO NOT READ SECONDARY OIL VOLUMES
              = 1, READ SECONDARY OIL VOLUMES ON CARD E11
    IDEBT   - CONTROL ON DEBT CALCULATIONS (NO DEFAULT)
              = 0, NO CAPITAL BORROWING DEBT CALCULATIONS
              = 1, INCLUDE CAPITAL BORROWING BASED ON DATA INPUT
                   ON CARD E3

CARD E3 ***** DEBT CONTROLS (READ IF IDEBT = 1 ON CARD E2)
  READ(IR,) PCTDBT,DBTINT,NYRRPY,NYPAID
    PCTDBT - PERCENT OF CAPITAL (TANGIBLE AND INTANGIBLE) COSTS
             TO BE BORROWED, PERCENT (DEFAULT=20.)
    DBTINT - DEBT INTEREST RATE, PERCENT (DEFAULT=15.)
    NYRRPY - FIRST YEAR OF DEBT REPAYMENT (DEFAULT=1.)
    NYPAID - LAST YEAR OF DEBT REPAYMENT (DEFAULT=5.)

CARD E4 ***** CAPITAL COST DATA
        IF DEFAULTING CAPITAL COSTS FOR WELLS (NCT=NCI=0 ON CARD E2 AND
        WPP1+WPP2+WPP3+WPP4.NE.0.0 ON CARD E7), THEN OTHER CAPITAL COSTS
        ENTERED ON THIS CARD WILL BE ROLLED-UP WITH WELL COSTS TO GIVE
        TOTAL CAPITAL. HOWEVER, IF CAPITAL COSTS ARE READ IN ON CARDS
        E18-E19 (NCT=NCI=1 ON CARD E2), THEN ONLY COMPRESSOR COSTS
        (CCOST) FROM THIS CARD WILL BE INCLUDED IN CAPITAL ROLL-UP, AND
        $ FOR GTRT, WTRT, ETC. SHOULD BE INCLUDED IN CAPITAL INVESTMENTS
        ENTERED ON CARDS E18-E19.
  READ(IR,) CCOST, GTRT, WTRT, CTACR, DCE, PLANT
    CCOST - COMPRESSOR COST, $/HP (DEFAULT= 1000.)
    GTRT  - WASTE GAS TREATING COST, $/MSCF/D (DEFAULT= 50.)
    WTRT  - WATER TREATING AND RECYCLE COST, $/BBL/D (DEFAULT= 75.)
    CTACR - AIR DISTRIBUTION, VAPOR RECOVERY, AND
            SURFACE FACILITIES COST, $/ACRE (DEFAULT= 26500.)
    DCE   - WELL DRILLING/COMPLETION/EQUIP COST, $/FOOT (DEFAULT=100.)
            NOTE: IF WPP1=WPP2=0.0 ON CARD E7, DCE NOT USED
    PLANT - CENTRAL PLANT FACILITIES COST, $/STB/D (DEFAULT= 500.)

CARD E5 ***** OPERATING COST DATA
  READ(IR,) WOCOST, WTCOST, WDCOST, COSTML, COSTTI
    WOCOST - ANNUAL WELL WORKOVER COST PER PATTERN, M$
             (DEFAULT= 0.25*CNVT). ASSUMES ONE WORKOVER PER PATTERN
             EVERY FOUR YEARS. CNVT IS THE COST TO CONVERT AN
             EXISTING PRODUCER TO AN INJECTION WELL. SEE SECTION 3
             FOR DEFAULT FOR CNVT.
    WTCOST - PRODUCED WATER TREATING COST, $/BBL (DEFAULT= 0.125)
    WDCOST - WATER DISPOSAL COST, $/BBL (DEFAULT= 0.10)
    COSTML - COMPRESSOR MAINT AND LABOR COST, $/MSCF (DEFAULT= 0.03)
    COSTTI - TECHNICIAN AND INSTRUMENT COST, $/MSCF (DEFAULT= 0.04)
```

```
CARD E6 ***** OPERATING DATA
  READ(IR,) WCAP, COSTRT, UNCO
    WCAP   - MONTHS OF WORKING CAPITAL, MONTHS (NO DEFAULT)
    COSTRT - PROJECT STARTUP COSTS, M$ (NO DEFAULT; THE NEGATIVE OF
             COSTRT WILL BE USED TO INITIALIZE CASH FLOW)
    UNCO   - OIL RATE UNCERTAINTY, FRACTION (DEFAULT= 0.001)

CARD E7 ***** DRILLING DATA
  READ(IR,) WPP1,WPP2,WPP3,WPP4
            (ENTER ALL ZEROS IF WELL CAPITAL COSTS INCLUDED ON CARDS
            E18-E19. SEE SECTION 3 FOR WELL CAPITAL COSTS DEFAULT
            EQUATIONS USING WPP'S.)
    WPP1 - NUMBER OF INJECTORS DRILLED PER PATTERN (NO DEFAULT)
    WPP2 - NUMBER OF PRODUCERS DRILLED PER PATTERN (NO DEFAULT)
    WPP3 - NUMBER OF PRIMARY PRODUCERS CONVERTED TO SECONDARY PRODUCERS
           PER PATTERN (NO DEFAULT)
    WPP4 - NUMBER OF EXISTING PRODUCERS CONVERTED TO INJECTORS
           PER PATTERN (NO DEFAULT)

CARD E8 ***** TAXES AND MONETARY DATA
  READ(IR,) XDR,XINF,XROY,XSEV,XFIT,XTCR,DTIM,XSTX
    XDR  - MONETARY DISCOUNT RATE (DEFAULT= 0.1)
    XINF - INFLATION RATE (NO DEFAULT)
    XROY - ROYALTY RATE (NO DEFAULT)
    XSEV - SEVERANCE TAX RATE (NO DEFAULT)
    XFIT - FEDERAL INCOME TAX RATE (NO DEFAULT)
    XTCR - INVESTMENT TAX CREDIT (NO DEFAULT)
    DTIM - INVESTMENT DEPRECIATION TIME, YRS (NO DEFAULT)
           IF DTIM = 0.0, USES ACCELERATED CAPITAL RECOVERY SYSTEM
           (5 YEAR DEPRECIATION) ACCORDING TO 1981 TAX ACT (SEE TABLE
           2-3). IF DTIM .GT. 0.0, USES STRAIGHT LINE DEPRECIATION FROM
           YEAR OF INVESTMENT OVER DTIM YEARS.
    XSTX - STATE INCOME TAX RATE (NO DEFAULT)

CARD E9 ***** WINDFALL EXCISE TAX DATA
  READ(IR,) XWPT,WPHO,EPHO,BTIM,BPOW
    XWPT - WINDFALL EXCISE TAX RATE. IF 0.0 THEN IGNORES TAX.
           SEE SECTION 3 FOR EXPLANATION OF WINDFALL EXCISE TAX.
    WPHO - WINDFALL TAX BEGINNING PHASE OUT DATE (DEFAULT= 1991.)
    EPHO - WINDFALL TAX ENDING PHASE OUT DATE (DEFAULT= 1993.)
    BTIM - BASE TIME FOR PROJECT START (DEFAULT= 1985.)
    BPOW - BASE OIL PRICE AT START OF PROJECT FOR WPT CALCULATIONS
           ONLY, $/BBL (DEFAULT= 23.07*(1.+XINF)**(BTIM-1983.)
           NOTE: OIL PRICE FOR SALES AND REVENUE PURPOSES IS ENTERED OR
           DEFAULTED ON CARD E14)
```

```
CARD E10 ***** SECONDARY OIL PRODUCTION DATA
  READ(IR,) OILB,OILC,DECL
    OILB - 1979 PROJECT BASE OIL RATE, MBBL/YR (DEFAULT = 0.)
    OILC - CURRENT NON-TERTIARY PROJECT OIL RATE, MBBL/YR
           (DEFAULT = OILB * (1.-DECL)**(BTIM-1979.))
    DECL - ANNUAL OIL PRODUCTION DECLINE RATE, PERCENT (DEFAULT = 15.)

CARD E11 ***** SECONDARY OIL PRODUCTION CURVE
         (READ IF ISO = 1 ON CARD E2)
  READ(IR,) (VOS(I),I=1,M)
    VOS(I) - VOLUME OF SECONDARY OIL PER PATTERN EACH YEAR, MBBL/YR
             (DEFAULT = OILC * (1.-DECL)**(FLOAT(I)-0.5))

CARD E12 ***** ESCALATION DATA FOR PRICES AND COSTS
  READ(IR,) ESCPO,ESCFO,ESCED,ESCCT,ESCCI,ESCWO
    ESCPO - ESCALATION RATE OF OIL PRICE (NO DEFAULT)
    ESCFO - ESCALATION RATE OF OPERATING COSTS (NO DEFAULT)
    ESCED - ESCALATION RATE OF ELEC. DRIVER COSTS (NO DEFAULT)
    ESCCT - ESCALATION RATE OF TANGIBLE CAPITAL (NO DEFAULT)
    ESCCI - ESCALATION RATE OF INTANGIBLE CAPITAL (NO DEFAULT)
    ESCWO - ESCALATION RATE OF WELL WORKOVER COST (NO DEFAULT)

CARD E13 ***** PROJECT PATTERN SCHEDULE
  READ(IR,) (PATI(I),I=1,M)
    PATI(I) - NUMBER OF PATTERNS INITIATED EACH YEAR OF THE PROJECT
              (NO DEFAULT)
```

IF IDAT=0 ON CARD E2, MODEL USES DEFAULT PRICES AND COSTS; SKIP TO CARD E18

IN ALL OF THE FOLLOWING ARRAYS, THE LAST LETTER (H, M, OR L) MEANS HIGH, MOST LIKELY, OR LOW VALUE OF THE PARAMETER IN A GIVEN YEAR. THE HIGH AND LOW VALUES SHOULD BE CHOSEN TO REPRESENT A CONFIDENCE LEVEL OF 80 PERCENT. LOW PRICE HAS A 90% CHANCE OF BEING OBTAINED, AND THE HIGH PRICE HAS ONLY A 10% CHANCE OF BEING REACHED.

PRICES AND COSTS, WHETHER ENTERED OR DEFAULTED, ARE SCALED BY PROGRAM (SUBROUTINE ECFTR) DUE TO VARIATION IN OIL PRICE FROM $30.00/BBL. THE PRICE FACTOR IS FACT=(POM(1)-30.00)/30., WHERE POM(1) IS ENTERED OR DEFAULTED ON CARD E14. THEN:

```
DRILLING AND COMPLETION FACTOR = 1.0 +(0.4 * FACT)
EQUIPMENT FACTOR = 1.0 +(0.3 * FACT)
OPERATING COSTS FACTOR = 1.0 +(0.2 * FACT)
OIL PRICE FACTOR = 1.0 + FACT
```

THESE FACTORS ARE ALSO USED TO ALTER VALUES ENTERED OR DEFAULTED ON CARDS E4 AND E5.

```
CARD E14 ***** OIL PRICE DATA
         (NOTE: SEE SECTION 3 FOR OIL PRICE REDUCTION BASED ON API
         GRAVITY AND TRANSPORATION PENALTY FOR ALASKA)
  READ(IR,) POL(1),POM(1),POH(1)
    POL(1) - LOW OIL PRICE, $/BBL (DEFAULT= POM(1) * 0.8)
    POM(1) - MOST LIKELY OIL PRICE, $/BBL (DEFAULT= 30.00)
    POH(1) - HIGH OIL PRICE, $/BBL (DEFAULT = POM(1) *1.2)

CARD E15 ***** FIXED ANNUAL OPERATING COST DATA
         (INCLUDES MAINTENANCE, OTHER COSTS THAT DO NOT DEPEND ON OIL
         RATE)
  READ(IR,) FOCL(1),FOCM(1),FOCH(1)
    FOCL(1) - LOW FIXED OPERATING COST PER PATTERN, $/YR
              (DEFAULT= 18000.)
    FOCM(1) - MOST LIKELY FIXED OPERATING COST PER PATTERN, $/YR
              (DEFAULT= 20000.)
    FOCH(1) - HIGH FIXED OPERATING COST PER PATTERN, $/YR
              (DEFAULT= 22000.)

CARD E16 ***** VARIABLE ANNUAL OPERATING COST DATA
         (INCLUDES LIFTING AND OTHER COSTS THAT DEPEND ON OIL PRODUCTION
          DIRECTLY, BUT NOT ROYALTY OR SEVERANCE)
  READ(IR,) OPCL(1),OPCM(1),OPCH(1)
    OPCL(1) - LOW VARIABLE OPERATING COST, $/BBL OIL PRODUCED
              (DEFAULT= 2.50)
    OPCM(1) - MOST LIKELY VARIABLE OPERATING COST, $/BBL OIL PRODUCED
              (DEFAULT= 3.00)
    OPCH(1) - HIGH VARIABLE OPERATING COST, $/BBL OIL PRODUCED
              (DEFAULT= 3.50)

CARD E17 ***** ELECTRIC DRIVER OPERATING COST DATA
         (COST BASED ON 95% DRIVE EFFICIENCY AND $0.07/KWHR)
  READ(IR,) EDPL(1),EDPM(1),EDPH(1)
    EDPL(1) - LOW DRIVER OPERATING COST, $/KWHR (DEFAULT= 0.05)
    EDPM(1) - MOST LIKELY DRIVER OPERATING COST, $/KWHR (DEFAULT= 0.07)
    EDPH(1) - HIGH DRIVER OPERATING COST, $/KWHR (DEFAULT= 0.09)

CARD E18 ***** TANGIBLE CAPITAL INVESTMENT (READ IF NCT=1 ON CARD E2)
         (FLOW LINES, WELLS, ROADS, AND PRODUCTION FACILITIES,
         BUT NOT COMPRESSORS). IF WELLS ENTERED ON CARD E7, DO NOT
         ENTER WELL CAPITAL COSTS ON THIS CARD.
  READ(IR,) ICT,CTPL,CTPM,CTPH
    ICT  - ENTER 1.0
    CTPL - LOW TANGIBLE CAPITAL COST PER PATTERN, $
    CTPM - MOST LIKELY TANGIBLE CAPITAL COST PER PATTERN, $
    CTPH - HIGH TANGIBLE CAPITAL COST PER PATTERN, $
```

```
CARD E19 ***** INTANGIBLE CAPITAL INVESTMENT (READ IF NCI=1 ON CARD E2)
         (CAPITAL EXPENSED IN A GIVEN YEAR).  IF WELLS ENTERED ON
         CARD E7, DO NOT ENTER WELL CAPITAL COSTS ON THIS CARD.
  READ(IR,) ICI,CIPL,CIPM,CIPH
    ICI  - ENTER 1.0
    CIPL - LOW INTANGIBLE CAPITAL COST PER PATTERN, $
    CIPM - MOST LIKELY INTANGIBLE CAPITAL COST PER PATTERN, $
    CIPH - HIGH INTANGIBLE CAPITAL COST PER PATTERN, $

CARD E20 ***** END CARD
  READ (IR,) END
    END - "END" IN COLUMNS 1-4

********** RETURN TO CARD R1 FOR NEW CASE ***********
```

TABLE 2-1
QUICK REFERENCE TO ICPM DATA ENTRY

Reservoir Data

R1 TITLE
R2 0 0 IWRIT IECON
R3 DEPTH PFORM TFORM
R4 TNET PERM POROS
R5 SOI 0.0 SWI
R6 API VISO BOI BWI
R7 AREA WELLSP ARIN FWA SWEEP BRNMX
R8 END (Enter if IECON=0)

Economic Data

E1 TITLE
E2 M ISTATE IDIST IOUT IFIT IDAT NCT NCI IDISC ISO IDEBT
E3 PCTDBT DBTINT NYRRPY NYPAID (Enter if IDEBT=1)
E4 CCOST GTRT WTRT CTACR DCE PLANT
E5 WOCOST WTCOST WDCOST COSTML COSTTI
E6 WCAP COSTRT UNCO
E7 WPP1 WPP2 WPP3 WPP4
E8 XDR XINF XROY XSEV XFIT XTCR DTIM XSTX
E9 XWPT WPHO EPHO BTIM BPOW
E10 OILB OILC DECL
E11 VOS(1), VOS(2), ... VOS(M) (Enter if ISO=1)
E12 ESCPO ESCFO ESCED ESCCT ESCCI ESCWO
E13 PAT(1), PAT(2), ... PAT(M)
E14 POL(1) POM(1) POH(1)
E15 FOCL(1) FOCM(1) FOCH(1)
E16 OPCL(1) OPCM(1) OPCH(1)
E17 EDPL(1) EDPM(1) EDPH(1)
E18 CTPL CTPM CTPH (Enter if NCI=1)
E19 CIPL CIPM CIPH (Enter if NCT=1)
E20 END

TABLE 2-2
PRINT CONTROLS

IWRIT - Print Control for Reservoir Calculations

Tables Printed (Example, Section 4)	IWRIT 0	IWRIT 1
Input Deck Echo (4-1)	Yes	Yes
Case Controls, etc. (4-2)	Yes	Yes
Pattern Report (4-3)	Yes	Yes
Combustion Pattern Recovery Report (4-3)	No	Yes
Pattern Production/Injection Report (4-4)	Yes	Yes

IOUT - Print Control for Economic Calculations

Tables Printed (Example, Section 4)	IOUT 0	IOUT 1	IOUT 2
Economic Data, Taxes (4-5)	Yes	Yes	Yes
Prices, Pattern Volumes (4-6)	No	Yes	Yes
Project Volumes, Prod./Inj. Rept. (4-7)	No	Yes	Yes
Major Capital Items, Capital Sch. (4-8)	No	Yes	Yes
Project Mean Values, DCFROR Iter. (4-9)	No	No	Yes
Undisc. Mean Values, Annual (4-10)	No	Yes	Yes
Undisc. Results, Cash Flow (4-11)	No	Yes	Yes
Summary, Project Profitability (4-12)	Yes	Yes	Yes

TABLE 2-3
CONSTANTS FOR ACCELERATED CAPITAL RECOVERY SYSTEM DEPRECIATION ACCORDING TO 1981 TAX ACT

This table used if DTIM = 0.0 (Card E8)

	Annual Depreciation as a Percent of Asset Value				
Service Year	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
1981-84	15	22	21	21	21
1985	18	33	25	16	8
1986+	20	32	24	16	8

SECTION 3
DEFAULT EQUATIONS

Default equations too lengthy for Section 2 are presented here. Table 3-1 summarizes defaults for all input data.

3.1 RESERVOIR DATA

Oil Viscosity

Oil viscosity, VISO, is defaulted according to API gravity (Chew and Connally, 1959). The model sets RS=100 MCF/STB, then calculates VIS100 and VIS210:

For API.LE.10.,

```
VIS100 = 10.**(8.35928-0.37539*API),                    (3.1)

VIS210 = 10.**(3.15424-0.11862*API).                    (3.2)
```

For API.GT.10.,

```
VIS100 = EXP[BB(1)*API+BB(2)+(((BB(6)/API
       + BB(5))/API+BB(4))/API+BB(3))/API],             (3.3)

VIS210 = EXP[BB(7)*API+BB(8)+(((BB(12)/API
       + BB(11))/API+BB(10))/API+BB(9))/API],           (3.4)
```

where the coefficients BB(I) are given in Table 3-2. In units of cp,

```
VISO = Y*(VIS**X),                                      (3.5)
```

where

```
Y = BB(19)*RS+BB(20)+BB(21)/RS
  + BB(22)/RS**2+BB(23)/RS**3
  + BB(24)/RS**4,                                       (3.6)
```

$$VIS = VIS100*(TFORM/100.)**(1.345*ALOG(VIS210/VIS100)), \quad (3.7)$$

and

$$X = BB(31)*RS+BB(32)+BB(33)/RS+BB(34)/RS**2+BB(35)/RS**3+BB(36)/RS**4. \quad (3.8)$$

Oil Formation Volume Factor

Oil Formation volume factor, BOI, is defaulted according to API gravity (Vasquez and Beggs, 1980).

$$BOI = 1.0+C1*RS+(C2+C3*RS)*(TFORM-60.)*(API/SGG), \quad (3.9)$$

Where SSG=0.8, and for API.LE.30.,

C1 = 4.677E-4
C2 = 1.751E-5
C3 = -1.811E-8

and for API.GT.30.,

C1 = 4.67E-4
C2 = 1.1E-5
C3 = 1.337E-9.

Water Formation Volume Factor

$$BWI = 1.0+1.2E-4*(TFORM-60.)+1.E-6*(TFORM-60.)**2 - 3.33E-6*PFORM, \quad (3.10)$$

Eq. 3.10 is a curve-fit of data for pure water (Keenan and Keyes, 1936).

Air Injection Rate

Air injection rate (ARIN) is defaulted based on the assumption that the air required to burn the swept volume of a pattern (either

40, 50, or 60%, depending on pattern area) will be injected in 10 years.

The injection rate for year one is 50% of the defaulted rate, and constant thereafter. This default tends to penalize projects with pattern lives less than 10 years.

The model first computes pattern area:

$$AREAP = AREA/WELLSI, \tag{3.11}$$

Where AREA = total developed area, and the number of injection wells is one-half the number of producing wells

$$WELLSI = WELLSP/2.0. \tag{3.12}$$

Pattern volume (ac-ft) is

$$PATVOL = AREAP*TNET. \tag{3.13}$$

The air requirement is based on the laboratory data of Garon and Wygal (1974):

$$AR = 0.073*ALOG10(VISO)+0.20 -0.10*FWA \tag{3.14}$$

where

FWA = 0.0, dry combustion
= 1.0, wet combustion.

In units of MSCF/D,

$$ARIN = 43560.*PATVOL*SWEEP*AR/365/PLIFE, \tag{3.15}$$

where SWEEP is defined on card R7, Section 2, and PLIFE is 10 years.

3.2 ECONOMIC DATA

ICPM Treatment of Well Capital Costs

Well tangible (WCT) and intangible (WCI) capital costs are calculated by the model as follows: define

$$DCE1 = DCE+DEPTH*(WPP1+WPP2), \tag{3.16}$$

where DCE is defaulted at $100.00/ft. The total well capital is

$$CAP = (CINJ*WPP1)+(CINJ+CEOP)*WPP2 + CSEC*WPP3+CNVT*WPP4+CREP, \tag{3.17}$$

where the CINJ, etc., are defined below. Per pattern,

$$WCI = 0.6*CAP, \tag{3.18}$$

and

$$WCT = DCE1-WCI. \tag{3.19}$$

The total tangible capital per pattern is

$$CTPM(I) = WCT+(CTACR*AREAP) \tag{3.19a}$$

where CTACR are facilities costs defaulted at $26,500/acre.

Note that the tangible/intangible capital split is not 40/60, i.e., WCT $\neq$ 0.4*CAP. The actual split realized will depend on the value of DCE relative to CINJ, etc. Note also that if WPP1 = WPP2 = 0.0, the value of DCE is irrelevant, and, that in such a case, WCI may be non-zero.

The well capital and operating costs defaults given below were taken from correlations from the DOE/EIA-0185(82) report, "Costs and Indexes for Domestic Oil and Gas Field Equipment and Production Operations, 1982." These defaults should be used with caution, however, as they were developed in an era when oil prices were $35.00/bbl and increasing. In mid-1985, drilling costs have dropped by 50% (or more) from the 1981-1982 period. In the model, an attempt

was made to account for some of this drop in costs by using cost adjustment factors (card E14, Section 2).

Drilling and Completion Costs

These costs (CINJ) include the cost of drilling and completing through the wellhead, including tubing, and are used to represent the cost of new injection wells. New producing wells have additional equipment costs, which are discussed below. CINJ is defaulted according to depth and region of the U.S. (Figure 3-1). In $/ well,

$$CINJ = DEPTH*(A0+A1*DEPTH+A2*DEPTH**A3), \quad (3.20)$$

where A0-A3 are shown in Table 3-3.

Costs To Equip New Producing Well

These costs (CEQP) consist of all costs to equip a new producing well for secondary recovery, excluding costs for tubing. CEQP is defaulted according to depth and region of the U.S. (Figure 3-2). In $/ producing well,

$$CEQP = B0+B1*DEPTH, \quad (3.21)$$

where B0 and B1 are shown in Table 3-4.

Costs of Additional Secondary Production Equipment for a Primary Well Converted to a Secondary Well

These costs (CSEC) assume that the existing processing and lease facilities would not be replaced, but that old producing well equipment is replaced, and include costs for drilling and equipping water supply wells. CSEC is defaulted according to depth and region of the U.S. (Figure 3-2). In $/ well,

$$CSEC = C0+C1*DEPTH, \quad (3.22)$$

where C0 and C1 are shown in Table 3-5.

Costs to Convert a Producing Well to an Injection Well

These costs (CNVT) include removal of producing equipment and tubing, acidizing and cleaning out the wellbore, and installing new plastic coated tubing and a waterflood packer. CNVT is defaulted by depth and region of the U.S. (Figure 3-2). In $/ well,

$$CNVT = E0+E1*DEPTH, \tag{3.23}$$

where E0 and E1 are shown in Table 3-6.

Costs To Upgrade Surface Processing Equipment and Lease Facilities For Secondary Recovery Operations

These costs (CREP) include flowlines, manifolds, separators, treaters, tanks, LACT unit, disposal system and accessories. CREP is defaulted by depth and region of the U.S. (Figure 3-2). In $/ producing well,

$$CREP = F0+F1*DEPTH+F2*DEPTH**2 + F3*DEPTH**3, \tag{3.24}$$

where F0-F3 are shown in Table 3-7. If WPP4=0 on Card E7, then the model sets CREP=0.

Direct Annual Operating Costs for Secondary Recovery Operations

These costs (CDAO) include all costs essential to the production of oil and gas, such as cost of labor, power, equipment repair and maintenance, fluid injection, treatment of oil and gas, etc. CDAO is defaulted according to depth and region of the U.S. (Figure 3-2). In $/ producing well/ year,

$$CDAO = G0+G1*DEPTH, \tag{3.25}$$

where G0 and G1 are shown in Table 3-8.

Costs for Offshore Operations

Defaults for these costs are as follows:

CINJ = 458492.-56.3271*DEPTH+0.03043*DEPTH**2, $/well

CEOP = 0.0

CSEC = 650000.+230000.*RATE
- 2800.*RATE**2, $/well

where RATE is the maximum water injection rate calculated by the model.

CNVT = 171366.+21.825*DEPTH, $/well

CREP = 0.0

CDAO = $169,000/well/yr

An additional operating cost for offshore water injection plants is defaulted in $/year as

CIWO = 40200.*RATE+8080.*RATE*PRGAS,

where PRGAS is the price of natural gas produced offshore, and is fixed in the model at POM(I)/6.

Oil Price Penalties

The read-in (or defaulted) oil price (card E14, Section 2.2) is penalized for API gravities less than 40 according to location. Figure 3-3 shows the multiplicative price reduction factors as a function of gravity for California (ISTATE=4) and for all other states. The latter

curve in Figure 3-3 is based on mid-continent posted prices (NPC, 1984).

For projects in Alaska (ISTATE=50) oil is priced in accordance with the solid curve of Figure 3-3 less another $9.00/bbl for transportation fees. These fees are associated with amortized capital, port of entry charges, and fixed tariffs and do not vary with oil price.

If ISTATE=53, then the API gravity penalty is disabled and the price reduction factor is 1.0 regardless of the value of API input. This feature was added to the model for projects outside the U.S., where different oil pricing scenarios may apply.

Windfall Profit Tax

The Windfall Profit Tax (WPT) effected by statute in 1980 is an excise tax on U.S. crude oil production. The WPT is applied as a percentage of the difference between the sales price of oil (POM(I) adjusted for API gravity and location) and a base price (BPOW or BPO(I)) that escalates with time. The base price varies with crude oil production method and field history.

The WPT tax rate (XWPT) also varies with production method, and with producer (major or independent). XWPT for heavy oil and/or incremental tertiary oil, as would be the case with the ICPM, is 30% for majors, and 0% up to 1,000 bpd (30% over 1,000 bpd) for independents (see Table 3-9). Definitions of Tier 1 and Tier 2 oil in Table 3-9 are quite complex, and may be found in "The Crude Oil Windfall Profit Tax," Price-Waterhouse, 1980.

In the ICPM, the WPT is calculated from

$$WPT(I) = VONET(I)*(1.-XSEV)*AWPP(I)*XWPT, \qquad (3.26)$$

where

VONET(I) = net oil sold (less royalty), BBL
XSEV = severance tax rate
AWPP(I) = sales price - BPO(I), $/BBL.

There is no WPT for API gravities of 16.0 or less.

That oil which would be produced without implementation of an EOR process is subject to a WPT tax rate of 70%. Part of the incremental tertiary oil must therefore be "released" from the higher tax rate. In the ICPM, this released oil is calculated using the secondary oil decline curve data input on cards E10-11.

TABLE 3-1

ICPM DEFAULTS

VARIABLE	CARD	DEFAULT
API	R6	None
AREA	R7	None
ARIN	R7	Eq. (3.15)
BOI	R6	Eq. (3.9)
BPOW	E9	23.07*(1.+XINF)**(BTIM-1983.) $/BBL
BTIM	E9	1985.
BRNMX	R7	150. ft
BWI	R6	Eq. (3.10)
CCOST	E4	1000. $/HP
CIPH	E19	None
CIPL	E19	None
CIPM	E19	None
COSTML	E5	0.03 $/MSCF
COSTRT	E6	None
COSTTI	E5	0.04 $/MSCF
CTACR	E4	26500. $/acre
CTPH	E18	None
CTPL	E18	None
CTPM	E18	None
DBTINT	E3	15. percent
DCE	E4	100.$/ft
DECL	E10	15. percent
DEPTH	R3	None
DTIM	E8	None
EDPH(1)	E17	0.09 $/KWHR
EDPL(1)	E17	0.05 $/KWHR
EDPM(1)	E17	0.07 $/KWHR
EPHO	E9	1993.
ESCCI	E12	None

TABLE 3-1
(Cont.)

VARIABLE	CARD	DEFAULT
ESCCT	E12	None
ESCED	E12	None
ESCFO	E12	None
ESCPO	E12	None
ESCWO	E12	None
FOCH(1)	E15	22000. $/yr
FOCL(1)	E15	18000. $/yr
FOCM(1)	E15	20000. $/yr
FWA	R7	If PERM.GE. 100 and VISO.GE.10. wet combustion; otherwise dry combustion
GTRT	E4	50. $/MSCF/D
IDAT	E2	None
IDEBT	E2	None
IDISC	E2	None
IDIST	E2	None
IECON	R1	None
IFIT	E2	None
IOUT	E2	None
ISO	E2	None
ISTATE	E2	None
IWRIT	R1	None
M	E2	None
NCI	E2	None
NCT	E2	None
NYPAID	E3	5.0
NYRRPY	E3	1.0

TABLE 3-1
(Cont.)

VARIABLE	CARD	DEFAULT
OILB	E10	0.MBBL/yr
OILC	E10	OILB*(1.-DECL)**(BTIM-1979.)
OPCH(1)	E16	3.50 $/BBL
OPCL(1)	E16	2.50 $/BBL
OPCM(1)	E16	3.00 $/BBL
PATI(I)	E13	None
PCDEBT	E3	20. percent
PERM	R4	None
PFORM	R3	14.7+((0.433/2.)*DEPTH) psia
PLANT	E4	500. $/STB/D
POH(1)	E14	POM(1)*1.2 $/BBL
POL(1)	E14	POM(1)*0.8 $/BBL
POM(1)	E14	$30.00/BBL
POROS	R4	None
SOI	R5	None
SWEEP	R7	0.40 for pat. area $\geq$ 20; 0.50 for 5 $\leq$ pat. area < 20; 0.60 for pat. area < 5.
SWI	R5	None
TFORM	R3	70.0 + (0.011*DEPTH)°F
TITLE	R1, E1	None
TNET	R4	None
UNCO	E6	0.001
VISO	R6	Eq. (3.5)
VOS(I)	E11	OILC*(1.-DECL)**(FLOAT(I)-0.5)
WCAP	E6	None
WDCOST	E5	0.10 $/BBL

TABLE 3-1
(Cont.)

VARIABLE	CARD	DEFAULT
WELLSP	R7	None
WOCOST	E5	0.25*CNVT (Eq. 3.23)
WPHO	E9	1991.
WPP1	E7	None
WPP2	E7	None
WPP3	E7	None
WPP4	E7	None
WTCOST	E5	0.125 $/BBL
WTRT	E4	75.0 $/BBL/D
XDR	E8	0.10
XINF	E8	None
XFIT	E8	None
XROY	E8	None
XSEV	E8	None
XSTX	E8	None
XTCR	E8	None
XWPT	E9	None

TABLE 3-2

COEFFICIENTS FOR CURVE-FITTING VISCOSITY CORRELATION

I	BB(I)
1	-6.76824896E-04
2	-3.89570682E+00
3	2.72180350E+02
4	-3.47080568E+03
5	3.68814527E+04
6	-1.48843074E+05
7	-2.51952935E-02
8	-9.64528667E-01
9	9.50590107E+01
10	-3.98368883E+02
11	-1.90395376E+02
12	4.16101142E+03
13	-1.49577301E-03
14	9.44396001E-01
15	3.98464375E+00
16	-1.86338863E+02
17	3.32520064E+03
18	-1.81471583E+04
19	-4.55391223E-05
20	1.34211338E-01
21	2.81437484E+02
22	-5.37919095E+04
23	4.98525603E+06
24	-1.73099129E+08
25	-4.75188363E-04
26	8.84019819E-01
27	7.38565439E+00
28	-2.37472458E+02
29	3.30129337E+03
30	-1.56440226E+04
31	-7.34670759E-05
32	5.41912201E-01
33	1.33649237E+02
34	-2.67713439E+04
35	2.79978044E+06
36	-1.10373996E+08
37	5.47456526E-04
38	-3.75792641E-01
39	1.35019571E+02
40	-8.57863129E+02
41	-6.88146740E+04
42	1.17880005E+06

TABLE 3-3

COEFFICIENTS FOR DRILLING AND COMPLETION COSTS (EQ. 3.20)

Region (Fig. 3-1)	A0	A1	A2	A3
Pacific Coast	77.080	4.688E-3	1.901E-10	2.8
Rocky Mountains	95.540	-3.855E-2	6.300E-3	1.2
Permian Basin[1]	41.583	4.439E-4	2.530E-10	2.8
Gulf Coast[2]	32.250	4.526E-3	2.255E-10	2.8
Mid-Continent[3]	34.483	2.472E-3	2.839E-10	2.8
Northeastern	33.522	1.175E-3	1.502E-8	2.4

[1] Includes Texas RRC Districts 7-9.

[2] Includes Texas RRC Districts 1-6.

[3] Includes Texas RRC District 10.

TABLE 3-4

COEFFICIENTS FOR COSTS TO EQUIP NEW PRODUCING WELL (EQ. 3.21)

Region (Fig. 3-2)	B0	B1
Permian Basin	15145.0	18.0632
Pacific Coast	17635.0	29.0925
Rocky Mountains[1]	15615.0	18.2418
Western Gulf Coast[2]	11755.0	19.4718
Eastern Gulf Coast[3]	12585.0	21.0825
Mid-Continent and Northeastern[4]	11455.0	18.8818

1 Includes New Mexico District 1.

2 Includes Texas RRC Districts 1-3.

3 Includes Florida, and Louisiana District 2.

4 Includes Texas RRC District 9.

TABLE 3-5

COEFFICIENTS FOR COSTS OF ADDITIONAL SECONDARY PRODUCTION EQUIPMENT (EQ. 3.22)

Region (Fig. 3-2)	C0	C1
Permian Basin	14830.0	22.486
Pacific Coast	17480.0	33.467
Rocky Mountains[1]	11775.0	22.901
Western Gulf Coast[2]	11645.0	22.653
Eastern Gulf Coast[3]	12460.0	24.234
Mid-Continent and Northeastern[4]	11330.0	22.037

1 Includes New Mexico District 1.

2 Includes Texas RRC Districts 1-3.

3 Includes Florida, and Louisiana District 2.

4 Includes Texas RRC District 9.

TABLE 3-6

COEFFICIENTS FOR COSTS TO CONVERT PRODUCING WELL TO INJECTION WELL (EQ. 3.23)

Region (Fig. 3-2)	E0	E1
Permian Basin	5463.0	5.979
Pacific Coast	6924.0	6.051
Rocky Mountains[1]	6240.0	6.109
Western Gulf Coast[2]	5679.0	5.921
Eastern Gulf Coast[3]	6280.0	5.950
Mid-Continent and Northeastern[4]	6051.0	5.888

[1] Includes New Mexico District 1.

[2] Includes Texas RRC Districts 1-3.

[3] Includes Florida, and Louisiana District 2.

[4] Includes Texas RRC District 9.

TABLE 3-7

COEFFICIENTS FOR COSTS TO UPGRADE SURFACE PROCESSING EQUIPMENT (EQ. 3.24)

Region (Fig. 3-2)	F0	F1	F2	F3
Permian Basin	19047.0	-0.8017	3.2082E-4	-1.1398E-8
Pacific Coast	31981.0	3.0716	-1.0204E-4	-4.4933E-11
Rocky Mountains[1]	23846.0	0.7057	7.3254E-5	-2.6723E-9
Western Gulf Coast[2]	16143.0	4.5661	-2.1530E-4	2.6401E-9
Eastern Gulf Coast[3]	16186.0	5.7947	-3.7218E-4	8.0871E-9
Mid-Continent and Northeastern[4]	16656.0	1.5242	7.4214E-5	-4.9619E-9

1 Includes New Mexico District 1.

2 Includes Texas RRC Districts 1-3.

3 Includes Florida, Louisiana District 2.

4 Includes Texas RRC District 9.

TABLE 3-8

COEFFICIENTS FOR DIRECT ANNUAL OPERATING COSTS (EQ. 3.25)

Region (Fig. 3-2)	G0	G1
Permian Basin	15440.0	4.159
Pacific Coast	13068.0	9.062
Rocky Mountains[1]	19459.0	4.384
Western Gulf Coast[2]	19456.0	5.459
Eastern Gulf Coast[3]	21570.0	5.597
Mid-Continent and Northeastern[4]	13205.0	5.222

1 Includes New Mexico District 1.

2 Includes Texas RRC Districts 1-3.

3 Includes Florida, and Louisiana District 2.

4 Includes Texas RRC District 9.

TABLE 3-9

WINDFALL PROFIT TAX RATES

	TAX RATE, %		
	Major	Independent	
		<1000 bpd	>1000 bpd
Tier 1			
Lower Tier Oil	70	50	70
Upper Tier Oil	70	50	70
Market Level New Crude Oil	70	50	70
Marginal Well Oil	70	50	70
Tier 2			
Stripper Well Oil	60	30	60
National Petroleum Reserve Oil	60	30	60
Tier 3			
Newly Discovered Oil	30	0	30
Heavy Oil	30	0	30
Incremental Tertiary Oil	30	0	30

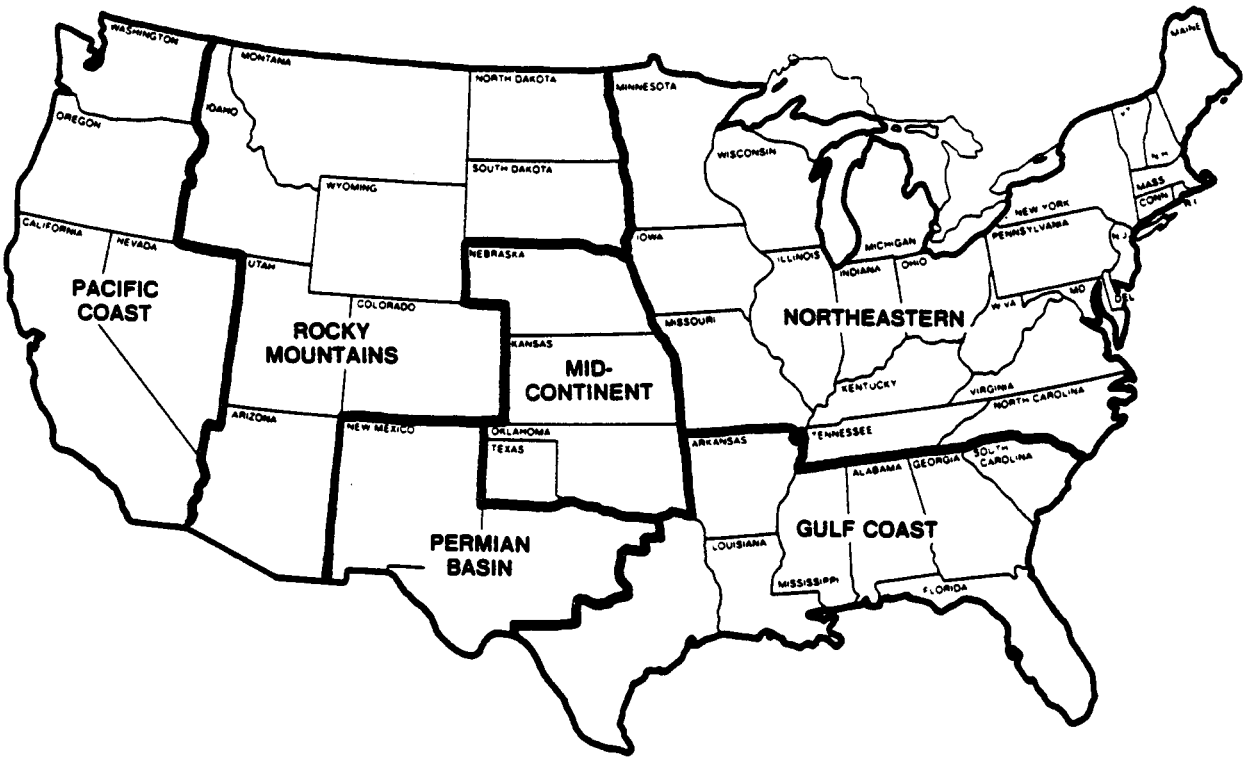

Figure 3-1. Cost Regions for Drilling and Completion Costs

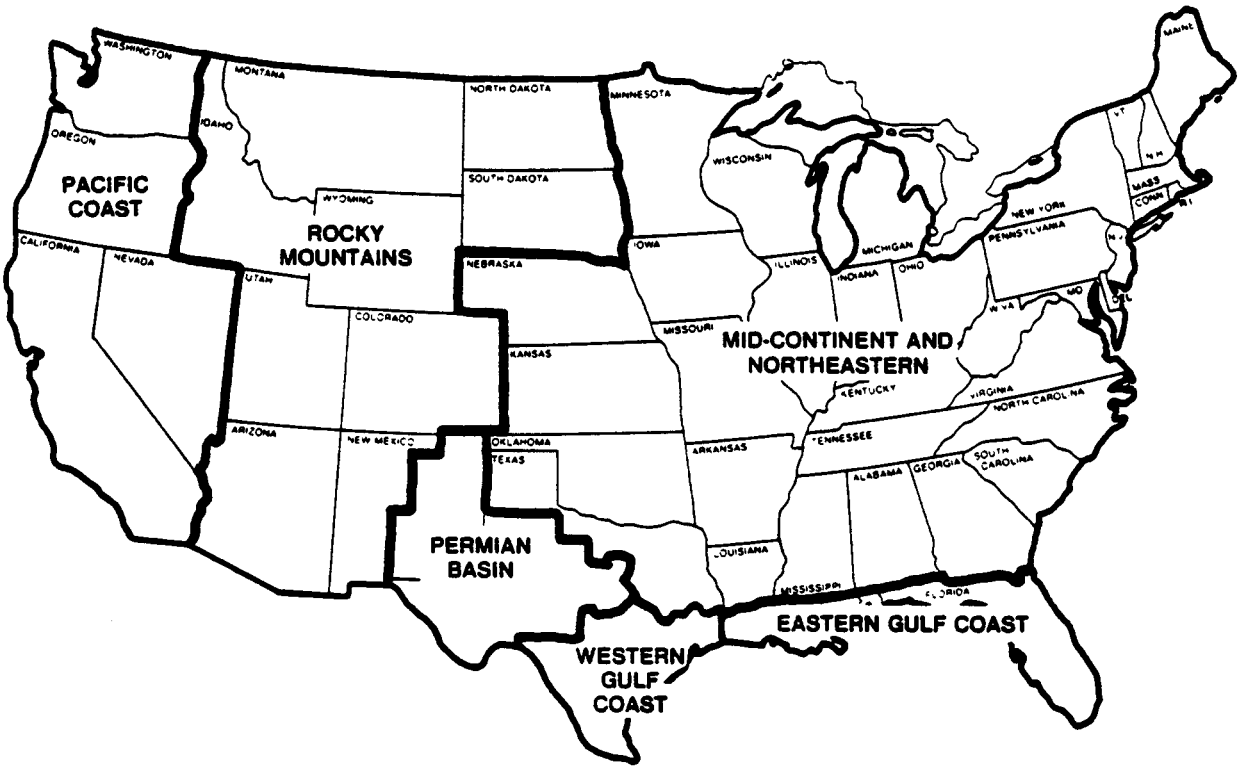

Figure 3-2. Cost Region for Equipment, Conversion, and Operating Costs and Secondary Facilities

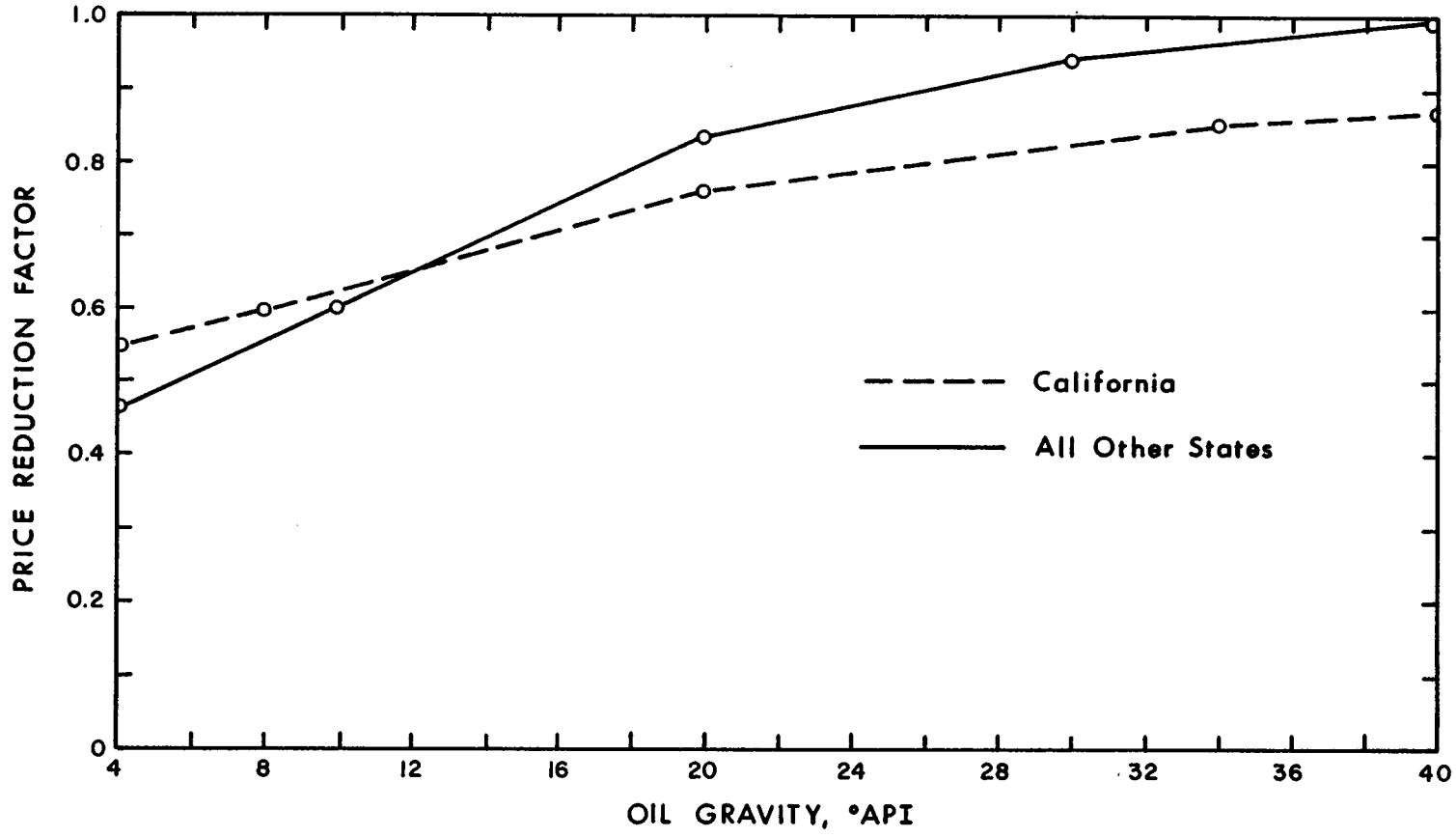

Figure 3-3. Oil Price Reduction Factors

SECTION 4
ICPM EXAMPLE RUNS

4.1 ICPM INPUT/OUTPUT

A brief discussion of I/O for an example run (the base case for the sensitivity runs described in Section 4.2) is given here.

Sample I/O are shown in the following tables: echo print of data input (4-1), reservoir data input summary (4-2), calculated combustion parameters and pattern cumulatives (4-3), production-injection schedule for a pattern (4-4), economic data input summary (4-5), prices, costs, and pattern volumes (4-6), project results, in this case for 40 patterns (4-7), capital costs and project capital schedule (4-8), project mean values and DCFROR iteration (4-9), annual cash flow tables (4-10), summary of undiscounted results and before-and after-tax discounted cash flow (4-11), and project present value and profitability (4-12).

Table 4-3 shows oil recovery for one pattern of about 32% of the oil-in-place for this dry combustion (water/air ratio = 0.0) case. Once fill-up is achieved, air injection, waste gas and water production rates are constant over the life of the pattern (Table 4-4).

Table 4-6 shows a reduction in the read-in (in this case defaulted) oil price of $30.00/bbl to $26.65/bbl due to a penalty for the 25°API oil. (From Figure 3-3, for non-California, 0.8883* $30.00 = $26.65). Notice, however, that there is no penalty on operating costs, etc., because the model uses the read-in oil price to calculate cost adjustment factors for these costs (see discussion for card E-14, Section 2). Since the read-in price is $30.00, there are no adjustments to operating costs even though the oil price to be derived from sales is only $26.65/bbl. If necessary, the user must make adjustments to operating costs, etc. outside the model if $30.00 is input for oil price, whenever oil gravity is below 40°API.

Table 4-7 shows rates and cumulatives as the 40 15-acre patterns are brought on at the rate of four per year. Note that because the economic life of a single pattern is less than ten years, the maximum number of patterns operating at any time is 36. The released oil (far right-hand column, Table 4-7) is equal to the oil produced as no

secondary oil decline curve was input. Revenues from released oil are used to offset the windfall profit tax whenever the latter are implemented (see Section 3.2 for a discussion of WPT).

Capital costs for wells, shown in Table 4-8, are computed as follows: from Eq. 3.20 for Texas (ISTATE=42) and RRC District 3,

```
CINJ = 3000*(32.25 + 4.526 E-3*3000 +
       2.255 E-10*3000**2.8)
     = $141,167/injection well,
```

and from Eq. 3.21,

```
CEQP = 11755 + 19.4718 *3000
     = $70,170/production well.
```

From Eq. 3.17, total capital for wells (for one pattern) is

```
CAP = 141167*1.0+(141167 + 70170)*(1.0 + 1.0)
    = $352,504.
```

From Eq. 3.18, intangible well capital is

```
WCI = 0.6*CAP
    = $211,503.
```

From Eq. 3.16,

```
DCE1 = 100*3000*(1.0 + 1.0)
     = $600,000 ,
```

and the tangible well capital, Eq. 3.19, is

```
WCT = 600000 - 211503
    = $388,497.
```

From Eq. 3.19a, the total tangible capital is

```
CTPM(1) = 388497 + (26500*15)
        = $785,997.
```

CTPM(1) and CIPM(1) are shown under "year 1" in the two far left-hand columns of Table 4-8.

All facilities capital is treated as tangible capital and is taken in the first year. The total tangible capital for the project is rolled-up as follows:

$$\begin{aligned} CTCM(1) &= 4*785997 + 9383800 \\ &= 12{,}528 \text{ M\$}, \end{aligned}$$

and for other years for which patterns are scheduled

$$\begin{aligned} CTCM(I) &= 4*785997 \\ &= 3{,}144 \text{ M\$}. \end{aligned}$$

Project intangible capital for all years is

$$\begin{aligned} CICM(I) &= 4*211503 \\ &= 846 \text{ M\$}. \end{aligned}$$

CTCM(I) and CICM(I) are shown in the two far right-hand columns of Table 4-8.

The capital split for compressor costs is 75% tangible/25% intangible, and the compressor figures are included in the final capital roll-up in the two far left-hand columns of Table 4-9. For this case the total tangible capital for year one is

$$\begin{aligned} CTCM(1) &= 12528 + 0.75*3593 \\ &= 15.22 \text{ MM\$}, \end{aligned}$$

and for other years in which compressors are added is

$$\begin{aligned} CTCM(I) &= 3144 + 0.75*3593 \\ &= 5.84 \text{ MM\$}. \end{aligned}$$

Total intangible capital for years for which compressors are added is

$$\begin{aligned} CICM(I) &= 846 + 0.25*3593 \\ &= 1.74 \text{ MM\$}. \end{aligned}$$

The present value factor (Table 4-11) shows at the end of the 18 year economic life, the project is worth about 21 cents of a 1985 dollar.

The project is not particularly profitable, as shown in Table 4-12, having a mean discounted cash flow rate-of-return (DCFROR) of 25.5% with a discount rate of 10%. Mean DCF is $18MM, with a 10% chance of making $71MM, but a 90% chance of losing $27MM. The majority of the project expenses are associated with operating costs.

4.2 SENSITIVITY RUNS

Sensitivity runs were conducted on a number of variables used in the ICPM. A Base Case model was selected which was assumed to have average values for the variables analyzed. The data used in the Base Case are listed in Tables 4-2, 4-5, and 4-6. Plots which depict the changes in cumulative oil production, oil recovery and DCFROR which resulted from changes in each of the variables, are given in Figs. 4-1 through 4-10.

The ICPM permits the use of default values for most of the economic data required by the model. The default values have been utilized throughout the sensitivity runs to provide basic consistency to the evaluations by eliminating possible arbitrary values for the rquired data.

Some of the runs were made with single inverted seven-spot patterns; however, most were conducted with a Base Case model with a total area of 600 acres and multiple inverted seven-spot patterns so that overall performance could be analyzed. Developmental schedules were utilized which resulted in either comparable lives for the variable pattern areas or widely ranging lifetimes for the same pattern area at different rates of development.

Comparisons were made for wet and dry combustion with variation in some of the basic parameters. A summary of the results from each sensitivity run follows.

Oil Gravity

Gravities ranging from 15-35°API were studied. As shown in Figure 4-1, in situ combustion in the Base Case reservoir with 15°API oil would be uneconomic due primarily to the low price for the crude oil produced. Cumulative oil production increases linearly for gravities from 20-35°API. DCFROR increases from 25% for 20°API oil to 57% for 35°API oil. Oil recoveries range from 28-36% based on cumulative oil at economic limit. (Oil recovery fraction reported in the model output is that recoverable by the in situ combustion process prior to the application of economics). Default values for viscosity based on internal correlations with API gravity were utilized. No separate studies of viscosity were conducted.

Permeability

A range of permeabilities from 100-1000 md was studied. There was no difference in values for oil recovery and DCFROR at all levels from 250-1000 md and only slightly lower results at 100 md. The results have not been plotted.

Thickness

Oil-in-place is directly proportional to thickness, and cumulative oil production increases linearly with thickness. The model is programmed to limit the maximum burn zone thickness to 150 ft. and any thickness above 150 ft. is assumed to involve (H/2 + 1) burn zones, where H is total net pay. This results in two burn zones of 100 ft. each for a 200-ft. reservoir and three burn zones for a 300-ft. reservoir. This effect is seen in Figure 4-2 wherein oil recovery decreases slightly over the range from 50-150 ft. in thickness and then increases to reflect the 100-ft. burn zones in the 200 and 300-ft. reservoirs. This effect is also seen in the stabilization of DCFROR above 150 ft., as the process is staged in the 100-ft. burn zones.

Pattern Area

Pattern area was studied both from the standpoint of total developed area of the Base Case model and for individual patterns alone. In the total area case, multiple patterns were present and the results were affected by the rate of development. Schedules were utilized which resulted in complete development in 8-10 years.

The results are shown in Figure 4-3. Cumulative oil production and percent recovery are the same for patterns of 10-17.64 acres. The model reduces sweep efficiency for patterns of 20 acres and above; therefore, the cumulative oil production and oil recovery show a drop at 20 acres. DCFROR is essentially linear over the entire range of pattern areas. Lower capital for the wider spacing of the wells on 20-acre spacing and lower horsepower for the compressors based on the reduced sweep efficiency compensate for the reduced recovery.

Single patterns of 3-30 acres were evaluated. The results are shown in Figure 4-4. Production was uneconomic at three acres in spite of the programmed increase in sweep efficiency to 60% below five acres. Cumulative oil production is linear with the offset in the graph due to the change in sweep efficiency at 20 acres. The percent oil recovery and the DCFROR curves also reflect the change in sweep efficiency. The increase in DCFROR at 20 acres is again attributable to the lower capital required.

Pattern Sequence

The total developed area of 600 acres was used with 40 15-acre patterns developed at the rate of 2-10 patterns per year, as shown in Figure 4-5. Cumulative oil production and recovery are the same for all schedules. The period of time required to develop the total area, the differing capital requirements, and the production schedules all combine to show a minimum DCFROR at five patterns per year with higher values at both slower and faster rates of development.

Water-Air Ratio

Single Base Case patterns of 15 acres were utilized to analyze water-air ratios from 0.5-2.0 B/MCF. As shown in Figure 4-6, cumulative oil production and percent oil recovery show decreases above 1 B/MCF, but DCFROR is highest at about 1.5 B/MCF.

The value of 1.5 B/MCF was used in some of the subsequent cases which compared wet versus dry combustion. In the ICPM, a default value of 1.0 B/MCF is provided when wet combustion is selected by the model based upon the criteria of permeability greater than or equal to 100 md and viscosity greater than 10 centipoise.

Porosity and Oil Saturation

Although these parameters were investigated separately, the results in Figures 4-7 and 4-8 show that a minimum S_o x porosity product of 0.10 is required for profitable operations. An S_o = 0.50 and porosities less than 20% result in uneconomic production with dry combustion. Some improvement is noted under wet combustion operations, with S_o = 0.50 and 20% porosity returning 16% DCFROR. With a porosity of 25%, oil saturations below 0.45 are uneconomical under dry combustion. Again, there is improvement under wet combustion, with S_o = 0.40 and 25% porosity showing 17% DCFROR. Results from wet combustion operations are not shown in Figures 4-7 and 4-8.

Wet versus Dry Combustion

Runs were made with 20° and 25°API oil and pattern areas of 10-30 acres. All other parameters were from the Base Case model. A total area of 600 acres was used with multiple patterns developed at the rate of eight patterns per year. Results are shown in Figures 4-9 and 4-10. With 20°API oil, dry combustion was uneconomical at 10 and 15 acres/pattern and only marginally profitable at pattern areas greater than 20 acres. Wet combustion was economical at all pattern areas with DCFROR ranging from 14-32% on areas from 10-30 acres/pattern.

With 25°API oil, wet combustion has slightly higher recovery than dry combustion below 20 acres/pattern, and slightly lower recovery

from patterns above 20 acres/pattern. Lower capital investment required for compressors results in higher DCFROR for wet combustion for all pattern sizes.

TABLE 4-1

INPUT DECK ECHO

```
 1  SENSITIVITY RUNS  BASE CASE MODEL
 2  0,   0,   1,   1
 3  3000.0,   500.0,   138.0
 4  150.0,   500.0,   0.25
 5  0.50,   0.0,   0.50
 6  25.0,   0.0,   1.10,   0.0
 7  600.0,   80.0,   0.0,   -1.0,   0.0,   1.0
 8  SENSITIVITY RUNS  BASE CASE MODEL
 9  30,   42,   30,   2,   0,   1,   0,   0,   1,   0,   0
10  0.0,   0.0,   0.0,   0.0,   0.0,   0.0
11  0.0,   0.0,   0.0,   0.0,   0.0
12  0.0,   0.0,   0.0
13  1.0,   1.0,   0.0,   0.0
14  0.1,   0.0,   0.125,   8.0E-02,   0.46,   0.1,   5.0,   4.0E-02
15  0.0,   0.0,   0.0,   1985.0,   23.07
16  0.0,   0.0,   0.0
17  0.0,   0.0,   0.0,   0.0,   0.0,   0.0
18  4.0,   4.0,   4.0,   4.0,   4.0,   4.0,   4.0,   4.0,   4.0,   4.0
19  0.0,   0.0,   0.0,   0.0,   0.0,   0.0,   0.0,   0.0,   0.0,   0.0
20  0.0,   0.0,   0.0,   0.0,   0.0,   0.0,   0.0,   0.0,   0.0,   0.0
21  0.0,   0.0,   0.0
22  0.0,   0.0,   0.0
23  0.0,   0.0,   0.0
24  0.0,   0.0,   0.0
25  END
```

TABLE 4-2

```
*****************************************
*                                       *
*      NATIONAL PETROLEUM COUNCIL       *
*  INSITU COMBUSTION PREDICTIVE MODEL   *
*        (ICPM - RELEASE 1.4.0)         *
*            ( APRIL ,1985 )            *
*****************************************
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SENSITIVITY RUNS BASE CASE MODEL

CASE CONTROLS

RECOVERY PREDICTION METHOD	0	IRES
PATTERN CONTROL	0	IPAT
PRINT CONTROL	1	IWRIT
ECONOMIC ANALYSIS CONTROL	1	IECON

FORMATION PROPERITIES

FORMATION DEPTH	3000.0	FEET
INITIAL PRESSURE	500.0	PSIA
INITIAL TEMPERATURE	138.0	DEG.F
FORMATION NET THICKNESS (PAY)	150.0	FEET
BURN ZONE THICKNESS (PAY)	150.0	FEET
FORMATION PERMEABILITY	500.0	MD
FORMATION POROSITY	0.2500	FRACTION

INITIAL CONDITIONS

INITIAL OIL SATURATION	0.5000	FRACTION
INITIAL GAS SATURATION	0.0000	FRACTION
INITIAL WATER SATURATION	0.5000	FRACTION
OIL GRAVITY	25.00	DEG.API
DEAD OIL VISCOSITY	8.34	CP
OIL FORMATION VOLUME FACTOR	1.1000	RB/STB
WATER FORMATION VOLUME FACTOR	1.0138	RB/STB
TOTAL DEVELOPED AREA	600.00	ACRES
NO. OF PRODUCING WELLS	80.00	WELLSP
TOTAL INITIAL OIL IN PLACE/BURN ZONE.	79.4	MM.STB
INITIAL PORE VOLUME/BURN ZONE	174.6	MM.RES.B
NO. BURN ZONES	1.0	

TABLE 4-3

PATTERN REPORT

INJECTION PRESSURE	516.7	PSIA
AIR INJECTION RATE	3587.9	MSCF/D
AIR REQUIREMENT	0.2672	MSCF/FT3
AIR / FUEL RATIO	70.0	MSCF/STB
WATER / AIR RATIO	0.0	STB/MSCF
MAXIMUM VOLUME SWEPT	0.5000	FRACTN
DISCHARGE PRESSURE	731.7	PSIA
COMPRESSOR HORSEPOWER	898.1	HP
INITIAL OIL IN PLACE/BURN ZONE	1983.6	MSTB
PATTERN AREA	15.00	ACRES
OIL RECOVERY	0.3191	FRACTN

COMBUSTION PATTERN RECOVERY REPORT (FOR ONE BURN ZONE)

	TIME YEARS	OIL RATE STB/D	CUM OIL PROD, MSTB	CUM WASTE GAS, MMSCF	CUM WATER PROD, MSTB	CUM AIR INJ, MMSCF	CUM WATER INJ, MSTB	CUM RATIO AIR/OIL	FRAC PAT VOL BURNED	OIL RECV FRACTION
1	0.00	0.0	0.	0.	0.	0.	0.	0.00	0.0000	0.0000
2	0.25	149.5	14.	74.	7.	82.	0.	6.00	0.0031	0.0069
3	0.50	211.5	33.	223.	20.	246.	0.	7.46	0.0094	0.0166
4	0.75	266.8	57.	447.	40.	491.	0.	8.57	0.0188	0.0289
5	1.00	314.2	86.	744.	67.	819.	0.	9.52	0.0313	0.0434
6	1.50	277.3	137.	1340.	121.	1474.	0.	10.79	0.0563	0.0689
7	2.00	247.8	182.	1935.	175.	2130.	0.	11.71	0.0813	0.0917
8	2.50	227.5	223.	2530.	229.	2785.	0.	12.46	0.1063	0.1126
9	3.00	211.5	262.	3126.	283.	3440.	0.	13.13	0.1313	0.1321
10	3.50	197.9	298.	3721.	337.	4095.	0.	13.73	0.1564	0.1503
11	4.00	186.0	332.	4316.	390.	4751.	0.	14.30	0.1814	0.1675
12	4.50	175.2	364.	4912.	444.	5406.	0.	14.84	0.2064	0.1836
13	5.00	165.2	394.	5507.	498.	6061.	0.	15.37	0.2314	0.1988
14	5.50	156.0	423.	6102.	552.	6716.	0.	15.88	0.2564	0.2132
15	6.00	147.3	450.	6698.	606.	7371.	0.	16.39	0.2814	0.2267
16	6.50	139.1	475.	7293.	660.	8027.	0.	16.89	0.3065	0.2395
17	7.00	131.3	499.	7888.	713.	8682.	0.	17.40	0.3315	0.2516
18	7.50	124.0	522.	8484.	767.	9337.	0.	17.90	0.3565	0.2630
19	8.00	117.0	543.	9079.	821.	9992.	0.	18.40	0.3815	0.2738
20	8.50	110.4	563.	9674.	875.	10648.	0.	18.90	0.4065	0.2840
21	9.00	104.0	582.	10270.	929.	11303.	0.	19.41	0.4315	0.2935
22	9.50	98.0	600.	10865.	983.	11958.	0.	19.93	0.4566	0.3026
23	10.00	92.3	617.	11460.	1036.	12613.	0.	20.44	0.4816	0.3111
24	10.50	86.8	633.	12056.	1090.	13269.	0.	20.97	0.5066	0.3191

TABLE 4-4

PATTERN PRODUCTION/INJECTION REPORT (FOR ONE BURN ZONE)

	TIME YEARS	OIL STB/D	WASTE GAS MSCF/D	WATER PROD STB/D	AIR INJ MSCF/D	WAT INJ STB/D	CUM OIL MBBL	RECOVERY FRACTION
1	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0000
2	0.25	149.5	815.0	73.7	897.0	0.0	13.6	0.0069
3	0.50	211.5	1630.0	147.4	1794.0	0.0	33.0	0.0166
4	0.75	266.8	2444.9	221.1	2690.9	0.0	57.3	0.0289
5	1.00	314.2	3259.9	294.8	3587.9	0.0	86.0	0.0434
6	1.50	277.3	3259.9	294.8	3587.9	0.0	136.7	0.0689
7	2.00	247.8	3259.9	294.8	3587.9	0.0	181.9	0.0917
8	2.50	227.5	3259.9	294.8	3587.9	0.0	223.4	0.1126
9	3.00	211.5	3259.9	294.8	3587.9	0.0	262.1	0.1321
10	3.50	197.9	3259.9	294.8	3587.9	0.0	298.2	0.1503
11	4.00	186.0	3259.9	294.8	3587.9	0.0	332.2	0.1675
12	4.50	175.2	3259.9	294.8	3587.9	0.0	364.2	0.1836
13	5.00	165.2	3259.9	294.8	3587.9	0.0	394.3	0.1988
14	5.50	156.0	3259.9	294.8	3587.9	0.0	422.8	0.2132
15	6.00	147.3	3259.9	294.8	3587.9	0.0	449.7	0.2267
16	6.50	139.1	3259.9	294.8	3587.9	0.0	475.1	0.2395
17	7.00	131.3	3259.9	294.8	3587.9	0.0	499.1	0.2516
18	7.50	124.0	3259.9	294.8	3587.9	0.0	521.7	0.2630
19	8.00	117.0	3259.9	294.8	3587.9	0.0	543.1	0.2738
20	8.50	110.4	3259.9	294.8	3587.9	0.0	563.3	0.2840
21	9.00	104.0	3259.9	294.8	3587.9	0.0	582.3	0.2935
22	9.50	98.0	3259.9	294.8	3587.9	0.0	600.2	0.3026
23	10.00	92.3	3259.9	294.8	3587.9	0.0	617.0	0.3111
24	10.50	86.8	3259.9	294.8	3587.9	0.0	632.9	0.3191

TABLE 4-5

```
*****************************************
*                                       *
*      NATIONAL PETROLEUM COUNCIL       *
*  INSITU COMBUSTION PREDICTIVE MODEL   *
*        (ICPM - RELEASE 1.4.0)         *
*           ( APRIL ,1985 )             *
*****************************************
```

SENSITIVITY RUNS BASE CASE MODEL

ECONOMIC DATA

NUMBER OF PROJECT YEARS	30	
STATE CODE	TX	
DISTRICT CODE	30	
FEDERAL INCOME TAX OPTION	0	
DISCOUNTING METHOD	1	
DEPRECIATION METHOD	0	
SECONDARY OIL DECLINE DATA FLAG	0	
RESERVOIR DEPTH	3000.0	FEET
INJECTORS DRILLED PER PATTERN (WPP1).	1.00	
PRODUCERS DRILLED PER PATTERN (WPP2).	1.00	
CONVTD PRIMARY PROD PER PAT (WPP3)...	0.00	
CONVTD PROD TO INJ PER PAT (WPP4) ...	0.00	
COMPRESSOR CAPITAL COST	1000.0	$/HP
WASTE GAS TREATMENT CAPITAL	50.0	$/MSCF/D
WATER TREATMENT/RECYCLE CAPITAL	75.0	$/BBL/D
AIR DIST, VAPOR REC, SURFACE FACIL...	26500.0	$/ACRE
WELL DRILL/COMP/EQUIP CAPITAL	100.0	$/FOOT
CENTRAL PLANT FACILITIES	500.0	$/STB/D
NO. OF MONTHS WORKING CAPITAL	0.00	
PROJECT STARTUP COSTS.....	0.0	$1000
OIL RATE UNCERTAINTY	0.0010	FRACTION
PERCENT OF CAPITAL BORROWED	0	PERCENT

TAXES AND ESCALATION

AVERAGE DISCOUNT RATE	0.100	FRACTION
AVERAGE INFLATION RATE	0.000	FRACTION
ROYALTY RATE	0.125	FRACTION
SEVERANCE TAX RATE	0.080	FRACTION
FEDERAL INCOME TAX RATE	0.460	FRACTION
INVESTMENT TAX CREDIT	0.100	FRACTION
STATE INCOME TAX RATE	0.040	FRACTION
WINDFALL EXCISE TAX RATE	0.000	FRACTION
WINDFALL PHASE OUT DATE	1991.	
BASE PROJECT START DATE	1985.	
BASE OIL PRICE FOR WINDFALL TAX	23.07	$/BBL
OIL PRICE ESCALATION RATE	0.000	FRACTION
OPERATING COSTS ESCALATION RATE	0.000	FRACTION
DRIVR OPN COST ESCALATION RATE	0.000	FRACTION
DEPRECIATION TIME (STRAIGHT LINE) ...	5.00	YEARS

TABLE 4-6

PRICES AND COSTS		LOW	MOST-LIKELY	HIGH
OIL PRICE	$/BBL	21.32	26.65	31.98
FIXED OPERATING COST PER PATTERN	$/YR	18000.	20000.	22000.
VARIABLE OPERATING COST	$/BBL	2.500	3.000	3.500
ELECTRIC DRIVER OPERATING COST	$/KWHR	0.050	0.070	0.090
WELL WORKOVER COST PER PATTERN	$/YR		5861.	
PROD WATER TREATING COST	$/BBL		0.125	
PROD WATER DISPOSAL COST	$/BBL		0.100	
COMPR MAINT AND LABOR COST	$/MCF		0.030	
TECHNICIAN AND INSTRUMENT COST	$/MCF		0.040	

PATTERN VOLUMES AND SCHEDULE - MOST LIKELY(FOR ONE BURN ZONE)

PATTERN LIFE IS: 9 YEARS

	---- PROD ----			---- INJ ----		PATTERNS	PATTERNS
YEAR	OIL, MB	GAS, MMCF	WATER, MB	AIR, MMCF	WATER, MB	INITIATD	TOTAL
1	86.0	744.2	67.3	819.1	0.0	4.0	4.0
2	95.9	1190.7	107.7	1310.5	0.0	4.0	8.0
3	80.2	1190.7	107.7	1310.5	0.0	4.0	12.0
4	70.1	1190.7	107.7	1310.5	0.0	4.0	16.0
5	62.2	1190.7	107.7	1310.5	0.0	4.0	20.0
6	55.4	1190.7	107.7	1310.5	0.0	4.0	24.0
7	49.4	1190.7	107.7	1310.5	0.0	4.0	28.0
8	44.0	1190.7	107.7	1310.5	0.0	4.0	32.0
9	39.2	1190.7	107.7	1310.5	0.0	4.0	36.0
10	34.8	1190.7	107.7	1310.5	0.0	4.0	36.0
11	15.9	595.3	53.8	655.2	0.0	0.0	32.0
12	0.0	0.0	0.0	0.0	0.0	0.0	28.0
13	0.0	0.0	0.0	0.0	0.0	0.0	24.0
14	0.0	0.0	0.0	0.0	0.0	0.0	20.0
15	0.0	0.0	0.0	0.0	0.0	0.0	16.0
16	0.0	0.0	0.0	0.0	0.0	0.0	12.0
17	0.0	0.0	0.0	0.0	0.0	0.0	8.0
18	0.0	0.0	0.0	0.0	0.0	0.0	4.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 4-7

PROJECT VOLUMES AND SCHEDULE - MOST LIKELY(ALL PATTERNS, ALL ZONES)

YEAR	PATTERNS TOTAL	PROD OIL, MB	PROD GAS, MMCF	PROD WATER, MB	INJ AIR, MMCF	INJ WATER, MB	WAT DISP, MB	COMPR, HP	SEC. OIL, MB	REL. OIL, MB
1	4.0	344.0	2976.7	269.2	3276.2	0.0	269.2	3592.5	0.0	344.0
2	8.0	727.6	7739.5	700.0	8518.2	0.0	700.0	7185.1	0.0	727.6
3	12.0	1048.2	12502.2	1130.7	13760.1	0.0	1130.7	10777.6	0.0	1048.2
4	16.0	1328.7	17265.0	1561.5	19002.1	0.0	1561.5	14370.2	0.0	1328.7
5	20.0	1577.3	22027.7	1992.2	24244.0	0.0	1992.2	17962.7	0.0	1577.3
6	24.0	1798.9	26790.5	2423.0	29485.9	0.0	2423.0	21555.3	0.0	1798.9
7	28.0	1996.4	31553.2	2853.7	34727.9	0.0	2853.7	25147.8	0.0	1996.4
8	32.0	2172.4	36316.0	3284.5	39969.8	0.0	3284.5	28740.3	0.0	2172.4
9	36.0	2329.0	41078.7	3715.2	45211.8	0.0	3715.2	32332.9	0.0	2329.0
10	36.0	2329.0	41078.7	3715.2	45211.8	0.0	3715.2	32332.9	0.0	2329.0
11	32.0	1985.0	38102.0	3446.0	41935.6	0.0	3446.0	28740.3	0.0	1985.0
12	28.0	1601.4	33339.3	3015.3	36693.6	0.0	3015.3	25147.8	0.0	1601.4
13	24.0	1280.8	28576.5	2584.5	31451.7	0.0	2584.5	21555.3	0.0	1280.8
14	20.0	1000.3	23813.8	2153.8	26209.7	0.0	2153.8	17962.7	0.0	1000.3
15	16.0	751.7	19051.0	1723.0	20967.8	0.0	1723.0	14370.2	0.0	751.7
16	12.0	530.2	14288.3	1292.3	15725.8	0.0	1292.3	10777.6	0.0	530.2
17	8.0	332.6	9525.5	861.5	10483.9	0.0	861.5	7185.1	0.0	332.6
18	4.0	156.6	4762.8	430.8	5241.9	0.0	430.8	3592.5	0.0	156.6
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PROJECT PRODUCTION/INJECTION REPORT(ALL PATTERNS, ALL ZONES)

	TIME YEARS	OIL STB/D	WASTE GAS MSCF/D	WATER STB/D	AIR INJ MSCF/D	WAT INJ STB/D	CUM OIL MBBL	OIL RECV FRACTION
1	1985.	942.6	8155.4	737.6	8975.9	0.0	344.0	0.0043
2	1986.	1993.5	21204.0	1917.7	23337.4	0.0	1071.7	0.0135
3	1987.	2871.9	34252.7	3097.9	37698.9	0.0	2119.9	0.0267
4	1988.	3640.2	47301.3	4278.0	52060.4	0.0	3448.6	0.0435
5	1989.	4321.5	60349.9	5458.1	66421.9	0.0	5026.0	0.0633
6	1990.	4928.4	73398.6	6638.3	80783.4	0.0	6824.8	0.0860
7	1991.	5469.5	86447.2	7818.4	95144.9	0.0	8821.2	0.1112
8	1992.	5951.8	99495.9	8998.6	109506.4	0.0	10993.6	0.1385
9	1993.	6380.9	112544.5	10178.7	123867.9	0.0	13322.6	0.1679
10	1994.	6380.9	112544.5	10178.7	123867.9	0.0	15651.7	0.1972
11	1995.	5438.3	104389.1	9441.1	114892.0	0.0	17636.6	0.2222
12	1996.	4387.4	91340.5	8261.0	100530.5	0.0	19238.0	0.2424
13	1997.	3509.0	78291.8	7080.8	86169.0	0.0	20518.8	0.2586
14	1998.	2740.6	65243.2	5900.7	71807.5	0.0	21519.1	0.2712

TABLE 4-7 (CONT'D)

15	1999.	2059.4	52194.5	4720.6	57446.0	0.0	22270.8	0.2806
16	2000.	1452.5	39145.9	3540.4	43084.5	0.0	22801.0	0.2873
17	2001.	911.3	26097.3	2360.3	28723.0	0.0	23133.6	0.2915
18	2002.	429.1	13048.6	1180.1	14361.5	0.0	23290.2	0.2935
19	2003.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
20	2004.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
21	2005.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
22	2006.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
23	2007.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
24	2008.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
25	2009.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
26	2010.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
27	2011.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
28	2012.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
29	2013.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935
30	2014.	0.0	0.0	0.0	0.0	0.0	23290.2	0.2935

TABLE 4-8

MAJOR CAPITAL ITEMS

INJECTOR DRILLING COST	141167.	$/WELL
PRODUCER EQUIPMENT COST	70170.	$/WELL
COST TO UPGRADE SECONDARY PROD	0.	$/WELL
COST TO CONVERT PROD TO INJ	0.	$/WELL
COST TO UPGRADE TO SEC. OPERATIONS ..	0.	$/WELL
WATER TREATMENT CAPITAL	0.0	M$
WASTE GAS TREATMENT CAPITAL	6193.4	M$
CENTRAL PLANT FACILITIES	3190.4	M$
TOTAL FACILITIES CAPITAL	9383.8	M$

PROJECT CAPITAL SCHEDULE - MOST LIKELY

YEAR	--- PATTERN --- TANGIBLE	INTANGBL	PATTERNS INITIATD	AIR MSCF/D	HP COMPRESS	--- PROJECT M$ --- COMPRESS	TANGIBLE	INTANGBL
1	785997.	211503.	4.0	8975.9	3593.	3593.	12528.	846.
2	0.	0.	4.0	23337.4	7185.	3593.	3144.	846.
3	0.	0.	4.0	37698.9	10778.	3593.	3144.	846.
4	0.	0.	4.0	52060.4	14370.	3593.	3144.	846.
5	0.	0.	4.0	66421.9	17963.	3593.	3144.	846.
6	0.	0.	4.0	80783.4	21555.	3593.	3144.	846.
7	0.	0.	4.0	95144.9	25148.	3593.	3144.	846.
8	0.	0.	4.0	109506.4	28740.	3593.	3144.	846.
9	0.	0.	4.0	123867.9	32333.	3593.	3144.	846.
10	0.	0.	4.0	123867.9	32333.	0.	3144.	846.
11	0.	0.	0.0	114892.0	28740.	0.	0.	0.
12	0.	0.	0.0	100530.5	25148.	0.	0.	0.
13	0.	0.	0.0	86169.0	21555.	0.	0.	0.
14	0.	0.	0.0	71807.5	17963.	0.	0.	0.
15	0.	0.	0.0	57446.0	14370.	0.	0.	0.
16	0.	0.	0.0	43084.5	10778.	0.	0.	0.
17	0.	0.	0.0	28723.0	7185.	0.	0.	0.
18	0.	0.	0.0	14361.5	3593.	0.	0.	0.
19	0.	0.	0.0	0.0	0.	0.	0.	0.
20	0.	0.	0.0	0.0	0.	0.	0.	0.
21	0.	0.	0.0	0.0	0.	0.	0.	0.
22	0.	0.	0.0	0.0	0.	0.	0.	0.
23	0.	0.	0.0	0.0	0.	0.	0.	0.
24	0.	0.	0.0	0.0	0.	0.	0.	0.
25	0.	0.	0.0	0.0	0.	0.	0.	0.
26	0.	0.	0.0	0.0	0.	0.	0.	0.
27	0.	0.	0.0	0.0	0.	0.	0.	0.
28	0.	0.	0.0	0.0	0.	0.	0.	0.
29	0.	0.	0.0	0.0	0.	0.	0.	0.
30	0.	0.	0.0	0.0	0.	0.	0.	0.

TABLE 4-9

PROJECT MEAN VALUES

YEAR	TANGIBLE CAPITAL $/YR	INTANGBL CAPITAL $/YR	OIL PRICE $/BBL	FIXED OPN COST $/YR	VARIABLE OPN COST $/BBL	DRIVER OPN COST $/KWHR	WELL WORKOVER $/YR	WATER TREATING $/BBL
1	15222233.	1744147.	26.65	80001.	3.000	0.070	29303.	0.125
2	5838397.	1744147.	26.65	160001.	3.000	0.070	46884.	0.125
3	5838397.	1744147.	26.65	240001.	3.000	0.070	70326.	0.125
4	5838397.	1744147.	26.65	320001.	3.000	0.070	93768.	0.125
5	5838397.	1744147.	26.65	400001.	3.000	0.070	117210.	0.125
6	5838397.	1744147.	26.65	480001.	3.000	0.070	140652.	0.125
7	5838397.	1744147.	26.65	560001.	3.000	0.070	164094.	0.125
8	5838397.	1744147.	26.65	640001.	3.000	0.070	187536.	0.125
9	5838398.	1744147.	26.65	720001.	3.000	0.070	210978.	0.125
10	3143989.	846011.	26.65	720001.	3.000	0.070	210978.	0.125
11	0.	0.	26.65	640001.	3.000	0.070	187536.	0.125
12	0.	0.	26.65	560001.	3.000	0.070	164094.	0.125
13	0.	0.	26.65	480001.	3.000	0.070	140652.	0.125
14	0.	0.	26.65	400001.	3.000	0.070	117210.	0.125
15	0.	0.	26.65	320001.	3.000	0.070	93768.	0.125
16	0.	0.	26.65	240001.	3.000	0.070	70326.	0.125
17	0.	0.	26.65	160001.	3.000	0.070	46884.	0.125
18	0.	0.	26.65	80001.	3.000	0.070	23442.	0.125
19	0.	0.	26.65	1.	3.000	0.070	0.	0.125
20	0.	0.	26.65	1.	3.000	0.070	0.	0.125
21	0.	0.	26.65	1.	3.000	0.070	0.	0.125
22	0.	0.	26.65	1.	3.000	0.070	0.	0.125
23	0.	0.	26.65	1.	3.000	0.070	0.	0.125
24	0.	0.	26.65	1.	3.000	0.070	0.	0.125
25	0.	0.	26.65	1.	3.000	0.070	0.	0.125
26	0.	0.	26.65	1.	3.000	0.070	0.	0.125
27	0.	0.	26.65	1.	3.000	0.070	0.	0.125
28	0.	0.	26.65	1.	3.000	0.070	0.	0.125
29	0.	0.	26.65	1.	3.000	0.070	0.	0.125
30	0.	0.	26.65	1.	3.000	0.070	0.	0.125

DCFROR ITERATION

ITR	OLD RATE	DCFAT $MM	NEW RATE	DCFATP
1	1.1000	15.96	1.1773	-206.446
2	1.1773	5.50	1.2265	-111.830
3	1.2265	1.65	1.2476	-78.330
4	1.2476	0.41	1.2536	-67.708
5	1.2536	0.09	1.2550	-64.984
6	1.2550	0.02	1.2553	-64.387

TABLE 4-10

ECONOMIC ANALYSIS OF AN INSITU COMBUSTION PROJECT

UNDISCOUNTED MEAN VALUES

YEAR ENDING	1 1985.	2 1986.	3 1987.	4 1988.	5 1989.	6 1990.	7 1991.	8 1992.	9 1993.	10 1994.
GROSS OIL PRODUCTION, MBBL	344.0	727.6	1048.2	1328.7	1577.3	1798.9	1996.4	2172.4	2329.0	2329.0
WASTE GAS PRODUCTION, MMSCF	2977.	7739.	12502.	17265.	22028.	26790.	31553.	36316.	41079.	41079.
ANNUAL WATER PRODUCTION, MBBL	269.	700.	1131.	1561.	1992.	2423.	2854.	3284.	3715.	3715.
ANNUAL AIR INJECTED, MMSCF	3276.	8518.	13760.	19002.	24244.	29486.	34728.	39970.	45212.	45212.
OIL PRODUCTION RATE, BBL/D	943.	1993.	2872.	3640.	4322.	4928.	5470.	5952.	6381.	6381.
GAS PRODUCTION RATE, MSCF/D	8155.	21204.	34253.	47301.	60350.	73399.	86447.	99496.	112544.	112544.
WATER PRODUCTION RATE, BBL/D	738.	1918.	3098.	4278.	5458.	6638.	7818.	8999.	10179.	10179.
AIR INJECTION RATE, MSCF/D	8976.	23337.	37699.	52060.	66422.	80783.	95145.	109506.	123868.	123868.
NET OIL SOLD (LESS ROYALTY), MBBL	301.0	636.7	917.2	1162.6	1380.2	1574.0	1746.8	1900.9	2037.9	2037.9
MEAN PRICE OF OIL, $/BBL	26.65	26.65	26.65	26.65	26.65	26.65	26.65	26.65	26.65	26.65
ANNUAL GROSS OIL SALES, MM$	9.17	19.39	27.93	35.41	42.03	47.94	53.20	57.89	62.07	62.07
ANNUAL ROYALTY, MM$	1.15	2.42	3.49	4.43	5.25	5.99	6.65	7.24	7.76	7.76
ANNUAL NET SALES, MM$	8.02	16.97	24.44	30.98	36.78	41.95	46.55	50.66	54.31	54.31
ANNUAL SEVERANCE TAX, MM$	0.64	1.36	1.96	2.48	2.94	3.36	3.72	4.05	4.34	4.34
ANNUAL FIXED OPERATING COST, MM$	0.08	0.16	0.24	0.32	0.40	0.48	0.56	0.64	0.72	0.72
ANNUAL VARIABLE OPERATING COST, MM$	1.03	2.18	3.14	3.99	4.73	5.40	5.99	6.52	6.99	6.99
ANNUAL ELECTRIC DRIVER OP COST, MM$	1.75	3.50	5.24	6.99	8.74	10.49	12.24	13.99	15.73	15.73
ANNUAL COMPR MAINT AND LABOR COST, MM$	0.10	0.26	0.41	0.57	0.73	0.88	1.04	1.20	1.36	1.36
ANNUAL TECHNICIAN AND INST COST, MM$	0.13	0.34	0.55	0.76	0.97	1.18	1.39	1.60	1.81	1.81
ANNUAL WELL WORKOVER COST, MM$	0.03	0.05	0.07	0.09	0.12	0.14	0.16	0.19	0.21	0.21
ANNUAL PROD WATER TREATING COST, MM$	0.03	0.09	0.14	0.20	0.25	0.30	0.36	0.41	0.46	0.46
ANNUAL PROD WATER DISPOSAL COST, MM$	0.03	0.07	0.11	0.16	0.20	0.24	0.29	0.33	0.37	0.37
ANNUAL OVERHEAD, MM$	1.09	1.60	2.25	2.89	3.50	4.09	4.68	5.24	5.80	5.73
ANNUAL TOTAL OPERATING COST, MM$	4.92	9.60	14.13	18.44	22.58	26.57	30.42	34.17	37.80	37.73
ANNUAL NET OPERATING INCOME, MM$	3.11	7.37	10.32	12.54	14.20	15.38	16.13	16.49	16.51	16.58
CUM NET OPERATING INCOME, MM$	3.11	10.48	20.79	33.33	47.54	62.92	79.04	95.53	112.04	128.62
ANNUAL WORKING CAPITAL, MM$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL TANGIBLE CAPITAL , MM$	15.22	5.84	5.84	5.84	5.84	5.84	5.84	5.84	5.84	3.14
ANNUAL INTANGIBLE CAPITAL, MM$	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	0.85
CUM CASH FLOW BEFORE TAXES, MM$	-13.86	-14.07	-11.34	-6.38	0.24	8.04	16.58	25.49	34.41	47.00
BASE PRICE OF OIL FOR WPT, $/BBL	23.07	23.53	24.00	24.48	24.97	25.47	25.98	26.50	27.03	27.57
ANNUAL WINDFALL PRICE DIFF, $/BBL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL NET INCOME LIMIT PRICE, $/BBL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL WINDFALL EXCISE TAX, MM$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL STATE INCOME TAX, MM$	0.12	0.29	0.41	0.50	0.57	0.62	0.65	0.66	0.66	0.66
ANNUAL INTANGIBLES AND DEPR, MM$	4.79	5.96	7.12	8.29	9.46	7.58	7.58	7.58	7.58	6.15
ANNUAL INVESTMENT TAX CREDIT, MM$	1.52	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.31
ANNUAL NET TAXABLE INCOME, MM$	-1.81	1.12	2.78	3.75	4.18	7.18	7.90	8.25	8.26	9.77
ANNUAL FEDERAL INCOME TAX, MM$	-2.35	-0.07	0.69	1.14	1.34	2.72	3.05	3.21	3.22	4.18
ANNUAL AFTER TAX CASH FLOW, MM$	-11.63	-0.44	1.63	3.32	4.72	4.46	4.85	5.04	5.05	7.75
CUM CASH FLOW AFTER TAXES, MM$	-11.63	-12.07	-10.44	-7.13	-2.41	2.05	6.90	11.94	16.99	24.73

TABLE 4-10 (CONT'D)

ECONOMIC ANALYSIS OF AN INSITU COMBUSTION PROJECT

UNDISCOUNTED MEAN VALUES

YEAR ENDING	11 1995.	12 1996.	13 1997.	14 1998.	15 1999.	16 2000.	17 2001.	18 2002.	19 2003.	20 2004.
GROSS OIL PRODUCTION, MBBL	1985.0	1601.4	1280.8	1000.3	751.7	530.2	332.6	156.6	0.0	0.0
WASTE GAS PRODUCTION, MMSCF	38102.	33339.	28577.	23814.	19051.	14288.	9526.	4763.	0.	0.
ANNUAL WATER PRODUCTION, MBBL	3446.	3015.	2585.	2154.	1723.	1292.	862.	431.	0.	0.
ANNUAL AIR INJECTED, MMSCF	41936.	36694.	31452.	26210.	20968.	15726.	10484.	5242.	0.	0.
OIL PRODUCTION RATE, BBL/D	5438.	4387.	3509.	2741.	2059.	1453.	911.	429.	0.	0.
GAS PRODUCTION RATE, MSCF/D	104389.	91340.	78292.	65243.	52195.	39146.	26097.	13049.	0.	0.
WATER PRODUCTION RATE, BBL/D	9441.	8261.	7081.	5901.	4721.	3540.	2360.	1180.	0.	0.
AIR INJECTION RATE, MSCF/D	114892.	100530.	86169.	71807.	57446.	43084.	28723.	14361.	0.	0.
NET OIL SOLD (LESS ROYALTY), MBBL	1736.9	1401.2	1120.7	875.3	657.7	463.9	291.1	137.0	0.0	0.0
MEAN PRICE OF OIL, $/BBL	26.65	26.65	26.65	26.65	26.65	26.65	26.65	26.65	26.65	26.65
ANNUAL GROSS OIL SALES, MM$	52.90	42.68	34.13	26.66	20.03	14.13	8.86	4.17	0.00	0.00
ANNUAL ROYALTY, MM$	6.61	5.33	4.27	3.33	2.50	1.77	1.11	0.52	0.00	0.00
ANNUAL NET SALES, MM$	46.29	37.34	29.86	23.33	17.53	12.36	7.76	3.65	0.00	0.00
ANNUAL SEVERANCE TAX, MM$	3.70	2.99	2.39	1.87	1.40	0.99	0.62	0.29	0.00	0.00
ANNUAL FIXED OPERATING COST, MM$	0.64	0.56	0.48	0.40	0.32	0.24	0.16	0.08	0.00	0.00
ANNUAL VARIABLE OPERATING COST, MM$	5.95	4.80	3.84	3.00	2.26	1.59	1.00	0.47	0.00	0.00
ANNUAL ELECTRIC DRIVER OP COST, MM$	13.99	12.24	10.49	8.74	6.99	5.24	3.50	1.75	0.00	0.00
ANNUAL COMPR MAINT AND LABOR COST, MM$	1.26	1.10	0.94	0.79	0.63	0.47	0.31	0.16	0.00	0.00
ANNUAL TECHNICIAN AND INST COST, MM$	1.68	1.47	1.26	1.05	0.84	0.63	0.42	0.21	0.00	0.00
ANNUAL WELL WORKOVER COST, MM$	0.19	0.16	0.14	0.12	0.09	0.07	0.05	0.02	0.00	0.00
ANNUAL PROD WATER TREATING COST, MM$	0.43	0.38	0.32	0.27	0.22	0.16	0.11	0.05	0.00	0.00
ANNUAL PROD WATER DISPOSAL COST, MM$	0.34	0.30	0.26	0.22	0.17	0.13	0.09	0.04	0.00	0.00
ANNUAL OVERHEAD, MM$	4.90	4.20	3.55	2.92	2.30	1.71	1.13	0.56	0.00	0.00
ANNUAL TOTAL OPERATING COST, MM$	33.08	28.20	23.67	19.36	15.22	11.23	7.38	3.63	0.00	0.00
ANNUAL NET OPERATING INCOME, MM$	13.21	9.14	6.19	3.96	2.30	1.13	0.38	0.02	0.00	0.00
CUM NET OPERATING INCOME, MM$	141.83	150.97	157.16	161.12	163.43	164.56	164.94	164.95	164.95	164.95
ANNUAL WORKING CAPITAL, MM$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL TANGIBLE CAPITAL , MM$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL INTANGIBLE CAPITAL, MM$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CUM CASH FLOW BEFORE TAXES, MM$	60.21	69.35	75.54	79.51	81.81	82.94	83.32	83.34	83.34	83.34
BASE PRICE OF OIL FOR WPT, $/BBL	28.12	28.68	29.26	29.84	30.44	31.05	31.67	32.30	32.95	33.61
ANNUAL WINDFALL PRICE DIFF, $/BBL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL NET INCOME LIMIT PRICE, $/BBL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL WINDFALL EXCISE TAX, MM$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL STATE INCOME TAX, MM$	0.53	0.37	0.25	0.16	0.09	0.05	0.02	0.00	0.00	0.00
ANNUAL INTANGIBLES AND DEPR, MM$	4.13	2.96	1.80	0.63	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL INVESTMENT TAX CREDIT, MM$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL NET TAXABLE INCOME, MM$	8.55	5.81	4.15	3.18	2.21	1.08	0.37	0.02	0.00	0.00
ANNUAL FEDERAL INCOME TAX, MM$	3.93	2.67	1.91	1.46	1.02	0.50	0.17	0.01	0.00	0.00
ANNUAL AFTER TAX CASH FLOW, MM$	8.75	6.10	4.04	2.34	1.19	0.59	0.20	0.01	0.00	0.00
CUM CASH FLOW AFTER TAXES, MM$	33.48	39.58	43.62	45.96	47.16	47.74	47.94	47.95	47.95	47.95

TABLE 4-11

UNDISCOUNTED MEAN RESULTS

PROJECT ECONOMIC LIFE	18.0	YEARS
TOTAL GROSS SALES	620.661	MM$
TOTAL NET SALES	543.079	MM$
TOTAL SEVERANCE TAX	43.446	MM$
TOTAL FIXED OPERATING COST	7.200	MM$
TOTAL VARIABLE OPERATING COST	69.871	MM$
TOTAL ELECTRIC DRIVER OP COST	157.347	MM$
TOTAL COMPR MAINT AND LABOR COST	13.564	MM$
TOTAL TECHNICIAN AND INSTR COST	18.085	MM$
TOTAL WELL WORKOVER COST	2.116	MM$
TOTAL PROD WATER TREATING COST	4.644	MM$
TOTAL PROD WATER DISPOSAL COST	3.715	MM$
TOTAL OVERHEAD	58.137	MM$
TOTAL OPERATING COST	378.124	MM$
TOTAL WORKING CAPITAL	0.000	MM$
TOTAL TANGIBLE CAPITAL	65.073	MM$
TOTAL INTANGIBLE CAPITAL	16.543	MM$
TOTAL CAPITAL INVESTMENT	81.617	MM$
TOTAL DEBT INTEREST EXPENSE	0.000	MM$
TOTAL PROJECT EXPENSE	459.741	MM$
TOTAL CASH FLOW BEFORE TAX	83.338	MM$
TOTAL WINDFALL EXCISE TAX	0.000	MM$
TOTAL STATE INCOME TAX	6.598	MM$
TOTAL FEDERAL INCOME TAX	28.793	MM$
TOTAL AFTER TAX PROFIT	47.947	MM$
TOTAL LOAN AMOUNT	0.000	MM$

ECONOMIC ANALYSIS OF AN INSITU COMBUSTION PROJECT

		PRESNT VALUE	MEAN VALUE CASH FLOW BEFORE TAX (MM$)			AFTER TAX (MM$)		
	YEAR	FACTOR	ANNUAL	CONST $	DISCNTD	ANNUAL	CONST $	DISCNTD
1	1985.	1.0000	-13.86	-13.86	-13.86	-11.63	-11.63	-11.63
2	1986.	0.9535	-14.07	-14.07	-14.06	-12.07	-12.07	-12.05
3	1987.	0.8668	-11.34	-11.34	-11.69	-10.44	-10.44	-10.64
4	1988.	0.7880	-6.38	-6.38	-7.79	-7.13	-7.13	-8.03
5	1989.	0.7164	0.24	0.24	-3.04	-2.41	-2.41	-4.65
6	1990.	0.6512	8.04	8.04	2.03	2.05	2.05	-1.74
7	1991.	0.5920	16.58	16.58	7.09	6.90	6.90	1.13
8	1992.	0.5382	25.49	25.49	11.89	11.94	11.94	3.84
9	1993.	0.4893	34.41	34.41	16.25	16.99	16.99	6.31
10	1994.	0.4448	47.00	47.00	21.85	24.73	24.73	9.76
11	1995.	0.4044	60.21	60.21	27.19	33.48	33.48	13.29
12	1996.	0.3676	69.35	69.35	30.55	39.58	39.58	15.53
13	1997.	0.3342	75.54	75.54	32.62	43.62	43.62	16.88
14	1998.	0.3038	79.51	79.51	33.83	45.96	45.96	17.60
15	1999.	0.2762	81.81	81.81	34.46	47.16	47.16	17.93
16	2000.	0.2511	82.94	82.94	34.75	47.74	47.74	18.07
17	2001.	0.2283	83.32	83.32	34.83	47.94	47.94	18.12
18	2002.	0.2075	83.34	83.34	34.84	47.95	47.95	18.12

TABLE 4-12

```
*****************************************
*                                       *
*      NATIONAL PETROLEUM COUNCIL       *
*  INSITU COMBUSTION PREDICTIVE MODEL   *
*        (ICPM - RELEASE 1.4.0)         *
*           ( APRIL ,1985 )             *
*****************************************
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SENSITIVITY RUNS BASE CASE MODEL

PRODUCTION SUMMARY

PROJECT ECONOMIC LIFE	18.0	YEARS
CUMULATIVE OIL PRODUCED	23290.	MBBL
CUMULATIVE AIR/OIL RATIO	19.41	MSCF/B
CUMULATIVE NET OIL SOLD	20379.	MBBL
PRESENT VALUE OF NET OIL SOLD	10845.	MBBL

MEAN RESULTS

PRESENT VALUE OF TOTAL GROSS SALES	330.282	MM$
PRESENT VALUE OF TOTAL NET SALES	288.996	MM$
TOTAL SEVERANCE TAX (PV)	23.120	MM$
TOTAL FIXED OPERATING COST (PV)	3.589	MM$
TOTAL VARIABLE OPERATING COST (PV)	37.181	MM$
TOTAL ELECTRIC DRIVER OP COST (PV)	78.427	MM$
TOTAL COMPR MAINT AND LABOR COST (PV) ..	6.639	MM$
TOTAL TECHNICIAN AND INSTR COST (PV) ...	8.852	MM$
TOTAL WELL WORKOVER COST (PV)	1.057	MM$
TOTAL PROD WATER TREATING COST (PV)	2.273	MM$
TOTAL PROD WATER DISPOSAL COST (PV)	1.819	MM$
TOTAL OVERHEAD (PV)	30.034	MM$
TOTAL OPERATING COST (PV)	192.991	MM$
TOTAL WORKING CAPITAL (PV)	0.000	MM$
TOTAL TANGIBLE CAPITAL INVESTED (PV) ...	49.288	MM$
TOTAL INTANGIBLE CAPITAL (PV)	11.880	MM$
TOTAL CAPITAL INVESTMENT (PV)	61.168	MM$
TOTAL INTEREST EXPENSE (PV)	0.000	MM$
TOTAL PROJECT EXPENSE (PV)	254.159	MM$
TOTAL LOAN PRINCIPAL REPAYMENT (PV)	0.000	MM$
DISCOUNTED COST PER DISC NET OIL	23.437	$/BBL
DISCOUNTED CASH FLOW BEFORE TAX	34.837	MM$

PROJECT PROFITABILITY (AFTER TAX)

AVERAGE MONETARY DISCOUNT RATE	10.00	PCNT
90 PCNT CONFIDENCE DCF	-27.038	MM$
MEAN DISCOUNTED CASH FLOW	18.120	MM$
10 PCNT CONFIDENCE DCF	71.050	MM$
STANDARD DEVIATION OF THE MEAN DCF	37.014	MM$
PAYOUT BASED ON AFTER TAX MEAN DCF	6.61	YEARS
MEAN DCF PROFIT TO INVESTMENT RATIO	0.296	P/I
MEAN DCF PROFIT TO EXPENSE RATIO	0.071	P/E
MEAN DCF PROFIT PER DISC NET OIL	1.671	$/BBL
MEAN INVESTMENT EFFICIENCY	1.572	
MEAN DCF RATE OF RETURN	25.53	PCNT

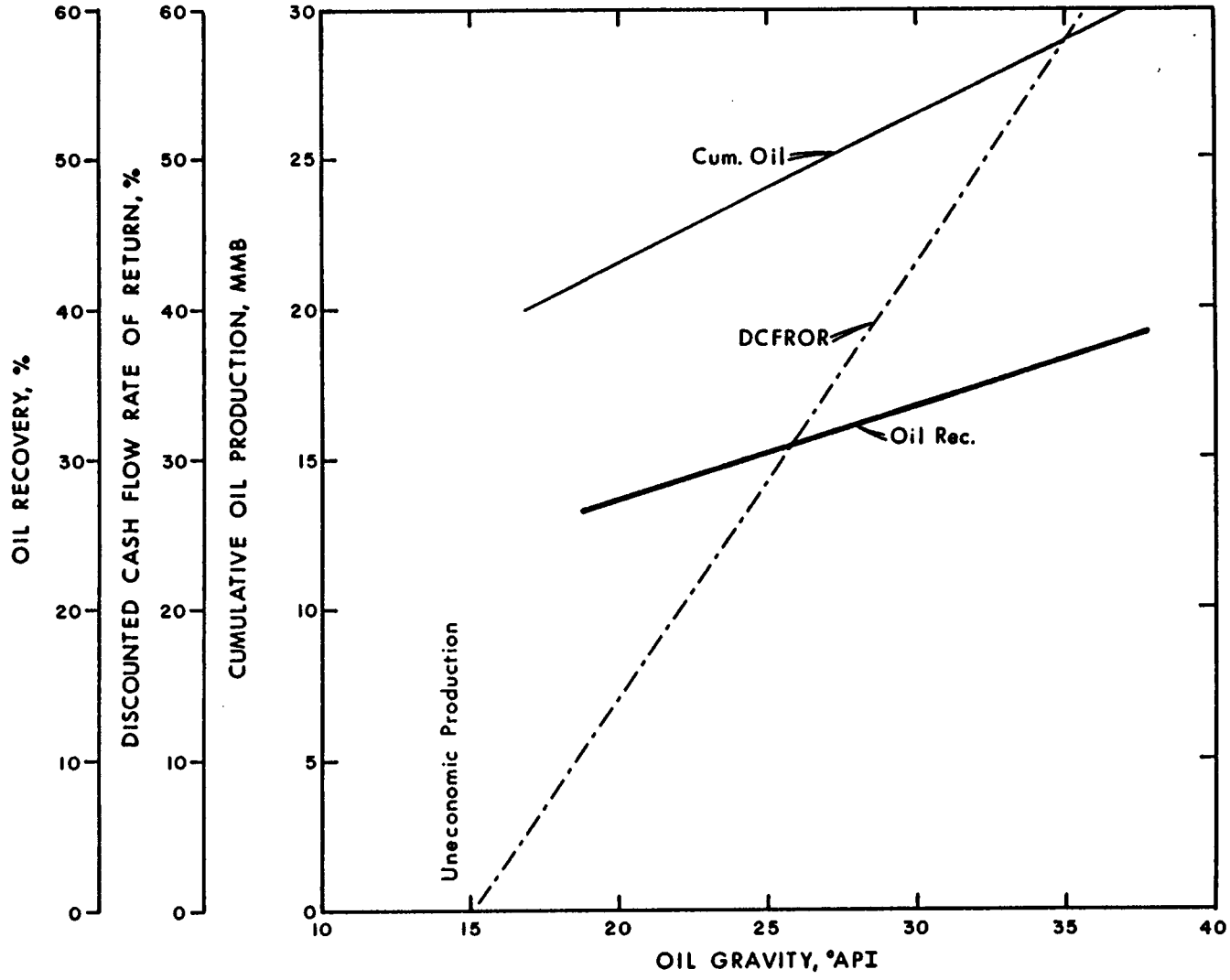

Figure 4-1. Sensitivity Runs - Oil Gravity

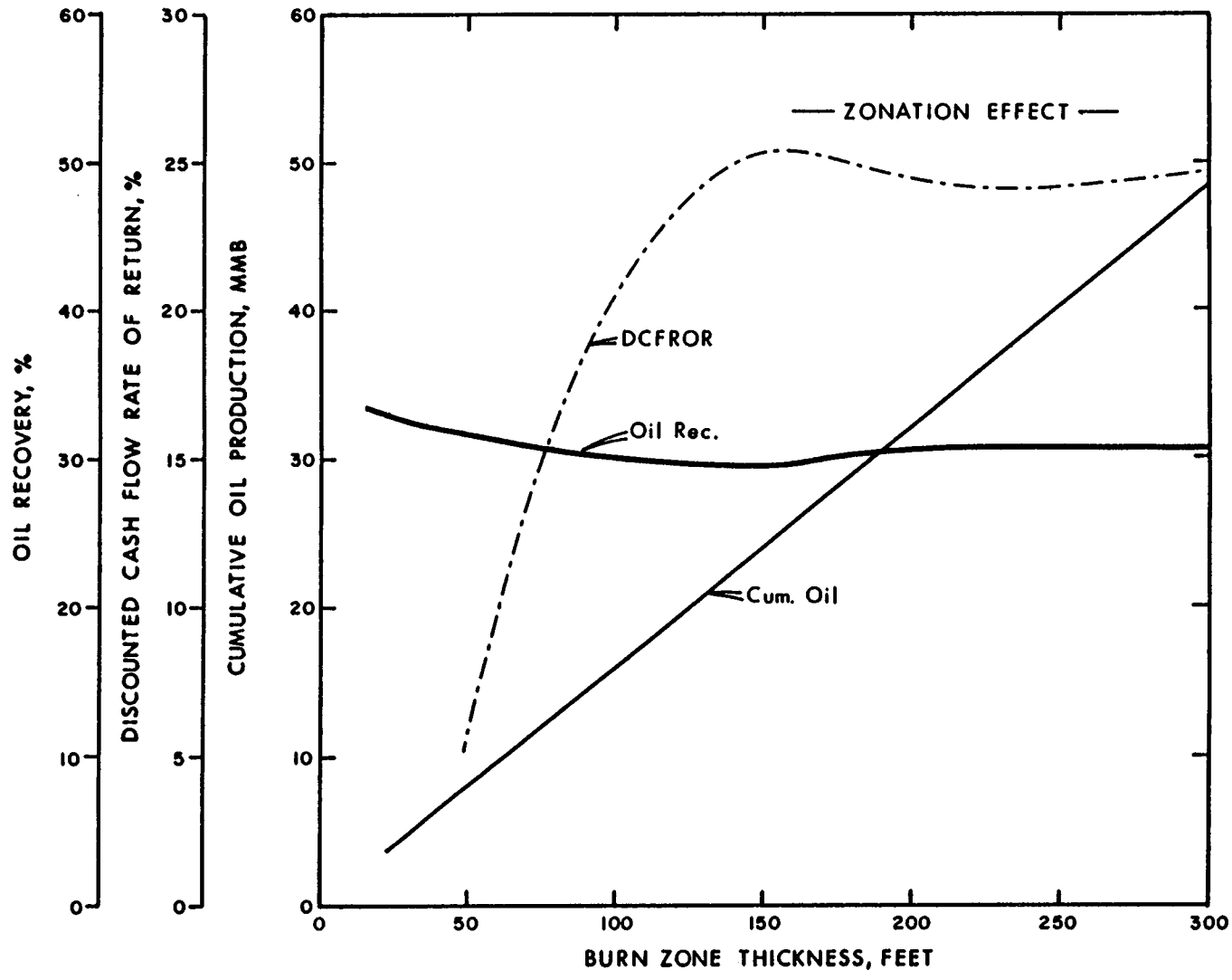

Figure 4-2. Sensitivity Runs - Burn Zone Thickness

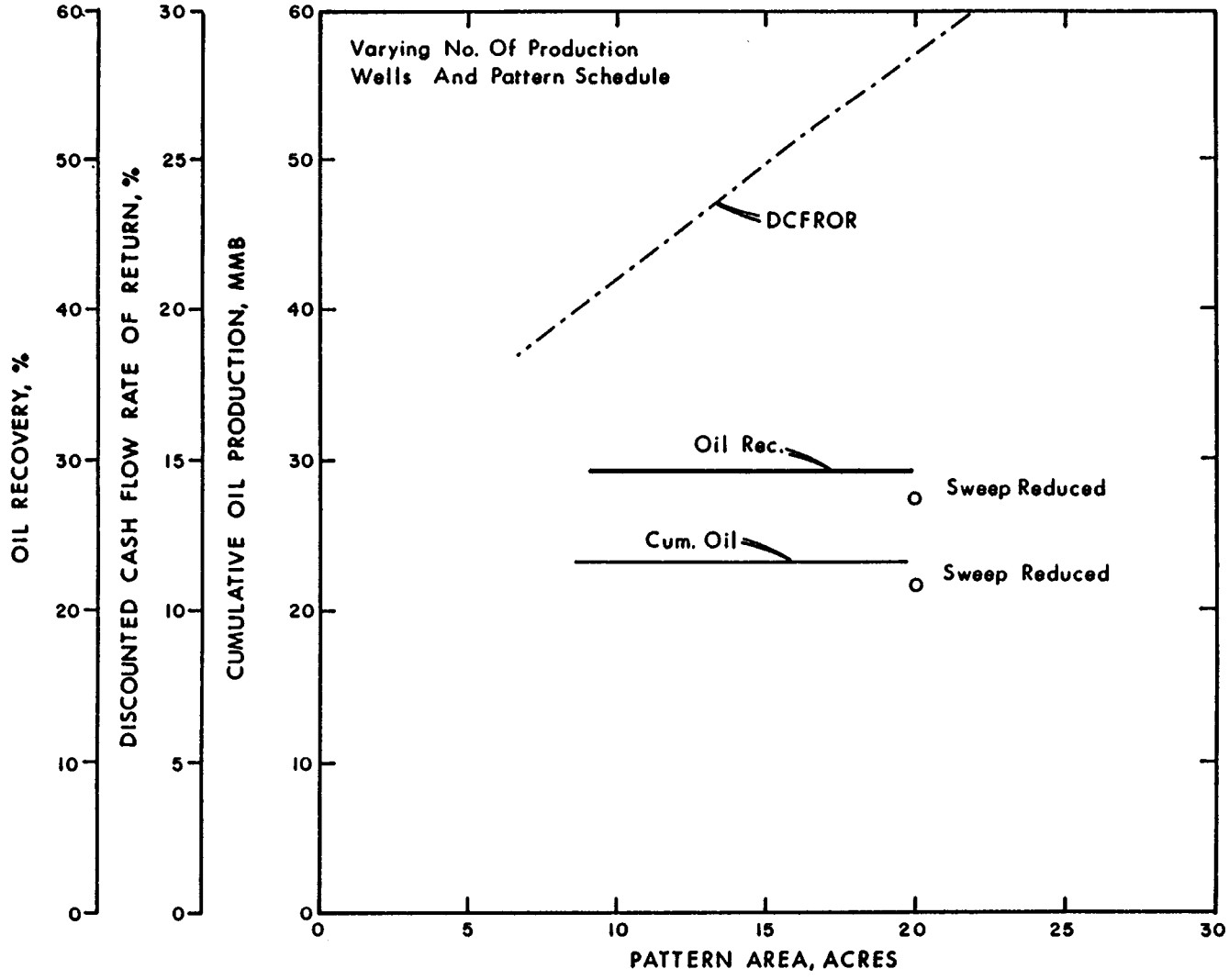

Figure 4-3. Sensitivity Runs - Pattern Area, Multiple Patterns

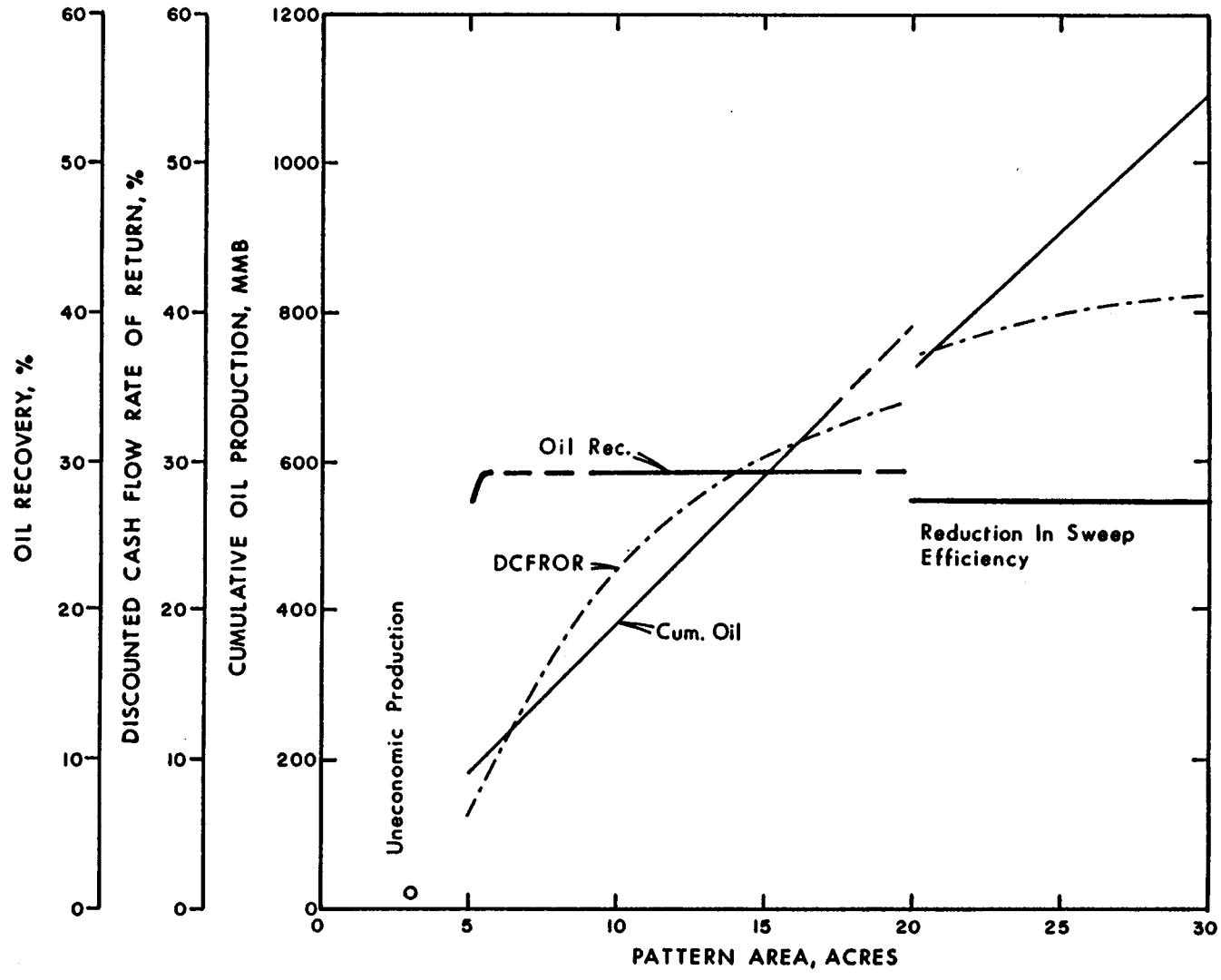

Figure 4-4. Sensitivity Runs - Pattern Area, Single Patterns

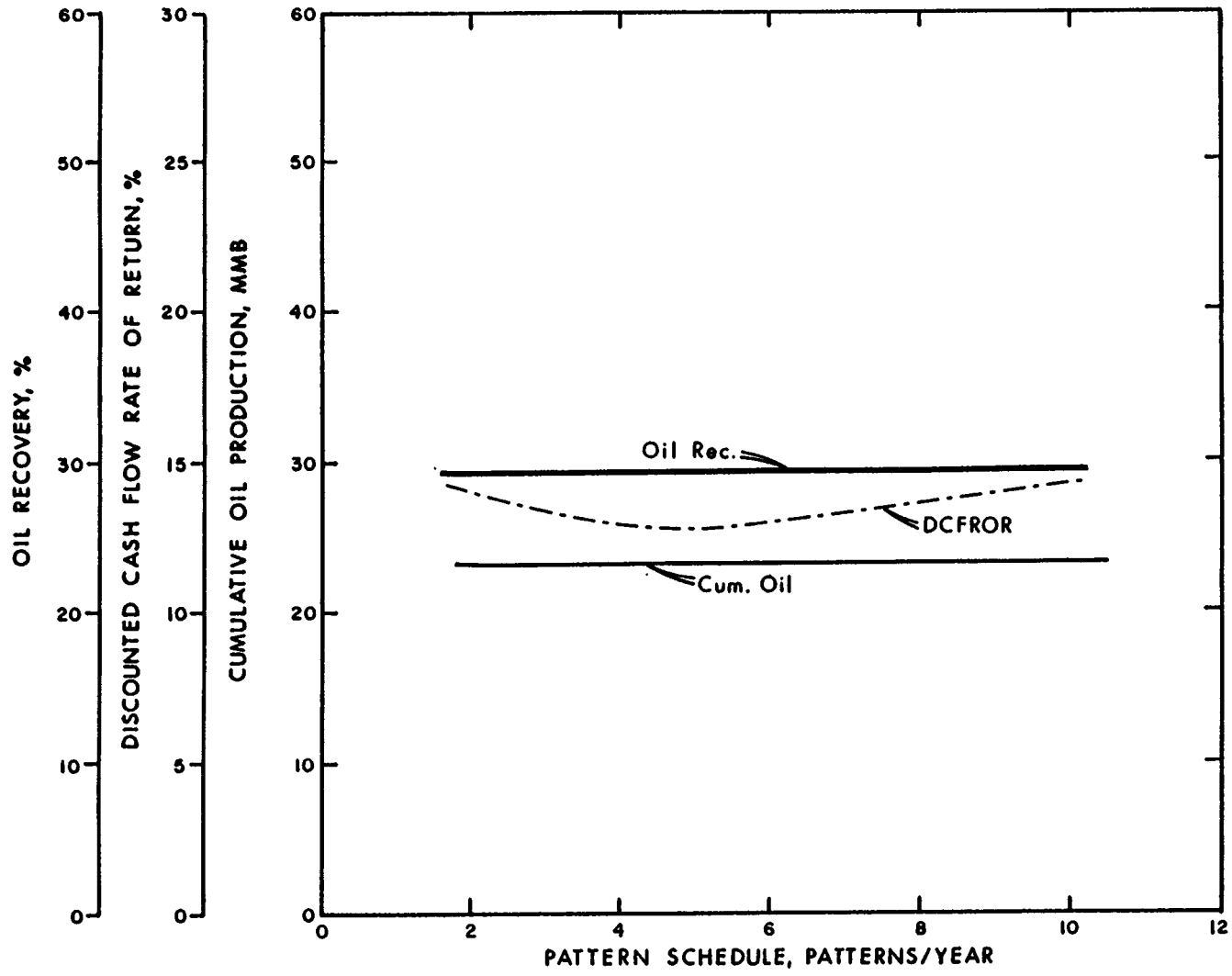

Figure 4-5. Sensitivity Runs - Pattern Schedule

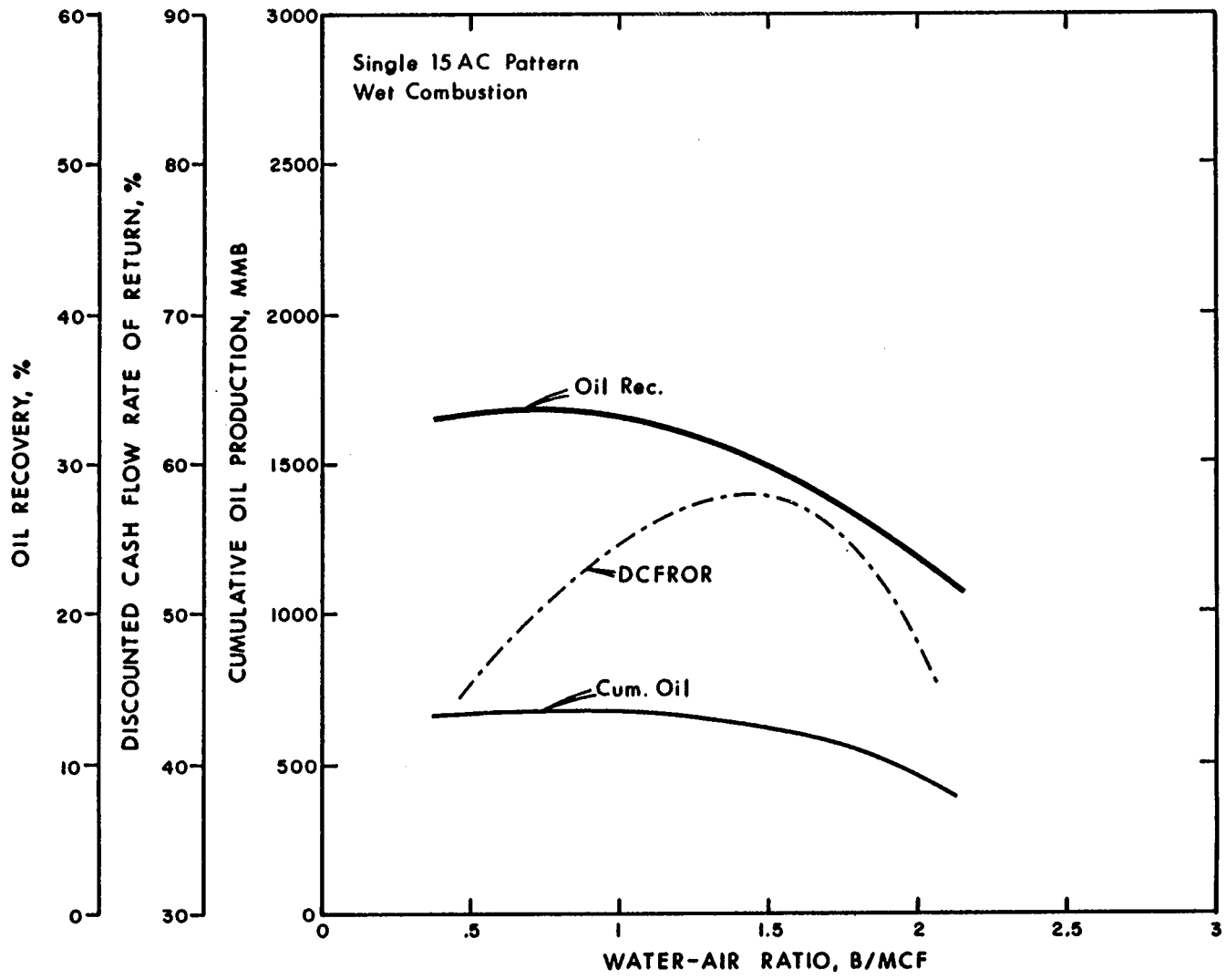

Figure 4-6. Sensitivity Runs - Water/Air Ratio

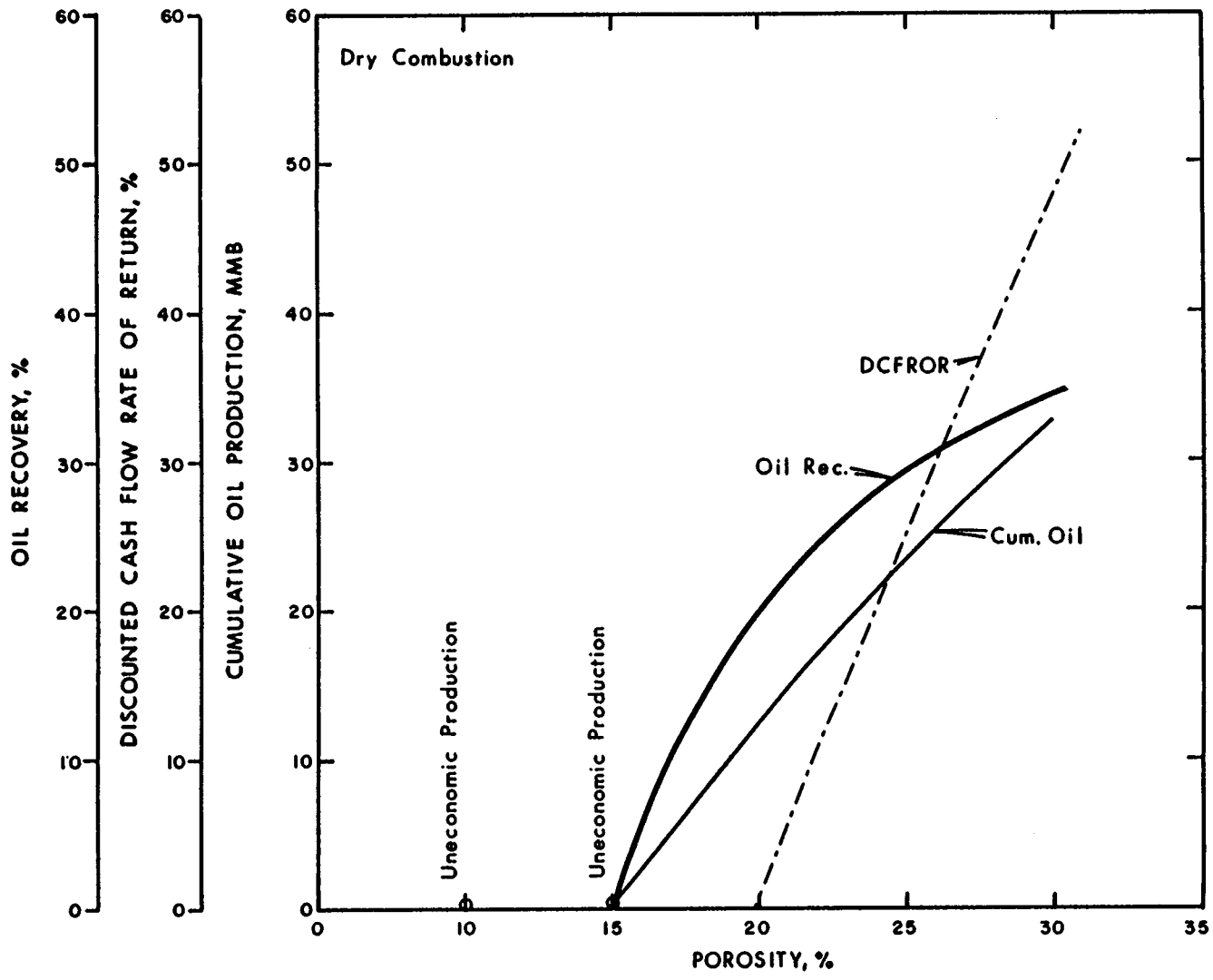

Figure 4-7. Sensitivity Runs - Porosity

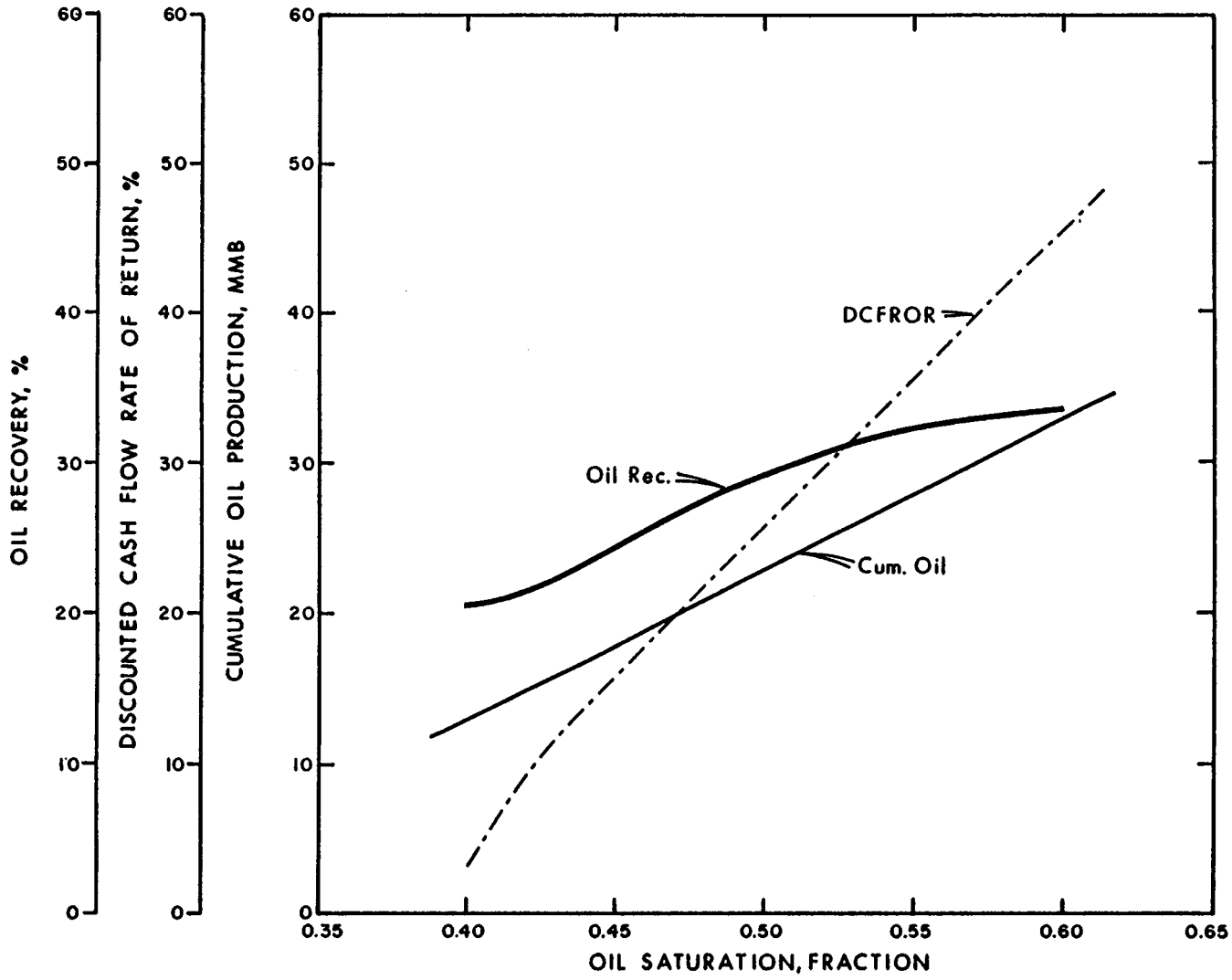

Figure 4-8. Sensitivity Runs - Oil Saturation

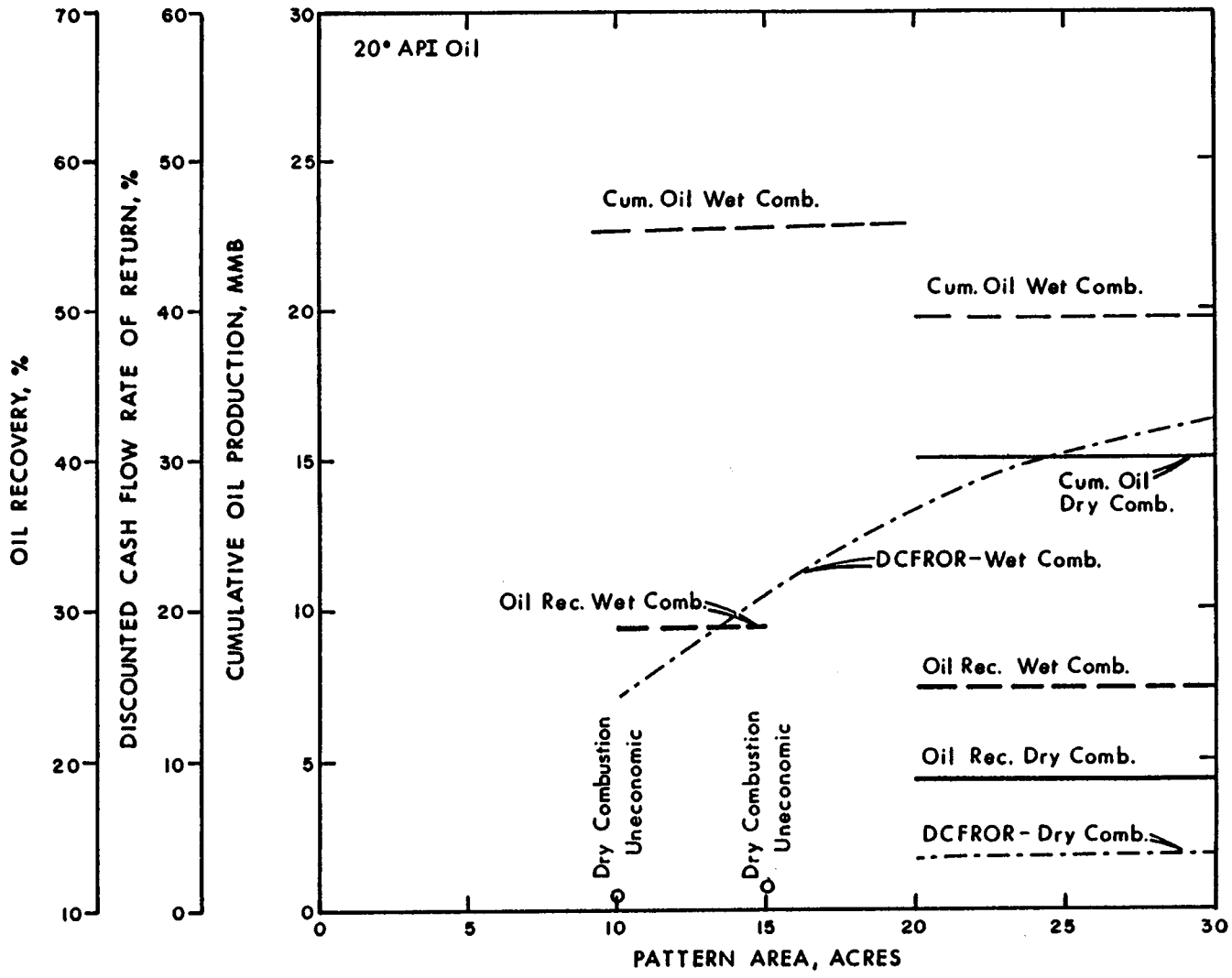

Figure 4-9. Sensitivity Runs - Wet vs. Dry Combustion, 20° API Oil

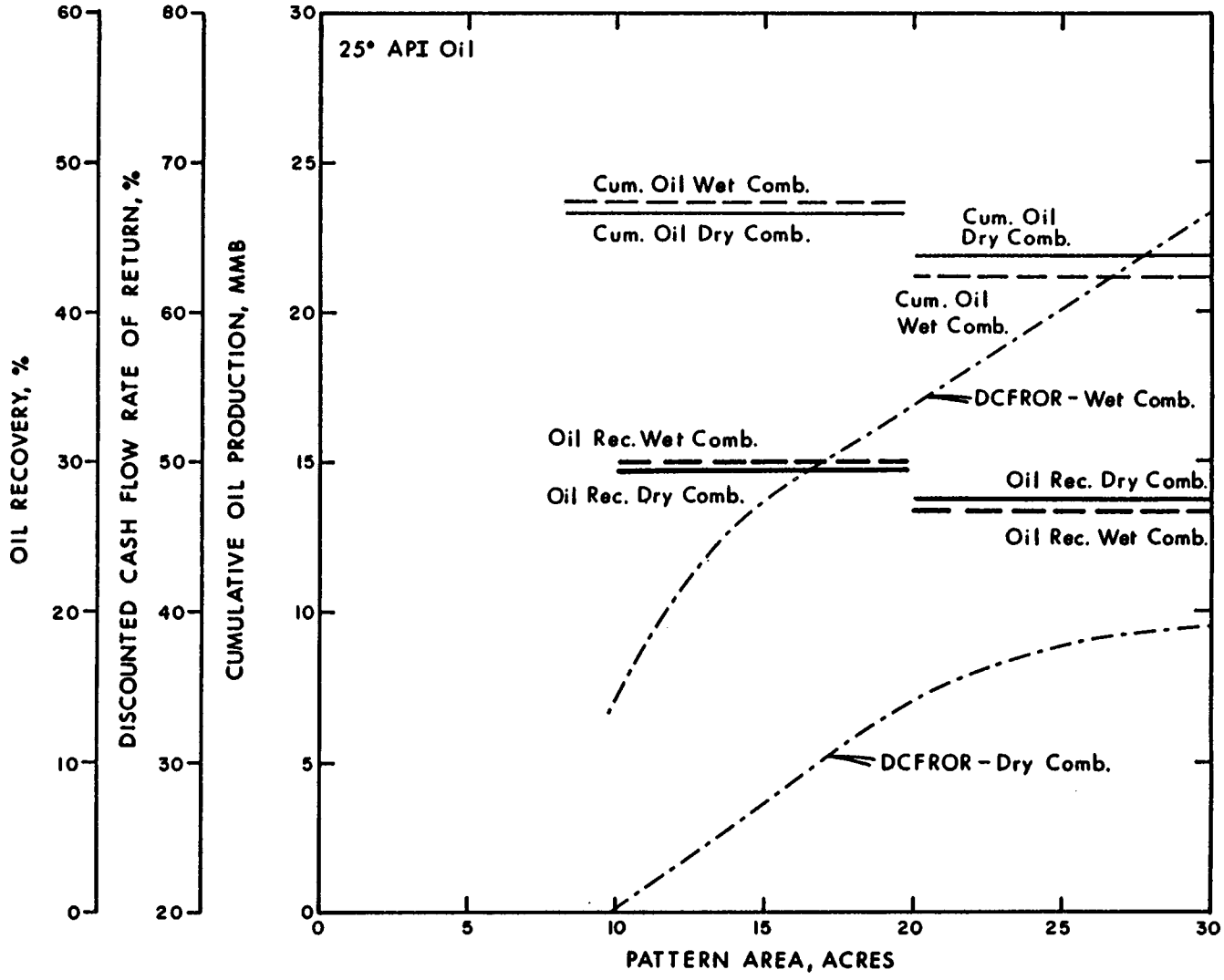

Figure 4-10. Sensitivity Runs - Wet vs. Dry Combustion, 25° API Oil

SECTION 5
ICPM SUBROUTINE GLOSSARY

THIS SECTION DESCRIBES THE MAIN PROGRAM AND SUBROUTINES, AND TABULATES SCALAR AND ARRAY VARIABLES. THE NOMENCLATURE IN THE GLOSSARY TABLES FOR THESE VARIABLES IS AS FOLLOWS:

TYPE	I*4	4-BYTE INTEGER
	R*4	4-BYTE REAL NUMBER
LOCATION	NAME	NAME OF LABELLED COMMON
	$LOCAL	LOCAL TO SUBROUTINE
	ARG	PASSED FROM ANOTHER SUBROUTINE
ACTION	SET	APPEARS ON L.H.S. OF EQUATION
	REF	APPEARS ON R.H.S. OF EQUATION
	ARG	PASSED TO ANOTHER SUBROUTINE

5.1 MAIN PROGRAM

DESCRIPTION : INITIALIZES VARIABLES, CALLS VARIOUS SUBROUTINES, CHECKS SWITCHES AND UPDATES TIME INCREMENTS

SUBROUTINES CALLED :
- TITLE - PRINTS HEADER WITH RELEASE NUMBER
- INPUT - INPUTS RESERVOIR DATA
- RESV - PREDICTS RESERVOIR PERFORMANCE, RECOVERY AND PRODUCTION RATES
- OUTR - WRITES RESERVOIR RECOVERY AND PRODUCTION REPORTS
- INEC - INPUTS ECONOMIC DATA AND CALCULATES PROJECT PERFORMANCE FROM PATTERN RESULTS
- ECON - PERFORMS ECONOMIC ANALYSIS OF THE PROJECT, CALCULATES DCF AND AFTER TAX DCFROR
- OUTE - WRITES ECONOMIC ANALYSIS REPORT

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	API	FPROP	ARG
R*4	FACT	$LOCAL	ARG
R*4	FDC	$LOCAL	ARG
R*4	FEQP	$LOCAL	ARG
R*4	FOPR	$LOCAL	ARG
R*4	FUEL	$LOCAL	ARG

I*4	I	$LOCAL	SET REF
I*4	IECON	FLAGS	REF
I*4	IERR	FLAGS	SET
I*4	IJ1	FLAGS	SET ARG
I*4	IMAX	$LOCAL	SET
I*4	IP	FLAGS	SET
I*4	IR	FLAGS	SET
I*4	IW	FLAGS	SET
I*4	J	$LOCAL	SET REF
I*4	MAXO	$LOCAL	SET REF
R*4	MUPPV	ECS	REF
R*4	PII	$LOCAL	SET
R*4	PRICEI	$LOCAL	ARG
R*4	UNIT	$LOCAL	SET
R*4	VALUE	$LOCAL	ARG
R*4	XHEND	$LOCAL	REF

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	AIRQ	REPORT	(200)	SET
R*4	CARD	$LOCAL	(20)	REF SET
R*4	CUMAW	REPORT	(200)	SET
R*4	CUMGAS	REPORT	(200)	SET
R*4	CUMIA	REPORT	(200)	SET
R*4	CUMIW	REPORT	(200)	SET
R*4	CUMOB	REPORT	(200)	SET
R*4	CUMOIL	REPORT	(200)	SET
R*4	CUMWAT	REPORT	(200)	SET
R*4	DATE	ECO	(50)	SET
R*4	DCFBT	ECO	(50)	SET
R*4	DTIME	REPORT	(200)	SET
R*4	FOSC	REPORT	(200)	SET
R*4	FOSI	REPORT	(200)	SET
R*4	FRVS	REPORT	(200)	SET
R*4	MUCI	ECC	(50)	REF
R*4	MUCT	ECC	(50)	REF
R*4	MUDB	ECC	(50)	REF
R*4	MUED	ECC	(50)	REF
R*4	MUFO	ECC	(50)	REF
R*4	MUIN	ECC	(50)	REF
R*4	MUOPC	ECC	(50)	REF
R*4	MUPB	ECC	(50)	REF
R*4	MUPG	ECC	(50)	REF
R*4	MUPO	ECC	(50)	REF
R*4	MURP	ECC	(50)	REF
R*4	MUVG	ECC	(50)	REF
R*4	MUVI	ECC	(50)	REF

R*4	MUVO	ECC	(50)	SET
R*4	MUVW	ECC	(50)	REF
R*4	MUWO	ECC	(50)	REF
R*4	PATI	ECI	(50)	SET
R*4	POL	ECI	(50)	SET
R*4	PRGAS	REPORT	(200)	SET
R*4	PRODS	REPORT	(200)	SET
R*4	PROIL	REPORT	(200)	SET
R*4	PRWAT	REPORT	(200)	SET
R*4	RECOV	REPORT	(200)	SET
R*4	SIGOPC	ECC	(50)	SET
R*4	TIME	REPORT	(200)	SET
R*4	TITL	ECI	(20)	SET ARG
R*4	WATQ	REPORT	(200)	SET

5.2 SUBROUTINE TITLE

CALLED FROM : MAIN , INEC , OUTE

DESCRIPTION : PRINTS HEADER WITH RELEASE NUMBER

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
I*4	IW	FLAGS	REF

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	TITL	ARG	(20)	REF

5.3 SUBROUTINE INPUT

CALLED FROM : MAIN

DESCRIPTION : INPUT SUBROUTINE FOR RESERVOIR DATA

SUBROUTINES CALLED : CHEKR - DEFAULT CHECKING FOR RESERVOIR DATA
OUT1 - WRITES RESERVOIR DATA AND CASE CONTROLS

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	API	FPROP	SET
R*4	AREA	RESVR	SET
R*4	ARIN	RESVR	SET
R*4	BOI	RESVR	SET
R*4	BRNMX	RESVR	SET
R*4	BWI	RESVR	SET
R*4	DEPTH	RESVR	SET
R*4	FWA	RESVR	SET
I*4	IECON	FLAGS	SET
I*4	IERR	FLAGS	SET
I*4	ILIT	$LOCAL	SET
I*4	IPAT	FLAGS	SET
I*4	IR	FLAGS	REF
I*4	IRES	FLAGS	SET
I*4	IW	FLAGS	REF
I*4	IWRIT	FLAGS	SET
I*4	KAS	$LOCAL	ARG
R*4	PERM	RESVR	SET
R*4	PFORM	RESVR	SET
R*4	POROS	RESVR	SET
R*4	SGI	RESVR	SET
R*4	SOI	RESVR	SET
R*4	SWEEP	RESVR	SET
R*4	SWI	RESVR	SET
R*4	TFORM	RESVR	SET
R*4	TNET	RESVR	SET
R*4	VISO	RESVR	SET
R*4	WELLSP	RESVR	SET

5.4 SUBROUTINE CHEKR

CALLED FROM : INPUT

DESCRIPTION : DEFAULT CHECKING FOR RESERVOIR DATA

SUBROUTINES CALLED : VISC -CALCULATES LIQUID VISCOSITIES
FVF -ESTIMATES OIL, GAS AND WATER FORMATION VOLUME FACTORS

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	API	FPROP	SET
R*4	AREA	RESVR	SET
R*4	BOI	RESVR	SET
R*4	BOIS	$LOCAL	ARG REF
R*4	BRNMX	RESVR	SET
R*4	BWI	RESVR	SET
R*4	BWIS	$LOCAL	ARG REF
R*4	DEPTH	RESVR	SET
R*4	ERROR	$LOCAL	SET REF
R*4	GGRAD	$LOCAL	SET REF
I*4	IERR	FLAGS	SET
I*4	IW	FLAGS	REF
I*4	NZONE	FLAGS	SET
R*4	PERM	RESVR	SET
R*4	PFORM	RESVR	SET ARG
R*4	PGRAD	$LOCAL	SET REF
R*4	POROS	RESVR	SET
R*4	RS	FPROP	SET
R*4	SGG	FPROP	SET
R*4	SGI	RESVR	SET
R*4	SGO	FPROP	SET
R*4	SGW	FPROP	SET
R*4	SOI	RESVR	SET
R*4	SWI	RESVR	SET
R*4	TFORM	RESVR	SET ARG
R*4	TGRG	$LOCAL	SET REF
R*4	TNET	RESVR	SET
R*4	TNETOR	SPECPA	SET
R*4	TOTOIL	RESVR	SET
R*4	TVP	RESVR	SET
R*4	UNIT	$LOCAL	SET REF
R*4	VIS100	FPROP	SET
R*4	VIS210	FPROP	SET
R*4	VISO	RESVR	ARG
R*4	VISW	RESVR	ARG

R*4	WELLSP	RESVR	SET
R*4	XZONE	$LOCAL	SET REF

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	BB	FPROP	(42)	REF

5.5 SUBROUTINE OUT1

CALLED FROM : INPUT

DESCRIPTION : WRITES RESERVOIR DATA AND CASE CONTROLS

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	API	FPROP	REF
R*4	AREA	RESVR	REF
R*4	BOI	RESVR	REF
R*4	BWI	RESVR	REF
R*4	DEPTH	RESVR	REF
I*4	IECON	FLAGS	REF
I*4	IPAT	FLAGS	REF
I*4	IRES	FLAGS	REF
I*4	IW	FLAGS	REF
I*4	IWRIT	FLAGS	REF
I*4	NZONE	FLAGS	REF
R*4	PERM	RESVR	REF
R*4	PFORM	RESVR	REF
R*4	POROS	RESVR	REF
R*4	SGI	RESVR	REF
R*4	SOI	RESVR	REF
R*4	SWI	RESVR	REF
R*4	TFORM	RESVR	REF
R*4	TNET	RESVR	REF
R*4	TNETOR	SPECPA	REF
R*4	TOTOIL	RESVR	REF
R*4	TVP	RESVR	REF
R*4	VISO	RESVR	REF
R*4	WELLSP	RESVR	REF
R*4	XZONE	$LOCAL	SET REF

5.6 SUBROUTINE RESV

CALLED FROM : MAIN

DESCRIPTION : PREDICTS RESERVOIR PERFORMANCE, RECOVERY AND PRODUCTION RATES

SUBROUTINES CALLED : COEF1 - CALCULATES INPUT PARAMETERS FOR IN SITU COMBUSTION CALCULATIONS
COMB - RECOVERY PREDICTION BY METHOD OF BRIGHAM, SATMAN, AND SOLIMAN (1980)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	AREA	RESVR	ARG
R*4	AREAP	RESVR	ARG
R*4	ARIN	RESVR	REF
R*4	ARINJ	RESVR	ARG SET
R*4	FWA	RESVR	ARG
I*4	IRES	FLAGS	ARG
R*4	PERM	RESVR	ARG
R*4	PFORM	RESVR	ARG
R*4	PINJ	RESVR	ARG
R*4	SWEEP	RESVR	ARG
R*4	TNET	RESVR	ARG
R*4	VISO	RESVR	ARG
R*4	WELLSI	RESVR	ARG
R*4	WELLSP	RESVR	ARG

5.7 SUBROUTINE COEF1

CALLED FROM : RESV

DESCRIPTION : CALCULATES INPUT PARAMETERS FOR IN SITU COMBUSTION CALCULATIONS

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	AR	$LOCAL	SET REF
R*4	AREA	ARG	REF
R*4	AREAP	ARG	SET
R*4	ARINJ	ARG	SET
R*4	FWA	ARG	SET
I*4	IWELLS	$LOCAL	SET
R*4	PATVOL	$LOCAL	SET REF
R*4	PERM	ARG	REF
R*4	PINJ	ARG	SET
R*4	PLIFE	$LOCAL	SET REF
R*4	PRES	ARG	REF
R*4	SWEEP	ARG	SET
R*4	TNET	ARG	REF
R*4	VISO	ARG	REF
R*4	WELLSI	ARG	SET
R*4	WELLSP	ARG	REF

5.8 SUBROUTINE COMB

CALLED FROM : RESV

DESCRIPTION : RECOVERY PREDICTION BY METHOD OF BRIGHAM, SATMAN, AND SOLIMAN (1980)

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	AFR	RESVR	SET
R*4	AINJ	$LOCAL	SET REF
R*4	AIROLD	$LOCAL	SET REF
R*4	AR	RESVR	SET
R*4	AREAP	RESVR	REF
R*4	ARINJ	RESVR	REF
R*4	BOI	RESVR	REF
R*4	BWI	RESVR	REF
R*4	C1	$LOCAL	SET REF
R*4	C2	$LOCAL	SET REF
R*4	DEPTH	RESVR	REF
R*4	DT	$LOCAL	SET REF
R*4	DTS	$LOCAL	SET REF
R*4	DUMMY	$LOCAL	SET REF
R*4	FWA	RESVR	REF
R*4	GASOLD	$LOCAL	SET REF
R*4	HPP	RESVR	SET
I*4	I	$LOCAL	SET REF
I*4	IJ1	FLAGS	SET
I*4	NZONE	FLAGS	REF
R*4	OILBF	RESVR	SET
R*4	OILOLD	$LOCAL	SET REF
R*4	OIP	RESVR	SET
R*4	PDP	RESVR	SET
R*4	PINJ	RESVR	REF
R*4	POROS	RESVR	REF
R*4	SOI	RESVR	REF
R*4	SWEEP	RESVR	REF
R*4	SWR	$LOCAL	SET REF
R*4	TNET	RESVR	REF
R*4	TOPK	$LOCAL	SET REF
R*4	UNIT	$LOCAL	SET REF
R*4	VB	$LOCAL	SET REF
R*4	VISO	RESVR	REF
R*4	VS	$LOCAL	SET REF
R*4	WAPOLD	$LOCAL	SET REF

R*4	WATOLD	$LOCAL	SET REF
R*4	X	$LOCAL	SET REF
R*4	XXL	$LOCAL	SET REF

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	AIRQ	REPORT	(200)	SET
R*4	CUMAW	REPORT	(200)	SET
R*4	CUMGAS	REPORT	(200)	SET
R*4	CUMIA	REPORT	(200)	SET
R*4	CUMIW	REPORT	(200)	SET
R*4	CUMOB	REPORT	(200)	SET
R*4	CUMOIL	REPORT	(200)	SET
R*4	CUMWAT	REPORT	(200)	SET
R*4	FOSC	REPORT	(200)	SET
R*4	FOSI	REPORT	(200)	SET
R*4	FRVS	REPORT	(200)	SET
R*4	PRGAS	REPORT	(200)	SET
R*4	PROIL	REPORT	(200)	SET
R*4	PRWAT	REPORT	(200)	SET
R*4	RECOV	REPORT	(200)	SET
R*4	TIME	REPORT	(200)	SET
R*4	WATQ	REPORT	(200)	SET

5.9 SUBROUTINE OUTR

CALLED FROM : MAIN

DESCRIPTION : WRITES RESERVOIR RECOVERY AND PRODUCTION REPORTS

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	AFR	RESVR	REF
R*4	AR	RESVR	REF
R*4	AREAP	RESVR	REF
R*4	ARINJ	RESVR	REF
R*4	FWA	RESVR	REF
R*4	HPP	RESVR	REF
I*4	I	$LOCAL	SET REF
I*4	IJ1	FLAGS	REF
I*4	IW	FLAGS	REF
I*4	IWRIT	FLAGS	REF
R*4	OIP	RESVR	REF
R*4	PDP	RESVR	REF
R*4	PINJ	RESVR	REF
R*4	RECO	$LOCAL	SET REF
R*4	SWEEP	RESVR	REF
R*4	UNIT	$LOCAL	SET

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	AIRQ	REPORT	(200)	REF
R*4	CUMGAS	REPORT	(200)	REF
R*4	CUMIA	REPORT	(200)	REF
R*4	CUMIW	REPORT	(200)	REF
R*4	CUMOIL	REPORT	(200)	REF
R*4	CUMWAT	REPORT	(200)	REF
R*4	FOSC	REPORT	(200)	REF
R*4	FRVS	REPORT	(200)	REF
R*4	PRGAS	REPORT	(200)	REF
R*4	PROIL	REPORT	(200)	REF
R*4	PRWAT	REPORT	(200)	REF
R*4	RECOV	REPORT	(200)	REF
R*4	TIME	REPORT	(200)	REF
R*4	WATQ	REPORT	(200)	REF

5.10 SUBROUTINE FVF

CALLED FROM : CHEKR

DESCRIPTION : ESTIMATES OIL, GAS AND WATER FORMATION VOLUME FACTORS

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	API	FPROP	REF
R*4	BO	ARG	SET
R*4	BW	ARG	SET
R*4	C1	$LOCAL	SET REF
R*4	C2	$LOCAL	SET REF
R*4	C3	$LOCAL	SET REF
R*4	PRES	ARG	REF
R*4	RHOIL	$LOCAL	SET
R*4	RHWAT	$LOCAL	SET
R*4	RS	FPROP	SET
R*4	RSS	$LOCAL	SET REF
R*4	SGG	FPROP	REF
R*4	SGO	FPROP	REF
R*4	SGW	FPROP	REF
R*4	TEMP	ARG	SET

5.11 SUBROUTINE VISC

CALLED FROM : CHEKR

DESCRIPTION : CALCULATES LIQUID VISCOSITIES

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	RS	FPROP	REF
R*4	SLOPE	$LOCAL	SET REF
R*4	TAV	$LOCAL	SET REF
R*4	TEMP	ARG	REF
R*4	VIS	$LOCAL	SET REF
R*4	VIS100	FPROP	REF
R*4	VIS210	FPROP	REF
R*4	VISO	ARG	SET
R*4	VISW	ARG	SET
R*4	YINT	$LOCAL	SET REF

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	BB	FPROP	(42)	REF

5.12 SUBROUTINE SDINT

CALLED FROM : INEC , CHEKE

DESCRIPTION : SINGLE DIMENSIONAL LINEAR INTERPOLATION

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
I*4	I	$LOCAL	SET REF
I*4	J	$LOCAL	SET REF
I*4	N	ARG	REF
R*4	SLOPE	$LOCAL	SET REF
R*4	THESIN	$LOCAL	SET REF
R*4	XVAL	ARG	REF

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	XARG	ARG	(200)	REF
R*4	YARG	ARG	(200)	REF

5.13 SUBROUTINE INEC

CALLED FROM : MAIN

DESCRIPTION : INPUTS ECONOMIC DATA, INITIALIZES ECONOMIC ARRAYS, WRITES ECONOMIC DATA, AND CALCULATES PROJECT PERFORMANCE FROM PATTERN RESULTS

SUBROUTINES CALLED : TITLE - PRINTS HEADER WITH RELEASE NUMBER
SDINT - SINGLE DIMENSIONAL LINEAR INTERPOLATION
ECFTR - CALCULATES COST ADJUSTMENT FACTORS DUE TO CHANGES IN OIL PRICE
CHEKE - DEFAULT CHECKING FOR ECONOMIC DATA
STCDE - GIVEN STATE ALPHA, COMPUTES STATE CODE, OR GIVEN STATE CODE, COMPUTES STATE ALPHA

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	AHP	$LOCAL	SET REF
R*4	AMAX	$LOCAL	SET REF
R*4	AOVH1	ECO	REF
R*4	API	FPROP	ARG
R*4	AREAP	RESVR	ARG
R*4	BPOW	ECI	SET
R*4	BTIM	ECI	SET
R*4	CAP	$LOCAL	SET REF
R*4	CAPG	$LOCAL	SET REF
R*4	CAPP	$LOCAL	SET REF
R*4	CAPT	$LOCAL	SET REF
R*4	CAPW	$LOCAL	SET REF
R*4	CCOST	ECI	SET
R*4	CEQP	ECS	REF
R*4	CG	$LOCAL	SET REF
R*4	CGS	$LOCAL	SET REF
R*4	CH	$LOCAL	SET REF
R*4	CHS	$LOCAL	SET REF
R*4	CI	$LOCAL	SET REF
R*4	CICMX	$LOCAL	SET REF
R*4	CINJ	ECS	REF
R*4	CIS	$LOCAL	SET REF
R*4	CNVT	ECS	REF
R*4	CO	$LOCAL	SET REF
R*4	COS	$LOCAL	SET REF
R*4	COST	$LOCAL	SET REF
R*4	COSTML	ECI	SET
R*4	COSTRT	ECI	SET
R*4	COSTTI	ECI	SET

R*4	CREP	ECS	REF
R*4	CSEC	ECS	REF
R*4	CTACR	ECI	SET
R*4	CTCMX	$LOCAL	SET REF
R*4	CUMOX	$LOCAL	SET REF
R*4	CW	$LOCAL	SET REF
R*4	CWS	$LOCAL	SET REF
R*4	DBTINT	ECI	SET
R*4	DCE	ECI	SET
R*4	DECL	ECI	SET
R*4	DEFF	$LOCAL	SET REF
R*4	DEPTH	RESVR	ARG
R*4	DMAX	$LOCAL	SET
R*4	DPP1	$LOCAL	SET REF
R*4	DPP2	$LOCAL	SET REF
R*4	DPP3	$LOCAL	SET REF
R*4	DPP4	$LOCAL	SET REF
R*4	DTIM	ECI	SET
R*4	EPHO	ECI	SET
R*4	ESCBP	ECI	REF
R*4	ESCCI	ECI	SET
R*4	ESCCT	ECI	SET
R*4	ESCED	ECI	SET
R*4	ESCFO	ECI	SET
R*4	ESCPG	ECI	REF
R*4	ESCPO	ECI	SET
R*4	ESCWO	ECI	SET
R*4	FACT	ARG	ARG
R*4	FACTOR	$LOCAL	SET REF
R*4	FDC	ARG	ARG
R*4	FEQP	ARG	ARG
R*4	FOCPH	ECI	SET
R*4	FOCPL	ECI	SET
R*4	FOCPM	ECI	SET
R*4	FOPR	ARG	ARG
R*4	FUEL	ARG	ARG
R*4	GENCX	$LOCAL	SET REF
R*4	GTRT	ECI	SET
R*4	HPMAX	$LOCAL	SET REF
R*4	HPP	RESVR	REF
I*4	I	$LOCAL	SET REF
I*4	I2	$LOCAL	SET REF
I*4	I3	$LOCAL	SET REF
I*4	ICI	$LOCAL	SET
I*4	ICT	$LOCAL	SET
I*4	IDAT	$LOCAL	SET REF
I*4	IDEBT	ECI	SET
I*4	IDEP	ECI	REF
I*4	IDEVT	$LOCAL	SET REF
I*4	IDISC	ECI	SET

I*4	IDIST	ECI	SET
I*4	IFIT	ECI	SET
I*4	IOUT	ECI	SET
I*4	IR	FLAGS	REF
I*4	ISO	ECI	SET
I*4	ISTATE	ECI	SET ARG
I*4	ITIM	ARG	ARG
I*4	IW	FLAGS	REF
I*4	J	$LOCAL	SET REF
I*4	JR	$LOCAL	SET REF
I*4	JST	$LOCAL	ARG REF
I*4	K	$LOCAL	SET REF
I*4	KYR	$LOCAL	SET REF
I*4	LPAT	$LOCAL	SET REF
I*4	LSTRT	$LOCAL	SET REF
I*4	LYR	$LOCAL	SET REF
I*4	M	ECI	SET
R*4	MUPPV	ECS	REF
I*4	MYR	ECI	REF
I*4	NCI	$LOCAL	SET REF ARG
I*4	NCT	$LOCAL	SET REF ARG
I*4	NSEQ	$LOCAL	SET REF
I*4	NYPAID	ECI	SET
I*4	NYRRPY	ECI	SET
I*4	NZONE	FLAGS	REF
R*4	OILB	ECI	SET
R*4	OILC	ECI	SET
R*4	OILD	$LOCAL	SET REF
R*4	OMAX	$LOCAL	SET REF
R*4	PCTDBT	ECI	SET
R*4	PLANT	ECI	SET
R*4	PRICEI	ARG	SET ARG
R*4	QGX	$LOCAL	SET REF
R*4	QHX	$LOCAL	SET REF
R*4	QIX	$LOCAL	SET REF
R*4	QOX	$LOCAL	SET REF
R*4	QWX	$LOCAL	SET REF
R*4	RECOX	$LOCAL	SET REF
R*4	REV	$LOCAL	SET REF
R*4	SUMP	$LOCAL	SET REF
R*4	TIMX	$LOCAL	SET REF
R*4	TOTOIL	RESVR	REF
R*4	UNCO	ECI	SET
R*4	UNIT	$LOCAL	SET REF
R*4	WCAP	ECI	SET
R*4	WDCOST	ECI	SET
R*4	WMAX	$LOCAL	SET REF
R*4	WOCOST	ECI	SET
R*4	WOPCT	$LOCAL	SET REF
R*4	WPHO	ECI	SET

R*4	WPP1	ECI	SET
R*4	WPP2	ECI	SET
R*4	WPP3	ECI	SET
R*4	WPP4	ECI	SET
R*4	WSUM	$LOCAL	SET REF
R*4	WTCOST	ECI	SET
R*4	WTRT	ECI	SET
R*4	WWO	$LOCAL	SET
R*4	XDR	ECI	SET
R*4	XFIT	ECI	SET
R*4	XINF	ECI	SET
R*4	XROY	ECI	SET
R*4	XSEV	ECI	SET
R*4	XSTX	ECI	SET
R*4	XTCR	ECI	SET
R*4	XWPT	ECI	SET
R*4	XXPAT	$LOCAL	SET REF
R*4	YR	$LOCAL	SET ARG

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	AOVH	ECO	(50)	SET
R*4	AQIR	ECO	(50)	SET
R*4	BPO	ECI	(50)	SET
R*4	CICH	ECI	(50)	SET
R*4	CICL	ECI	(50)	SET
R*4	CICM	ECI	(50)	SET
R*4	CIPH	ECI	(50)	SET
R*4	CIPL	ECI	(50)	SET
R*4	CIPM	ECI	(50)	SET
R*4	CML	ECI	(50)	SET
R*4	CTCH	ECI	(50)	SET
R*4	CTCL	ECI	(50)	SET
R*4	CTCM	ECI	(50)	SET
R*4	CTI	ECI	(50)	SET
R*4	CTPH	ECI	(50)	SET
R*4	CTPL	ECI	(50)	SET
R*4	CTPM	ECI	(50)	SET
R*4	CUMGAS	REPORT	(200)	ARG
R*4	CUMIA	REPORT	(200)	ARG
R*4	CUMIW	REPORT	(200)	ARG
R*4	CUMOIL	REPORT	(200)	ARG
R*4	CUMWAT	REPORT	(200)	ARG
R*4	DATE	ECO	(50)	SET
R*4	EDPH	ECI	(50)	SET
R*4	EDPL	ECI	(50)	SET
R*4	EDPM	ECI	(50)	SET

R*4	FOCH	ECI	(50)	SET
R*4	FOCL	ECI	(50)	SET
R*4	FOCM	ECI	(50)	SET
R*4	GENC	ECI	(50)	SET
R*4	MUCI	ECC	(50)	SET
R*4	MUCT	ECC	(50)	SET
R*4	MUDB	ECC	(50)	SET
R*4	MUED	ECC	(50)	SET
R*4	MUFO	ECC	(50)	SET
R*4	MUIN	ECC	(50)	SET
R*4	MUOPC	ECC	(50)	SET
R*4	MUPB	ECC	(50)	SET
R*4	MUPG	ECC	(50)	SET
R*4	MUPO	ECC	(50)	SET
R*4	MURP	ECC	(50)	SET
R*4	MUVG	ECC	(50)	SET
R*4	MUVI	ECC	(50)	SET
R*4	MUVO	ECC	(50)	SET
R*4	MUVW	ECC	(50)	SET
R*4	MUWO	ECC	(50)	SET
R*4	OILR	ECI	(50)	SET
R*4	OPCH	ECI	(50)	SET
R*4	OPCL	ECI	(50)	SET
R*4	OPCM	ECI	(50)	SET
R*4	PATI	ECI	(50)	SET
R*4	PATIOX	ECI	(50)	SET
R*4	PGH	ECI	(50)	SET
R*4	PGL	ECI	(50)	SET
R*4	PGM	ECI	(50)	SET
R*4	POH	ECI	(50)	SET
R*4	POL	ECI	(50)	SET
R*4	POM	ECI	(50)	SET
R*4	QHM	ECI	(50)	SET
R*4	QHP	ECI	(50)	SET
R*4	SIGCI	ECC	(50)	SET
R*4	SIGCT	ECC	(50)	SET
R*4	SIGED	ECC	(50)	SET
R*4	SIGFO	ECC	(50)	SET
R*4	SIGOPC	ECC	(50)	SET
R*4	SIGPF	ECC	(50)	SET
R*4	SIGPG	ECC	(50)	SET
R*4	SIGPO	ECC	(50)	SET
R*4	SIGVO	ECC	(50)	SET
R*4	TIME	REPORT	(200)	ARG
R*4	TITL	ECI	(20)	ARG
R*4	VDM	ECI	(50)	SET
R*4	VGM	ECI	(50)	SET
R*4	VGP	ECI	(50)	SET
R*4	VHM	ECI	(50)	SET
R*4	VHP	ECI	(50)	SET

R*4	VIM	ECI	(50)	SET
R*4	VIP	ECI	(50)	SET
R*4	VOH	ECI	(50)	SET
R*4	VOL	ECI	(50)	SET
R*4	VOM	ECI	(50)	SET
R*4	VOP	ECI	(50)	SET
R*4	VOS	ECI	(50)	SET
R*4	VWM	ECI	(50)	SET
R*4	VWP	ECI	(50)	SET
R*4	WDC	ECI	(50)	SET
R*4	WO	ECI	(50)	SET
R*4	WTC	ECI	(50)	SET

5.14 SUBROUTINE STCDE

CALLED FROM : INEC

DESCRIPTION : GIVEN STATE ALPHA, COMPUTES STATE CODE, OR
GIVEN STATE CODE, COMPUTES STATE ALPHA

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
I*4	I	$LOCAL	SET REF
I*4	IST	ARG	SET
I*4	K	$LOCAL	SET
I*4	ST	ARG	SET

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
I*4	STATE	$LOCAL	(53)	REF

5.15 SUBROUTINE CHEKE

CALLED FROM : INEC

DESCRIPTION : DEFAULT CHECKING FOR ECONOMIC DATA

SUBROUTINES CALLED : SDINT - SINGLE DIMENSIONAL LINEAR INTERPOLATION
CIND - DEFINES DEFAULT VALUES FOR PROCESS INDEPENDENT COST DATA

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	ACRES	ARG	REF
R*4	AOVH1	ECO	SET
R*4	API	ARG	ARG
R*4	BPOW	ECI	SET
R*4	BTIM	ECI	SET
R*4	CAP	$LOCAL	SET REF
R*4	CCOST	ECI	SET
R*4	CDAO	ECS	ARG
R*4	CEQP	ECS	ARG
R*4	CINJ	ECS	ARG
R*4	CIWO	ECS	ARG
R*4	CNVT	ECS	ARG
R*4	COSTML	ECI	SET
R*4	COSTTI	ECI	SET
R*4	CREP	ECS	ARG SET
R*4	CSEC	ECS	ARG
R*4	CTACR	ECI	SET
R*4	DBTINT	ECI	SET
R*4	DCE	ECI	SET
R*4	DCE1	$LOCAL	SET REF
R*4	DECL	ECI	SET
R*4	DEPTH	ARG	ARG
R*4	DTIM	ECI	SET
R*4	EPHO	ECI	SET
R*4	ESC	$LOCAL	SET REF
R*4	ESCBP	ECI	SET
R*4	ESCCI	ECI	SET
R*4	ESCCT	ECI	SET
R*4	ESCED	ECI	SET
R*4	ESCFO	ECI	SET
R*4	ESCPG	ECI	SET
R*4	ESCPO	ECI	SET
R*4	ESCWO	ECI	SET
R*4	FACTOR	$LOCAL	SET REF
R*4	GTRT	ECI	SET

I*4	I	$LOCAL	SET REF
I*4	IDEP	ECI	SET
I*4	IDIST	ECI	ARG
I*4	ISO	ECI	REF
I*4	ISTATE	ECI	ARG
I*4	M	ECI	REF
R*4	MUPPV	ECS	REF
I*4	MYR	ECI	SET
I*4	NYPAID	ECI	SET
I*4	NYRRPY	ECI	SET
R*4	OILB	ECI	SET
R*4	OILC	ECI	SET
R*4	PCTDBT	ECI	SET
R*4	PLANT	ECI	SET
R*4	UNCO	ECI	SET
R*4	UNIT	$LOCAL	SET REF
R*4	WCAP	ECI	SET
R*4	WCI	$LOCAL	SET REF
R*4	WCT	$LOCAL	SET REF
R*4	WDCOST	ECI	SET
R*4	WMAX	$LOCAL	ARG
R*4	WOCOST	ECI	SET
R*4	WPHO	ECI	SET
R*4	WPP1	ECI	REF
R*4	WPP2	ECI	REF
R*4	WPP3	ECI	REF
R*4	WPP4	ECI	REF
R*4	WTCOST	ECI	SET
R*4	WTRT	ECI	SET
R*4	XDR	ECI	SET
R*4	XFIT	ECI	SET
R*4	XINF	ECI	SET
R*4	XPRICE	$LOCAL	SET REF
R*4	XROY	ECI	SET
R*4	XSEV	ECI	SET
R*4	XSTX	ECI	SET
R*4	XTCR	ECI	SET

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	API1	$LOCAL	(5)	REF ARG
R*4	API2	$LOCAL	(5)	REF ARG
R*4	BPO	ECI	(50)	SET
R*4	CIPH	ECI	(50)	SET
R*4	CIPL	ECI	(50)	SET
R*4	CIPM	ECI	(50)	SET
R*4	CML	ECI	(50)	SET

R*4	CTI	ECI	(50)	SET
R*4	CTPH	ECI	(50)	SET
R*4	CTPL	ECI	(50)	SET
R*4	CTPM	ECI	(50)	SET
R*4	DATE	ECO	(50)	SET
R*4	EDPH	ECI	(50)	SET
R*4	EDPL	ECI	(50)	SET
R*4	EDPM	ECI	(50)	SET
R*4	FOCH	ECI	(50)	SET
R*4	FOCL	ECI	(50)	SET
R*4	FOCM	ECI	(50)	SET
R*4	OILP1	$LOCAL	(5)	REF ARG
R*4	OILP2	$LOCAL	(5)	REF ARG
R*4	OPCH	ECI	(50)	SET
R*4	OPCL	ECI	(50)	SET
R*4	OPCM	ECI	(50)	SET
R*4	PGH	ECI	(50)	SET
R*4	PGL	ECI	(50)	SET
R*4	PGM	ECI	(50)	SET
R*4	POH	ECI	(50)	SET
R*4	POL	ECI	(50)	SET
R*4	POM	ECI	(50)	SET
R*4	VOS	ECI	(50)	SET
R*4	WDC	ECI	(50)	SET
R*4	WO	ECI	(50)	SET
R*4	WTC	ECI	(50)	SET

5.16 SUBROUTINE CIND

CALLED FROM : CHEKE

DESCRIPTION : DEFINES DEFAULT VALUES FOR PROCESS INDEPENDENT COST DATA

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	CDAO	ARG	SET
R*4	CEQP	ARG	SET
R*4	CINJ	ARG	SET
R*4	CIWO	ARG	SET
R*4	CNVT	ARG	SET
R*4	CREP	ARG	SET
R*4	CSEC	ARG	SET
R*4	DEPTH	ARG	REF
I*4	IDIST	ARG	REF
I*4	ISTATE	ARG	REF
R*4	PRGAS	ARG	REF
R*4	RATE	ARG	REF

5.17 SUBROUTINE ECFTR

CALLED FROM : INEC

DESCRIPTION : CALCULATES COST ADJUSTMENT FACTORS DUE TO CHANGES IN OIL PRICE

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	FACT	ARG	SET
R*4	FDC	ARG	SET
R*4	FEQP	ARG	SET
R*4	FOPR	ARG	SET
R*4	FUEL	ARG	SET
I*4	ISTATE	ARG	REF
R*4	PRICE	ARG	REF

5.18 SUBROUTINE ECON

CALLED FROM : MAIN

DESCRIPTION : CALCULATES ANNUAL CASH FLOW (REVENUES, COSTS AND TAXES), CALCULATES CAPITAL DEPRECIATION AND PRESENT VALUE

SUBROUTINES CALLED : DCFROR - COMPUTES DCF RATE OF RETURN

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	API	ARG	REF
R*4	BPONE	$LOCAL	SET REF
R*4	BTINC	$LOCAL	SET REF
R*4	CC	ECS	SET
R*4	CCC	$LOCAL	SET REF
R*4	CCD	$LOCAL	SET REF
R*4	CFATT	$LOCAL	SET ARG
R*4	CFMAX	$LOCAL	SET REF
L*4	CHKR1	$LOCAL	REF
L*4	CHKR2	$LOCAL	REF
R*4	CINV	$LOCAL	SET REF
R*4	COSR	ECS	SET
R*4	COSTRT	ECI	SET ARG
R*4	CREC	$LOCAL	SET REF
R*4	CTXC	$LOCAL	SET REF
R*4	DBTINT	ECI	REF
R*4	DCFB	ECS	SET
R*4	DEPAMT	$LOCAL	SET REF
R*4	DIFF	$LOCAL	SET REF
R*4	DNB	ECS	SET
R*4	DTIM	ECI	ARG
R*4	EFFINV	ECS	ARG
R*4	EPHO	ECI	REF
R*4	EQAP	$LOCAL	SET REF
R*4	FACT	ARG	REF
R*4	FDC	ARG	REF
R*4	FEQP	ARG	REF
R*4	FOPR	ARG	REF
I*4	I	$LOCAL	SET REF
I*4	IDEBT	ECI	REF
I*4	IDEP	ECI	REF
I*4	IDISC	ECI	ARG
I*4	IDT	$LOCAL	SET REF
I*4	IFIT	ECI	REF
I*4	IHJH	$LOCAL	SET REF
I*4	ILIF	$LOCAL	SET REF

I*4	IOUT	ECI	ARG
I*4	IPAY	$LOCAL	SET REF
I*4	ISTATE	ECI	REF
I*4	IW	FLAGS	REF
I*4	J	$LOCAL	SET REF
I*4	JL	$LOCAL	SET REF
I*4	JU	$LOCAL	SET REF
I*4	M	ECI	REF
I*4	M1	$LOCAL	SET REF
R*4	MUPPV	ECS	SET ARG
I*4	MYR	ECI	SET
I*4	NYPAID	ECI	REF
I*4	NYRRPY	ECI	REF
R*4	ONPKAI	$LOCAL	SET
R*4	ONPKNO	$LOCAL	SET
R*4	OPCI	$LOCAL	SET REF
R*4	OPCS	$LOCAL	SET REF
R*4	PAYOUT	ECS	SET
R*4	PCTDBT	ECI	REF
R*4	PLIFE	ECS	SET
R*4	ROR	ECS	ARG SET
R*4	SCIPV	$LOCAL	SET REF
R*4	SCTPV	$LOCAL	SET REF
R*4	SEDPV	$LOCAL	SET REF
R*4	SFOPV	$LOCAL	SET REF
R*4	SIGCI2	$LOCAL	SET REF
R*4	SIGCT2	$LOCAL	SET REF
R*4	SIGED2	$LOCAL	SET REF
R*4	SIGFO2	$LOCAL	SET REF
R*4	SIGG2	$LOCAL	SET REF
R*4	SIGO2	$LOCAL	SET REF
R*4	SINT	ECS	SET
R*4	SNOS	ECS	SET
R*4	SOPCP	$LOCAL	SET REF
R*4	SPGPV	$LOCAL	SET REF
R*4	SPOPV	$LOCAL	SET REF
R*4	SPRP	ECS	SET
R*4	SRPV	ECS	SET
R*4	SSEV	ECS	SET
R*4	SSIGCI	$LOCAL	SET REF
R*4	SSIGCT	$LOCAL	SET REF
R*4	SSIGED	$LOCAL	SET REF
R*4	SSIGFO	$LOCAL	SET REF
R*4	SSIGG	$LOCAL	SET REF
R*4	SSIGO	$LOCAL	SET REF
R*4	STDDEV	ECS	SET
R*4	SUMCI	ECS	SET
R*4	SUMED	ECS	SET
R*4	SUMFO	ECS	SET
R*4	SUMML	ECS	SET

R*4	SUMOH	ECS	SET
R*4	SUMOPC	ECS	SET
R*4	SUMP	$LOCAL	SET
R*4	SUMTD	$LOCAL	SET
R*4	SUMTI	ECS	SET
R*4	SUMTO	$LOCAL	SET
R*4	SUMVIM	$LOCAL	SET REF
R*4	SUMVOM	ECS	SET
R*4	SUMWC	ECS	SET
R*4	SUMWD	ECS	SET
R*4	SUMWO	ECS	SET
R*4	SUMWT	ECS	SET
R*4	SVGS	ECS	SET
R*4	SVON	ECS	SET
R*4	SVOS	ECS	SET
R*4	TCRED	$LOCAL	SET REF
R*4	TOTD	ECS	SET ARG
R*4	UATP	ECS	SET
R*4	UCFB	ECS	SET
R*4	UFIT	ECS	SET
R*4	UINT	ECS	SET
R*4	ULOAN	ECS	SET
R*4	UMM	$LOCAL	SET REF
R*4	UNIT	$LOCAL	SET REF
R*4	UNOS	ECS	SET
R*4	URPV	ECS	SET
R*4	USCI	ECS	SET
R*4	USED	ECS	SET
R*4	USEV	ECS	SET
R*4	USFO	ECS	SET
R*4	USIT	ECS	SET
R*4	USML	ECS	SET
R*4	USOH	ECS	SET
R*4	USOPC	ECS	SET
R*4	USTC	ECS	SET
R*4	USTI	ECS	SET
R*4	USTO	ECS	SET
R*4	USWD	ECS	SET
R*4	USWO	ECS	SET
R*4	USWT	ECS	SET
R*4	UWCAP	ECS	SET
R*4	UWPT	ECS	SET
R*4	VOSOLD	$LOCAL	SET REF
R*4	WCAP	ECI	REF
R*4	WPHO	ECI	REF
R*4	WPHOF	$LOCAL	SET REF
R*4	XCRED	$LOCAL	SET REF
R*4	XDR	ECI	ARG
R*4	XFIT	ECI	ARG
R*4	XINF	ECI	ARG

R*4	XONE	$LOCAL	SET REF
R*4	XROY	ECI	REF
R*4	XSEV	ECI	REF
R*4	XSTX	ECI	REF
R*4	XTCR	ECI	REF
R*4	XTHREE	$LOCAL	SET REF
R*4	XWC	$LOCAL	SET REF
R*4	XWPT	ECI	REF
R*4	XX	$LOCAL	SET REF
R*4	YC	$LOCAL	SET REF
R*4	YY	$LOCAL	SET REF

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	ACAP	ECO	(50)	SET
R*4	ACML	ECO	(50)	SET
R*4	ACOST	ECO	(50)	SET
R*4	ACRS	$LOCAL	(5, 3)	REF
R*4	AEDP	ECO	(50)	SET
R*4	AFIT	ECO	(50)	SET
R*4	AFOC	ECO	(50)	SET
R*4	ANET	ECO	(50)	SET
R*4	ANOI	ECO	(50)	SET
R*4	ANTI	ECO	(50)	SET
R*4	AOVH	ECO	(50)	SET
R*4	AQGR	ECO	(50)	SET
R*4	AQIR	ECO	(50)	SET
R*4	AQOR	ECO	(50)	SET
R*4	AQWR	ECO	(50)	SET
R*4	AREV	ECO	(50)	SET
R*4	AREVG	ECO	(50)	SET
R*4	AREVO	ECO	(50)	SET
R*4	AROY	ECO	(50)	SET
R*4	ARVWPT	ECO	(50)	SET
R*4	ASEV	ECO	(50)	SET
R*4	ASTX	ECO	(50)	SET
R*4	ATIN	ECO	(50)	SET
R*4	ATPR	ECO	(50)	SET
R*4	AVOC	ECO	(50)	SET
R*4	AWCP	ECO	(50)	SET
R*4	AWDC	ECO	(50)	SET
R*4	AWPP	ECO	(50)	SET
R*4	AWPT	ECO	(50)	SET
R*4	AWTC	ECO	(50)	SET
R*4	BPO	ECI	(50)	REF
R*4	CDAT	ECO	(50)	SET
R*4	CDBT	ECO	(50)	SET

R*4	CFAT	ECO	(50)	SET
R*4	CFBT	ECO	(50)	SET
R*4	CICH	ECI	(50)	REF
R*4	CICL	ECI	(50)	REF
R*4	CICM	ECI	(50)	REF
R*4	CML	ECI	(50)	REF
R*4	CNOI	ECO	(50)	SET
R*4	CTCH	ECI	(50)	REF
R*4	CTCL	ECI	(50)	REF
R*4	CTCM	ECI	(50)	REF
R*4	CTI	ECI	(50)	REF
R*4	DATE	ECO	(50)	REF
R*4	DCFAT	ECO	(50)	SET
R*4	DCFBT	ECO	(50)	SET
R*4	DEPS	ECO	(50)	SET
R*4	EDPH	ECI	(50)	REF
R*4	EDPL	ECI	(50)	REF
R*4	EDPM	ECI	(50)	REF
R*4	FOCH	ECI	(50)	REF
R*4	FOCL	ECI	(50)	REF
R*4	FOCM	ECI	(50)	REF
R*4	MUCI	ECC	(50)	SET
R*4	MUCT	ECC	(50)	SET
R*4	MUDB	ECC	(50)	SET
R*4	MUED	ECC	(50)	SET
R*4	MUFO	ECC	(50)	SET
R*4	MUIN	ECC	(50)	SET
R*4	MUOPC	ECC	(50)	SET
R*4	MUPB	ECC	(50)	SET
R*4	MUPG	ECC	(50)	SET
R*4	MUPO	ECC	(50)	SET
R*4	MURP	ECC	(50)	SET
R*4	MUVG	ECC	(50)	SET
R*4	MUVI	ECC	(50)	SET
R*4	MUVO	ECC	(50)	SET
R*4	MUVW	ECC	(50)	SET
R*4	MUWO	ECC	(50)	SET
R*4	OILR	ECI	(50)	REF
R*4	OPCH	ECI	(50)	REF
R*4	OPCL	ECI	(50)	REF
R*4	OPCM	ECI	(50)	REF
R*4	PATI	ECI	(50)	REF
R*4	PGH	ECI	(50)	REF
R*4	PGL	ECI	(50)	REF
R*4	PGM	ECI	(50)	REF
R*4	POH	ECI	(50)	REF
R*4	POL	ECI	(50)	REF
R*4	POM	ECI	(50)	REF
R*4	PVDF	ECO	(50)	SET
R*4	QHM	ECI	(50)	REF

R*4	SIGCI	ECC	(50)	SET
R*4	SIGCT	ECC	(50)	SET
R*4	SIGED	ECC	(50)	SET
R*4	SIGFO	ECC	(50)	SET
R*4	SIGOPC	ECC	(50)	SET
R*4	SIGPG	ECC	(50)	SET
R*4	SIGPO	ECC	(50)	SET
R*4	SIGVO	ECC	(50)	SET
R*4	TXCR	ECO	(50)	SET
R*4	VDM	ECI	(50)	REF
R*4	VGM	ECI	(50)	REF
R*4	VGNET	ECO	(50)	SET
R*4	VIM	ECI	(50)	REF
R*4	VOH	ECI	(50)	REF
R*4	VOL	ECI	(50)	REF
R*4	VOM	ECI	(50)	REF
R*4	VONET	ECO	(50)	SET
R*4	VOSLD	ECO	(50)	SET
R*4	VWM	ECI	(50)	REF
R*4	WDC	ECI	(50)	REF
R*4	WO	ECI	(50)	REF
R*4	WTC	ECI	(50)	REF

5.19 SUBROUTINE DCFROR

CALLED FROM : ECON

DESCRIPTION : COMPUTES DCF RATE OF RETURN

SUBROUTINES CALLED : (NONE)

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	CCF	$LOCAL	SET REF
R*4	COSTRT	ARG	REF
I*4	COUNT	$LOCAL	REF
R*4	DCFATP	$LOCAL	SET REF
R*4	DCFATT	$LOCAL	SET REF
R*4	DMUL	$LOCAL	SET REF
R*4	EFFINV	ARG	SET
I*4	I	$LOCAL	SET REF
I*4	IDISC	ARG	REF
I*4	IOUT	ARG	REF
I*4	IT	$LOCAL	SET REF
I*4	ITMAX	$LOCAL	SET REF
I*4	IW	FLAGS	REF
I*4	J	$LOCAL	SET REF
L*4	MARK	$LOCAL	REF SET
R*4	MAXNCF	$LOCAL	REF SET
I*4	MUPPV	$LOCAL	SET
R*4	MUSPV	$LOCAL	REF SET
R*4	MUXPV	ARG	REF
I*4	MYR	ARG	REF
I*4	NEGYR	$LOCAL	SET
I*4	NSCHG	$LOCAL	SET REF
R*4	ROR	ARG	SET
R*4	SUMNCF	$LOCAL	SET REF
R*4	SUMPCF	$LOCAL	SET REF
R*4	T1	$LOCAL	SET REF
R*4	T2	$LOCAL	SET REF
R*4	XDR	ARG	REF
R*4	XDRN	$LOCAL	SET REF
R*4	XDRS	$LOCAL	SET REF
R*4	XINF	ARG	REF
R*4	XINVES	$LOCAL	SET REF
R*4	XROR	$LOCAL	SET REF
R*4	XX	$LOCAL	SET REF
I*4	YR	$LOCAL	REF SET

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	ATPR	ARG	(50)	REF
R*4	CFAT	ARG	(50)	REF
R*4	DCFAT	ARG	(50)	REF
R*4	MUCI	ECC	(50)	REF
R*4	MUCT	ECC	(50)	REF
R*4	MUDB	ECC	(50)	REF
R*4	MUED	ECC	(50)	REF
R*4	MUFO	ECC	(50)	REF
R*4	MUIN	ECC	(50)	REF
R*4	MUOPC	ECC	(50)	REF
R*4	MUPB	ECC	(50)	REF
R*4	MUPG	ECC	(50)	REF
R*4	MUPO	ECC	(50)	REF
R*4	MURP	ECC	(50)	REF
R*4	MUVG	ECC	(50)	REF
R*4	MUVI	ECC	(50)	REF
R*4	MUVO	ECC	(50)	REF
R*4	MUVW	ECC	(50)	REF
R*4	MUWO	ECC	(50)	REF

5.20 SUBROUTINE OUTE

CALLED FROM : MAIN

DESCRIPTION : WRITES ECONOMIC ANALYSIS REPORT

SUBROUTINES CALLED : TITLE - PRINTS HEADER WITH RELEASE NUMBER

SCALARS REFERENCED

TYPE	NAME	LOCATION	ACTION
R*4	CC	ECS	REF
R*4	COSR	ECS	REF
R*4	DCFB	ECS	REF
R*4	DCFGS	$LOCAL	SET REF
R*4	DCFH	$LOCAL	SET REF
R*4	DCFL	$LOCAL	SET REF
R*4	DCPDB	$LOCAL	SET REF
R*4	DNB	ECS	REF
R*4	EFFINV	ECS	REF
I*4	I	$LOCAL	SET REF
I*4	IDEBT	ECI	REF
I*4	IDSH	$LOCAL	REF
I*4	IFIN	$LOCAL	SET REF
I*4	INIT	$LOCAL	SET REF
I*4	IOUT	ECI	REF
I*4	IW	FLAGS	REF
I*4	M	ECI	REF
R*4	MUPPV	ECS	REF
I*4	MYR	ECI	REF
R*4	OROR	$LOCAL	SET
R*4	PAYOUT	ECS	REF
R*4	PCC	$LOCAL	SET
R*4	PLIFE	ECS	REF
R*4	PROBZ	$LOCAL	SET
R*4	PXDR	$LOCAL	SET REF
R*4	ROR	ECS	REF
R*4	RPE	$LOCAL	SET REF
R*4	RPI	$LOCAL	SET REF
R*4	SINT	ECS	REF
R*4	SNOS	ECS	REF
R*4	SPRP	ECS	REF
R*4	SRPV	ECS	REF
R*4	SSEV	ECS	REF
R*4	STDDEV	ECS	REF
R*4	SUMCI	ECS	REF
R*4	SUMED	ECS	REF
R*4	SUMFO	ECS	REF

R*4	SUMML	ECS	REF
R*4	SUMOH	ECS	REF
R*4	SUMOPC	ECS	REF
R*4	SUMTI	ECS	REF
R*4	SUMVOM	ECS	REF
R*4	SUMWC	ECS	REF
R*4	SUMWD	ECS	REF
R*4	SUMWO	ECS	REF
R*4	SUMWT	ECS	REF
R*4	SVON	ECS	REF
R*4	TEXP	$LOCAL	SET REF
R*4	TINV	$LOCAL	SET REF
R*4	TOPC	$LOCAL	SET REF
R*4	TOTD	ECS	REF
R*4	UATP	ECS	REF
R*4	UCFB	ECS	REF
R*4	UFIT	ECS	REF
R*4	UINT	ECS	REF
R*4	ULOAN	ECS	REF
R*4	UMM	$LOCAL	SET REF
R*4	UNIT	$LOCAL	SET REF
R*4	UNOS	ECS	REF
R*4	URPV	ECS	REF
R*4	USCI	ECS	REF
R*4	USED	ECS	REF
R*4	USEV	ECS	REF
R*4	USFO	ECS	REF
R*4	USIT	ECS	REF
R*4	USML	ECS	REF
R*4	USOH	ECS	REF
R*4	USOPC	ECS	REF
R*4	USTC	ECS	REF
R*4	USTI	ECS	REF
R*4	USWD	ECS	REF
R*4	USWO	ECS	REF
R*4	USWT	ECS	REF
R*4	UWCAP	ECS	REF
R*4	UWPT	ECS	REF
R*4	XDR	ECI	REF
R*4	XINF	ECI	REF

ARRAYS REFERENCED

TYPE	NAME	LOCATION	DIMENSIONS	ACTION
R*4	ACAP	ECO	(50)	REF
R*4	ACML	ECO	(50)	REF
R*4	ACOST	ECO	(50)	REF
R*4	AEDP	ECO	(50)	REF

R*4	AFIT	ECO	(50)	REF
R*4	AFOC	ECO	(50)	REF
R*4	ANET	ECO	(50)	REF
R*4	ANIP	ECO	(50)	REF
R*4	ANOI	ECO	(50)	REF
R*4	ANTI	ECO	(50)	REF
R*4	AOVH	ECO	(50)	REF
R*4	AQGR	ECO	(50)	REF
R*4	AQIR	ECO	(50)	REF
R*4	AQOR	ECO	(50)	REF
R*4	AQWR	ECO	(50)	REF
R*4	AREVO	ECO	(50)	REF
R*4	AROY	ECO	(50)	REF
R*4	ASEV	ECO	(50)	REF
R*4	ASTX	ECO	(50)	REF
R*4	ATIN	ECO	(50)	REF
R*4	ATPR	ECO	(50)	REF
R*4	AVOC	ECO	(50)	REF
R*4	AWCP	ECO	(50)	REF
R*4	AWDC	ECO	(50)	REF
R*4	AWPP	ECO	(50)	REF
R*4	AWPT	ECO	(50)	REF
R*4	AWTC	ECO	(50)	REF
R*4	BPO	ECI	(50)	REF
R*4	CDAT	ECO	(50)	REF
R*4	CDBT	ECO	(50)	REF
R*4	CFAT	ECO	(50)	REF
R*4	CFBT	ECO	(50)	REF
R*4	CNOI	ECO	(50)	REF
R*4	DATE	ECO	(50)	REF
R*4	DCFAT	ECO	(50)	REF
R*4	DCFBT	ECO	(50)	REF
I*4	IDS1	$LOCAL	(50)	REF SET
I*4	IDS2	$LOCAL	(50)	REF SET
R*4	MUCI	ECC	(50)	REF
R*4	MUCT	ECC	(50)	REF
R*4	MUDB	ECC	(50)	REF
R*4	MUED	ECC	(50)	REF
R*4	MUFO	ECC	(50)	REF
R*4	MUIN	ECC	(50)	REF
R*4	MUOPC	ECC	(50)	REF
R*4	MUPB	ECC	(50)	REF
R*4	MUPG	ECC	(50)	SET
R*4	MUPO	ECC	(50)	SET
R*4	MURP	ECC	(50)	REF
R*4	MUVG	ECC	(50)	SET
R*4	MUVI	ECC	(50)	SET
R*4	MUVO	ECC	(50)	SET
R*4	MUVW	ECC	(50)	SET
R*4	MUWO	ECC	(50)	REF

R*4	PVDF	ECO	(50)	REF
R*4	TITL	ECI	(20)	ARG
R*4	TXCR	ECO	(50)	REF
R*4	VGM	ECI	(50)	SET
R*4	VONET	ECO	(50)	REF

SECTION 6
ICPM COMMON GLOSSARY

VARIABLES IN LABELLED COMMON ARE DEFINED IN THIS SECTION. THERE IS NO BLANK COMMON IN ICPM.

6.1 COMMON /FLAGS/

IJ1 - NOT USED
IRES - NOT USED
IPAT - NOT USED
IWRIT - CONTROLS PRINTING OF INTERMEDIATE RESULTS OF RESERVOIR CALCULATIONS
IECON - CONTROLS ECONOMIC ANALYSIS
IERR - ERROR FLAG
IR - UNIT NUMBER FROM WHICH A SINGLE SET OF DATA IS PROCESSED = 7
IW - UNIT NUMBER FOR PRINTOUT = 6
IP - NOT USED
NZONE - NUMBER OF BURN ZONES

6.2 COMMON /RESVR/

DEPTH - RESERVOIR DEPTH, FT
PFORM - CURRENT RESERVOIR PRESSURE, PSIA
TFORM - CURRENT RESERVOIR TEMPERATURE, DEG. F
TNET - TOTAL NET THICKNESS, OR BURN ZONE THICKNESS, FT.
PERM - RESERVOIR ABSOLUTE PERMEABILITY, MD
POROS - RESERVOIR POROSITY, FRACTION
VISO - DEAD OIL VISCOSITY, CP
VISW - WATER VISCOSITY IN RESERVOIR, CP
BOI - OIL FORMATION VOLUME FACTOR, RB/STB
BWI - WATER FORMATION VOLUME FACTOR, RB/STB
AREA - TOTAL DEVELOPED AREA, ACRES
WELLSP - NUMBER OF PRODUCING WELLS IN DEVELOPED AREA
SOI - CURRENT OIL SATURATION IN RESERVOIR, FRACTION
SGI - CURRENT GAS SATURATION IN RESERVOIR, FRACTION (ZERO)
SWI - CURRENT WATER SATURATION IN RESERVOIR, FRACTION
BRNMX - MAXIMUM THICKNESS PER BURN ZONE, FT
OIP - OIL IN PLACE/PATTERN/BURN ZONE, MSTB
WIP - NOT USED
GIP - NOT USED
TOTOIL - TOTAL OIL IN PLACE/ BURN ZONE, MMSTB
TVP - TOTAL PORE VOLUME/ BURN ZONE, MM RES BBL
SWEEP - MAXIMUM VOLUME SWEPT, FRACTION
ARIN - AIR INJECTION RATE, MSCF/D
ARINJ - AIR INJECTION RATE, MSCF/D

PINJ - INJECTION PRESSURE, PSIA
WELLSI - NUMBER OF INJECTION WELLS
HPP - COMPRESSOR HORSEPOWER PER PATTERN
PDP - DISCHARGE PRESSURE, PSIA
AREAP - PATTERN AREA, ACRES
FWA - WATER/AIR RATIO, STB/MSCF
OILBF - FINAL OIL BURNED, STB/ACRE-FT
PATVOL - PATTERN VOLUME, ACRE-FT
AFR - AIR/FUEL RATIO, MSCF/STB OIL BURNED
AR - AIR REQUIREMENT, MSCF/FT3 RESV

6.3 COMMON /SPECPAR/

TNETORG - TOTAL NET THICKNESS, FT

6.4 COMMON /REPORT/

CUMOIL(200) - CUMULATIVE OIL PRODUCED PER PATTERN, MSTB
CUMGAS(200) - CUMULATIVE GAS PRODUCED PER PATTERN, MMSCF
CUMWAT(200) - CUMULATIVE WATER PRODUCED PER PATTERN, MBBL
CUMOB(200) - CUMULATIVE OIL BURNED AS FUEL PER PATTERN, MSTB
CUMIA(200) - CUMULATIVE AIR INJECTED PER PATTERN, MMSCF
CUMIW(200) - CUMULATIVE WATER INJECTED PER PATTERN, MBBL
CUMAW(200) - CUMULATIVE EQUIV. AIR INJECTED FOR WET COMB. PER PATTERN, MMSCF
FOSC(200) - CUMULATIVE OIL/AIR RATIO, STB/MSCF
FOSI(200) - OIL/AIR RATIO AT TIME I, STB/MSCF
PROIL(200) - OIL PRODUCTION RATE PER PATTERN, STB/D
PRGAS(200) - GAS PRODUCTION RATE PER PATTERN, MSCF/D
PRWAT(200) - WATER PRODUCTION RATE PER PATTERN, STB/D
AIRQ(200) - AIR INJECTION RATE PER PATTERN, MSCF/D
WATQ(200) - WATER INJECTION RATE PER PATTERN, STB/D
TIME(200) - TIME IN YEARS
DTIME(200) - DIMENSIONLESS TIME
FRVS(200) - VOLUME OF PATTERN BURNED, FRACTION
RECOV(200) - OIL RECOVERY, FRACTION
PRODS(200) - NOT USED

6.5 COMMON /FPROP/

API - OIL GRAVITY, DEG. API
RS - CURRENT SOLUTION GAS-OIL RATIO, MSCF/RBBL
VIS80 - NOT USED
VIS100 - VISCOSITY OF OIL AT 100 DEG. F., CP
VIS210 - VISCOSITY OF OIL AT 210 DEG. F., CP
VIS1 - NOT USED
VIS2 - NOT USED

SGO - OIL SPECIFIC GRAVITY (W.R.T. WATER), FRACTION
SGW - WATER SPECIFIC GRAVITY, FRACTION
SGG - GAS SPECIFIC GRAVITY (W.R.T. AIR), FRACTION
BB(42) - COEFFICIENTS FOR CURVE-FITTING VISCOSITY CORRELATION

6.6 COMMON /ECI/

M - NUMBER OF YEARS IN THE PROJECT (FOR ALL PATTERNS)
MYR - NUMBER OF YEARS OF PRODUCTION
IOUT - INTERMEDIATE OUTPUT CONTROL
ISTATE - STATE CODE
IDIST - DISTRICT CODE (WITHIN A STATE)
IFIT - FEDERAL INCOME TAX CREDIT OPTION
IDISC - CONTROL FOR DISCOUNTING METHOD
IFUL - NOT USED
ISO - CONTROL FOR READING SECONDARY OIL VOLUMES
IDEP - CONTROL FOR DEPRECIATION METHOD
PCTDBT - PERCENT OF CAPITAL (TANGIBLE AND INTANGIBLE) COSTS TO BE BORROWED, PERCENT
DBTINT - DEBT INTEREST RATE, PERCENT
NYRRPY - NUMBER OF YEARS BEFORE BEGINNING DEBT REPAYMENT
NYPAID - NUMBER OF YEARS BEFORE COMPLETING DEBT REPAYMENT
IDEBT - CONTROL ON DEBT CALCULATIONS
CCOST - COMPRESSOR COST, $/HP
GTRT - WASTE GAS TREATING COST, $/MSCF/D
WTRT - WATER TREATING AND RECYCLE COST, $/BBL/D
CTACR - AIR DIST, VAPOR RECOV, AND SURFACE FACIL COST, $/ACRE
DCE - WELL DRILLING/COMPLETION/EQUIP COST, $/FOOT
PLANT - CENTRAL PLANT FACILITIES COST, $/STB/D
WOCOST - ANNUAL WELL WORKOVER COST PER PATTERN, M$
WTCOST - PRODUCED WATER TREATING COST, $/BBL
WDCOST - WATER DISPOSAL COST, $/BBL
COSTML - COMPRESSOR MAINT AND LABOR COST, $/MSCF
COSTTI - TECHNICIAN AND INSTRUMENT COST, $/MSCF
WCAP - MONTHS OF WORKING CAPITAL, MONTHS
UNCO - OIL RATE UNCERTAINTY, FRACTION
WPP - NUMBER OF WELLS DRILLED PER PATTERN
COSTRT - PROJECT STARTUP COSTS, M$
WPP1 - NUMBER OF INJECTORS DRILLED PER PATTERN
WPP2 - NUMBER OF PRODUCERS DRILLED PER PATTERN
WPP3 - NUMBER OF PRIMARY PRODUCERS CONVERTED TO SECONDARY PRODUCERS PER PATTERN
WPP4 - NUMBER OF EXISTING PRODUCERS CONVERTED TO INJECTORS PER PATTERN
POBASE - NOT USED
OILB - 1979 PROJECT BASE OIL RATE, MBBL/YR
OILC - CURRENT NON-TERTIARY PROJECT OIL RATE, MBBL/YR
DECL - ANNUAL OIL PRODUCTION DECLINE RATE, FRACTION
XDR - MONETARY DISCOUNT RATE, FRACTION
XINF - INFLATION RATE, FRACTION

XROY - ROYALTY RATE, FRACTION
XSEV - SEVERANCE TAX RATE, FRACTION
XWPT - WINDFALL EXCISE TAX RATE, FRACTION
XFIT - FEDERAL INCOME TAX RATE, FRACTION
XTCR - INVESTMENT TAX CREDIT, FRACTION
DTIM - INVESTMENT DEPRECIATION TIME, YRS
XSTX - STATE INCOME TAX RATE, FRACTION
WPHO - WINDFALL TAX BEGINNING PHASE OUT DATE
EPHO - WINDFALL TAX ENDING PHASE OUT DATE
BTIM - BASE TIME FOR PROJECT START
BPOW - BASE OIL PRICE AT START OF PROJECT FOR PURPOSES OF WPT CALCULATIONS, $/BBL
ESCPO - ESCALATION RATE OF OIL PRICE, FRACTION
ESCPG - ESCALATION RATE OF GAS PRICE, FRACTION
ESCPF - NOT USED
ESCFO - ESCALATION RATE OF FIXED OPERATING COSTS, FRACTION
ESCED - ESCALATION RATE OF ELECTRIC DRIVER OPERATING COST, FRACTION
ESCCT - ESCALATION RATE OF TANGIBLE CAPITAL, FRACTION
ESCCI - ESCALATION RATE OF INTANGIBLE CAPITAL, FRACTION
ESCWO - ESCALATION RATE OF WELL WORKOVER COSTS, FRACTION
ESCWT - NOT USED
ESCWI - NOT USED
ESCBP - INFLATION RATE PLUS TWO PERCENT
OILR(50)- OIL RELEASED, BBL
VOS(50) - VOLUME OF SECONDARY OIL PRODUCED PER PATTERN, MBBL/YR
POL(50) - OIL PRICE, LOW, $/BBL
POM(50) - OIL PRICE, MOST LIKELY, $/BBL
POH(50) - OIL PRICE, HIGH, $/BBL
PGL(50) - GAS PRICE, LOW, $/MSCF
PGM(50) - GAS PRICE, MOST LIKELY, $/MSCF
PGH(50) - GAS PRICE, HIGH, $/MSCF
FOCL(50) - FIXED OPERATING COST PER PATTERN, LOW, $/YR
FOCM(50) - FIXED OPERATING COST PER PATTERN, MOST LIKELY, $/YR
FOCH(50) - FIXED OPERATING COST PER PATTERN, HIGH, $/YR
OPCL(50) - VARIABLE OPERATING COST, LOW, $/BBL OIL PRODUCED
OPCM(50) - VARIABLE OPERATING COST, MOST LIKELY, $/BBL OIL PRODUCED
OPCH(50) - VARIABLE OPERATING COST, HIGH, $/BBL OIL PRODUCED
EDPL(50) - ELECTRIC DRIVER OPERATING COST, LOW, $/KWHR
EDPM(50) - ELECTRIC DRIVER OPERATING COST, MOST LIKELY, $/KWHR
EDPH(50) - ELECTRIC DRIVER OPERATING COST, HIGH, $/KWHR
WTC(50) - PRODUCED WATER TREATING COST FOR PROJECT , $/BBL
WDC(50) - WATER DISPOSAL COST, $/BBL
CML(50) - MAINTENANCE AND LABOR COST, $/MSCF
CTPL(50) - TANGIBLE CAPITAL COSTS PER PATTERN, LOW, $
CTPM(50) - TANGIBLE CAPITAL COSTS PER PATTERN, MOST LIKELY, $
CTPH(50) - TANGIBLE CAPITAL COSTS PER PATTERN, HIGH, $
CIPL(50) - INTANGIBLE CAPITAL COSTS PER PATTERN, LOW, $
CIPM(50) - INTANGIBLE CAPITAL COSTS PER PATTERN, MOST LIKELY, $
CIPH(50) - INTANGIBLE CAPITAL COSTS PER PATTERN, HIGH, $
CTCL(50) - TANGIBLE CAPITAL COSTS FOR PROJECT , LOW, $

CTCM(50) - TANGIBLE CAPITAL COSTS FOR PROJECT , MOST-LIKELY, $
CTCH(50) - TANGIBLE CAPITAL COSTS FOR PROJECT , HIGH, $
CICL(50) - INTANGIBLE CAPITAL COSTS FOR PROJECT, LOW, $
CICM(50) - INTANGIBLE CAPITAL COSTS FOR PROJECT, MOST-LIKELY, $
CICH(50) - INTANGIBLE CAPITAL COSTS FOR PROJECT, HIGH, $
VOL(50) - OIL PRODUCTION , LOW , STB/YR
VOM(50) - OIL PRODUCTION , MOST-LIKELY , STB/YR
VOH(50) - OIL PRODUCTION , HIGH , STB/YR
WO(50) - WELL WORKOVER COST PER PATTERN, $/YR
BPO(50) - BASE PRICE OF OIL FOR WPT , $/BBL
CTI(50) - TECHNICIAN AND INSTRUMENT COSTS, $/MSCF
VGM(50) - VOLUME OF WASTE GAS PRODUCED FOR PROJECT, MOST LIKELY, MMSCF/YR
VWM(50) - VOLUME OF WATER PRODUCED FOR PROJECT, MOST LIKELY, STB/YR
VIM(50) - AIR INJECTED FOR PROJECT, MOST-LIKELY , MMSCF/YEAR
GNUM(50) - NUMBER OF COMPRESSORS PURCHASED EACH OF MYR YEARS
GENC(50) - COMPRESSOR CAPITAL COST, M$
TITL(20) - UP TO 80 ALPHA-NUMERIC CHARACTERS TO IDENTIFY RUN
QHM(50) - TOTAL COMPRESSOR HORSEPOWER, MOST LIKELY, KW-HR/YR
VHM(50) - WATER INJECTED, MOST LIKELY, STB/YEAR
VDM(50) - WATER DISPOSAL, MOST LIKELY, STB/YEAR
QHP(50) - ANNUAL COMPRESSOR HORSEPOWER, KW-HR/YR/PATTERN
VHP(50) - ANNUAL WATER INJECTED, MMBBL/YR/PATTERN
VOP(50) - VOLUME OIL PRODUCED, MBBL/YR/PATTERN
VGP(50) - VOLUME GAS PRODUCED, MMSCF/YR/PATTERN
VWP(50) - VOLUME WATER PRODUCED, MBBL/YR/PATTERN
VIP(50) - VOLUME AIR INJECTED, MMSCF/YR/PATTERN
PATI(50) - NUMBER OF PATTERNS INITIATED EACH YEAR OF THE PROJECT

6.7 COMMON /ECC/

MUVO(50) - MEAN OIL VOLUME, BBL
MUVG(50) - MEAN GAS VOLUME, MMSCF
MUVW(50) - MEAN WATER VOLUME, BBL
MUVI(50) - MEAN AIR INJECTED , MMSCF
MUPO(50) - MEAN OIL PRICE, MM$/BBL
MUPG(50) - MEAN GAS PRICE, MM$/MSCF
MUWO(50) - MEAN WELL WORKOVER COST, MM$
MUFO(50) - MEAN FIXED OPERATING COST, MM$/YR
MUOPC(50) - MEAN VARIABLE OPERATING COST, MM$/BBL OIL
MUED(50) - MEAN ELECTRIC DRIVER OPERATING COST, MM$/KWHR
MUCT(50) - MEAN TANGIBLE CAPITAL, MM$
MUCI(50) - MEAN INTANGIBLE CAPITAL, MM$
MUDB(50) - MEAN DEBT ADDED, MM$
MURP(50) - MEAN PRINCIPAL REPAYMENT, MM$
MUIN(50) - MEAN INTEREST PAYMENT, MM$
MUPB(50) - MEAN PRINCIPAL BALANCE AT END OF YEAR (AFTER PRINCIPAL PAYMENT), MM$
SIGVO(50) - OIL VOLUME VARIANCE, STB/YR

SIGPO(50) - OIL PRICE VARIANCE, MM$/BBL
SIGPG(50) - GAS PRICE VARIANCE, MM$/MSCF
SIGPF(50) - NOT USED
SIGFO(50) - FIXED OPERATING COST VARIANCE, MM$/YR
SIGED(50) - ELECTRIC DRIVER COST VARIANCE, MM$/KW-HR
SIGCT(50) - TANGIBLE CAPITAL COST VARIANCE, MM$
SIGCI(50) - INTANGIBLE CAPITAL COST VARIANCE, MM$
SIGOPC(50) - VARIABLE OPERATING COST VARIANCE, MM$/BBL OIL PRODUCED

6.8 COMMON /ECS/

SUMVOM - TOTAL OIL PRODUCED, MBBL
COSR - TOTAL AIR/OIL RATIO, MSCF/BBL
TOTD - TOTAL TANGIBLE CAPITAL, PRESENT VALUE (DISCOUNTED), MM$
SUMCI - TOTAL INTANGIBLE CAPITAL, PRESENT VALUE (DISCOUNTED), MM$
SVOS - TOTAL GROSS OIL SOLD, MBBL (DISCOUNTED)
SVGS - TOTAL GROSS GAS SOLD, MMSCF (DISCOUNTED)
SVPS - NOT USED
SVIS - NOT USED
SUMWT - TOTAL PRODUCED WATER TREATING COST, PRESENT VALUE (DISCOUNTED), MM$
CINJ - COST OF DRILLING AND COMPLETION FOR AN INJECTION WELL ($/WELL)
CEQP - COST TO EQUIP NEW PRODUCING WELL ($/NEW PRODUCER)
CSEC - COST OF ADDITIONAL SECONDARY PRODUCTION EQUIPMENT FOR A PRIMARY WELL CONVERTED TO A SECONDARY, $/WELL
CNVT - COST TO CONVERT AN EXISTING PRODUCER TO AN INJECTION WELL, $/CONVERTED WELL
CREP - COST TO UPGRADE SURFACE PROCESSING EQUIPMENT AND LEASE FACILITIES FOR SECONDARY RECOVERY OPERATIONS, $/PRODUCING WELL
CDAO - DIRECT ANNUAL OPERATING COSTS FOR SECONDARY RECOVERY OPERATIONS, $/PRODUCING WELL/YR
CIWO - ADDITIONAL ANNUAL OPERATING COSTS FOR OFFSHORE WATER INJECTION, $/YR
URPV - TOTAL GROSS REVENUE (UNDISCOUNTED), MM$
UNOS - TOTAL NET OIL SALES (UNDISCOUNTED), MM$
USEV - TOTAL SEVERENCE TAX (UNDISCOUNTED), MM$
USFO - TOTAL FIXED OPERATING COST (UNDISCOUNTED), MM$
USOPC - TOTAL VARIABLE OPERATING COST (UNDISCOUNTED), MM$
USED - TOTAL ELECTRIC DRIVER OPERATING COST (UNDISCOUNTED), MM$
USWO - TOTAL WELL WORKOVER COST (UNDISCOUNTED), MM$
USTO - TOTAL OPERATING COST, VARIABLE + FIXED (UNDISCOUNTED), MM$
UWCAP - TOTAL WORKING CAPITAL (UNDISCOUNTED), MM$
USWT - TOTAL PRODUCED WATER TREATING COST (UNDISCOUNTED), MM$
USWD - TOTAL PRODUCED WATER DISPOSAL COST (UNDISCOUNTED), MM$
USOH - TOTAL OVERHEAD COST (UNDISCOUNTED), MM$
USTC - TOTAL TANGIBLE CAPITAL (UNDISCOUNTED), MM$
USCI - TOTAL INTANGIBLE CAPITAL (UNDISCOUNTED), MM$
UCFB - TOTAL CASH FLOW BEFORE TAX (UNDISCOUNTED), MM$

USML - TOTAL COMPRESSOR MAINTENANCE AMD LABOR COST (UNDISCOUNTED), MM$
USTI - TOTAL TECHNICIAN AND INSTRUMENT COST (UNDISCOUNTED), MM$
UWPT - TOTAL WINDFALL PROFITS TAX (UNDISCOUNTED), MM$
USIT - TOTAL STATE INCOME TAX (UNDISCOUNTED), MM$
UFIT - TOTAL FEDERAL INCOME TAX (UNDISCOUNTED), MM$
UATP - TOTAL AFTER TAX PROFIT (UNDISCOUNTED), MM$
UINT - TOTAL INTEREST COST (UNDISCOUNTED), MM$
ULOAN - TOTAL PRINCIPAL REPAYMENT (UNDISCOUNTED), MM$
SINT - TOTAL DEBT INTEREST COST, PRESENT VALUE (DISCOUNTED), MM$
SPRP - TOTAL PRINCIPAL REPAYMENT, PRESENT VALUE (DISCOUNTED), MM$
SRPV - TOTAL REVENUE, PRESENT VALUE (DISCOUNTED), MM$
SNOS - TOTAL NET OIL SALES, PRESENT VALUE (DISCOUNTED), MM$
SSEV - TOTAL SEVERANCE TAX, PRESENT VALUE (DISCOUNTED), MM$
SUMFO - TOTAL FIXED OPERATING COST, PRESENT VALUE (DISCOUNTED), MM$
SUMOPC - TOTAL VARIABLE OPERATING COST, PRESENT VALUE (DISCOUNTED), MM$
SUMED - TOTAL ELECTIC DRIVER OPERATING COST, PRESENT VALUE (DISCOUNTED), MM$
SUMWO - TOTAL WELL WORKOVER COST, PRESENT VALUE (DISCOUNTED), MM$
SUMWD - TOTAL PRODUCED WATER DISPOSAL COST, PRESENT VALUE (DISCOUNTED), MM$
SUMOH - TOTAL OVERHEAD COST, PRESENT VALUE (DISCOUNTED), MM$
SUMML - TOTAL COMPRESSOR MAINTENANCE AND LABOR COST, PRESENT VALUE (DISCOUNTED), MM$
SUMTI - TOTAL TECHNICIAN AND INSTRUMENT COST, PRESENT VALUE (DISCOUNTED),MM$
DCFB - TOTAL DISCOUNTED CASH FLOW BEFORE TAX, MM$
MUPPV - MEAN DISCOUNTED CASH FLOW , MM$
STDDEV - STANDARD DEVIATION OF THE MEAN DISCOUNTED CASH FLOW, MM$
PAYOUT - TIME AT WHICH AFTER TAX DISCOUNTED CASH FLOW = 0, YEARS
PLIFE - PROJECT ECONOMIC LIFE, YEARS
ROR - MEAN DCF RATE OF RETURN, PERCENT
CC - PRESENT VALUE RATE=(1.+XINF)*(1.+XDR)-1.
SUMIN - TOTAL INJECTION COST, MM$ (NOT USED)
SUMWC - TOTAL WORKING CAPITAL, PRESENT VALUE (DISCOUNTED), MM$
DNB - PRESENT VALUE OF NET OIL SOLD (DISCOUNTED), MBBL
SVON - CUMULATIVE NET OIL SOLD, MBBL
EFFINV - MEAN INVESTMENT EFFICIENCY = RATIO OF SUM OF POSITIVE DISCOUNTED CASH FLOWS TO ABSOLUTE VALUE OF SUM OF NEGATIVE DISCOUNTED CASH FLOWS

6.9 COMMON /ECO/

DATE(50) - DATE (YEAR)
VOSLD(50) - ANNUAL VOLUME OF OIL SOLD, MBBL
VONET(50) - ANNUAL NET OIL SOLD (LESS ROYALTY), MBBL
AOVH(50) - ANNUAL OVERHEAD, MM$
AOVH1 - ANNUAL OVERHEAD ON DRILLING AND COMPLETION, MM$
VGNET(50) - ANNUAL NET GAS SOLD (LESS ROYALTY), MMSCF

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AREVO(50)  - ANNUAL GROSS OIL REVENUE, MM$
AREVG(50)  - ANNUAL GROSS GAS REVENUE, MM$
ARVWPT(50) - ANNUAL RELEASED OIL REVENUES, MM$
AREV(50)   - ANNUAL GROSS REVENUE, MM$
AROY(50)   - ANNUAL ROYALTY, MM$
ANET(50)   - ANNUAL NET REVENUE (LESS ROYALTY), MM$
ASEV(50)   - ANNUAL SEVERANCE TAX, MM$
AWTC(50)   - ANNUAL PRODUCED WATER TREATING COST, MM$
AWDC(50)   - ANNUAL PRODUCED WATER DISPOSAL COST, MM$
ACML(50)   - ANNUAL COMPRESSOR MAINTENANCE AND LABOR COST, MM$
ATIN(50)   - ANNUAL TECHNICIAN AND INSTRUMENT COST, MM$
AINJ(50)   - ANNUAL CHEMICAL PURCHASE COST, MM$ (NOT USED)
AFOC(50)   - ANNUAL FIXED OPERATING COST, MM$
AVOC(50)   - ANNUAL VARIABLE OPERATING COST, MM$
AEDP(50)   - ANNUAL ELECTRIC DRIVER OPERATING COST, MM$
ACOST(50)  - ANNUAL TOTAL OPERATING COST, MM$
ACAP(50)   - ANNUAL INTANGIBLES AND DEPRECIATION, MM$
AWPP(50)   - ANNUAL WINDFALL PRICE DIFFERENCE, $/BBL
ANIP(50)   - ANNUAL NET INCOME LIMITATION ON WINDFALL PRICE
             DIFFERENCE, $/BBL
TXCR(50)   - ANNUAL INVESTMENT TAX CREDIT, MM$
DEPS(50)   - ANNUAL DEPRECIATION, MM$
AWCP(50)   - ANNUAL WORKING CAPITAL, MM$
AQOR(50)   - OIL PRODUCTION RATE, BBL/D
AQGR(50)   - GAS PRODUCTION RATE, MSCF/D
AQWR(50)   - WATER PRODUCTION RATE, BBL/D
AQIR(50)   - AIR INJECTION RATE, MSCF/D
ANOI(50)   - ANNUAL NET OPERATING INCOME BEFORE WPT AND FIT, MM$
ASTX(50)   - ANNUAL STATE INCOME TAX, MM$
AWPT(50)   - ANNUAL WINDFALL PROFITS TAX, MM$
ANTI(50)   - ANNUAL NET TAXABLE INCOME, MM$
AFIT(50)   - ANNUAL FEDERAL INCOME TAX, MM$
ATPR(50)   - ANNUAL AFTER TAX CASH FLOW , MM$
CFAT(50)   - CUMULATIVE CASH FLOW AFTER TAX, MM$
CDAT(50)   - CUMULATIVE CASH FLOW AFTER TAX WITH CONSTANT DOLLARS, MM$
DCFAT(50)  - CUMULATIVE DISCOUNTED CASH FLOW AFTER TAX, MM$
PVDF(50)   - PRESENT VALUE FACTOR=1./(1.+CC)**(I-1)
CNOI(50)   - CUMULATIVE NET OPERATING INCOME, MM$
CFBT(50)   - CUMULATIVE CASH FLOW BEFORE TAX, MM$
CDBT(50)   - CUMULATIVE CASH FLOW BEFORE TAX WITH CONSTANT DOLLARS, MM$
DCFBT(50)  - CUMULATIVE DISCOUNTED CASH FLOW BEFORE TAX, MM$
```

SECTION 7
ICPM FLOWCHARTS

7.1 LOGIC AND SUBROUTINE MAP

A logic and subroutine map is shown in Figure 7-1, page 7-2. In Figure 7-1, IERR.GT.0 indicates an error was found in checking the input data in subroutine CHEKR. This will happen whenever a zero is input for required data: API(IERR=3), DEPTH(IERR=4), TNET(IERR=5), PERM(IERR=6) POROS(IERR=7), AREA(IERR=8), and WELLSP(IERR=9). The program will print the appropriate error message and terminate when IERR is positive, eg., if IERR=3, "REQUIRED OIL GRAVITY NOT INPUT" will be printed.

7.2 TOTALFLOW OUTPUT

On the pages following page 7-2 is found the output obtained by passing the ICPM source code through the TOTALFLOW program (written by H. H. Hyndman, Jr., Boeing Computer Services, Wichita, Kansas, 1975). TOTALFLOW gives the complete detail of program logic.

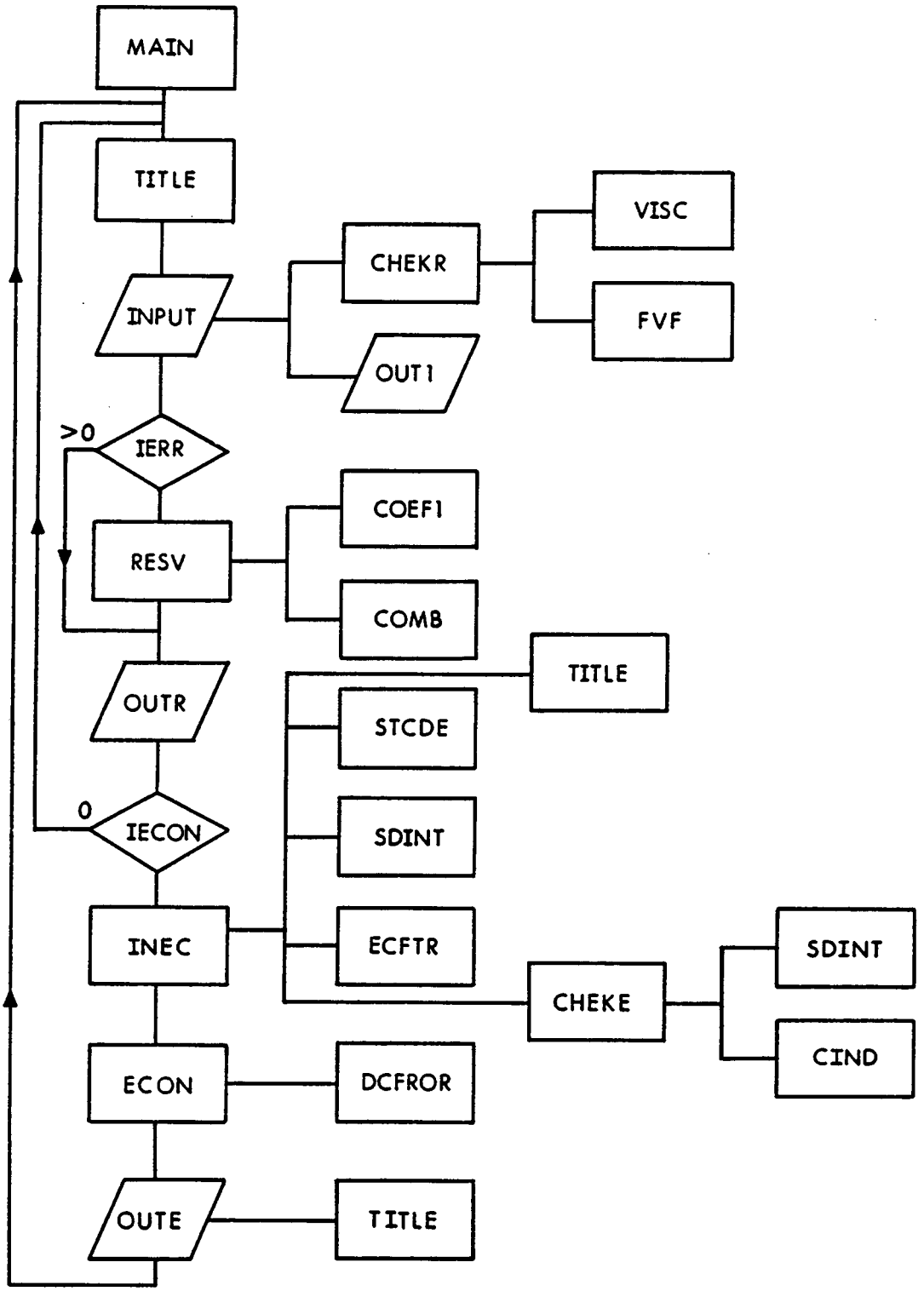
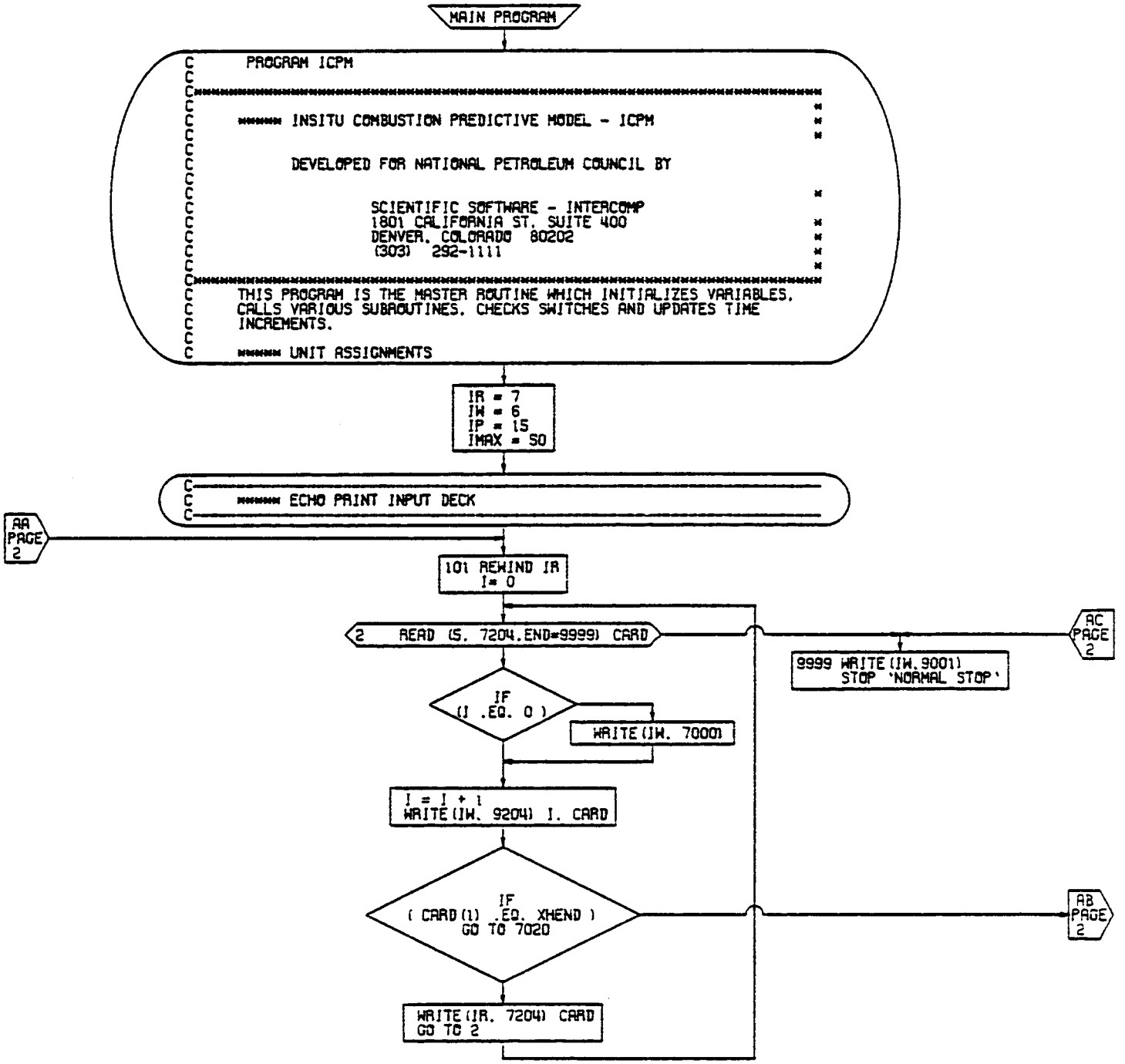


Figure 7-1. ICPM Logic Overview and Subroutine Map


MAIN PROGRAM
C PROGRAM ICPM
C
C
C ****** INSITU COMBUSTION PREDICTIVE MODEL - ICPM
C
C DEVELOPED FOR NATIONAL PETROLEUM COUNCIL BY
C
C SCIENTIFIC SOFTWARE - INTERCOMP
C 1801 CALIFORNIA ST. SUITE 400
C DENVER, COLORADO 80202
C (303) 292-1111
C
C THIS PROGRAM IS THE MASTER ROUTINE WHICH INITIALIZES VARIABLES,
C CALLS VARIOUS SUBROUTINES, CHECKS SWITCHES AND UPDATES TIME
C INCREMENTS.
C
C ****** UNIT ASSIGNMENTS
IR = 7
IW = 6
IP = 15
IMAX = 50
C
C ****** ECHO PRINT INPUT DECK
C
AA PAGE 2
101 REWIND IR
I= 0
2 READ (5, 7204,END=9999) CARD
AC PAGE 2
9999 WRITE(IW,9001)
STOP 'NORMAL STOP'
IF (I .EQ. 0)
WRITE(IW, 7000)
I = I + 1
WRITE(IW, 9204) I, CARD
IF (CARD(1) .EQ. XHEND)
GO TO 7020
AB PAGE 2
WRITE(IR, 7204) CARD
GO TO 2

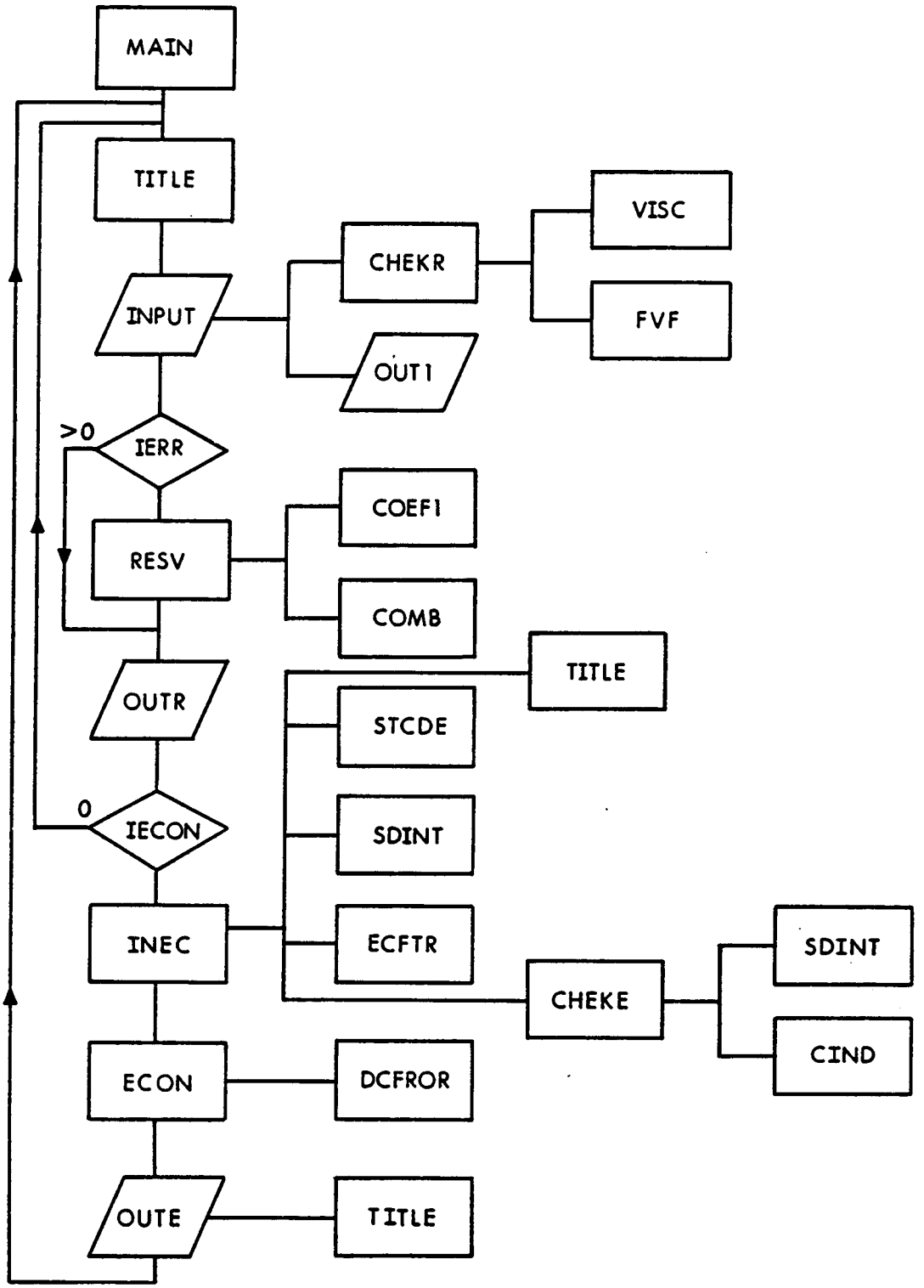
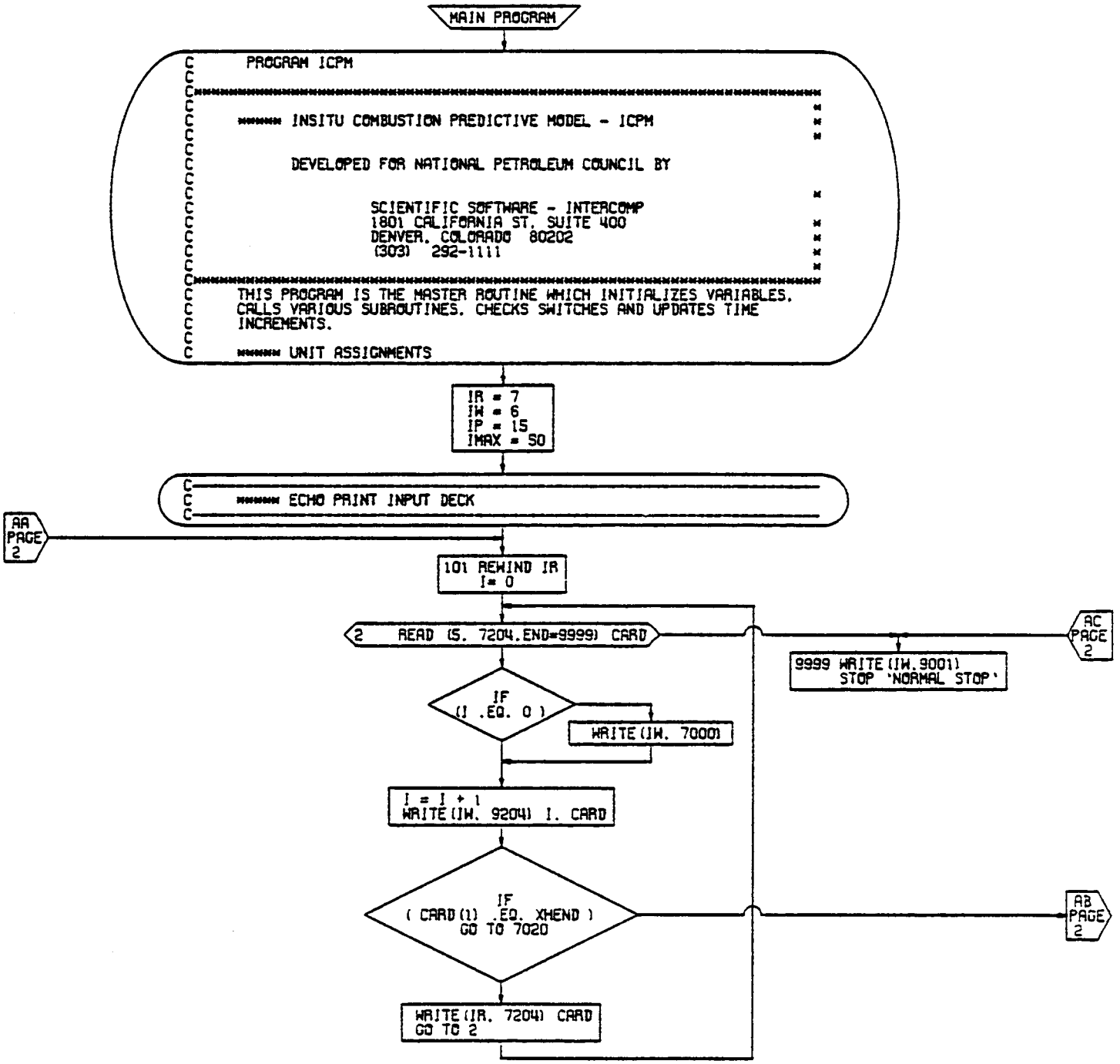


Figure 7-1. ICPM Logic Overview and Subroutine Map


MAIN PROGRAM
C PROGRAM ICPM
C
C
C ****** INSITU COMBUSTION PREDICTIVE MODEL - ICPM
C
C DEVELOPED FOR NATIONAL PETROLEUM COUNCIL BY
C
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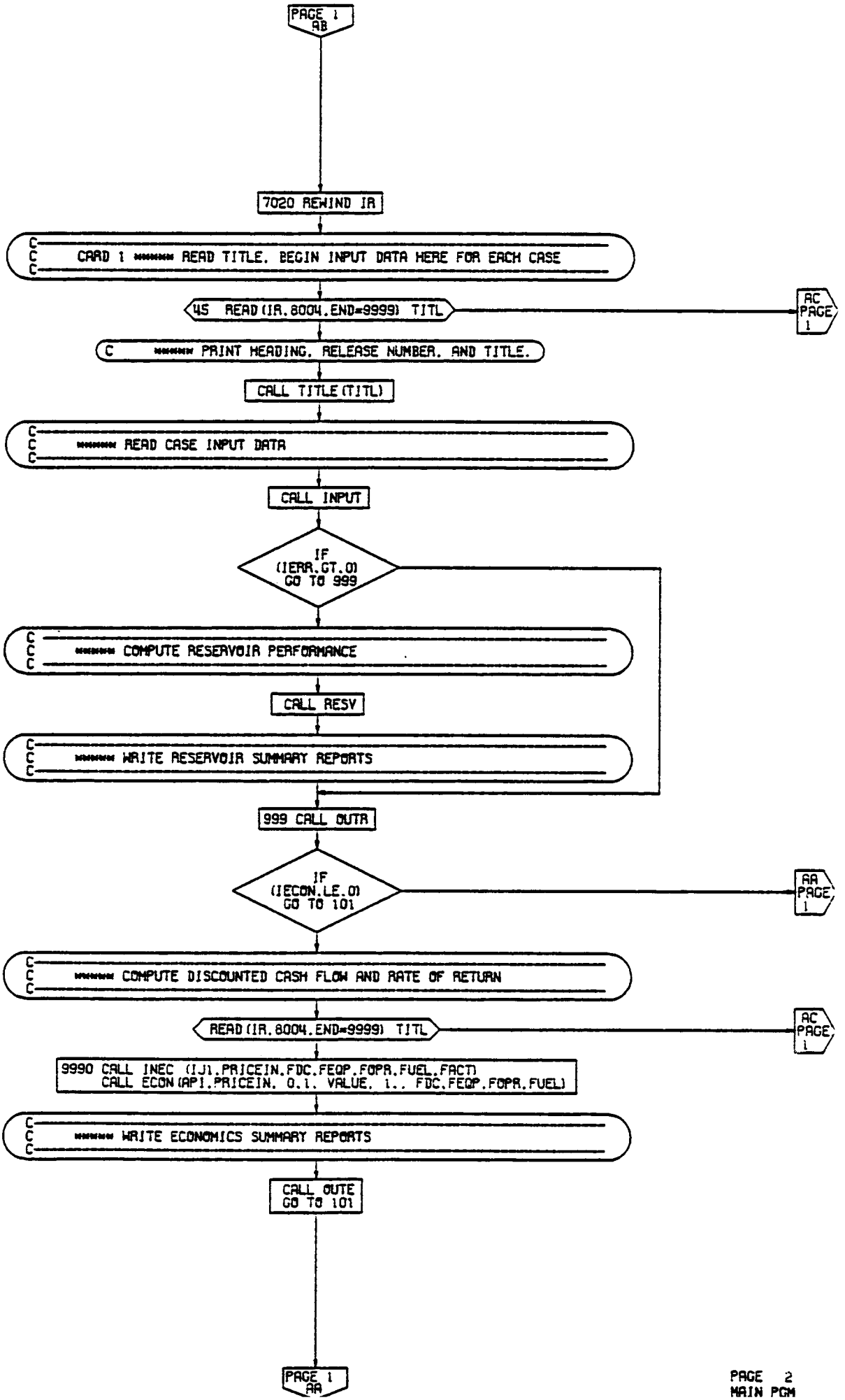
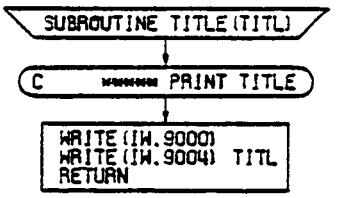
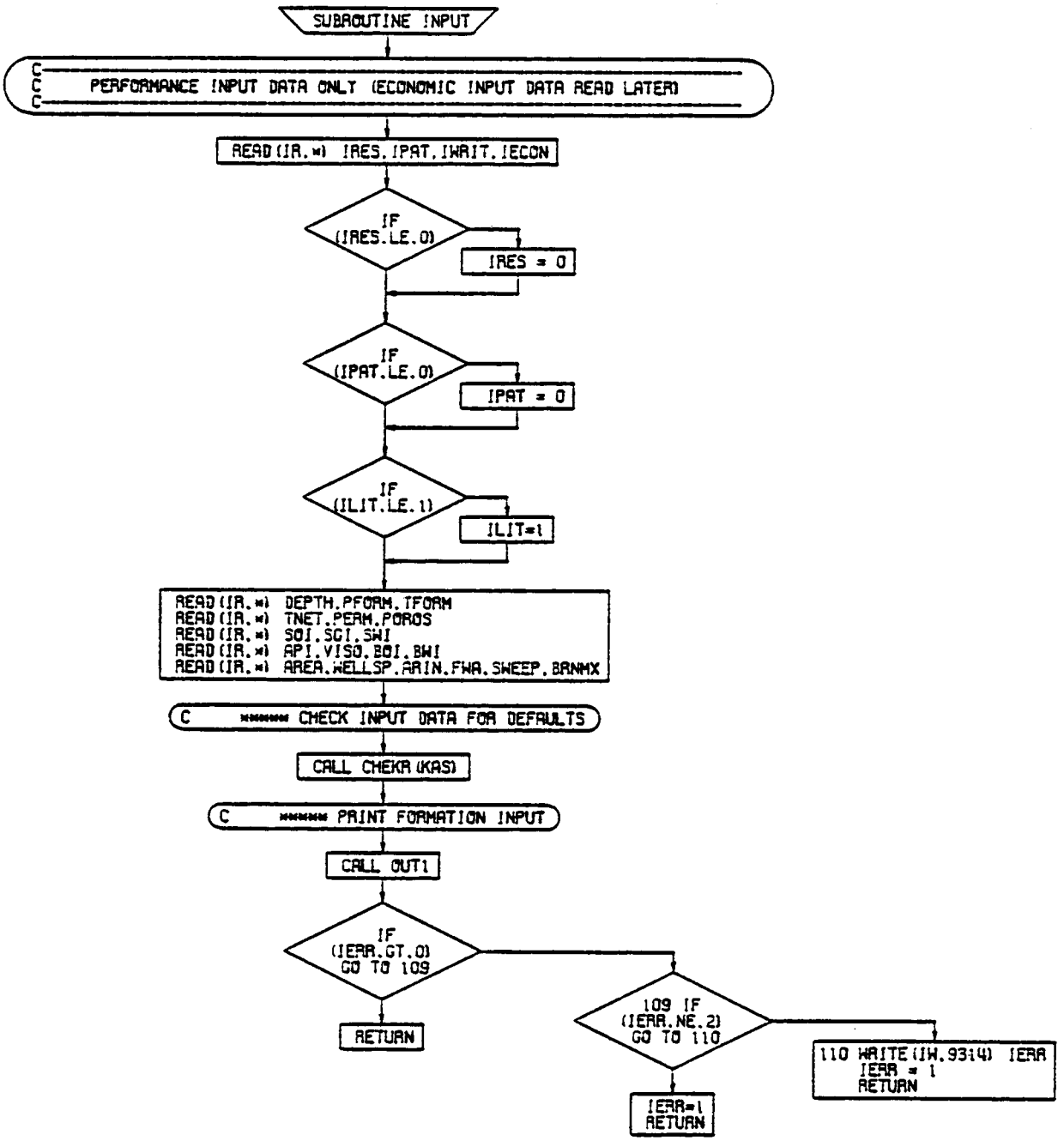
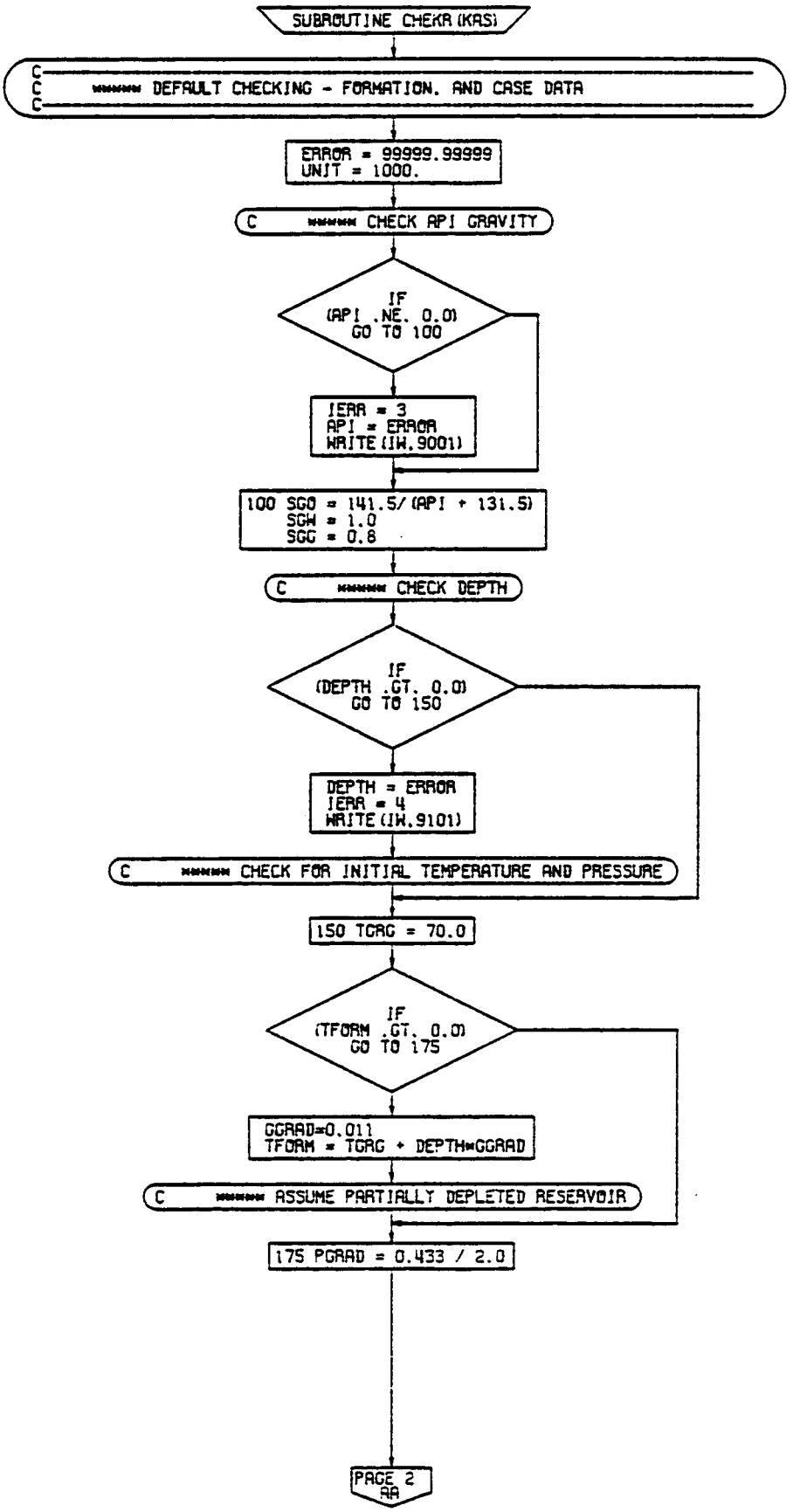
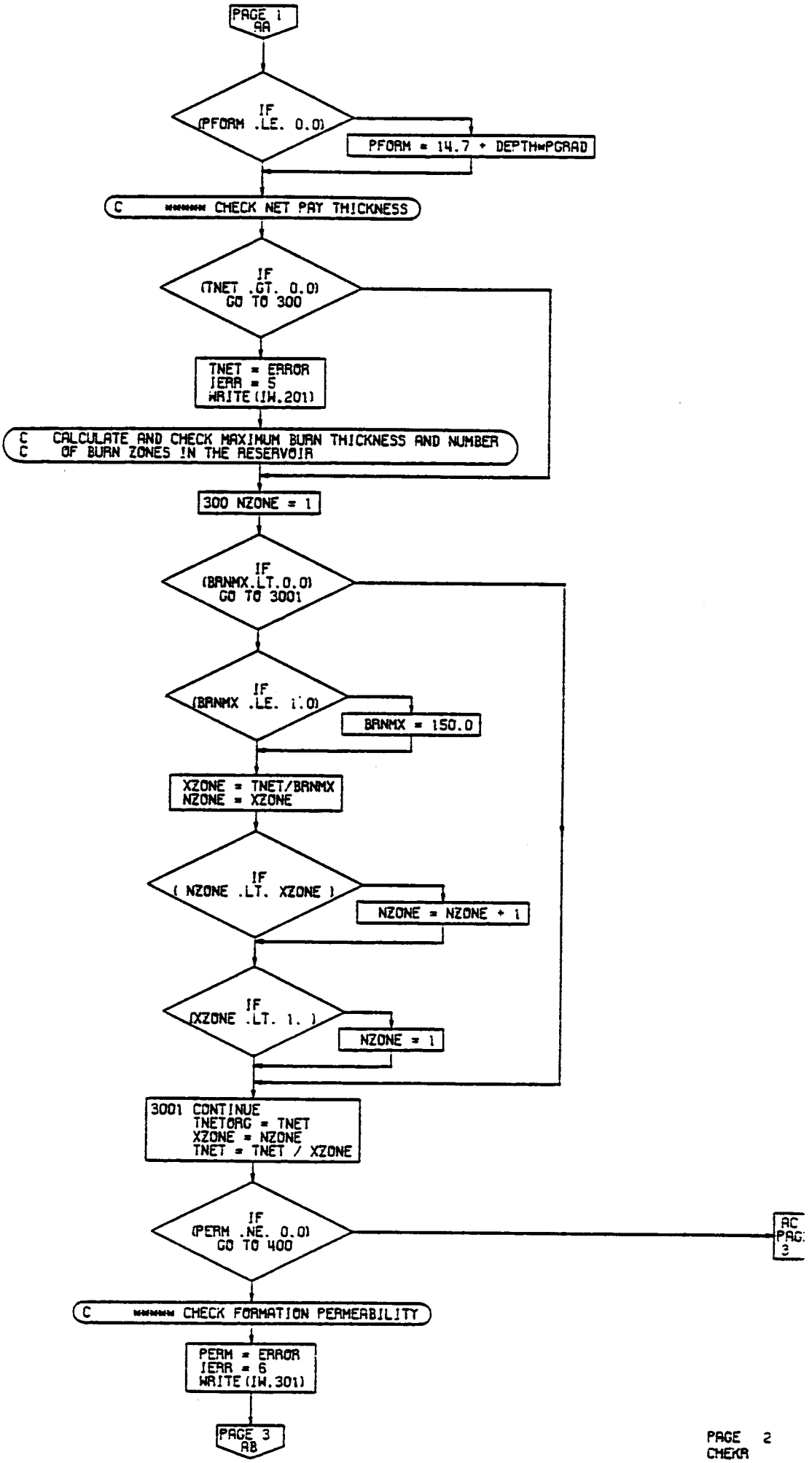
C
C THIS PROGRAM IS THE MASTER ROUTINE WHICH INITIALIZES VARIABLES,
C CALLS VARIOUS SUBROUTINES, CHECKS SWITCHES AND UPDATES TIME
C INCREMENTS.
C
C ****** UNIT ASSIGNMENTS
IR = 7
IW = 6
IP = 15
IMAX = 50
C
C ****** ECHO PRINT INPUT DECK
C
AA PAGE 2
101 REWIND IR
I= 0
2 READ (5, 7204,END=9999) CARD
AC PAGE 2
9999 WRITE(IW,9001)
STOP 'NORMAL STOP'
IF (I .EQ. 0)
WRITE(IW, 7000)
I = I + 1
WRITE(IW, 9204) I, CARD
IF (CARD(1) .EQ. XHEND)
GO TO 7020
AB PAGE 2
WRITE(IR, 7204) CARD
GO TO 2


PAGE 1 AB
7020 REWIND IR
C C C CARD 1 ****** READ TITLE. BEGIN INPUT DATA HERE FOR EACH CASE
45 READ(IR,8004,END=9999) TITL
AC PAGE 1
C ****** PRINT HEADING, RELEASE NUMBER, AND TITLE.
CALL TITLE(TITL)
C C C ****** READ CASE INPUT DATA
CALL INPUT
IF (IERR.GT.0) GO TO 999
C C C ****** COMPUTE RESERVOIR PERFORMANCE
CALL RESV
C C C ****** WRITE RESERVOIR SUMMARY REPORTS
999 CALL OUTR
IF (IECON.LE.0) GO TO 101
AA PAGE 1
C C C ****** COMPUTE DISCOUNTED CASH FLOW AND RATE OF RETURN
READ(IR,8004,END=9999) TITL
AC PAGE 1
9990 CALL INEC (IJ1,PRICEIN,FDC,FEQP,FOPR,FUEL,FACT)
CALL ECON(API,PRICEIN, 0.1, VALUE, 1., FDC,FEQP,FOPR,FUEL)
C C C ****** WRITE ECONOMICS SUMMARY REPORTS
CALL OUTE
GO TO 101
PAGE 1 AA

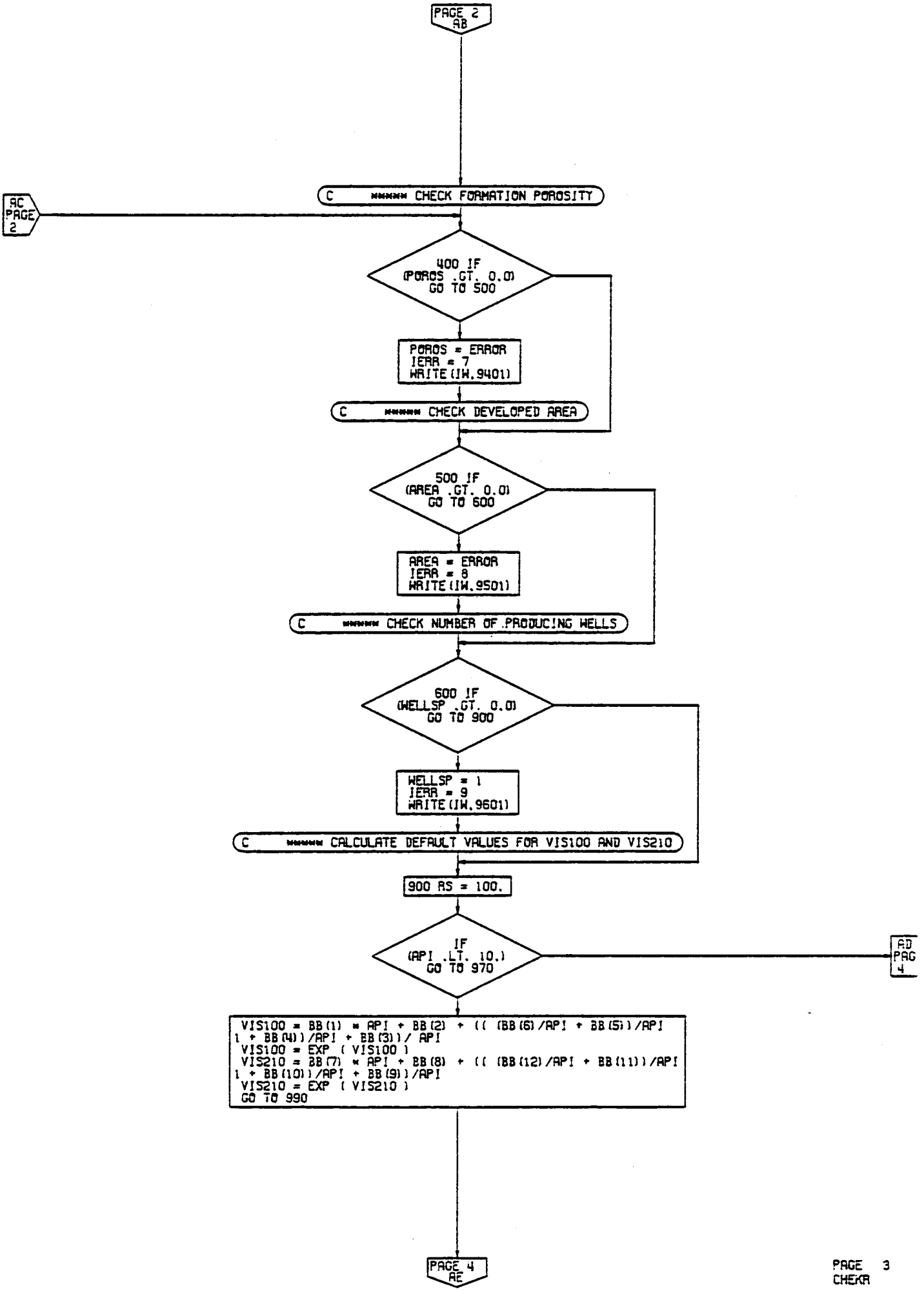

SUBROUTINE TITLE(TITL)
C ******** PRINT TITLE
WRITE(IW,9000)
WRITE(IW,9004) TITL
RETURN

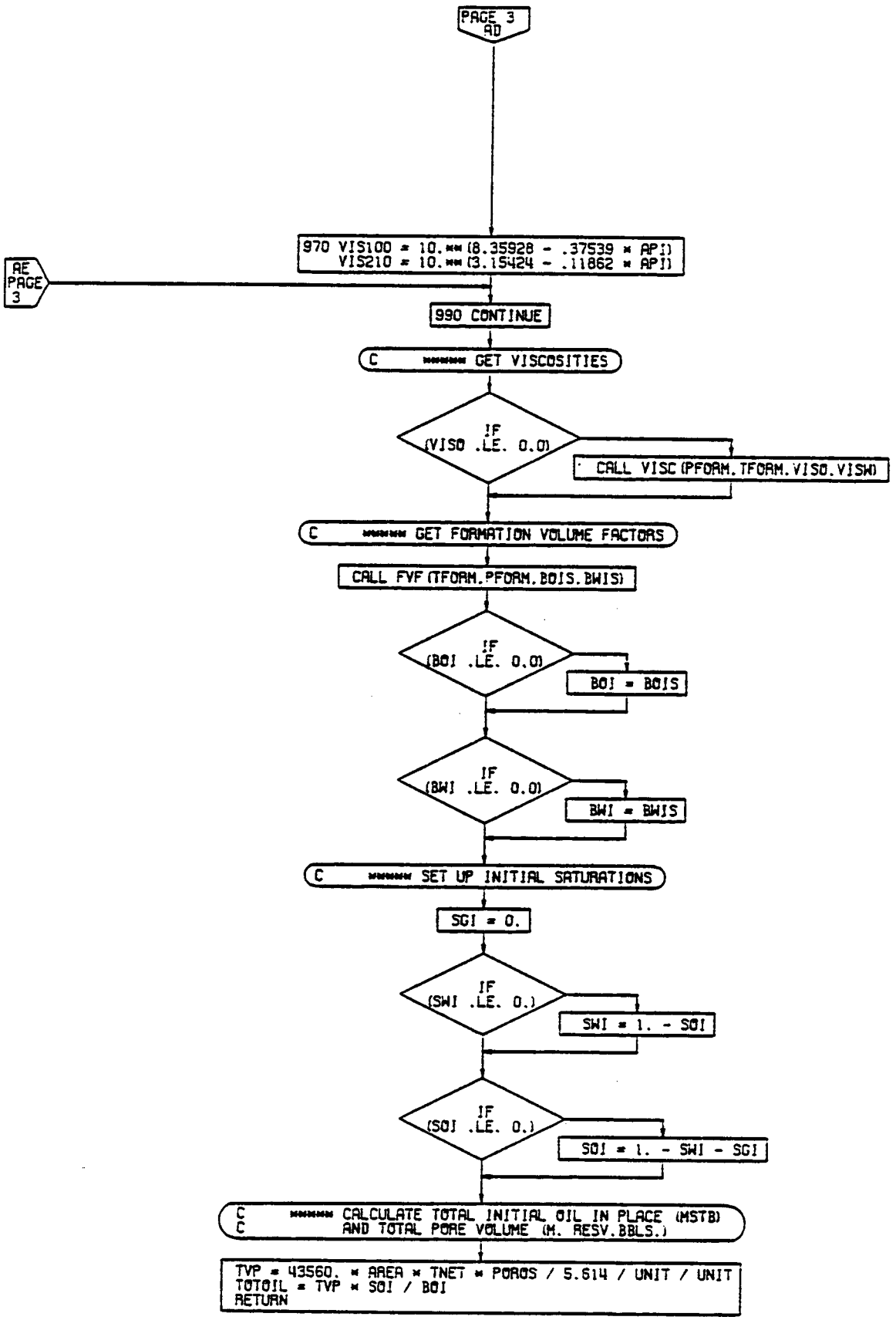

SUBROUTINE INPUT
C
C PERFORMANCE INPUT DATA ONLY (ECONOMIC INPUT DATA READ LATER)
C
READ(IR,*) IRES,IPAT,IWRIT,IECON
IF (IRES.LE.0)
IRES = 0
IF (IPAT.LE.0)
IPAT = 0
IF (ILIT.LE.1)
ILIT=1
READ(IR,*) DEPTH,PFORM,TFORM
READ(IR,*) TNET,PERM,POROS
READ(IR,*) SOI,SGI,SWI
READ(IR,*) API,VISO,BOI,BWI
READ(IR,*) AREA,WELLSP,ARIN,FWA,SWEEP,BANMX
C ******* CHECK INPUT DATA FOR DEFAULTS
CALL CHEKR(KAS)
C ******* PRINT FORMATION INPUT
CALL OUT1
IF (IERR.GT.0) GO TO 109
RETURN
109 IF (IERR.NE.2) GO TO 110
IERR=1
RETURN
110 WRITE(IW,9314) IERR
IERR = 1
RETURN


SUBROUTINE CHEKR (KAS)
C
C ****** DEFAULT CHECKING - FORMATION. AND CASE DATA
C
ERROR = 99999.99999
UNIT = 1000.
C ****** CHECK API GRAVITY
IF
(API .NE. 0.0)
GO TO 100
IERR = 3
API = ERROR
WRITE (IW,9001)
100 SGO = 141.5/(API + 131.5)
SGW = 1.0
SGG = 0.8
C ****** CHECK DEPTH
IF
(DEPTH .GT. 0.0)
GO TO 150
DEPTH = ERROR
IERR = 4
WRITE (IW,9101)
C ****** CHECK FOR INITIAL TEMPERATURE AND PRESSURE
150 TGRG = 70.0
IF
(TFORM .GT. 0.0)
GO TO 175
GGRAD=0.011
TFORM = TGRG + DEPTH*GGRAD
C ****** ASSUME PARTIALLY DEPLETED RESERVOIR
175 PGRAD = 0.433 / 2.0
PAGE 2
AA


PAGE 1
AA
IF
(PFORM .LE. 0.0)
PFORM = 14.7 + DEPTH*PGRAD
C ****** CHECK NET PAY THICKNESS
IF
(TNET .GT. 0.0)
GO TO 300
TNET = ERROR
IERR = 5
WRITE(IW,201)
C CALCULATE AND CHECK MAXIMUM BURN THICKNESS AND NUMBER
C OF BURN ZONES IN THE RESERVOIR
300 NZONE = 1
IF
(BRNMX.LT.0.0)
GO TO 3001
IF
(BRNMX .LE. 1.0)
BRNMX = 150.0
XZONE = TNET/BRNMX
NZONE = XZONE
IF
(NZONE .LT. XZONE)
NZONE = NZONE + 1
IF
(XZONE .LT. 1.)
NZONE = 1
3001 CONTINUE
TNETORG = TNET
XZONE = NZONE
TNET = TNET / XZONE
IF
(PERM .NE. 0.0)
GO TO 400
AC
PAG
3
C ****** CHECK FORMATION PERMEABILITY
PERM = ERROR
IERR = 6
WRITE(IW,301)
PAGE 3
AB

PAGE 2
CHEKR


PAGE 2
AB
AC
PAGE
2
C ****** CHECK FORMATION POROSITY
400 IF
(POROS .GT. 0.0)
GO TO 500
POROS = ERROR
IERR = 7
WRITE(IW,9401)
C ****** CHECK DEVELOPED AREA
500 IF
(AREA .GT. 0.0)
GO TO 600
AREA = ERROR
IERR = 8
WRITE(IW,9501)
C ****** CHECK NUMBER OF PRODUCING WELLS
600 IF
(WELLSP .GT. 0.0)
GO TO 900
WELLSP = 1
IERR = 9
WRITE(IW,9601)
C ****** CALCULATE DEFAULT VALUES FOR VIS100 AND VIS210
900 RS = 100.
IF
(API .LT. 10.)
GO TO 970
AD
PAG
4
VIS100 = BB(1) * API + BB(2) + (((BB(6)/API + BB(5))/API
1 + BB(4))/API + BB(3))/ API
VIS100 = EXP (VIS100)
VIS210 = BB(7) * API + BB(8) + (((BB(12)/API + BB(11))/API
1 + BB(10))/API + BB(9))/API
VIS210 = EXP (VIS210)
GO TO 990
PAGE 4
AE


PAGE 3
AD
AE
PAGE
3
970 VIS100 = 10.**(8.35928 - .37539 * API)
VIS210 = 10.**(3.15424 - .11862 * API)
990 CONTINUE
C ****** GET VISCOSITIES
IF
(VISO .LE. 0.0)
CALL VISC(PFORM,TFORM,VISO,VISW)
C ****** GET FORMATION VOLUME FACTORS
CALL FVF(TFORM,PFORM,BOIS,BWIS)
IF
(BOI .LE. 0.0)
BOI = BOIS
IF
(BWI .LE. 0.0)
BWI = BWIS
C ****** SET UP INITIAL SATURATIONS
SGI = 0.
IF
(SWI .LE. 0.)
SWI = 1. - SOI
IF
(SOI .LE. 0.)
SOI = 1. - SWI - SGI
C ****** CALCULATE TOTAL INITIAL OIL IN PLACE (MSTB)
C AND TOTAL PORE VOLUME (M. RESV.BBLS.)
TVP = 43560. * AREA * TNET * POROS / 5.614 / UNIT / UNIT
TOTOIL = TVP * SOI / BOI
RETURN

```
SUBROUTINE OUT1

C
C       ****** THIS SUBROUTINE OUTPUTS THE CASE CONTROL AND RESERVOIR
C               INPUT DATA
C
C       ****** WRITE CASE CONTROLS

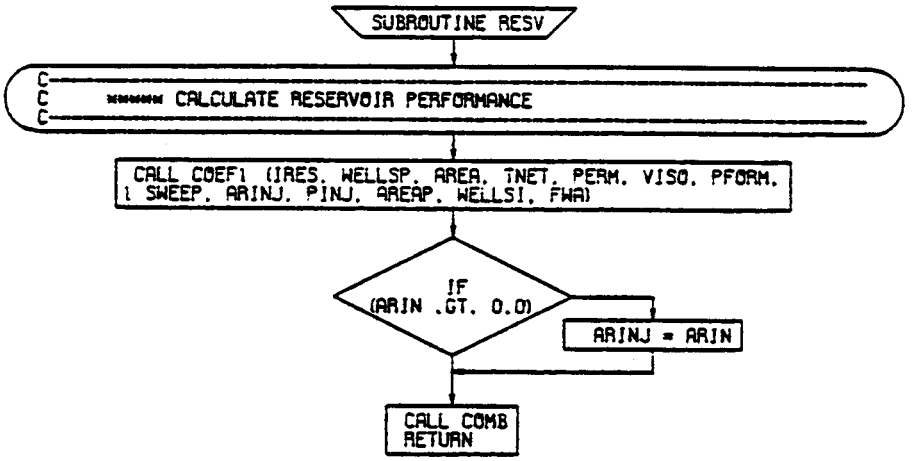
 WRITE(IW,9300)
 WRITE(IW,9305)  IRES.IPAT.IWRIT.IECON

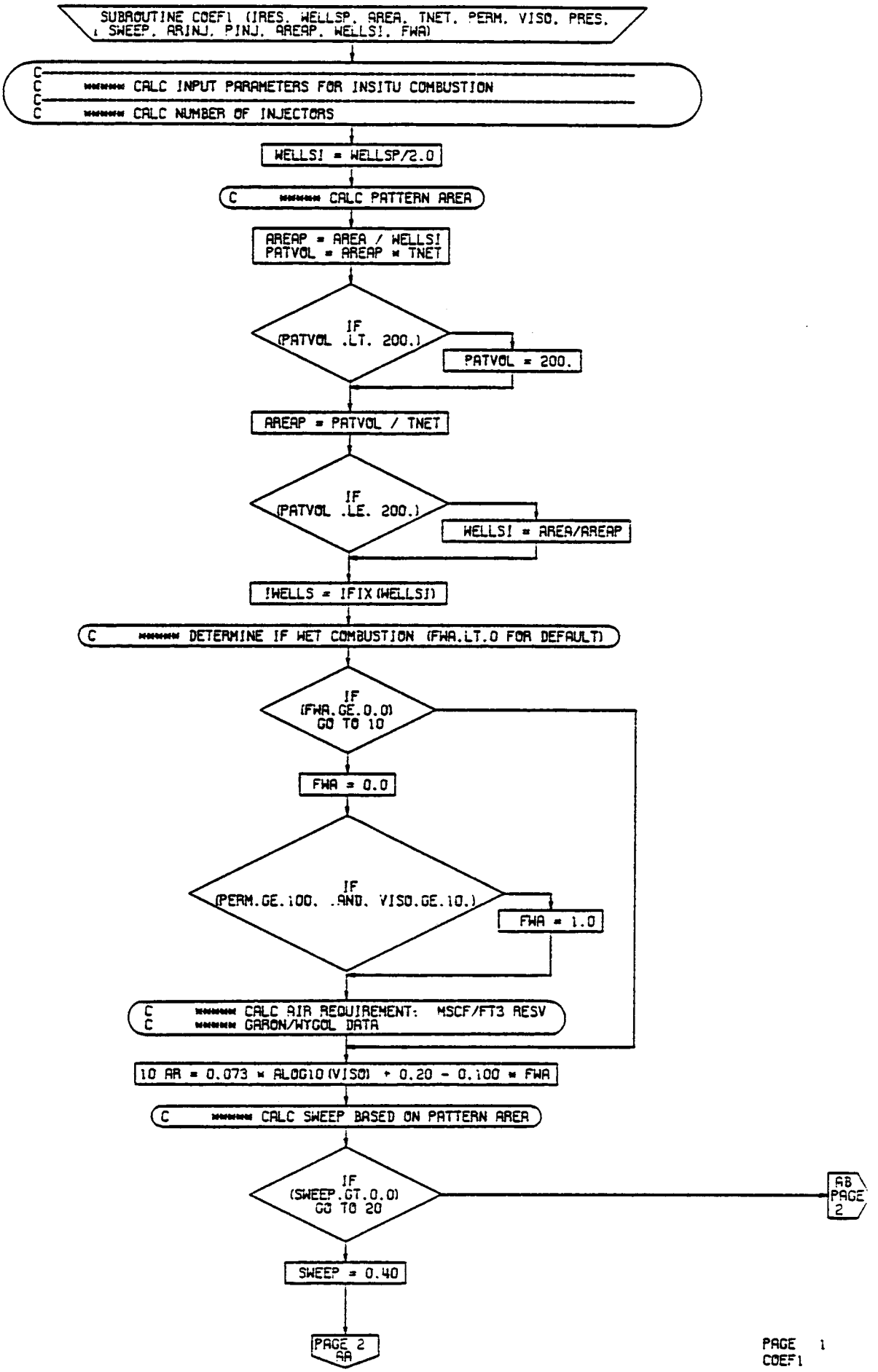
C       ****** WRITE FORMATION PROPERTIES AND INITIAL CONDITIONS

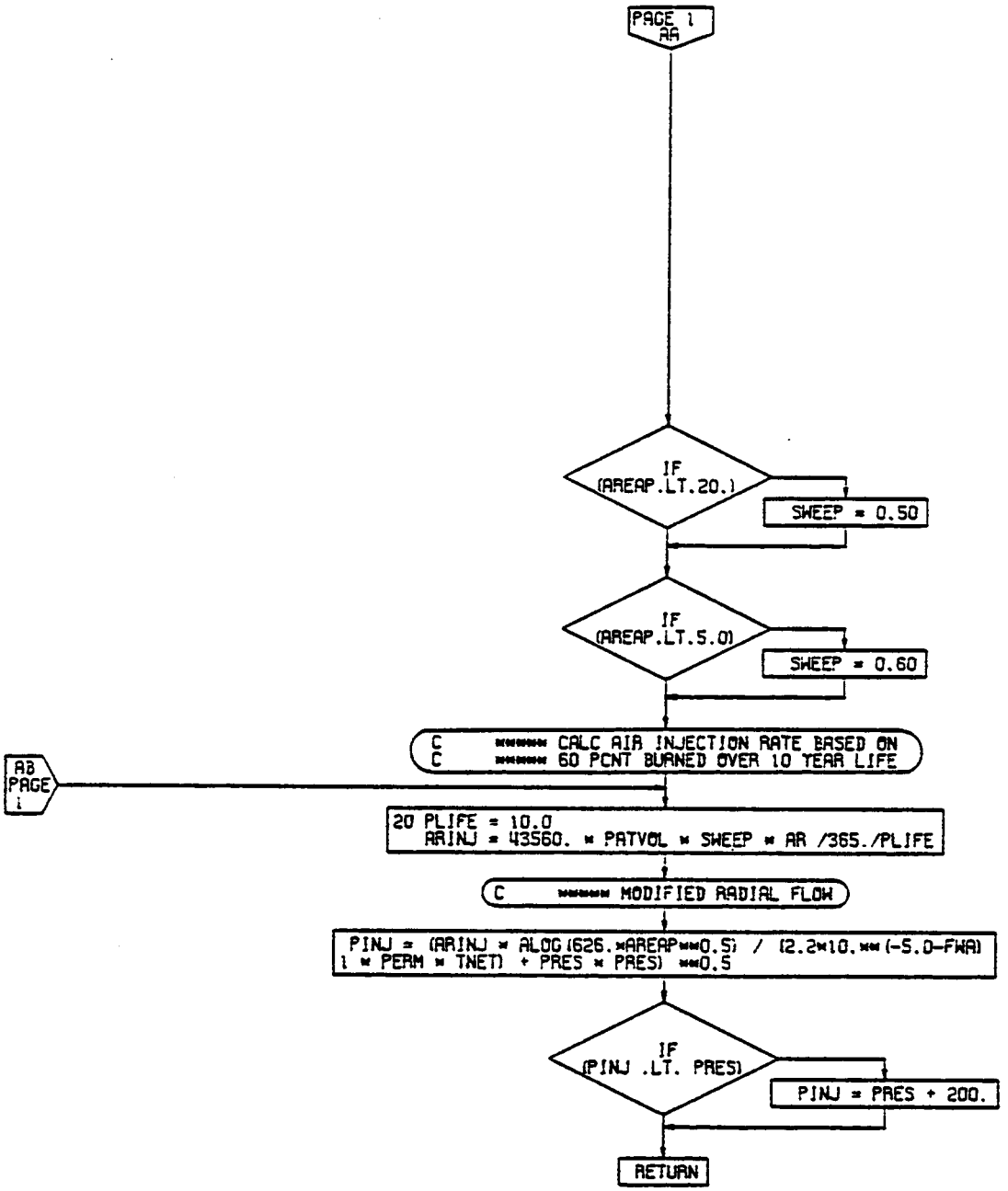
 WRITE(IW,9340)
 WRITE(IW,9350)  DEPTH.PFORM.TFORM
 WRITE(IW,9360)  TNETORG.TNET.PERM.POROS

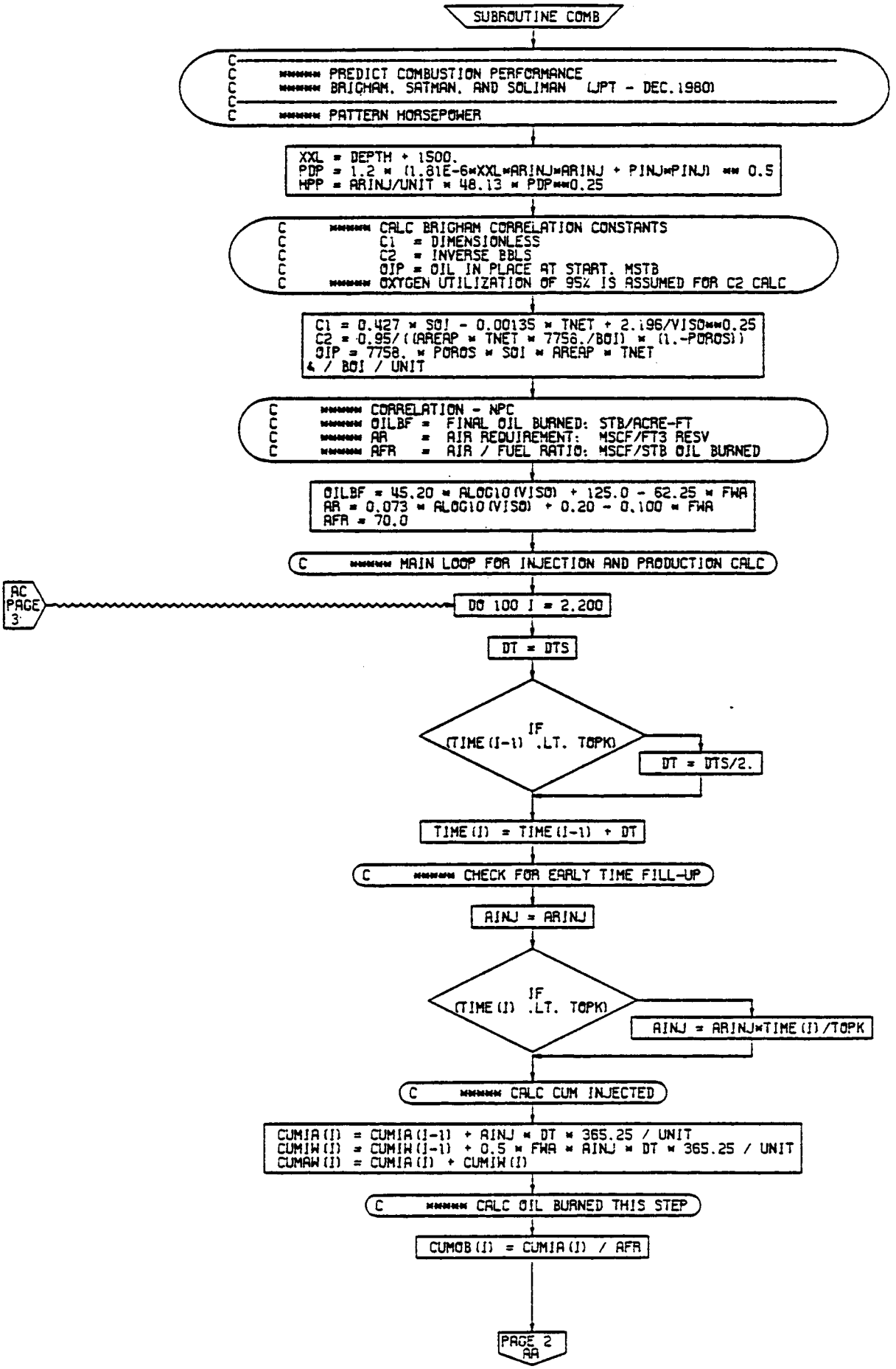
C       ****** WRITE INITIAL CONDITIONS

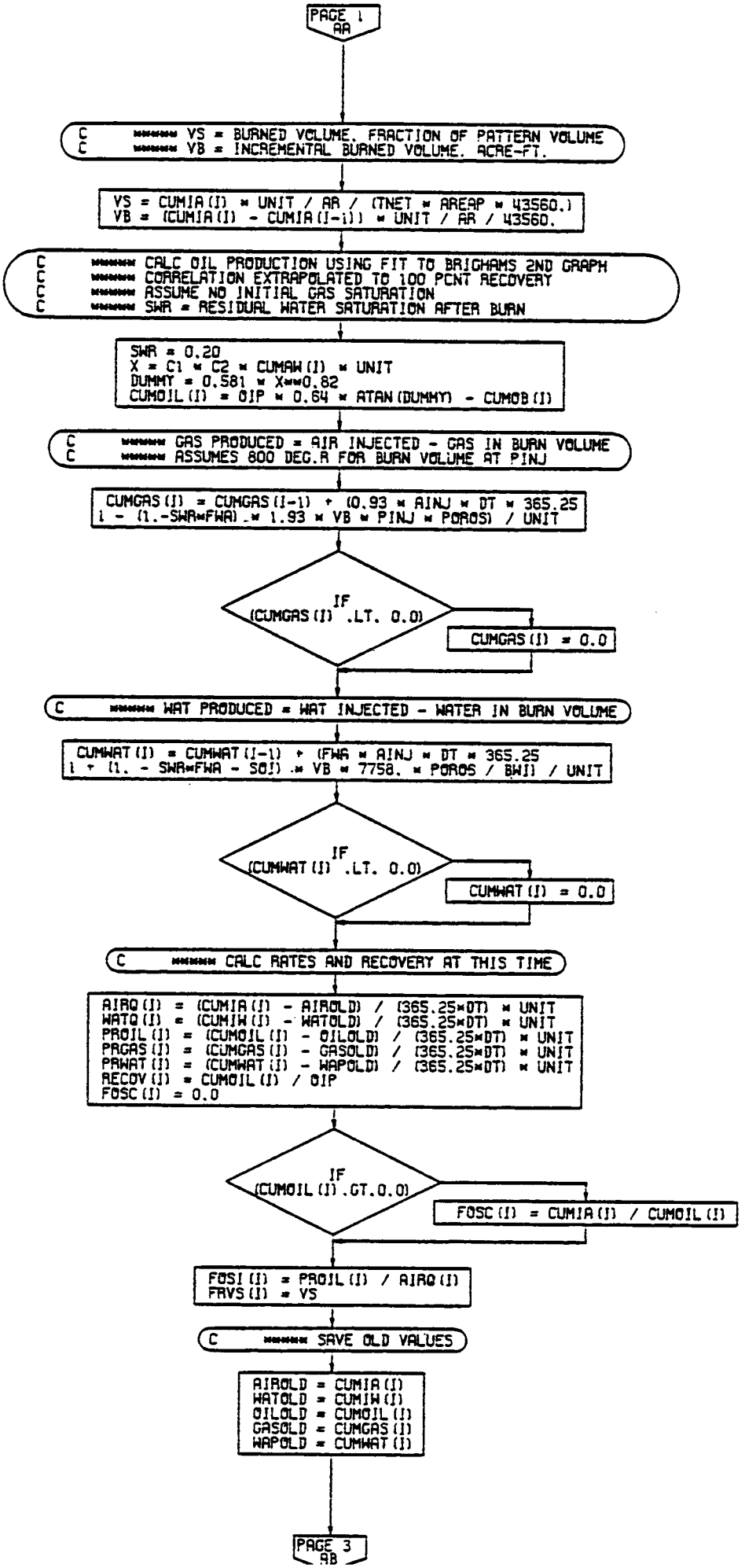
 WRITE(IW,9400)
 WRITE(IW,9405)  SOI.SGI.SWI.API.
1 VISO. BOI. BWI
 XZONE =NZONE
 WRITE(IW,9410)  AREA. WELLSP. ARIN. SWEEP. TOTOIL. TVP . XZONE
 RETURN
```

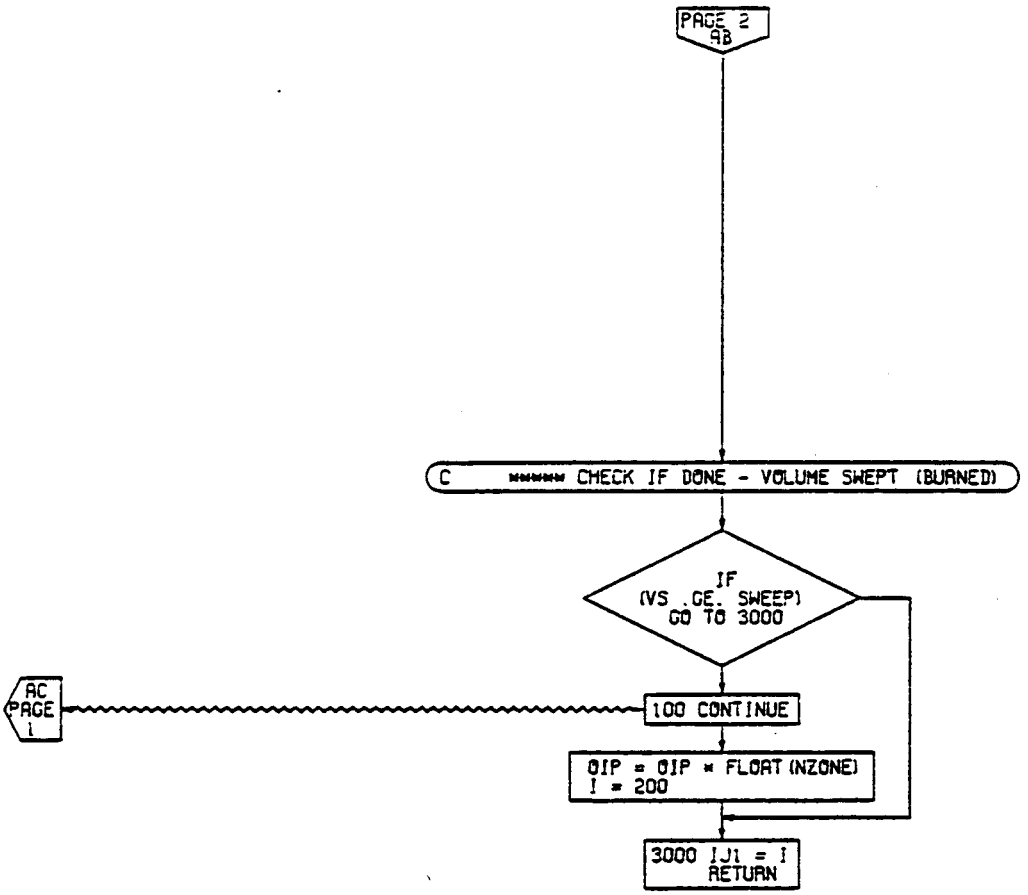

SUBROUTINE RESV
C
C ****** CALCULATE RESERVOIR PERFORMANCE
C
CALL COEF1 (IRES, WELLSP, AREA, TNET, PERM, VISO, PFORM,
1 SWEEP, ARINJ, PINJ, AREAP, WELLSI, FWA)
IF
(ARIN .GT. 0.0)
ARINJ = ARIN
CALL COMB
RETURN

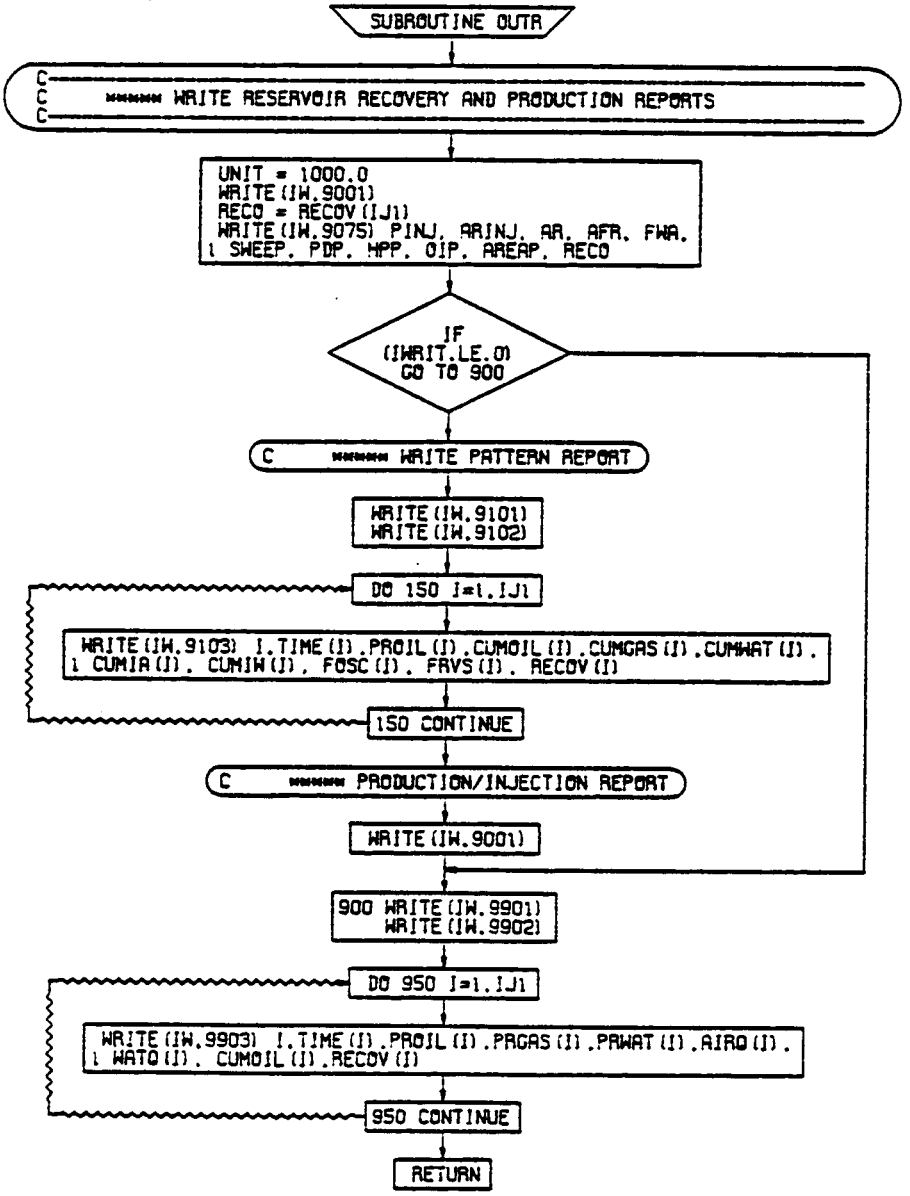

SUBROUTINE COEF1 (IRES, WELLSP, AREA, TNET, PERM, VISO, PRES,
1 SWEEP, ARINJ, PINJ, AREAP, WELLSI, FWA)
C ****** CALC INPUT PARAMETERS FOR INSITU COMBUSTION
C ****** CALC NUMBER OF INJECTORS
WELLSI = WELLSP/2.0
C ****** CALC PATTERN AREA
AREAP = AREA / WELLSI
PATVOL = AREAP * TNET
IF (PATVOL .LT. 200.)
PATVOL = 200.
AREAP = PATVOL / TNET
IF (PATVOL .LE. 200.)
WELLSI = AREA/AREAP
IWELLS = IFIX(WELLSI)
C ****** DETERMINE IF WET COMBUSTION (FWA.LT.0 FOR DEFAULT)
IF (FWA.GE.0.0) GO TO 10
FWA = 0.0
IF (PERM.GE.100. .AND. VISO.GE.10.)
FWA = 1.0
C ****** CALC AIR REQUIREMENT: MSCF/FT3 RESV
C ****** GARON/WYGOL DATA
10 AR = 0.073 * ALOG10(VISO) + 0.20 - 0.100 * FWA
C ****** CALC SWEEP BASED ON PATTERN AREA
IF (SWEEP.GT.0.0) GO TO 20
AB PAGE 2
SWEEP = 0.40
PAGE 2 AA

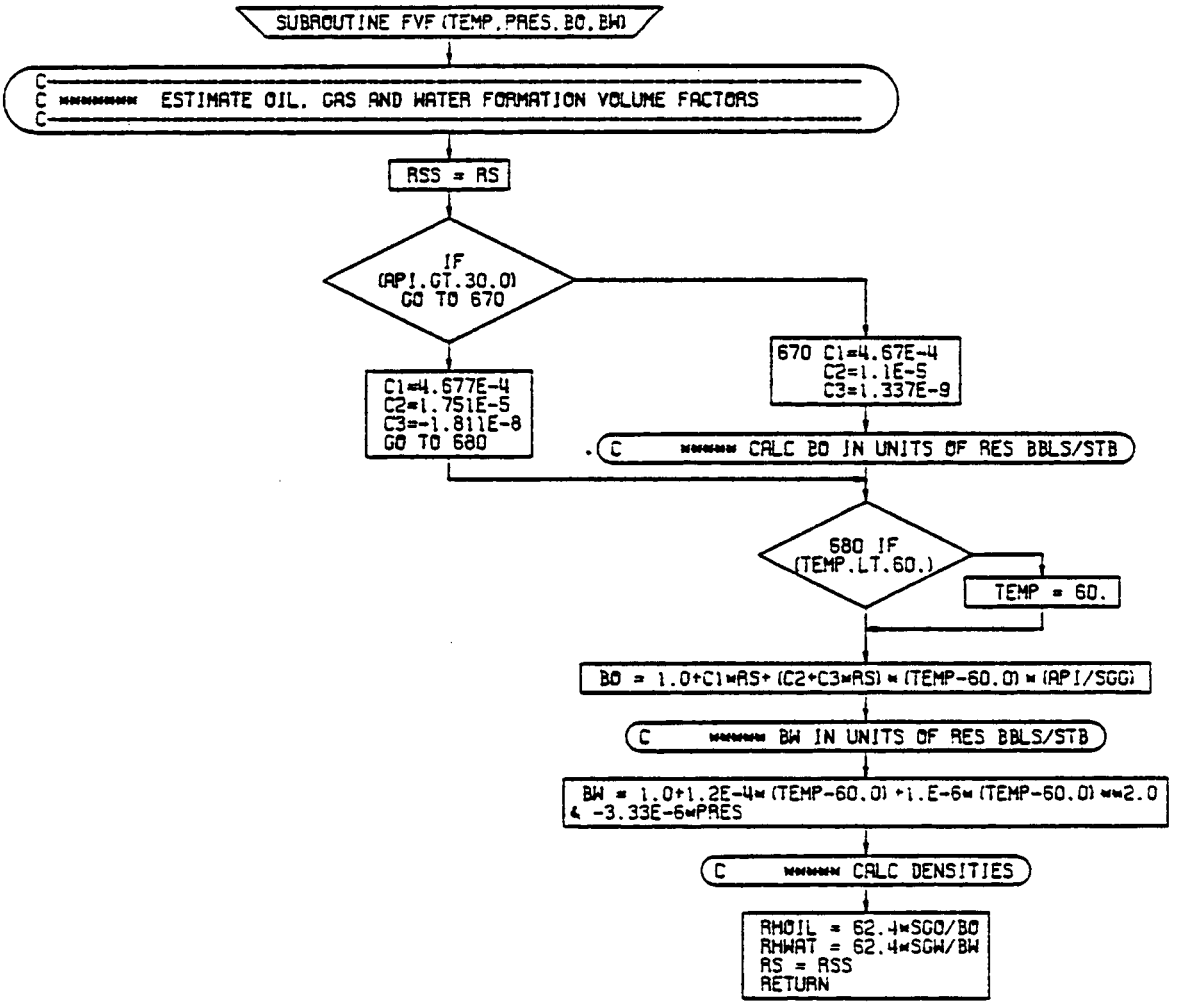

PAGE 1
AA
IF
(AREAP.LT.20.)
SWEEP = 0.50
IF
(AREAP.LT.5.0)
SWEEP = 0.60
C ****** CALC AIR INJECTION RATE BASED ON
C ****** 60 PCNT BURNED OVER 10 YEAR LIFE
AB
PAGE
1
20 PLIFE = 10.0
ARINJ = 43560. * PATVOL * SWEEP * AR /365./PLIFE
C ****** MODIFIED RADIAL FLOW
PINJ = (ARINJ * ALOG(626.*AREAP**0.5) / (2.2*10.**(-5.0-FWA)
1 * PERM * TNET) + PRES * PRES) **0.5
IF
(PINJ .LT. PRES)
PINJ = PRES + 200.
RETURN

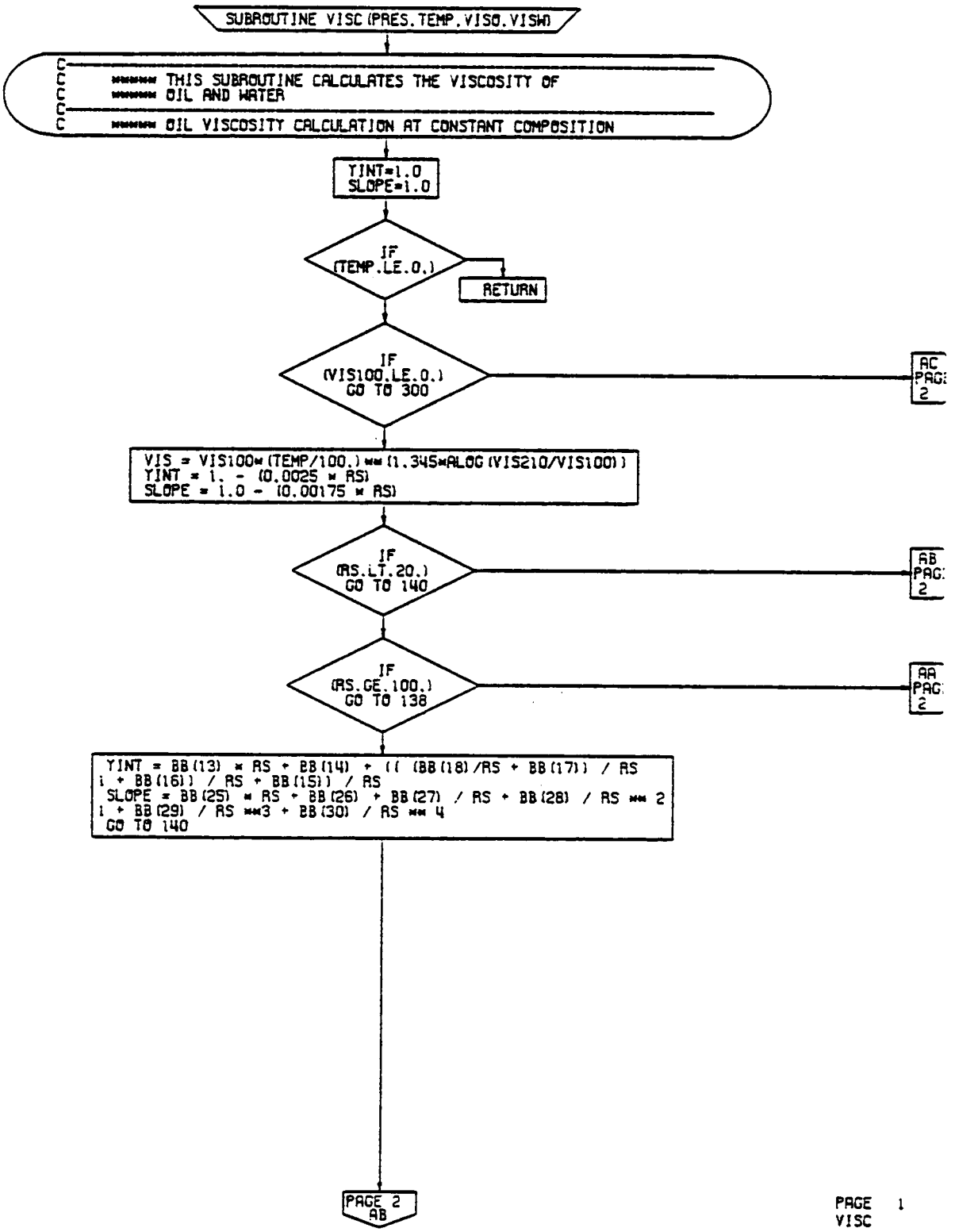

SUBROUTINE COMB
C ****** PREDICT COMBUSTION PERFORMANCE
C ****** BRIGHAM, SATMAN, AND SOLIMAN (JPT - DEC.1980)
C ****** PATTERN HORSEPOWER
XXL = DEPTH + 1500.
PDP = 1.2 * (1.81E-6*XXL*ARINJ*ARINJ + PINJ*PINJ) ** 0.5
HPP = ARINJ/UNIT * 48.13 * PDP**0.25
C ****** CALC BRIGHAM CORRELATION CONSTANTS
C C1 = DIMENSIONLESS
C C2 = INVERSE BBLS
C OIP = OIL IN PLACE AT START, MSTB
C ****** OXYGEN UTILIZATION OF 95% IS ASSUMED FOR C2 CALC
C1 = 0.427 * SOI - 0.00135 * TNET + 2.196/VISO**0.25
C2 = 0.95/((AREAP * TNET * 7758./BOI) * (1.-POROS))
OIP = 7758. * POROS * SOI * AREAP * TNET
& / BOI / UNIT
C ****** CORRELATION - NPC
C ****** OILBF = FINAL OIL BURNED: STB/ACRE-FT
C ****** AR = AIR REQUIREMENT: MSCF/FT3 RESV
C ****** AFR = AIR / FUEL RATIO: MSCF/STB OIL BURNED
OILBF = 45.20 * ALOG10(VISO) + 125.0 - 62.25 * FWA
AR = 0.073 * ALOG10(VISO) + 0.20 - 0.100 * FWA
AFR = 70.0
C ****** MAIN LOOP FOR INJECTION AND PRODUCTION CALC
AC PAGE 3
DO 100 I = 2,200
DT = DTS
IF (TIME(I-1) .LT. TOPK)
DT = DTS/2.
TIME(I) = TIME(I-1) + DT
C ****** CHECK FOR EARLY TIME FILL-UP
AINJ = ARINJ
IF (TIME(I) .LT. TOPK)
AINJ = ARINJ*TIME(I)/TOPK
C ****** CALC CUM INJECTED
CUMIA(I) = CUMIA(I-1) + AINJ * DT * 365.25 / UNIT
CUMIW(I) = CUMIW(I-1) + 0.5 * FWA * AINJ * DT * 365.25 / UNIT
CUMAW(I) = CUMIA(I) + CUMIW(I)
C ****** CALC OIL BURNED THIS STEP
CUMOB(I) = CUMIA(I) / AFR
PAGE 2 AA

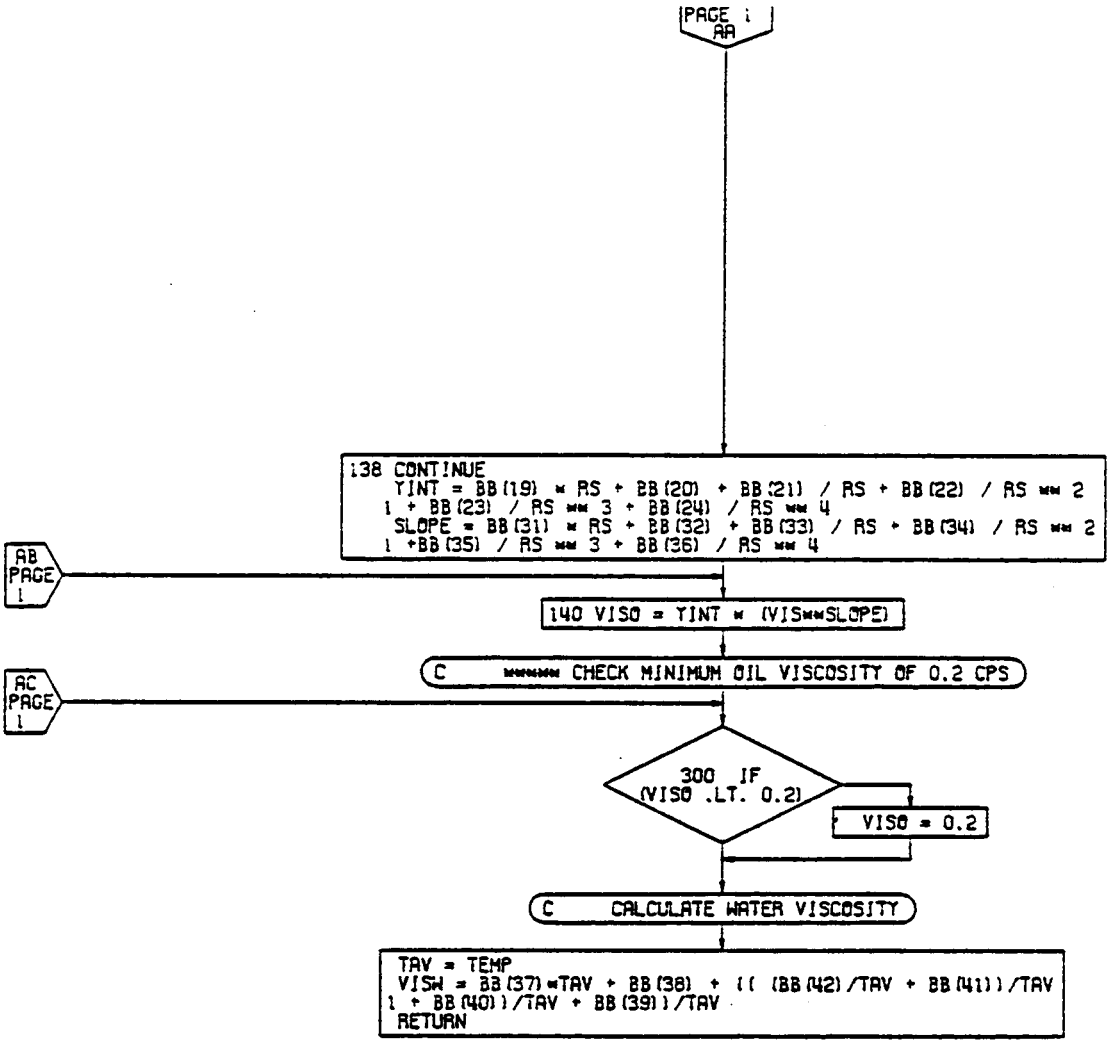

PAGE 1
AA
C ****** VS = BURNED VOLUME. FRACTION OF PATTERN VOLUME
C ****** VB = INCREMENTAL BURNED VOLUME. ACRE-FT.
VS = CUMIA(I) * UNIT / AR / (TNET * AREAP * 43560.)
VB = (CUMIA(I) - CUMIA(I-1)) * UNIT / AR / 43560.
C ****** CALC OIL PRODUCTION USING FIT TO BRIGHAMS 2ND GRAPH
C ****** CORRELATION EXTRAPOLATED TO 100 PCNT RECOVERY
C ****** ASSUME NO INITIAL GAS SATURATION
C ****** SWR = RESIDUAL WATER SATURATION AFTER BURN
SWR = 0.20
X = C1 * C2 * CUMAW(I) * UNIT
DUMMY = 0.581 * X**0.82
CUMOIL(I) = OIP * 0.64 * ATAN(DUMMY) - CUMOB(I)
C ****** GAS PRODUCED = AIR INJECTED - GAS IN BURN VOLUME
C ****** ASSUMES 800 DEG.R FOR BURN VOLUME AT PINJ
CUMGAS(I) = CUMGAS(I-1) + (0.93 * AINJ * DT * 365.25
1 - (1.-SWR*FWA) * 1.93 * VB * PINJ * POROS) / UNIT
IF (CUMGAS(I) .LT. 0.0)
CUMGAS(I) = 0.0
C ****** WAT PRODUCED = WAT INJECTED - WATER IN BURN VOLUME
CUMWAT(I) = CUMWAT(I-1) + (FWA * AINJ * DT * 365.25
1 + (1. - SWR*FWA - SOI) * VB * 7758. * POROS / BWI) / UNIT
IF (CUMWAT(I) .LT. 0.0)
CUMWAT(I) = 0.0
C ****** CALC RATES AND RECOVERY AT THIS TIME
AIRQ(I) = (CUMIA(I) - AIROLD) / (365.25*DT) * UNIT
WATQ(I) = (CUMIW(I) - WATOLD) / (365.25*DT) * UNIT
PROIL(I) = (CUMOIL(I) - OILOLD) / (365.25*DT) * UNIT
PRGAS(I) = (CUMGAS(I) - GASOLD) / (365.25*DT) * UNIT
PRWAT(I) = (CUMWAT(I) - WAPOLD) / (365.25*DT) * UNIT
RECOV(I) = CUMOIL(I) / OIP
FOSC(I) = 0.0
IF (CUMOIL(I) .GT. 0.0)
FOSC(I) = CUMIA(I) / CUMOIL(I)
FOSI(I) = PROIL(I) / AIRQ(I)
FRVS(I) = VS
C ****** SAVE OLD VALUES
AIROLD = CUMIA(I)
WATOLD = CUMIW(I)
OILOLD = CUMOIL(I)
GASOLD = CUMGAS(I)
WAPOLD = CUMWAT(I)
PAGE 3
AB

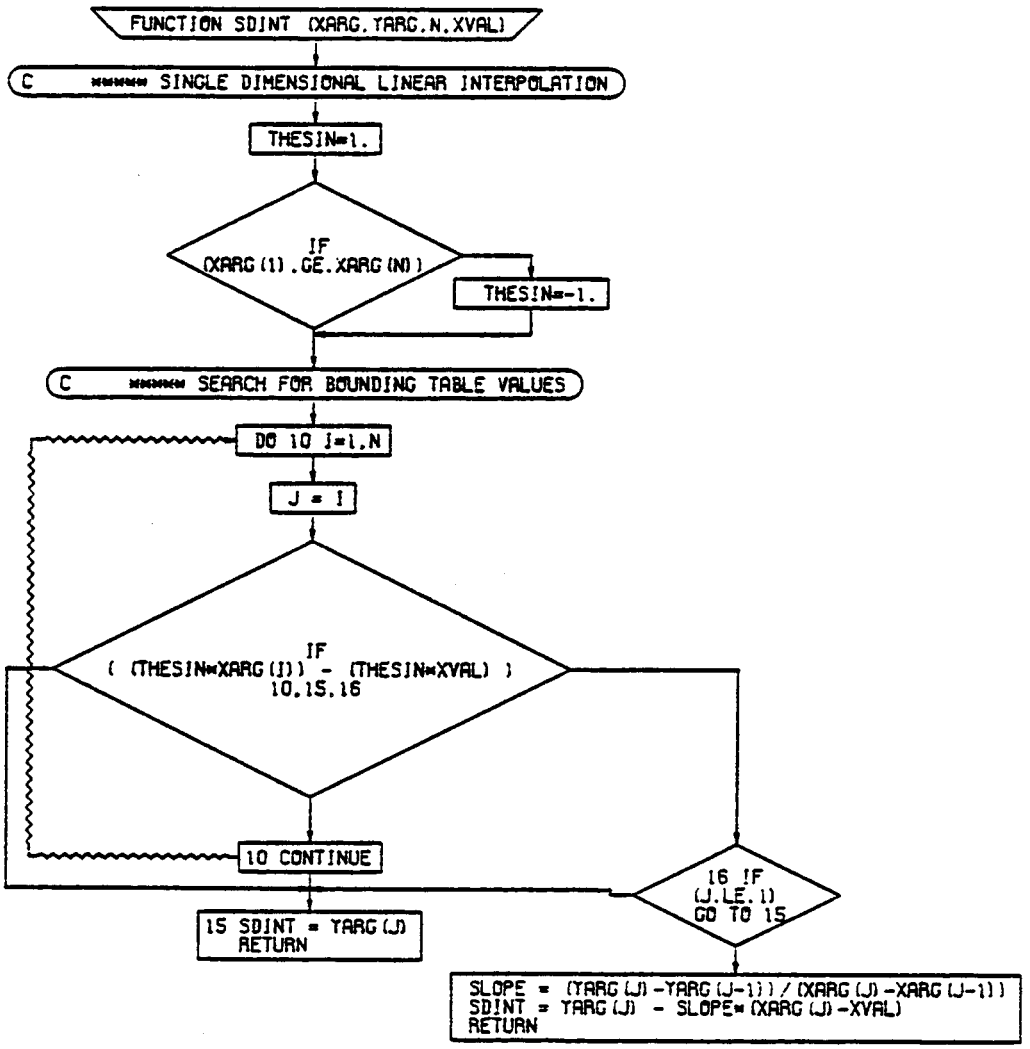

PAGE 2
AB
C ****** CHECK IF DONE - VOLUME SWEPT (BURNED)
IF
(VS .GE. SWEEP)
GO TO 3000
AC
PAGE
1
100 CONTINUE
OIP = OIP * FLOAT(NZONE)
I = 200
3000 IJ1 = I
RETURN

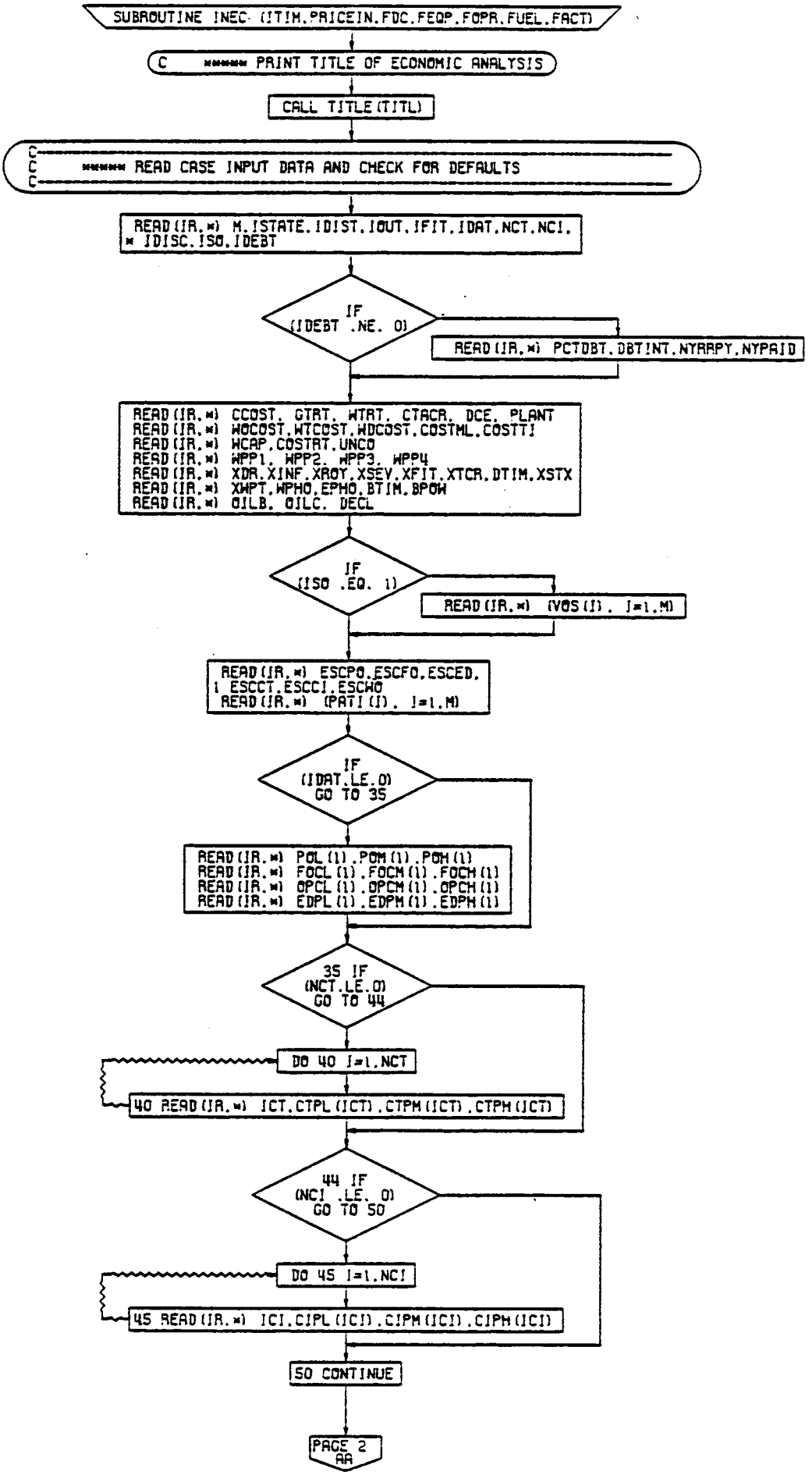

SUBROUTINE OUTR
C
C ****** WRITE RESERVOIR RECOVERY AND PRODUCTION REPORTS
C
UNIT = 1000.0
WRITE(IW,9001)
RECO = RECOV(IJ1)
WRITE(IW,9075) PINJ, ARINJ, AR, AFR, FWA,
1 SWEEP, PDP, HPP, OIP, AREAP, RECO
IF
(IWRIT.LE.0)
GO TO 900
C ****** WRITE PATTERN REPORT
WRITE(IW,9101)
WRITE(IW,9102)
DO 150 I=1,IJ1
WRITE(IW,9103) I,TIME(I),PROIL(I),CUMOIL(I),CUMGAS(I),CUMWAT(I),
1 CUMIA(I), CUMIW(I), FOSC(I), FRVS(I), RECOV(I)
150 CONTINUE
C ****** PRODUCTION/INJECTION REPORT
WRITE(IW,9001)
900 WRITE(IW,9901)
WRITE(IW,9902)
DO 950 I=1,IJ1
WRITE(IW,9903) I,TIME(I),PROIL(I),PRGAS(I),PRWAT(I),AIRQ(I),
1 WATQ(I), CUMOIL(I),RECOV(I)
950 CONTINUE
RETURN

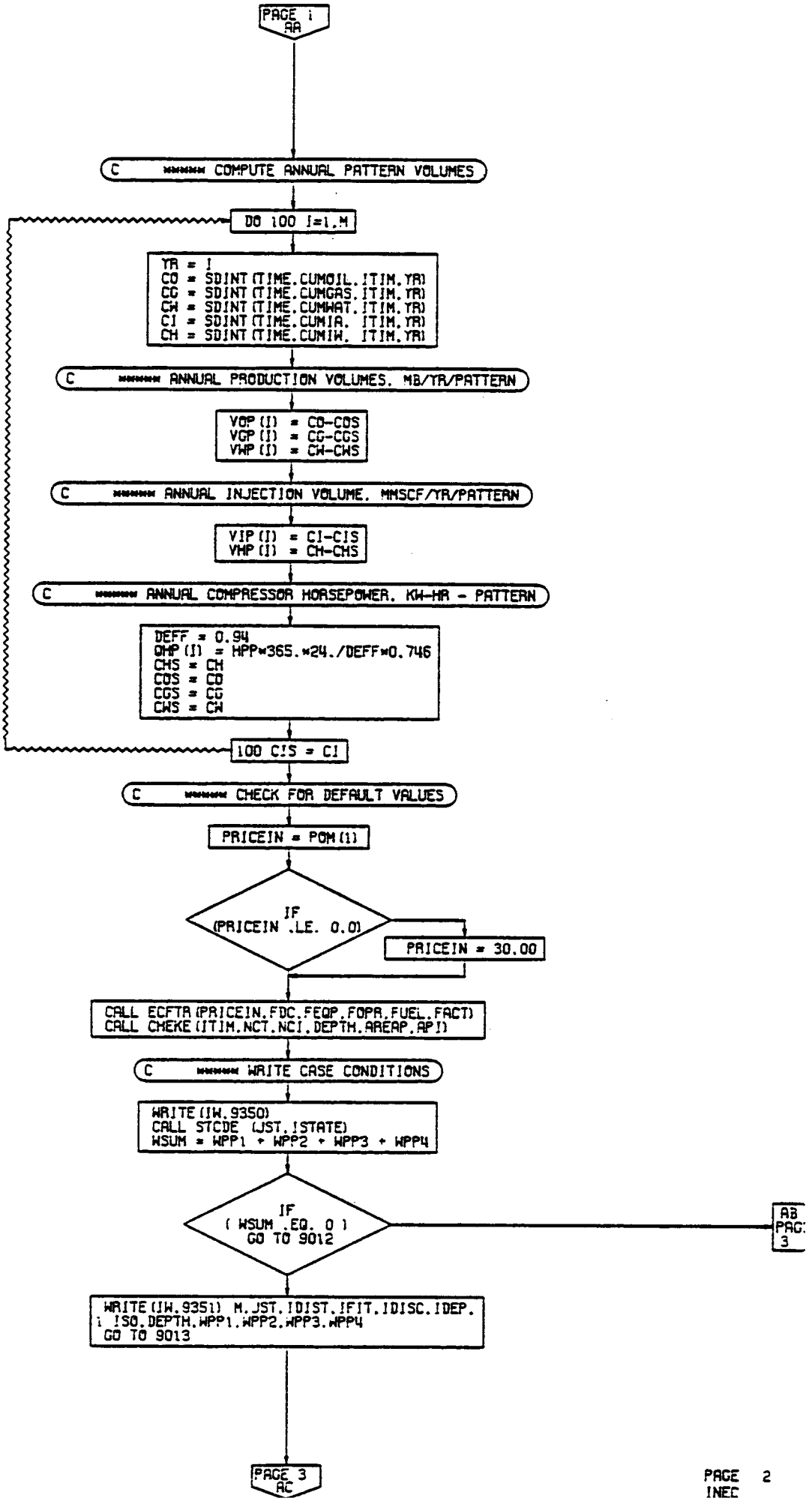

SUBROUTINE FVF (TEMP,PRES,BO,BW)
C
C ******** ESTIMATE OIL, GAS AND WATER FORMATION VOLUME FACTORS
C
RSS = RS
IF (API.GT.30.0) GO TO 670
C1=4.677E-4
C2=1.751E-5
C3=-1.811E-8
GO TO 680
670 C1=4.67E-4
C2=1.1E-5
C3=1.337E-9
C ******* CALC BO IN UNITS OF RES BBLS/STB
680 IF (TEMP.LT.60.)
TEMP = 60.
BO = 1.0+C1*RS+(C2+C3*RS)*(TEMP-60.0)*(API/SGG)
C ******* BW IN UNITS OF RES BBLS/STB
BW = 1.0+1.2E-4*(TEMP-60.0)+1.E-6*(TEMP-60.0)**2.0
& -3.33E-6*PRES
C ******* CALC DENSITIES
RHOIL = 62.4*SGO/BO
RHWAT = 62.4*SGW/BW
RS = RSS
RETURN

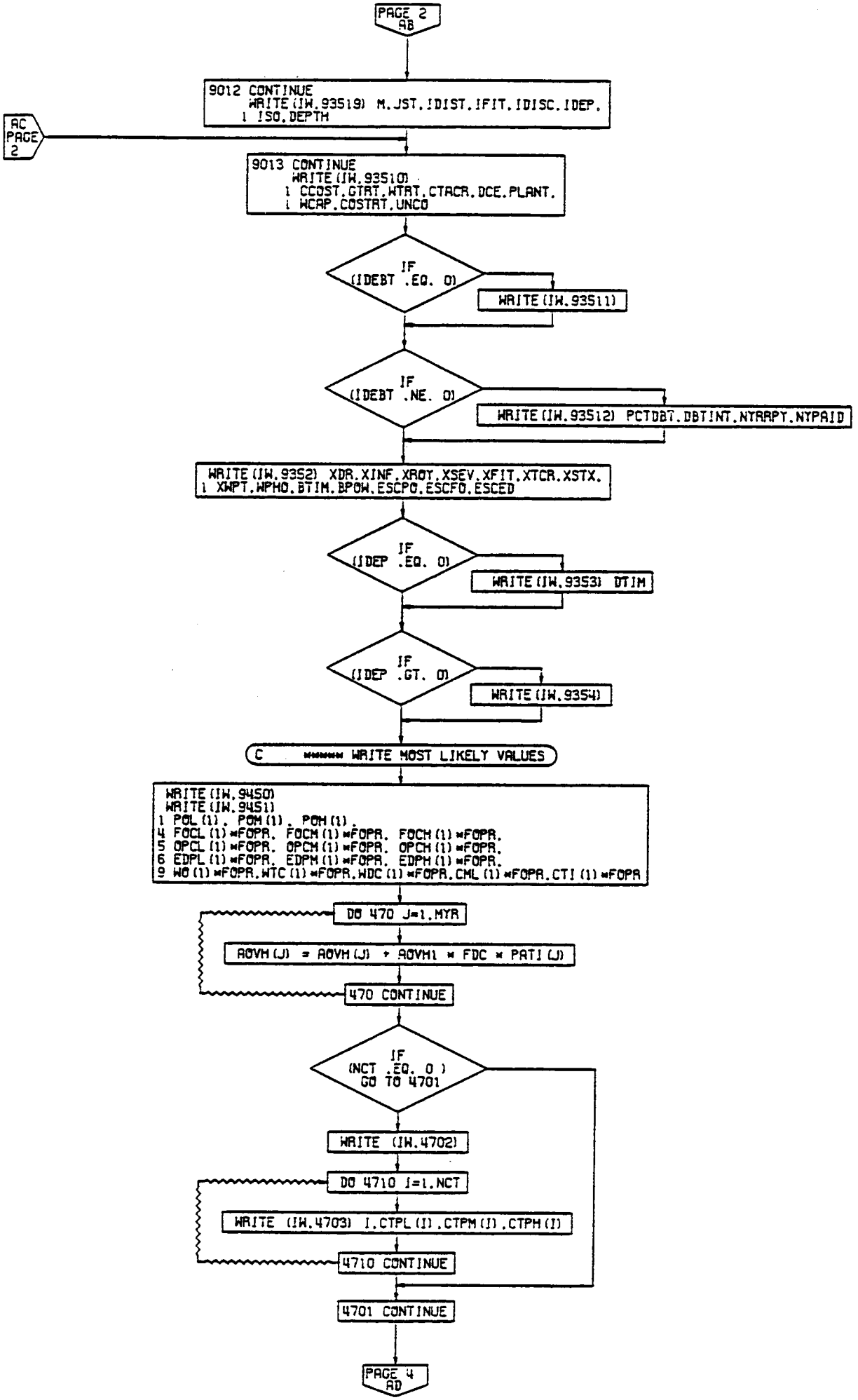

SUBROUTINE VISC(PRES,TEMP,VISO,VISW)
C
C ****** THIS SUBROUTINE CALCULATES THE VISCOSITY OF
C ****** OIL AND WATER
C
C ****** OIL VISCOSITY CALCULATION AT CONSTANT COMPOSITION
YINT=1.0
SLOPE=1.0
IF (TEMP.LE.0.)
RETURN
IF (VIS100.LE.0.) GO TO 300
AC PAG 2
VIS = VIS100*(TEMP/100.)**(1.345*ALOG(VIS210/VIS100))
YINT = 1. - (0.0025 * RS)
SLOPE = 1.0 - (0.00175 * RS)
IF (RS.LT.20.) GO TO 140
AB PAG 2
IF (RS.GE.100.) GO TO 138
AA PAG 2
YINT = BB(13) * RS + BB(14) + (((BB(18)/RS + BB(17)) / RS
1 + BB(16)) / RS + BB(15)) / RS
SLOPE = BB(25) * RS + BB(26) + BB(27) / RS + BB(28) / RS ** 2
1 + BB(29) / RS **3 + BB(30) / RS ** 4
GO TO 140
PAGE 2 AB

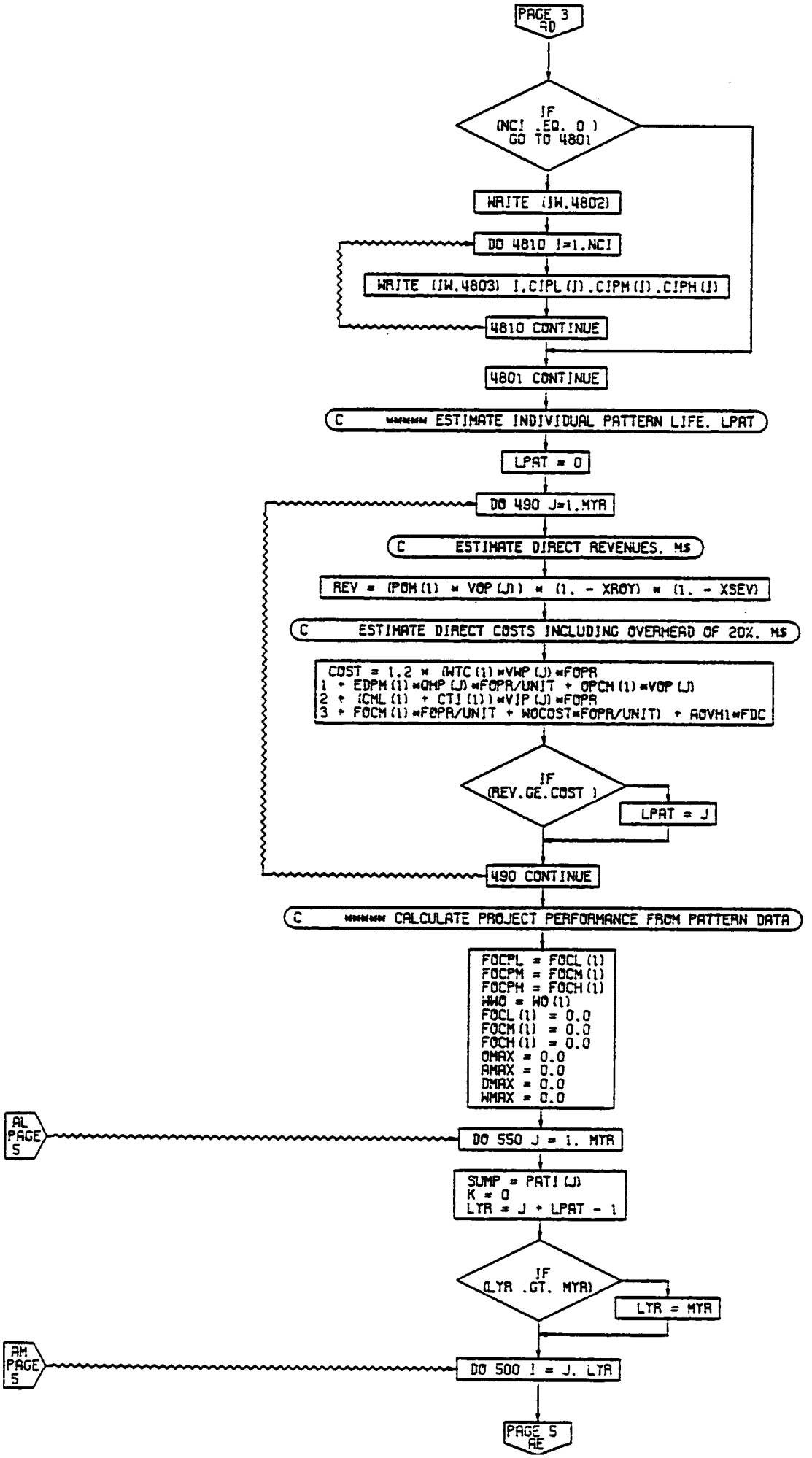

PAGE 1
AA
138 CONTINUE
TINT = BB(19) * RS + BB(20) + BB(21) / RS + BB(22) / RS ** 2
1 + BB(23) / RS ** 3 + BB(24) / RS ** 4
SLOPE = BB(31) * RS + BB(32) + BB(33) / RS + BB(34) / RS ** 2
1 +BB(35) / RS ** 3 + BB(36) / RS ** 4
AB
PAGE
1
140 VISO = TINT * (VIS**SLOPE)
C ****** CHECK MINIMUM OIL VISCOSITY OF 0.2 CPS
AC
PAGE
1
300 IF
(VISO .LT. 0.2)
VISO = 0.2
C CALCULATE WATER VISCOSITY
TAV = TEMP
VISW = BB(37)*TAV + BB(38) + (((BB(42)/TAV + BB(41))/TAV
1 + BB(40))/TAV + BB(39))/TAV
RETURN

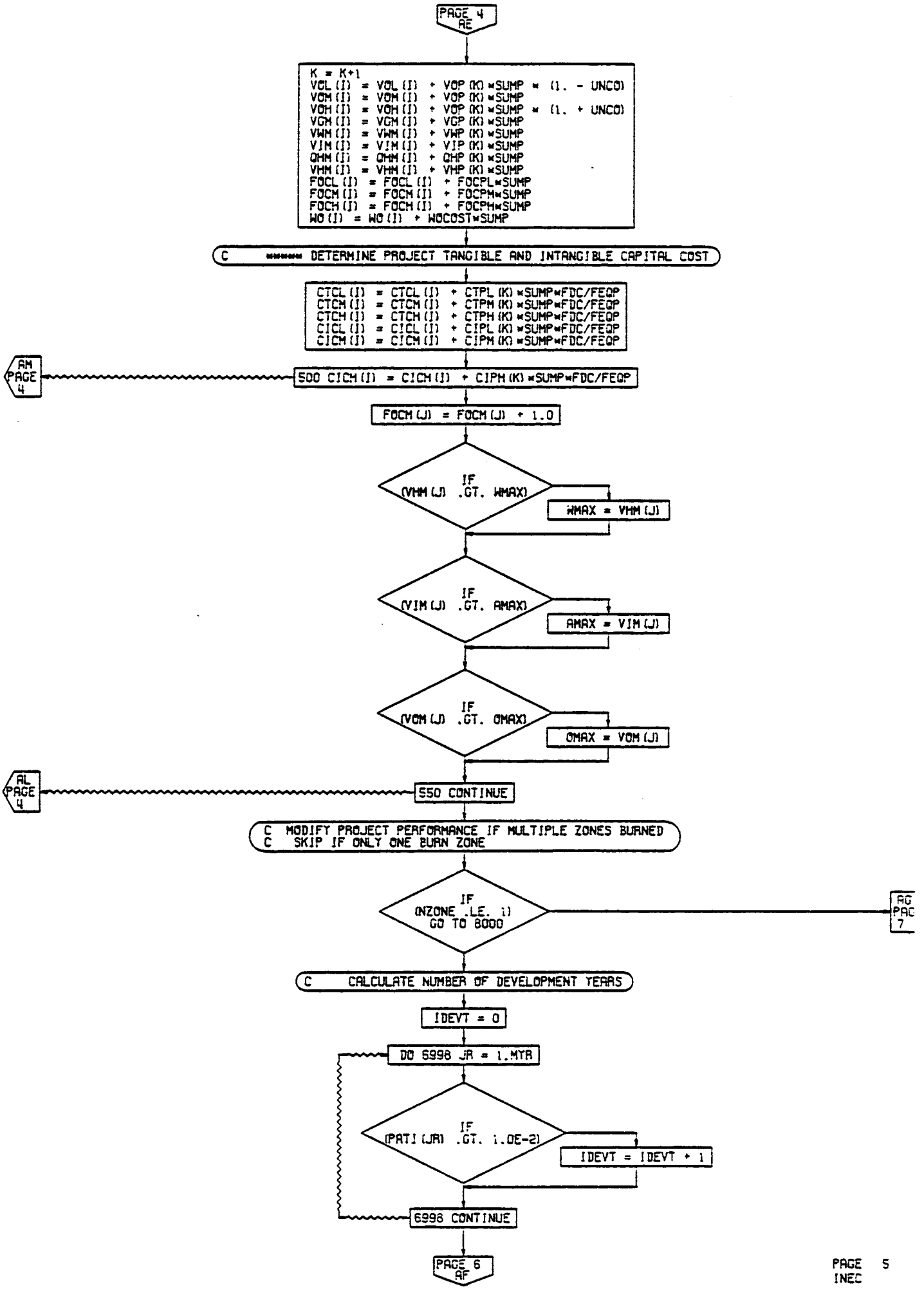

FUNCTION SDINT (XARG,YARG,N,XVAL)
C ****** SINGLE DIMENSIONAL LINEAR INTERPOLATION
THESIN=1.
IF (XARG(1).GE.XARG(N))
THESIN=-1.
C ****** SEARCH FOR BOUNDING TABLE VALUES
DO 10 I=1,N
J = I
IF ((THESIN*XARG(I)) - (THESIN*XVAL)) 10,15,16
10 CONTINUE
16 IF (J.LE.1) GO TO 15
15 SDINT = YARG(J)
RETURN
SLOPE = (YARG(J)-YARG(J-1)) / (XARG(J)-XARG(J-1))
SDINT = YARG(J) - SLOPE*(XARG(J)-XVAL)
RETURN

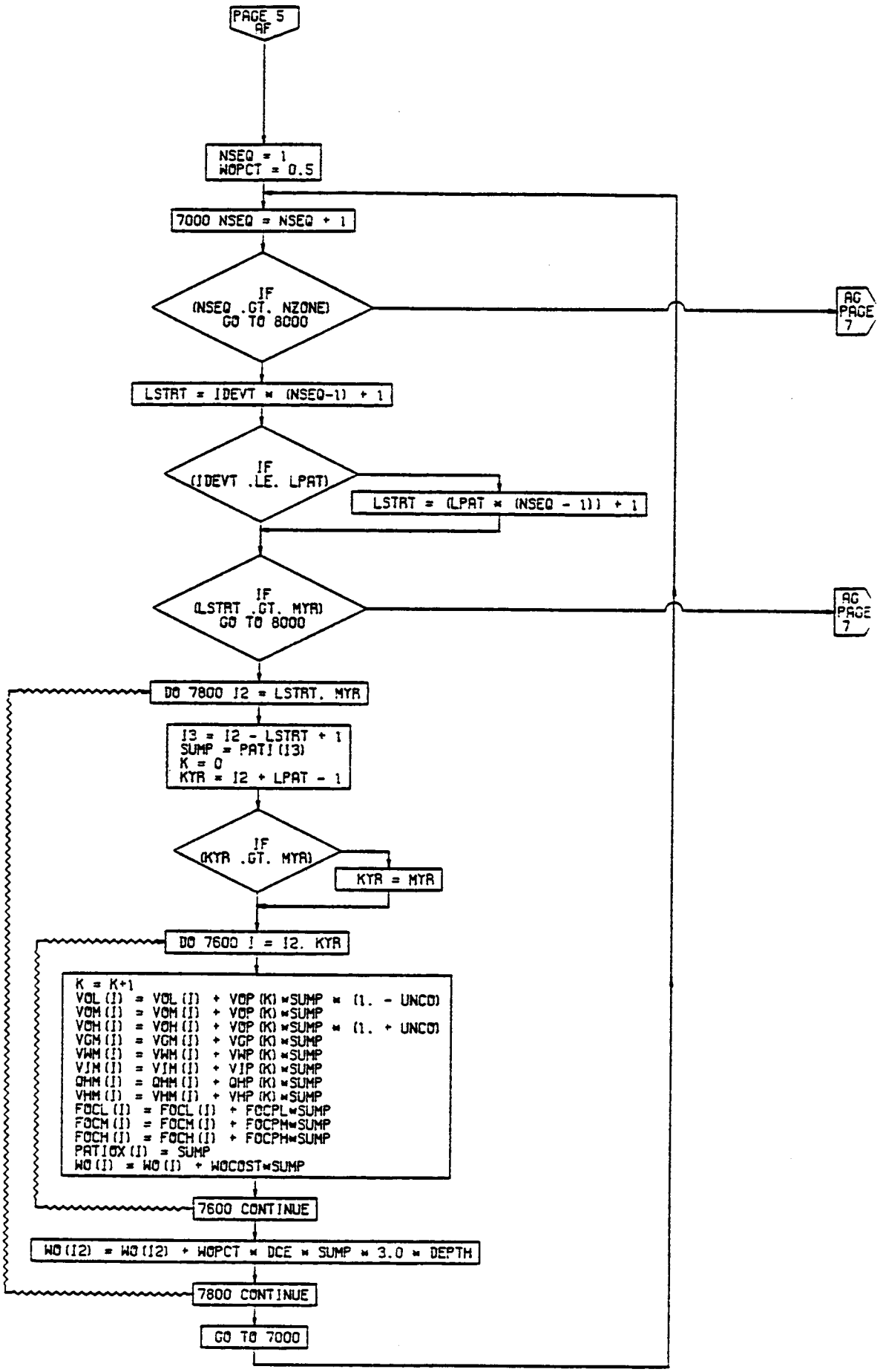

SUBROUTINE INEC (ITIM,PRICEIN,FDC,FEQP,FOPR,FUEL,FACT)
C ****** PRINT TITLE OF ECONOMIC ANALYSIS
CALL TITLE(TITL)
C ****** READ CASE INPUT DATA AND CHECK FOR DEFAULTS
READ(IR,*) M,ISTATE,IDIST,IOUT,IFIT,IDAT,NCT,NCI,
* IDISC,ISO,IDEBT
IF (IDEBT .NE. 0)
READ(IR,*) PCTDBT,DBTINT,NYRRPY,NYPAID
READ(IR,*) CCOST, GTRT, WTRT, CTACR, DCE, PLANT
READ(IR,*) WOCOST,WTCOST,WDCOST,COSTML,COSTTI
READ(IR,*) WCAP,COSTRT,UNCO
READ(IR,*) WPP1, WPP2, WPP3, WPP4
READ(IR,*) XDR,XINF,XROY,XSEV,XFIT,XTCR,DTIM,XSTX
READ(IR,*) XWPT,WPHO,EPHO,BTIM,BPOW
READ(IR,*) OILB, OILC, DECL
IF (ISO .EQ. 1)
READ(IR,*) (VOS(I), I=1,M)
READ(IR,*) ESCPO,ESCFO,ESCED,
1 ESCCT,ESCCI,ESCWO
READ(IR,*) (PATI(I), I=1,M)
IF (IDAT.LE.0) GO TO 35
READ(IR,*) POL(1),POM(1),POH(1)
READ(IR,*) FOCL(1),FOCM(1),FOCH(1)
READ(IR,*) OPCL(1),OPCM(1),OPCH(1)
READ(IR,*) EDPL(1),EDPM(1),EDPH(1)
35 IF (NCT.LE.0) GO TO 44
DO 40 I=1,NCT
40 READ(IR,*) ICT,CTPL(ICT),CTPM(ICT),CTPH(ICT)
44 IF (NCI .LE. 0) GO TO 50
DO 45 I=1,NCI
45 READ(IR,*) ICI,CIPL(ICI),CIPM(ICI),CIPH(ICI)
50 CONTINUE
PAGE 2 AA

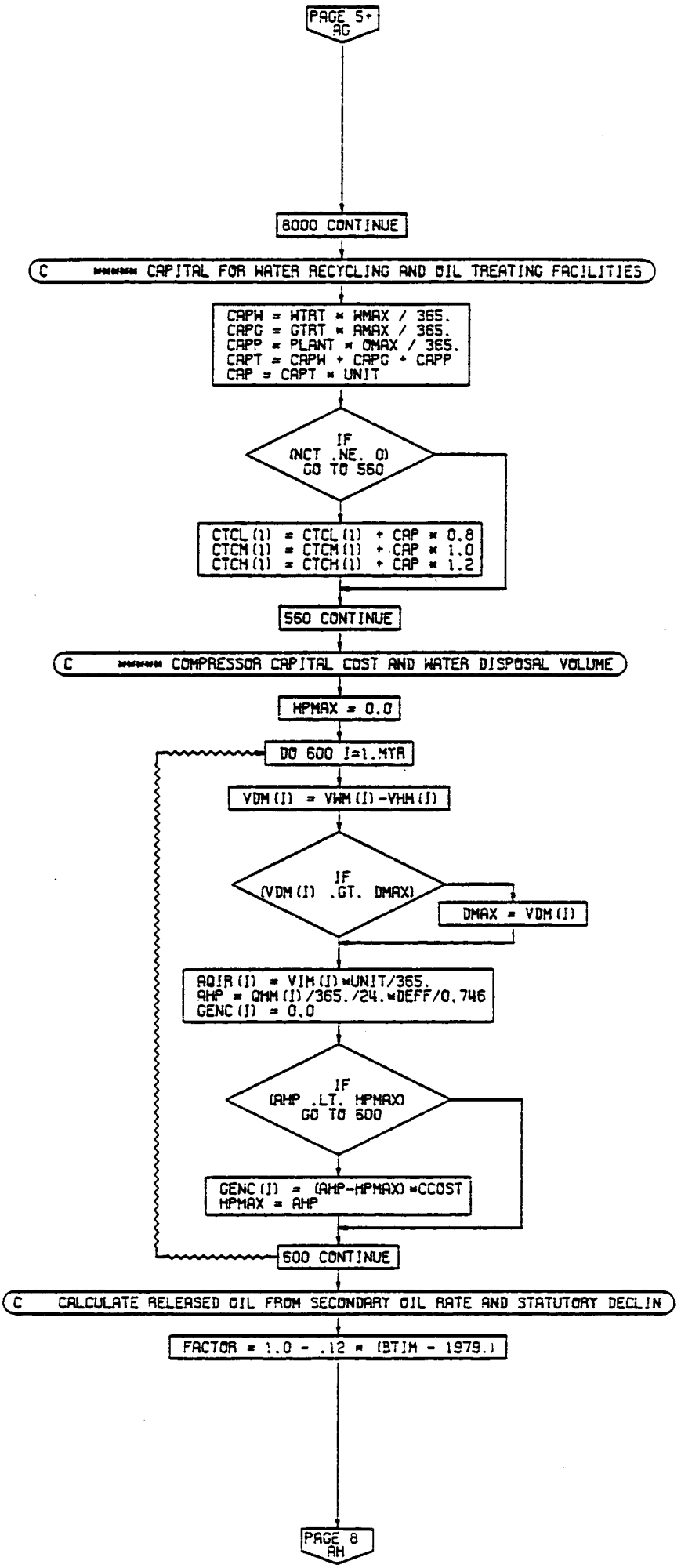

PAGE 1
AA
C ****** COMPUTE ANNUAL PATTERN VOLUMES
DO 100 I=1,M
YR = I
CO = SDINT(TIME,CUMOIL,ITIM,YR)
CG = SDINT(TIME,CUMGAS,ITIM,YR)
CW = SDINT(TIME,CUMWAT,ITIM,YR)
CI = SDINT(TIME,CUMIA, ITIM,YR)
CH = SDINT(TIME,CUMIW, ITIM,YR)
C ****** ANNUAL PRODUCTION VOLUMES, MB/YR/PATTERN
VOP(I) = CO-COS
VGP(I) = CG-CGS
VWP(I) = CW-CWS
C ****** ANNUAL INJECTION VOLUME, MMSCF/YR/PATTERN
VIP(I) = CI-CIS
VHP(I) = CH-CHS
C ****** ANNUAL COMPRESSOR HORSEPOWER, KW-HR - PATTERN
DEFF = 0.94
QHP(I) = HPP*365.*24./DEFF*0.746
CHS = CH
COS = CO
CGS = CG
CWS = CW
100 CIS = CI
C ****** CHECK FOR DEFAULT VALUES
PRICEIN = POM(1)
IF
(PRICEIN .LE. 0.0)
PRICEIN = 30.00
CALL ECFTR(PRICEIN,FDC,FEQP,FOPR,FUEL,FACT)
CALL CHEKE(ITIM,NCT,NCI,DEPTH,AREAP,API)
C ****** WRITE CASE CONDITIONS
WRITE(IW,9350)
CALL STCDE (JST,ISTATE)
WSUM = WPP1 + WPP2 + WPP3 + WPP4
IF
(WSUM .EQ. 0)
GO TO 9012
AB
PAGE
3
WRITE(IW,9351) M,JST,IDIST,IFIT,IDISC,IDEP,
1 ISO,DEPTH,WPP1,WPP2,WPP3,WPP4
GO TO 9013
PAGE 3
AC

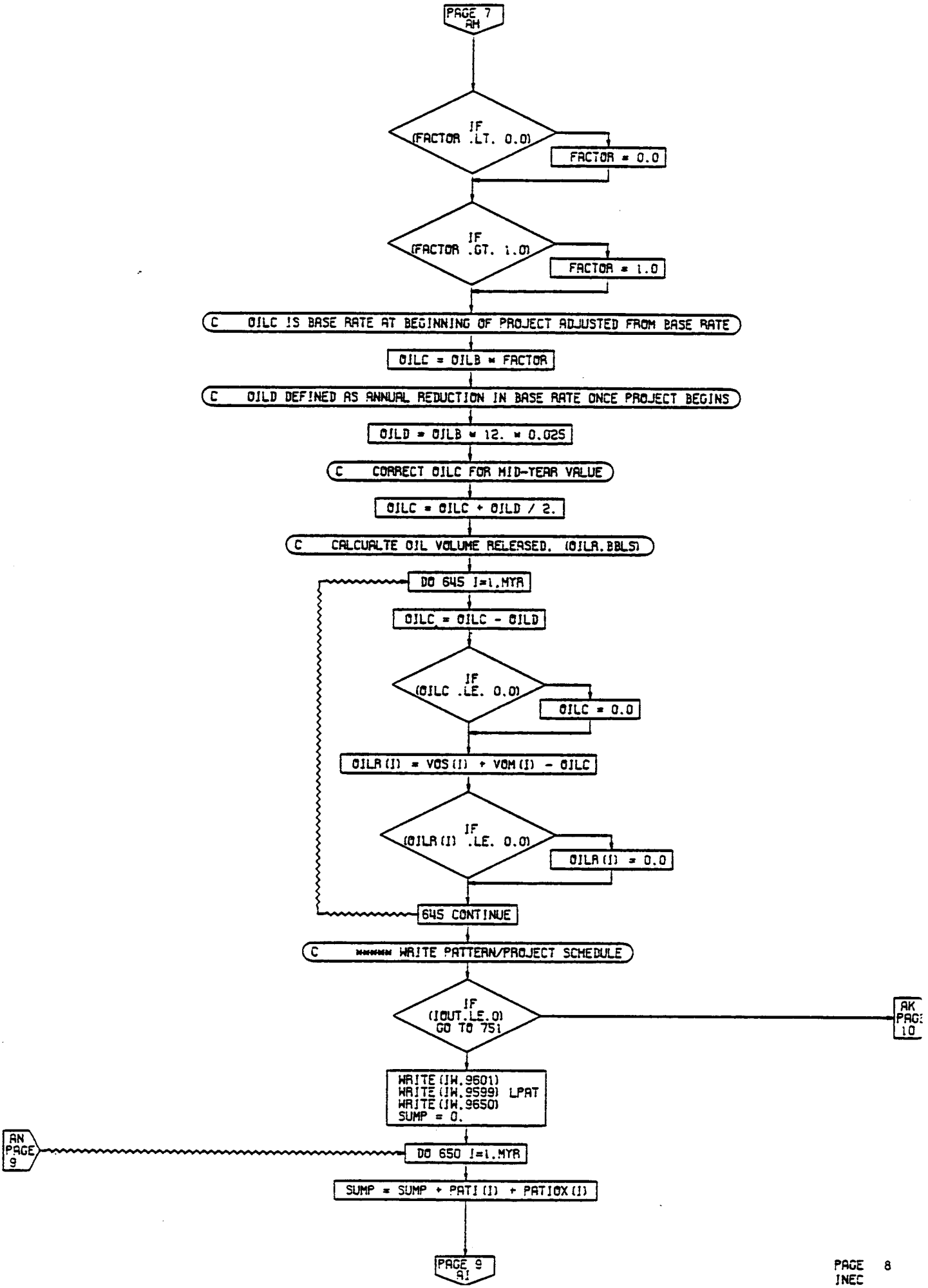

PAGE 2
AB
9012 CONTINUE
WRITE(IW,93519) M,JST,IDIST,IFIT,IDISC,IDEP,
1 ISO,DEPTH
AC
PAGE
2
9013 CONTINUE
WRITE(IW,93510)
1 CCOST,GTRT,WTRT,CTRCR,DCE,PLANT,
1 WCAP,COSTRT,UNCO
IF
(IDEBT .EQ. 0)
WRITE(IW,93511)
IF
(IDEBT .NE. 0)
WRITE(IW,93512) PCTDBT,DBTINT,NYRRPY,NYPAID
WRITE(IW,9352) XDR,XINF,XROY,XSEV,XFIT,XTCR,XSTX,
1 XWPT,WPHO,BTIM,BPOW,ESCPO,ESCFO,ESCED
IF
(IDEP .EQ. 0)
WRITE(IW,9353) DTIM
IF
(IDEP .GT. 0)
WRITE(IW,9354)
C ****** WRITE MOST LIKELY VALUES
WRITE(IW,9450)
WRITE(IW,9451)
1 POL(1), POM(1), POH(1),
4 FOCL(1)*FOPR, FOCM(1)*FOPR, FOCH(1)*FOPR,
5 OPCL(1)*FOPR, OPCM(1)*FOPR, OPCH(1)*FOPR,
6 EDPL(1)*FOPR, EDPM(1)*FOPR, EDPH(1)*FOPR,
9 WO(1)*FOPR,WTC(1)*FOPR,WDC(1)*FOPR,CML(1)*FOPR,CTI(1)*FOPR
DO 470 J=1,MYR
AOVH(J) = AOVH(J) + AOVH1 * FDC * PATI(J)
470 CONTINUE
IF
(NCT .EQ. 0)
GO TO 4701
WRITE (IW,4702)
DO 4710 I=1,NCT
WRITE (IW,4703) I,CTPL(I),CTPM(I),CTPH(I)
4710 CONTINUE
4701 CONTINUE
PAGE 4
AD

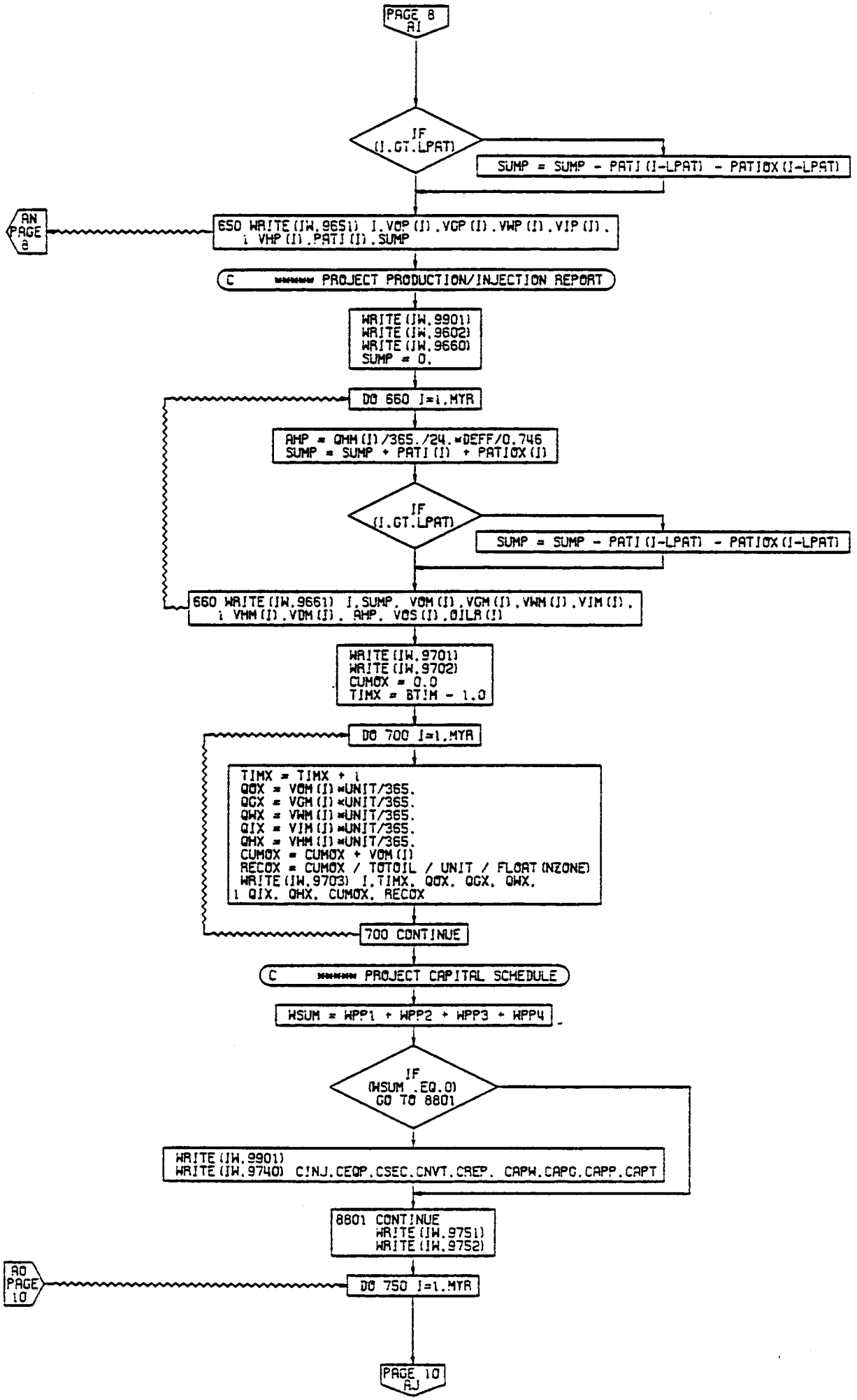

PAGE 3
AD
IF
(NCI .EQ. 0)
GO TO 4801
WRITE (IW,4802)
DO 4810 I=1,NCI
WRITE (IW,4803) I,CIPL(I),CIPM(I),CIPH(I)
4810 CONTINUE
4801 CONTINUE
C ****** ESTIMATE INDIVIDUAL PATTERN LIFE, LPAT
LPAT = 0
DO 490 J=1,MYR
C ESTIMATE DIRECT REVENUES, M$
REV = (POM(1) * VOP(J)) * (1. - XROY) * (1. - XSEV)
C ESTIMATE DIRECT COSTS INCLUDING OVERHEAD OF 20%, M$
COST = 1.2 * (WTC(1)*VWP(J)*FOPR
1 + EDPM(1)*QMP(J)*FOPR/UNIT + OPCM(1)*VOP(J)
2 + (CML(1) + CTI(1))*VIP(J)*FOPR
3 + FOCM(1)*FOPR/UNIT + WOCOST*FOPR/UNIT) + AOVH1*FDC
IF
(REV.GE.COST)
LPAT = J
490 CONTINUE
C ****** CALCULATE PROJECT PERFORMANCE FROM PATTERN DATA
FOCPL = FOCL(1)
FOCPM = FOCM(1)
FOCPH = FOCH(1)
WWO = WO(1)
FOCL(1) = 0.0
FOCM(1) = 0.0
FOCH(1) = 0.0
OMAX = 0.0
AMAX = 0.0
DMAX = 0.0
WMAX = 0.0
AL
PAGE
5
DO 550 J = 1, MYR
SUMP = PATI(J)
K = 0
LYR = J + LPAT - 1
IF
(LYR .GT. MYR)
LYR = MYR
AM
PAGE
5
DO 500 I = J, LYR
PAGE 5
AE

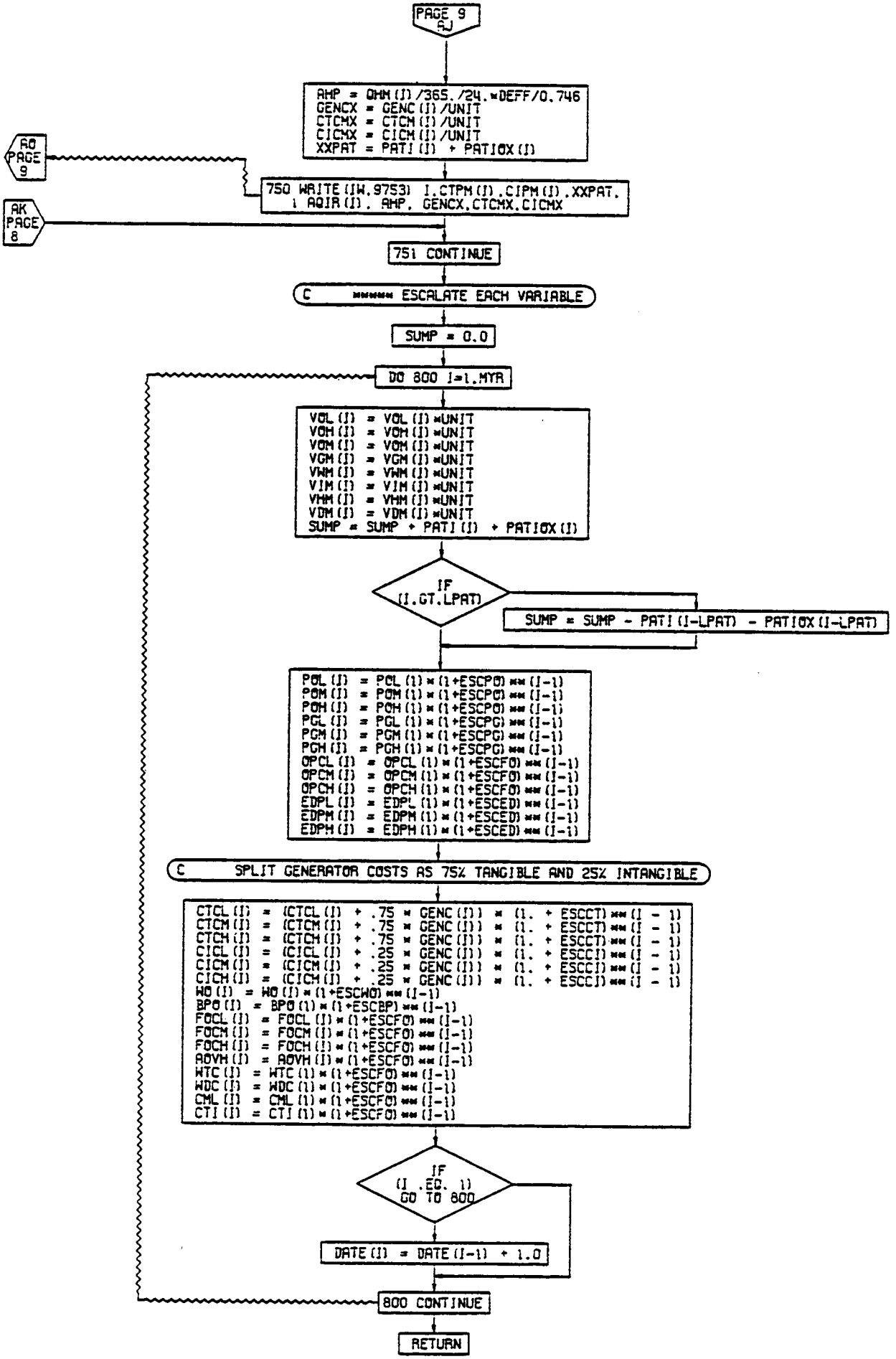

PAGE 4
AE
K = K+1
VOL(I) = VOL(I) + VOP(K)*SUMP * (1. - UNCO)
VOM(I) = VOM(I) + VOP(K)*SUMP
VOH(I) = VOH(I) + VOP(K)*SUMP * (1. + UNCO)
VGM(I) = VGM(I) + VGP(K)*SUMP
VWM(I) = VWM(I) + VWP(K)*SUMP
VIM(I) = VIM(I) + VIP(K)*SUMP
QHM(I) = QHM(I) + QHP(K)*SUMP
VHM(I) = VHM(I) + VHP(K)*SUMP
FOCL(I) = FOCL(I) + FOCPL*SUMP
FOCM(I) = FOCM(I) + FOCPM*SUMP
FOCH(I) = FOCH(I) + FOCPH*SUMP
WO(I) = WO(I) + WOCOST*SUMP
C ****** DETERMINE PROJECT TANGIBLE AND INTANGIBLE CAPITAL COST
CTCL(I) = CTCL(I) + CTPL(K)*SUMP*FDC/FEQP
CTCM(I) = CTCM(I) + CTPM(K)*SUMP*FDC/FEQP
CTCH(I) = CTCH(I) + CTPH(K)*SUMP*FDC/FEQP
CICL(I) = CICL(I) + CIPL(K)*SUMP*FDC/FEQP
CICM(I) = CICM(I) + CIPM(K)*SUMP*FDC/FEQP
AM
PAGE
4
500 CICM(I) = CICM(I) + CIPM(K)*SUMP*FDC/FEQP
FOCM(J) = FOCM(J) + 1.0
IF
(VHM(J) .GT. WMAX)
WMAX = VHM(J)
IF
(VIM(J) .GT. AMAX)
AMAX = VIM(J)
IF
(VOM(J) .GT. OMAX)
OMAX = VOM(J)
AL
PAGE
4
550 CONTINUE
C MODIFY PROJECT PERFORMANCE IF MULTIPLE ZONES BURNED
C SKIP IF ONLY ONE BURN ZONE
IF
(NZONE .LE. 1)
GO TO 8000
AG
PAG
7
C CALCULATE NUMBER OF DEVELOPMENT YEARS
IDEVT = 0
DO 6998 JR = 1,MYR
IF
(PATI(JR) .GT. 1.0E-2)
IDEVT = IDEVT + 1
6998 CONTINUE
PAGE 6
AF

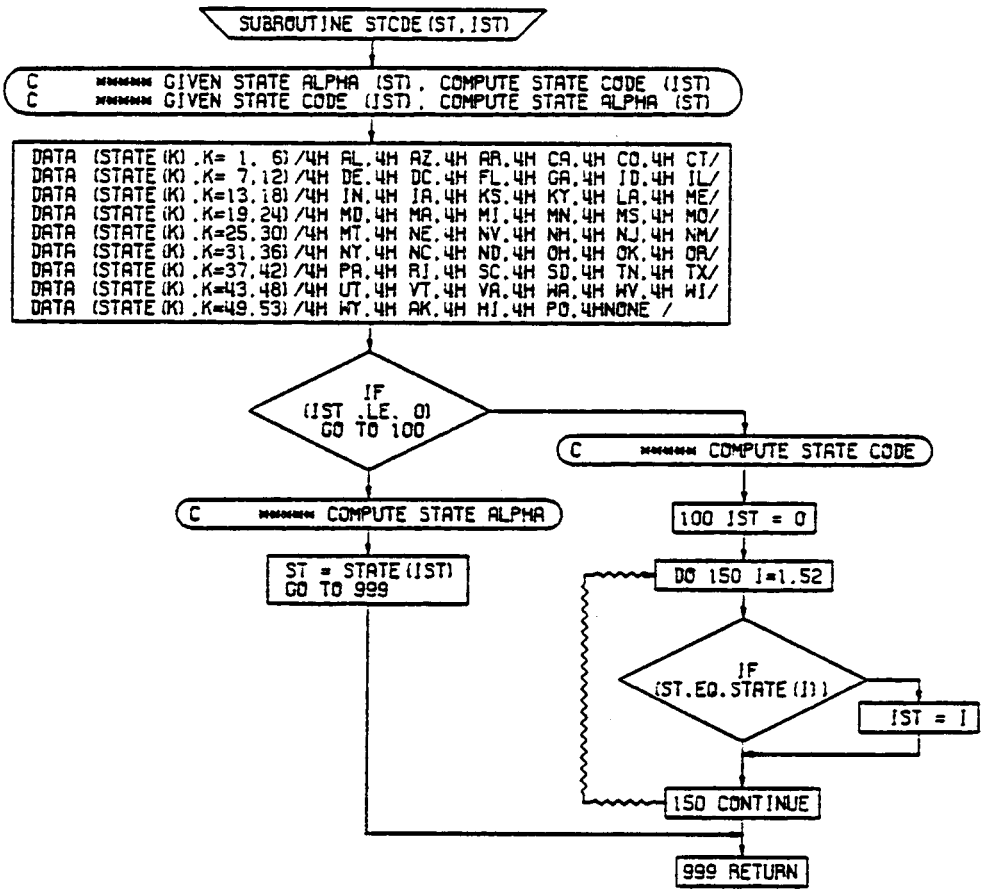

PAGE 5
AF
NSEQ = 1
WOPCT = 0.5
7000 NSEQ = NSEQ + 1
IF
(NSEQ .GT. NZONE)
GO TO 8000
AG
PAGE
7
LSTRT = IDEVT * (NSEQ-1) + 1
IF
(IDEVT .LE. LPAT)
LSTRT = (LPAT * (NSEQ - 1)) + 1
IF
(LSTRT .GT. MYR)
GO TO 8000
AG
PAGE
7
DO 7800 I2 = LSTRT, MYR
I3 = I2 - LSTRT + 1
SUMP = PATI(I3)
K = 0
KYR = I2 + LPAT - 1
IF
(KYR .GT. MYR)
KYR = MYR
DO 7600 I = I2, KYR
K = K+1
VOL(I) = VOL(I) + VOP(K)*SUMP * (1. - UNCO)
VOM(I) = VOM(I) + VOP(K)*SUMP
VOH(I) = VOH(I) + VOP(K)*SUMP * (1. + UNCO)
VGM(I) = VGM(I) + VGP(K)*SUMP
VWM(I) = VWM(I) + VWP(K)*SUMP
VIM(I) = VIM(I) + VIP(K)*SUMP
QHM(I) = QHM(I) + QHP(K)*SUMP
VHM(I) = VHM(I) + VHP(K)*SUMP
FOCL(I) = FOCL(I) + FOCPL*SUMP
FOCM(I) = FOCM(I) + FOCPM*SUMP
FOCH(I) = FOCH(I) + FOCPH*SUMP
PATIOX(I) = SUMP
WO(I) = WO(I) + WOCOST*SUMP
7600 CONTINUE
WO(I2) = WO(I2) + WOPCT * DCE * SUMP * 3.0 * DEPTH
7800 CONTINUE
GO TO 7000

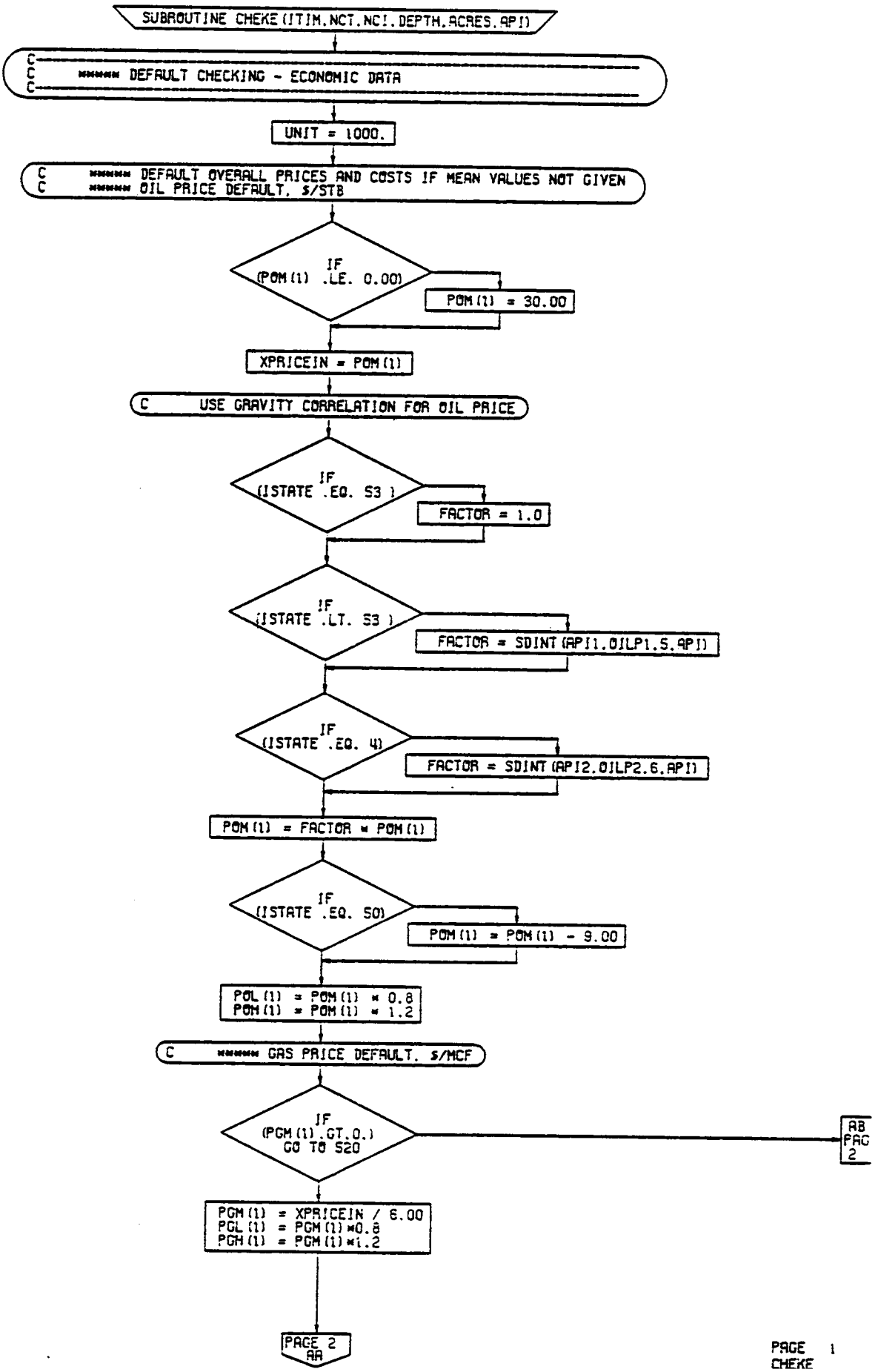

PAGE 5
AG
8000 CONTINUE
C ****** CAPITAL FOR WATER RECYCLING AND OIL TREATING FACILITIES
CAPW = WTRT * WMAX / 365.
CAPG = GTRT * AMAX / 365.
CAPP = PLANT * OMAX / 365.
CAPT = CAPW + CAPG + CAPP
CAP = CAPT * UNIT
IF
(NCT .NE. 0)
GO TO 560
CTCL(1) = CTCL(1) + CAP * 0.8
CTCM(1) = CTCM(1) + CAP * 1.0
CTCH(1) = CTCH(1) + CAP * 1.2
560 CONTINUE
C ****** COMPRESSOR CAPITAL COST AND WATER DISPOSAL VOLUME
HPMAX = 0.0
DO 600 I=1,MTR
VDM(I) = VWM(I)-VHM(I)
IF
(VDM(I) .GT. DMAX)
DMAX = VDM(I)
AQIR(I) = VIM(I)*UNIT/365.
AHP = QHM(I)/365./24.*DEFF/0.746
GENC(I) = 0.0
IF
(AHP .LT. HPMAX)
GO TO 600
GENC(I) = (AHP-HPMAX)*CCOST
HPMAX = AHP
600 CONTINUE
C CALCULATE RELEASED OIL FROM SECONDARY OIL RATE AND STATUTORY DECLIN
FACTOR = 1.0 - .12 * (BTIM - 1979.)
PAGE 8
AH

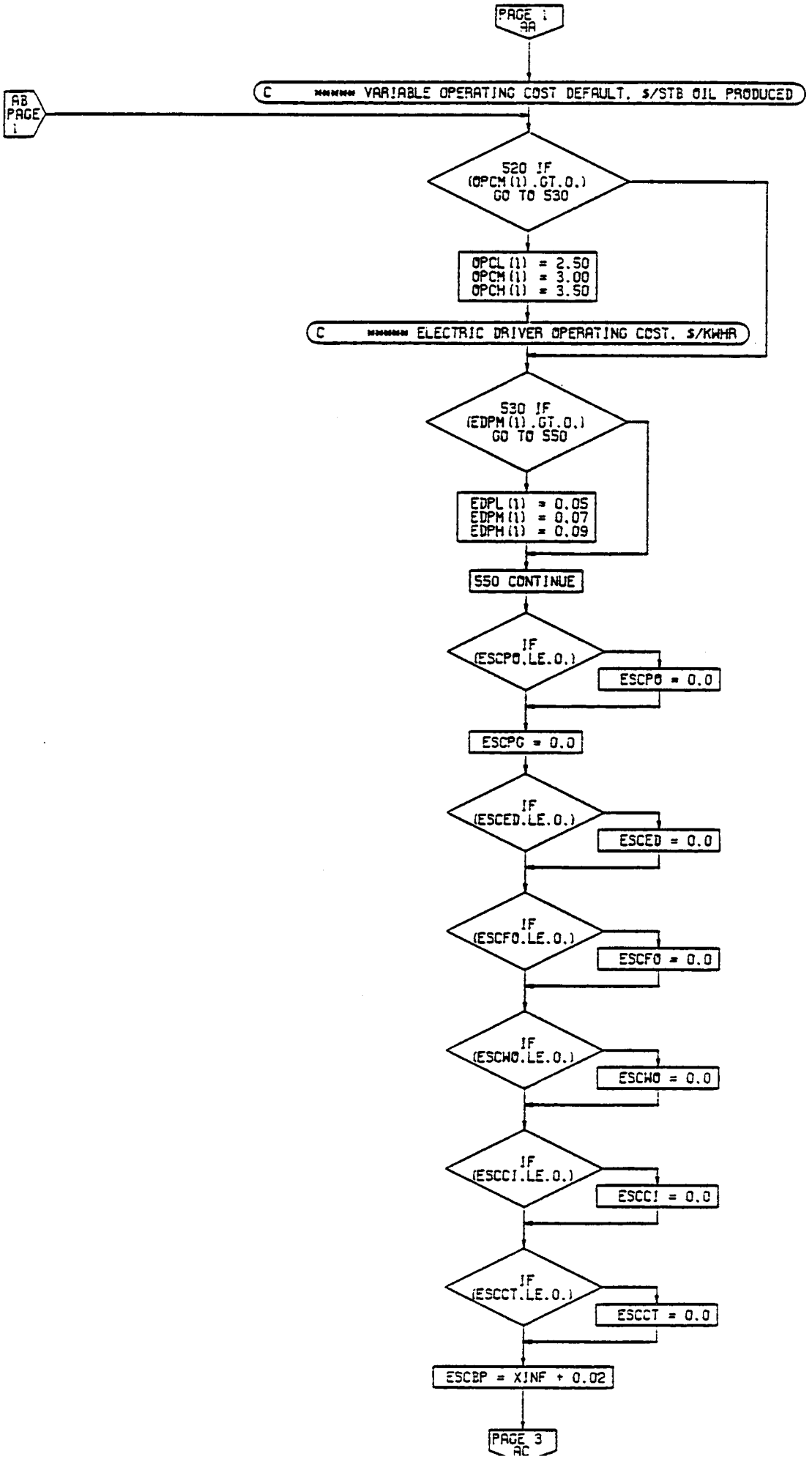

PAGE 7
AH
IF
(FACTOR .LT. 0.0)
FACTOR = 0.0
IF
(FACTOR .GT. 1.0)
FACTOR = 1.0
C OILC IS BASE RATE AT BEGINNING OF PROJECT ADJUSTED FROM BASE RATE
OILC = OILB * FACTOR
C OILD DEFINED AS ANNUAL REDUCTION IN BASE RATE ONCE PROJECT BEGINS
OILD = OILB * 12. * 0.025
C CORRECT OILC FOR MID-YEAR VALUE
OILC = OILC + OILD / 2.
C CALCUALTE OIL VOLUME RELEASED. (OILR.BBLS)
DO 645 I=1,MYR
OILC = OILC - OILD
IF
(OILC .LE. 0.0)
OILC = 0.0
OILR(I) = VOS(I) + VOM(I) - OILC
IF
(OILR(I) .LE. 0.0)
OILR(I) = 0.0
645 CONTINUE
C ****** WRITE PATTERN/PROJECT SCHEDULE
IF
(IOUT.LE.0)
GO TO 751
AK
PAGE
10
WRITE(IW,9601)
WRITE(IW,9599) LPAT
WRITE(IW,9650)
SUMP = 0.
AN
PAGE
9
DO 650 I=1,MYR
SUMP = SUMP + PATI(I) + PATIOX(I)
PAGE 9
AI

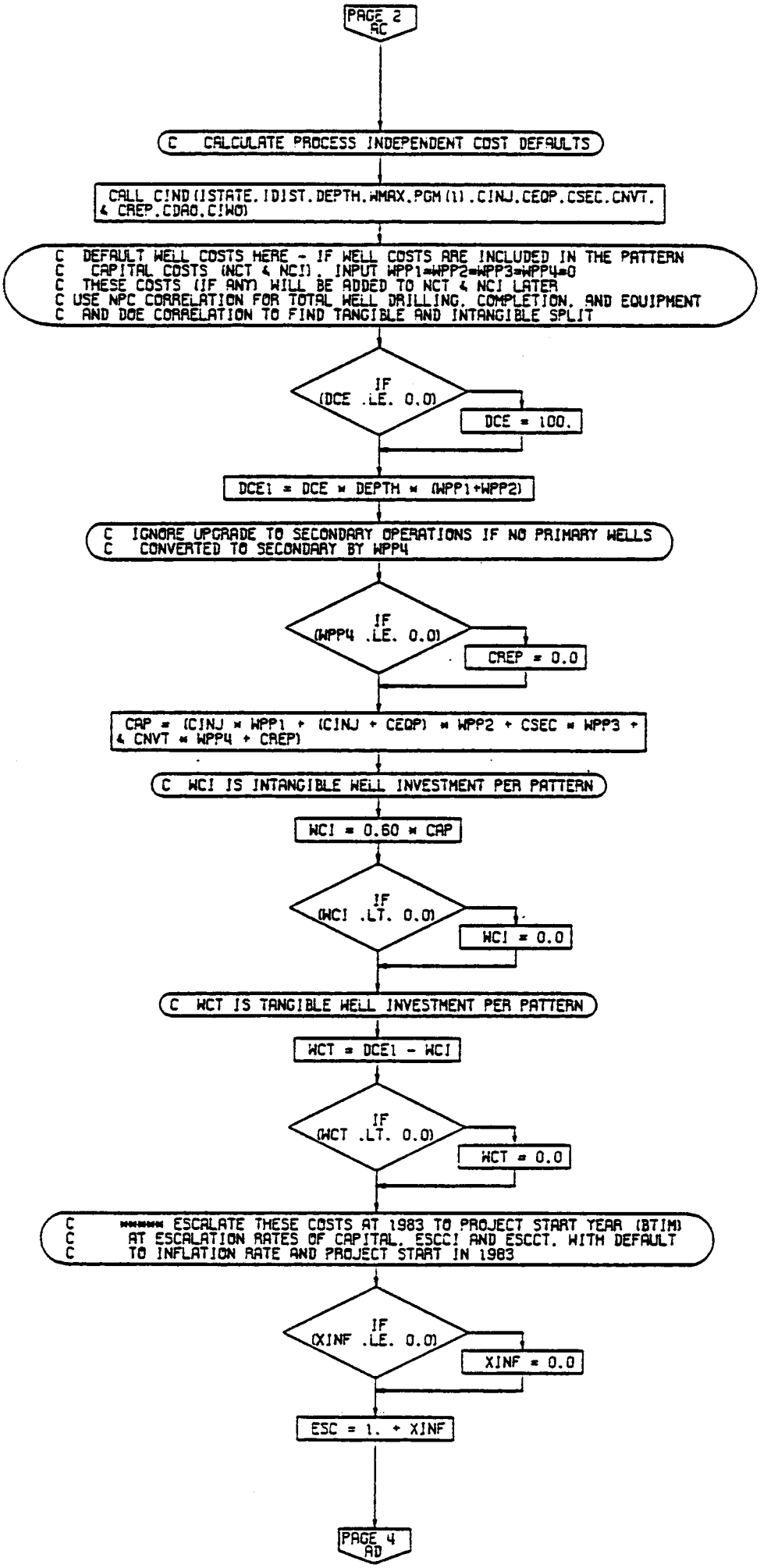

PAGE 8
AI
IF
(I.GT.LPAT)
SUMP = SUMP - PATI(I-LPAT) - PATIOX(I-LPAT)
AN
PAGE
8
650 WRITE(IW,9651) I,VOP(I),VGP(I),VWP(I),VIP(I),
1 VHP(I),PATI(I),SUMP
C ****** PROJECT PRODUCTION/INJECTION REPORT
WRITE(IW,9901)
WRITE(IW,9602)
WRITE(IW,9660)
SUMP = 0.
DO 660 I=1,MYR
AHP = QHM(I)/365./24.*DEFF/0.746
SUMP = SUMP + PATI(I) + PATIOX(I)
IF
(I.GT.LPAT)
SUMP = SUMP - PATI(I-LPAT) - PATIOX(I-LPAT)
660 WRITE(IW,9661) I,SUMP, VOM(I),VGM(I),VWM(I),VIM(I),
1 VHM(I),VDM(I), AHP, VOS(I),OILR(I)
WRITE(IW,9701)
WRITE(IW,9702)
CUMOX = 0.0
TIMX = BTIM - 1.0
DO 700 I=1,MYR
TIMX = TIMX + 1
QOX = VOM(I)*UNIT/365.
QGX = VGM(I)*UNIT/365.
QWX = VWM(I)*UNIT/365.
QIX = VIM(I)*UNIT/365.
QHX = VHM(I)*UNIT/365.
CUMOX = CUMOX + VOM(I)
RECOX = CUMOX / TOTOIL / UNIT / FLOAT(NZONE)
WRITE(IW,9703) I,TIMX, QOX, QGX, QWX,
1 QIX, QHX, CUMOX, RECOX
700 CONTINUE
C ****** PROJECT CAPITAL SCHEDULE
WSUM = WPP1 + WPP2 + WPP3 + WPP4
IF
(WSUM .EQ.0)
GO TO 8801
WRITE(IW,9901)
WRITE(IW,9740) CINJ,CEQP,CSEC,CNVT,CREP, CAPW,CAPG,CAPP,CAPT
8801 CONTINUE
WRITE(IW,9751)
WRITE(IW,9752)
AO
PAGE
10
DO 750 I=1,MYR
PAGE 10
AJ

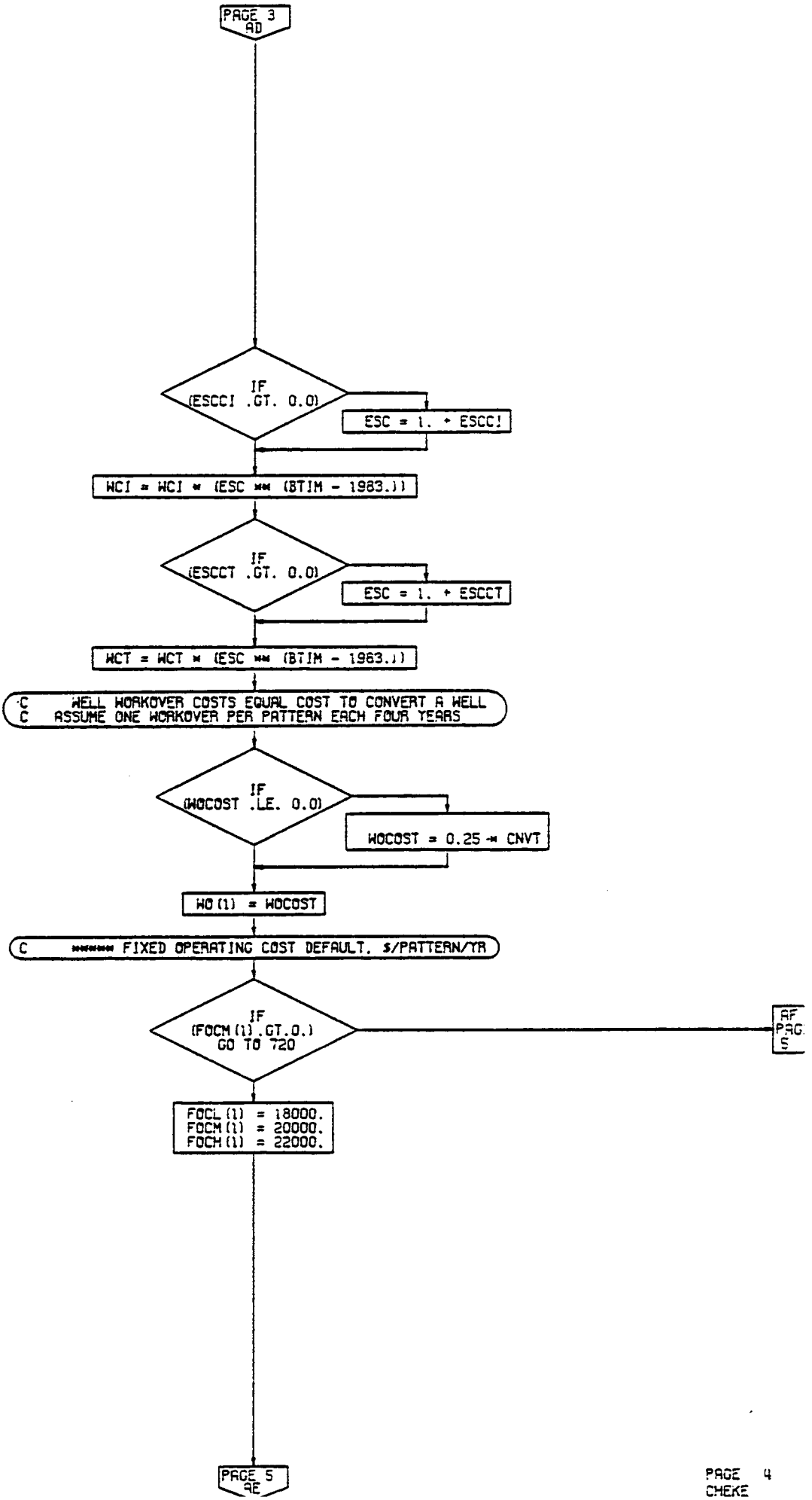

PAGE 9 AJ
AHP = QHM(I)/365./24.*DEFF/0.746
GENCX = GENC(I)/UNIT
CTCMX = CTCM(I)/UNIT
CICMX = CICM(I)/UNIT
XXPAT = PATI(I) + PATIOX(I)
AO PAGE 9
750 WRITE(IW,9753) I,CTPM(I),CIPM(I),XXPAT,
1 AQIR(I), AHP, GENCX,CTCMX,CICMX
AK PAGE 8
751 CONTINUE
C ****** ESCALATE EACH VARIABLE
SUMP = 0.0
DO 800 I=1,MYR
VOL(I) = VOL(I)*UNIT
VOM(I) = VOM(I)*UNIT
VOM(I) = VOM(I)*UNIT
VGM(I) = VGM(I)*UNIT
VWM(I) = VWM(I)*UNIT
VIM(I) = VIM(I)*UNIT
VHM(I) = VHM(I)*UNIT
VDM(I) = VDM(I)*UNIT
SUMP = SUMP + PATI(I) + PATIOX(I)
IF (I.GT.LPAT)
SUMP = SUMP - PATI(I-LPAT) - PATIOX(I-LPAT)
POL(I) = POL(1)*(1+ESCPO)**(I-1)
POM(I) = POM(1)*(1+ESCPO)**(I-1)
POH(I) = POH(1)*(1+ESCPO)**(I-1)
PGL(I) = PGL(1)*(1+ESCPG)**(I-1)
PGM(I) = PGM(1)*(1+ESCPG)**(I-1)
PGH(I) = PGH(1)*(1+ESCPG)**(I-1)
OPCL(I) = OPCL(1)*(1+ESCFO)**(I-1)
OPCM(I) = OPCM(1)*(1+ESCFO)**(I-1)
OPCH(I) = OPCH(1)*(1+ESCFO)**(I-1)
EDPL(I) = EDPL(1)*(1+ESCED)**(I-1)
EDPM(I) = EDPM(1)*(1+ESCED)**(I-1)
EDPH(I) = EDPH(1)*(1+ESCED)**(I-1)
C SPLIT GENERATOR COSTS AS 75% TANGIBLE AND 25% INTANGIBLE
CTCL(I) = (CTCL(I) + .75 * GENC(I)) * (1. + ESCCT)**(I - 1)
CTCM(I) = (CTCM(I) + .75 * GENC(I)) * (1. + ESCCT)**(I - 1)
CTCH(I) = (CTCH(I) + .75 * GENC(I)) * (1. + ESCCT)**(I - 1)
CICL(I) = (CICL(I) + .25 * GENC(I)) * (1. + ESCCI)**(I - 1)
CICM(I) = (CICM(I) + .25 * GENC(I)) * (1. + ESCCI)**(I - 1)
CICH(I) = (CICH(I) + .25 * GENC(I)) * (1. + ESCCI)**(I - 1)
WO(I) = WO(I)*(1+ESCWO)**(I-1)
BPO(I) = BPO(1)*(1+ESCBP)**(I-1)
FOCL(I) = FOCL(I)*(1+ESCFO)**(I-1)
FOCM(I) = FOCM(I)*(1+ESCFO)**(I-1)
FOCH(I) = FOCH(I)*(1+ESCFO)**(I-1)
AOVH(I) = AOVH(I)*(1+ESCFO)**(I-1)
WTC(I) = WTC(1)*(1+ESCFO)**(I-1)
WDC(I) = WDC(1)*(1+ESCFO)**(I-1)
CML(I) = CML(1)*(1+ESCFO)**(I-1)
CTI(I) = CTI(1)*(1+ESCFO)**(I-1)
IF (I .EQ. 1) GO TO 800
DATE(I) = DATE(I-1) + 1.0
800 CONTINUE
RETURN

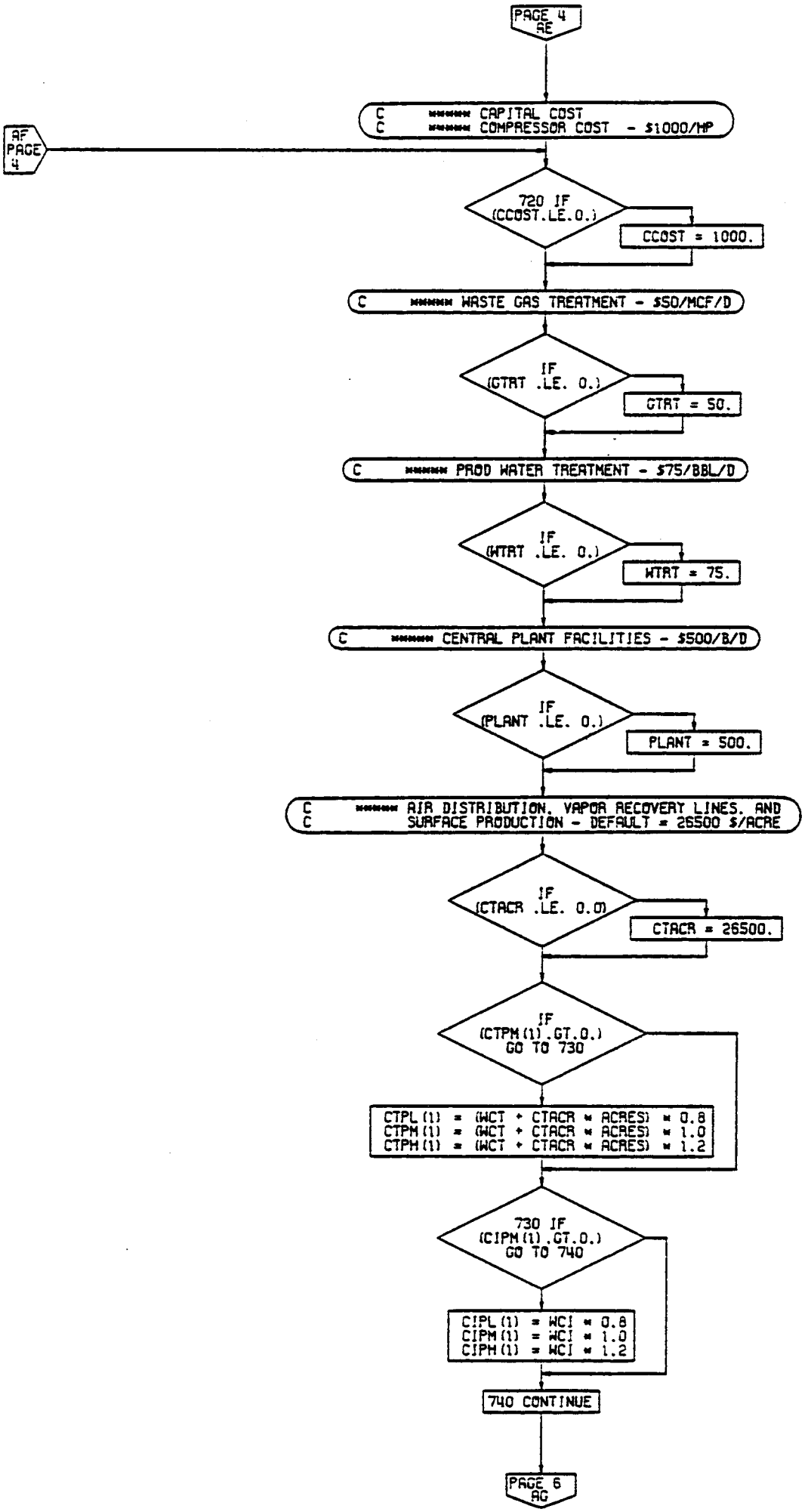

SUBROUTINE STCDE(ST,IST)
C ****** GIVEN STATE ALPHA (ST), COMPUTE STATE CODE (IST)
C ****** GIVEN STATE CODE (IST), COMPUTE STATE ALPHA (ST)
DATA (STATE(K),K= 1, 6)/4H AL,4H AZ,4H AR,4H CA,4H CO,4H CT/
DATA (STATE(K),K= 7,12)/4H DE,4H DC,4H FL,4H GA,4H ID,4H IL/
DATA (STATE(K),K=13,18)/4H IN,4H IA,4H KS,4H KY,4H LA,4H ME/
DATA (STATE(K),K=19,24)/4H MD,4H MA,4H MI,4H MN,4H MS,4H MO/
DATA (STATE(K),K=25,30)/4H MT,4H NE,4H NV,4H NH,4H NJ,4H NM/
DATA (STATE(K),K=31,36)/4H NY,4H NC,4H ND,4H OH,4H OK,4H OR/
DATA (STATE(K),K=37,42)/4H PA,4H RI,4H SC,4H SD,4H TN,4H TX/
DATA (STATE(K),K=43,48)/4H UT,4H VT,4H VA,4H WA,4H WV,4H WI/
DATA (STATE(K),K=49,53)/4H WY,4H AK,4H HI,4H PO,4HNONE /
IF (IST .LE. 0) GO TO 100
C ****** COMPUTE STATE ALPHA
ST = STATE(IST)
GO TO 999
C ****** COMPUTE STATE CODE
100 IST = 0
DO 150 I=1,52
IF (ST.EQ.STATE(I))
IST = I
150 CONTINUE
999 RETURN

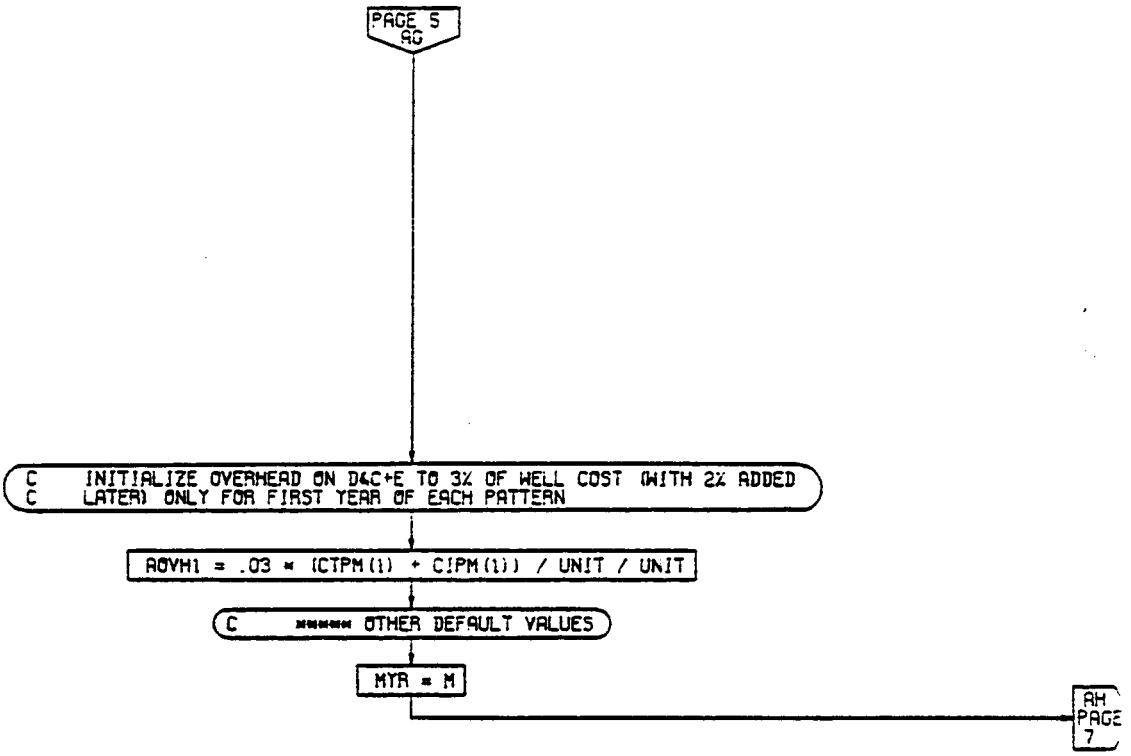

SUBROUTINE CHEKE(ITIM,NCT,NCI,DEPTH,ACRES,API)
C
C ****** DEFAULT CHECKING - ECONOMIC DATA
C
UNIT = 1000.
C ****** DEFAULT OVERALL PRICES AND COSTS IF MEAN VALUES NOT GIVEN
C ****** OIL PRICE DEFAULT, $/STB
IF (POM(1) .LE. 0.00)
POM(1) = 30.00
XPRICEIN = POM(1)
C USE GRAVITY CORRELATION FOR OIL PRICE
IF (ISTATE .EQ. S3)
FACTOR = 1.0
IF (ISTATE .LT. S3)
FACTOR = SDINT(API1,OILP1,S,API)
IF (ISTATE .EQ. 4)
FACTOR = SDINT(API2,OILP2,6,API)
POM(1) = FACTOR * POM(1)
IF (ISTATE .EQ. 50)
POM(1) = POM(1) - 9.00
POL(1) = POM(1) * 0.8
POH(1) = POM(1) * 1.2
C ****** GAS PRICE DEFAULT, $/MCF
IF (PGM(1).GT.0.) GO TO S20
AB PAG 2
PGM(1) = XPRICEIN / 6.00
PGL(1) = PGM(1)*0.8
PGH(1) = PGM(1)*1.2
PAGE 2 AA

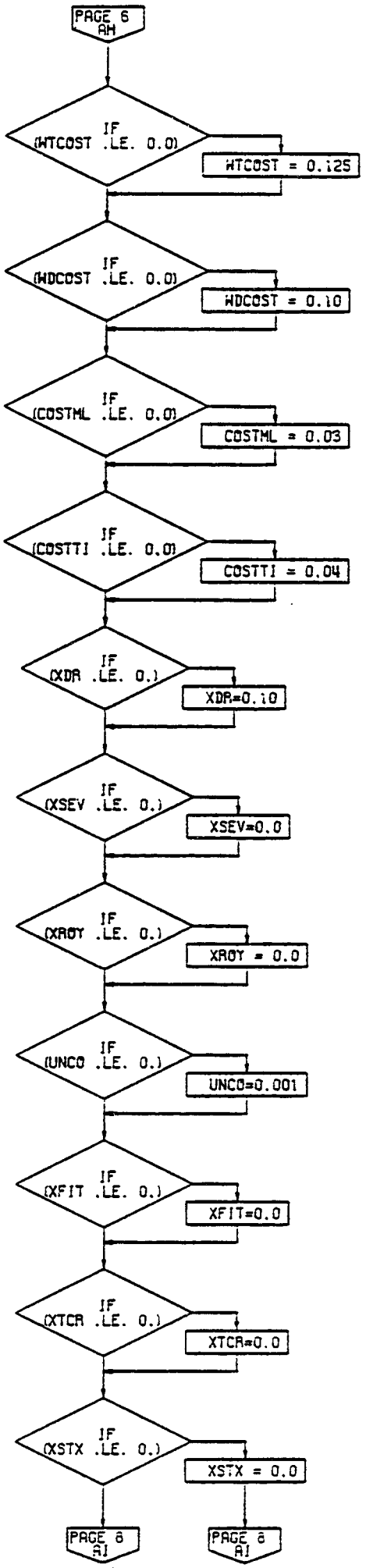

PAGE 1
AA
AB
PAGE
1
C ****** VARIABLE OPERATING COST DEFAULT. $/STB OIL PRODUCED
520 IF
(OPCM(1).GT.0.)
GO TO 530
OPCL(1) = 2.50
OPCM(1) = 3.00
OPCH(1) = 3.50
C ****** ELECTRIC DRIVER OPERATING COST. $/KWHR
530 IF
(EDPM(1).GT.0.)
GO TO 550
EDPL(1) = 0.05
EDPM(1) = 0.07
EDPH(1) = 0.09
550 CONTINUE
IF
(ESCPO.LE.0.)
ESCPO = 0.0
ESCPG = 0.0
IF
(ESCED.LE.0.)
ESCED = 0.0
IF
(ESCFO.LE.0.)
ESCFO = 0.0
IF
(ESCWO.LE.0.)
ESCWO = 0.0
IF
(ESCCI.LE.0.)
ESCCI = 0.0
IF
(ESCCT.LE.0.)
ESCCT = 0.0
ESCBP = XINF + 0.02
PAGE 3
AC

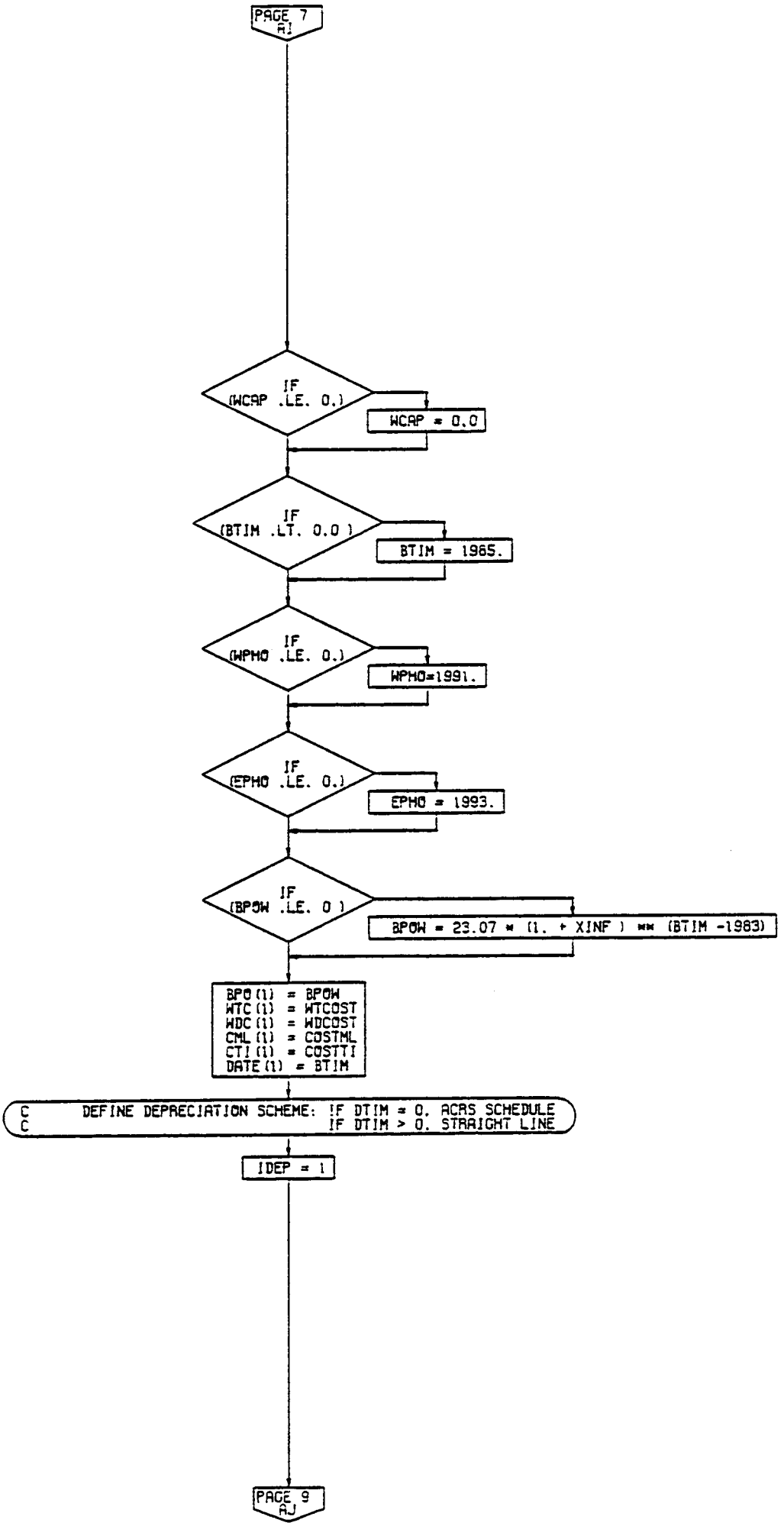

PAGE 2
AC
C CALCULATE PROCESS INDEPENDENT COST DEFAULTS
CALL CIND(ISTATE.IDIST.DEPTH.WMAX.PGM(1).CINJ.CEQP.CSEC.CNVT.
& CREP.CDAO.CIWO)
C DEFAULT WELL COSTS HERE - IF WELL COSTS ARE INCLUDED IN THE PATTERN
C CAPITAL COSTS (NCT & NCI). INPUT WPP1=WPP2=WPP3=WPP4=0
C THESE COSTS (IF ANY) WILL BE ADDED TO NCT & NCI LATER
C USE NPC CORRELATION FOR TOTAL WELL DRILLING. COMPLETION. AND EQUIPMENT
C AND DOE CORRELATION TO FIND TANGIBLE AND INTANGIBLE SPLIT
IF (DCE .LE. 0.0)
DCE = 100.
DCE1 = DCE * DEPTH * (WPP1+WPP2)
C IGNORE UPGRADE TO SECONDARY OPERATIONS IF NO PRIMARY WELLS
C CONVERTED TO SECONDARY BY WPP4
IF (WPP4 .LE. 0.0)
CREP = 0.0
CAP = (CINJ * WPP1 + (CINJ + CEQP) * WPP2 + CSEC * WPP3 +
& CNVT * WPP4 + CREP)
C WCI IS INTANGIBLE WELL INVESTMENT PER PATTERN
WCI = 0.60 * CAP
IF (WCI .LT. 0.0)
WCI = 0.0
C WCT IS TANGIBLE WELL INVESTMENT PER PATTERN
WCT = DCE1 - WCI
IF (WCT .LT. 0.0)
WCT = 0.0
C ****** ESCALATE THESE COSTS AT 1983 TO PROJECT START YEAR (BTIM)
C AT ESCALATION RATES OF CAPITAL. ESCCI AND ESCCT. WITH DEFAULT
C TO INFLATION RATE AND PROJECT START IN 1983
IF (XINF .LE. 0.0)
XINF = 0.0
ESC = 1. + XINF
PAGE 4
AD

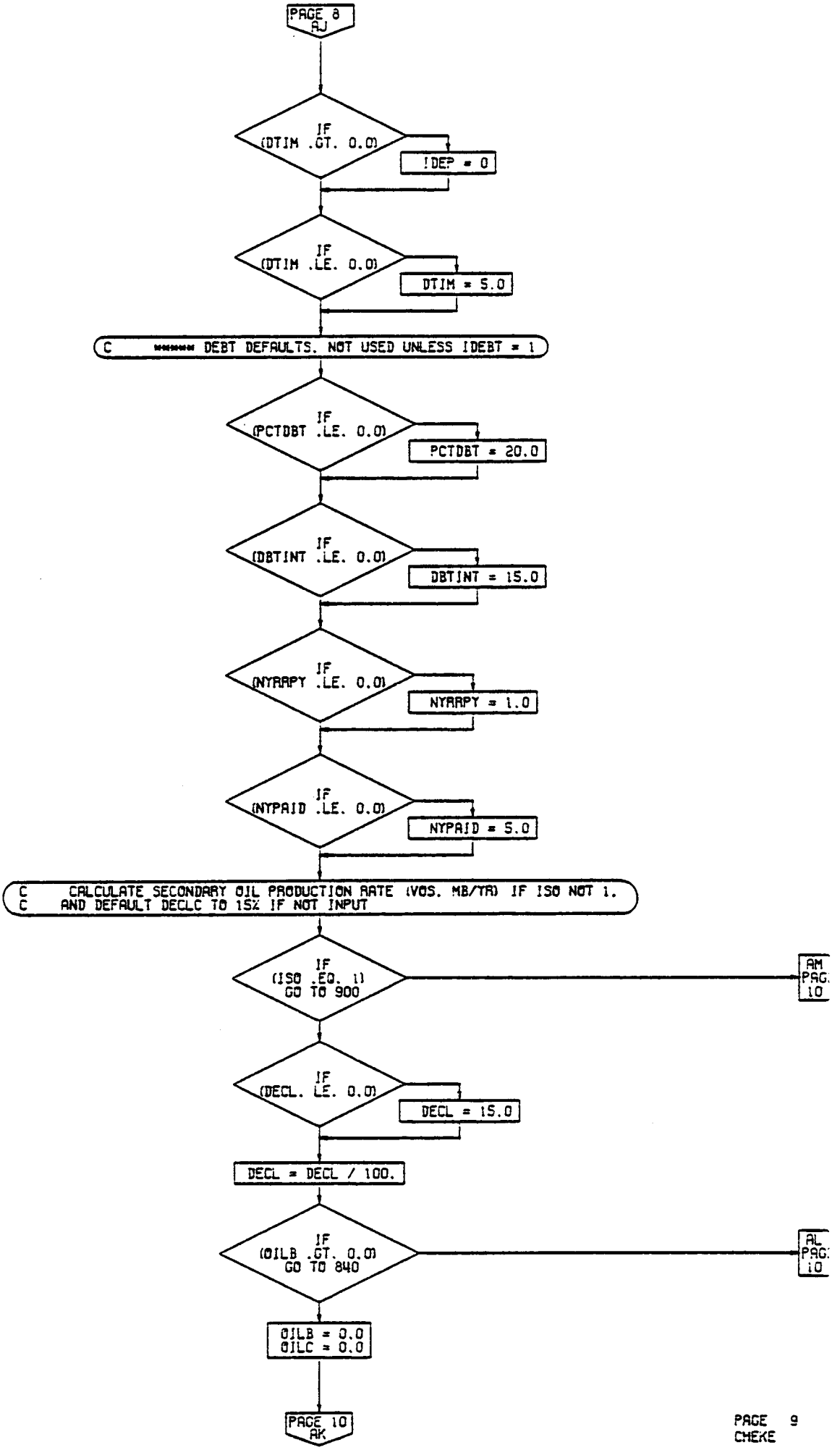

PAGE 3
AD
IF
(ESCCI .GT. 0.0)
ESC = 1. + ESCCI
WCI = WCI * (ESC ** (BTIM - 1983.))
IF
(ESCCT .GT. 0.0)
ESC = 1. + ESCCT
WCT = WCT * (ESC ** (BTIM - 1983.))
C WELL WORKOVER COSTS EQUAL COST TO CONVERT A WELL
C ASSUME ONE WORKOVER PER PATTERN EACH FOUR YEARS
IF
(WOCOST .LE. 0.0)
WOCOST = 0.25 * CNVT
WO(1) = WOCOST
C ******* FIXED OPERATING COST DEFAULT. $/PATTERN/YR
IF
(FOCM(1).GT.0.)
GO TO 720
AF
PAG
5
FOCL(1) = 18000.
FOCM(1) = 20000.
FOCH(1) = 22000.
PAGE 5
AE

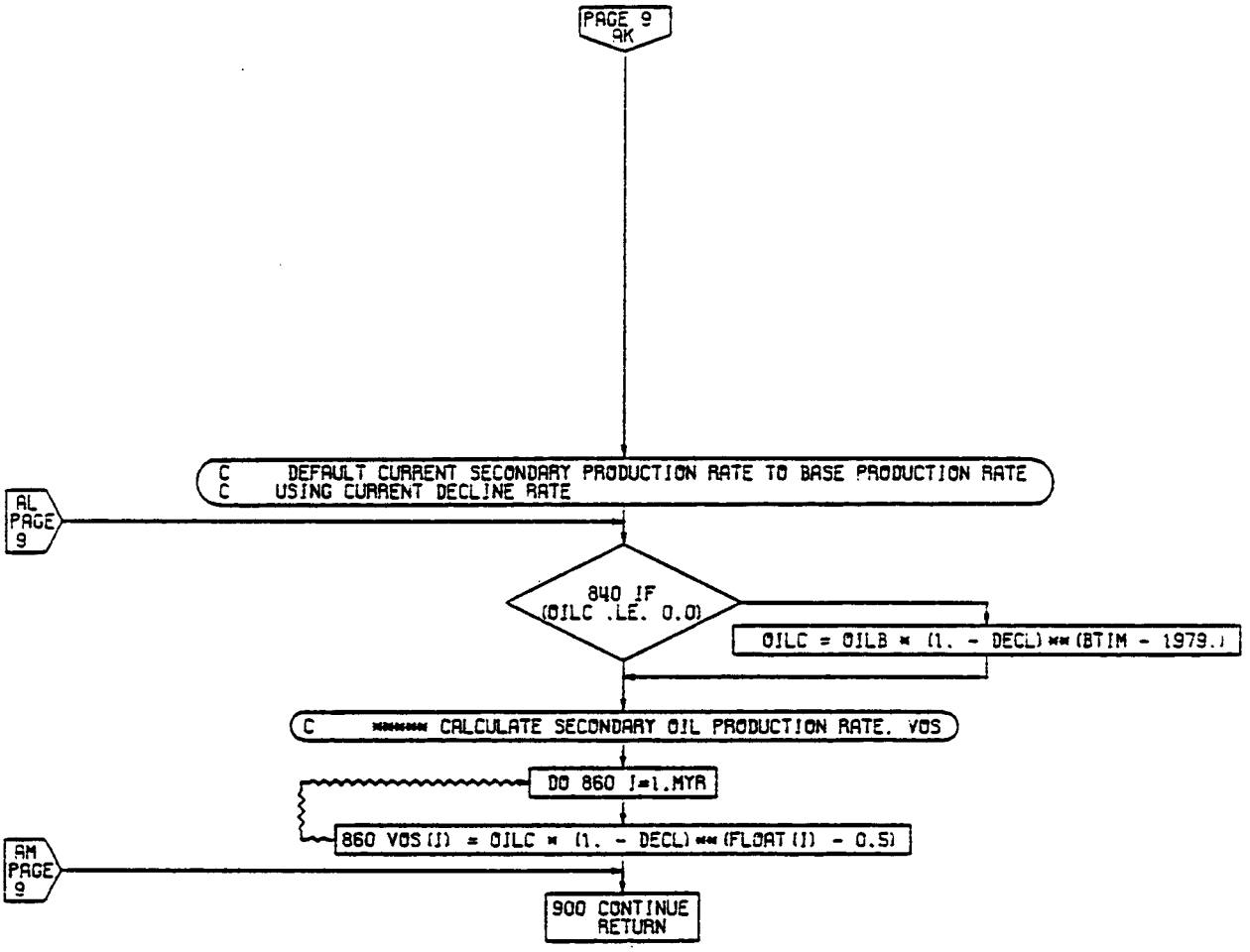

PAGE 4
AE
C ****** CAPITAL COST
C ****** COMPRESSOR COST - $1000/HP
AF
PAGE
4
720 IF
(CCOST.LE.0.)
CCOST = 1000.
C ****** WASTE GAS TREATMENT - $50/MCF/D
IF
(GTRT .LE. 0.)
GTRT = 50.
C ****** PROD WATER TREATMENT - $75/BBL/D
IF
(WTRT .LE. 0.)
WTRT = 75.
C ****** CENTRAL PLANT FACILITIES - $500/B/D
IF
(PLANT .LE. 0.)
PLANT = 500.
C ****** AIR DISTRIBUTION, VAPOR RECOVERY LINES, AND
C SURFACE PRODUCTION - DEFAULT = 26500 $/ACRE
IF
(CTACR .LE. 0.0)
CTACR = 26500.
IF
(CTPM(1).GT.0.)
GO TO 730
CTPL(1) = (WCT + CTACR * ACRES) * 0.8
CTPM(1) = (WCT + CTACR * ACRES) * 1.0
CTPH(1) = (WCT + CTACR * ACRES) * 1.2
730 IF
(CIPM(1).GT.0.)
GO TO 740
CIPL(1) = WCI * 0.8
CIPM(1) = WCI * 1.0
CIPH(1) = WCI * 1.2
740 CONTINUE
PAGE 6
AG


PAGE 5
AG
C INITIALIZE OVERHEAD ON D&C+E TO 3% OF WELL COST (WITH 2% ADDED
C LATER) ONLY FOR FIRST YEAR OF EACH PATTERN
AOVH1 = .03 * (CTPM(1) + CIPM(1)) / UNIT / UNIT
C ****** OTHER DEFAULT VALUES
MYR = M
AH
PAGE
7


PAGE 6
AH
IF
(WTCOST .LE. 0.0)
WTCOST = 0.125
IF
(WDCOST .LE. 0.0)
WDCOST = 0.10
IF
(COSTML .LE. 0.0)
COSTML = 0.03
IF
(COSTTI .LE. 0.0)
COSTTI = 0.04
IF
(XDR .LE. 0.)
XDR=0.10
IF
(XSEV .LE. 0.)
XSEV=0.0
IF
(XROT .LE. 0.)
XROT = 0.0
IF
(UNCO .LE. 0.)
UNCO=0.001
IF
(XFIT .LE. 0.)
XFIT=0.0
IF
(XTCR .LE. 0.)
XTCR=0.0
IF
(XSTX .LE. 0.)
XSTX = 0.0
PAGE 8
AI
PAGE 8
AI

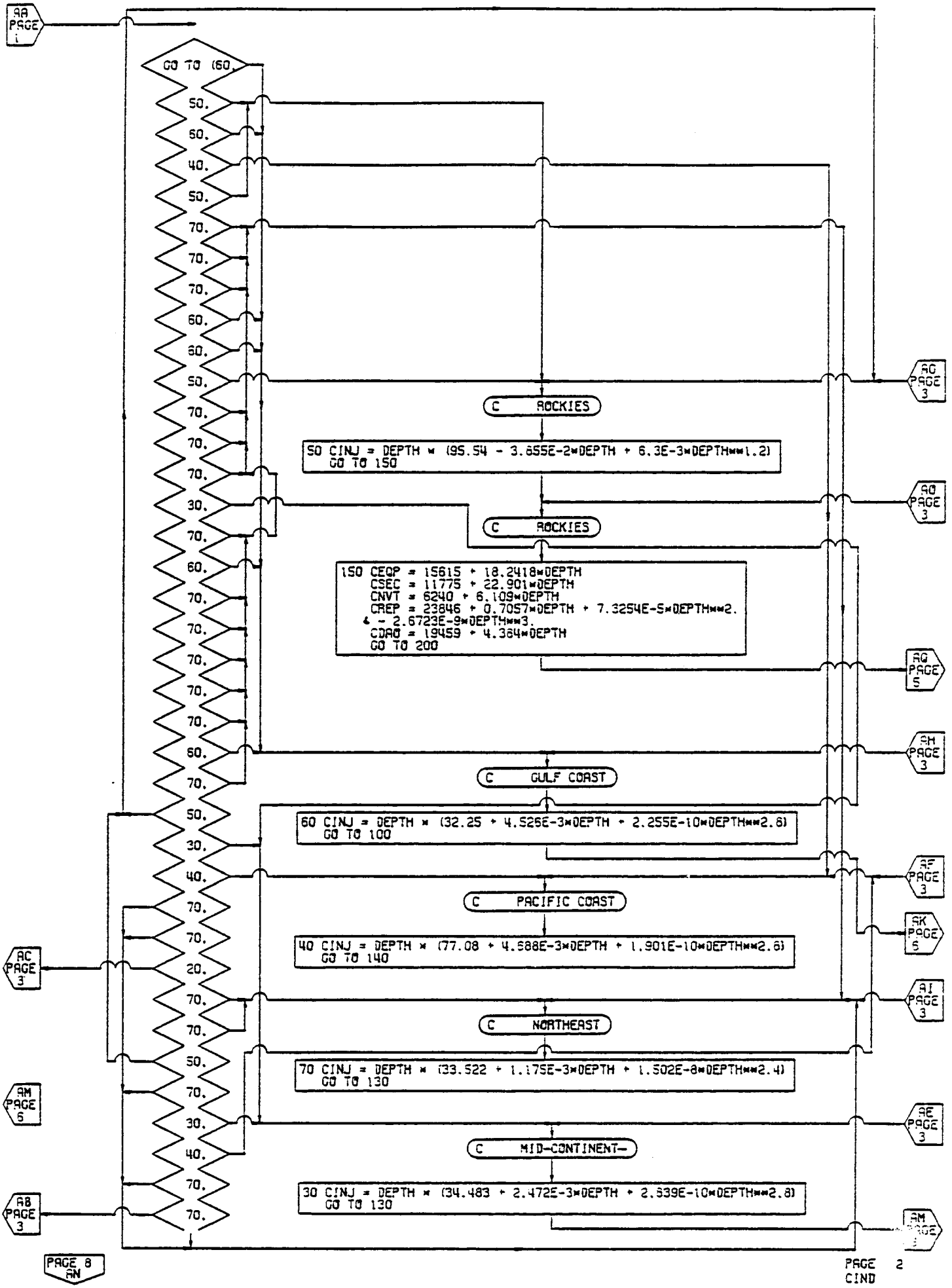

PAGE 7
AI
IF (WCAP .LE. 0.)
WCAP = 0.0
IF (BTIM .LT. 0.0)
BTIM = 1985.
IF (WPHO .LE. 0.)
WPHO=1991.
IF (EPHO .LE. 0.)
EPHO = 1993.
IF (BPOW .LE. 0)
BPOW = 23.07 * (1. + XINF) ** (BTIM -1983)
BPO(1) = BPOW
WTC(1) = WTCOST
WDC(1) = WDCOST
CML(1) = COSTML
CTI(1) = COSTTI
DATE(1) = BTIM
C DEFINE DEPRECIATION SCHEME: IF DTIM = 0. ACRS SCHEDULE
C IF DTIM > 0. STRAIGHT LINE
IDEP = 1
PAGE 9
AJ


PAGE 8
AJ
IF
(DTIM .GT. 0.0)
IDEP = 0
IF
(DTIM .LE. 0.0)
DTIM = 5.0
C ****** DEBT DEFAULTS. NOT USED UNLESS IDEBT = 1
IF
(PCTDBT .LE. 0.0)
PCTDBT = 20.0
IF
(DBTINT .LE. 0.0)
DBTINT = 15.0
IF
(NYRRPY .LE. 0.0)
NYRRPY = 1.0
IF
(NYPAID .LE. 0.0)
NYPAID = 5.0
C CALCULATE SECONDARY OIL PRODUCTION RATE (VOS. MB/YR) IF ISO NOT 1.
C AND DEFAULT DECLC TO 15% IF NOT INPUT
IF
(ISO .EQ. 1)
GO TO 900
AM
PAG.
10
IF
(DECL. LE. 0.0)
DECL = 15.0
DECL = DECL / 100.
IF
(OILB .GT. 0.0)
GO TO 840
AL
PAG:
10
OILB = 0.0
OILC = 0.0
PAGE 10
AK


PAGE 9
AK
C DEFAULT CURRENT SECONDARY PRODUCTION RATE TO BASE PRODUCTION RATE
C USING CURRENT DECLINE RATE
AL
PAGE
9
840 IF
(OILC .LE. 0.0)
OILC = OILB * (1. - DECL) ** (BTIM - 1979.)
C ******* CALCULATE SECONDARY OIL PRODUCTION RATE. VOS
DO 860 I=1,MYR
860 VOS(I) = OILC * (1. - DECL) ** (FLOAT(I) - 0.5)
AM
PAGE
9
900 CONTINUE
RETURN

```
      SUBROUTINE CIND(ISTATE,IDIST,DEPTH,RATE,PRGAS,
     & CINJ,CEQP,CSEC,CNVT,CREP,CDAO,CIWO)
C=====================================================================
C     THIS SUBROUTINE DEFINES THE PROCESS INDEPENDENT COST PARAMETER
C      DEFAULT VALUES. THESE COSTS INCLUDE:
C=====================================================================
```

AA
PAGE
2


AA PAGE 1
GO TO (60,
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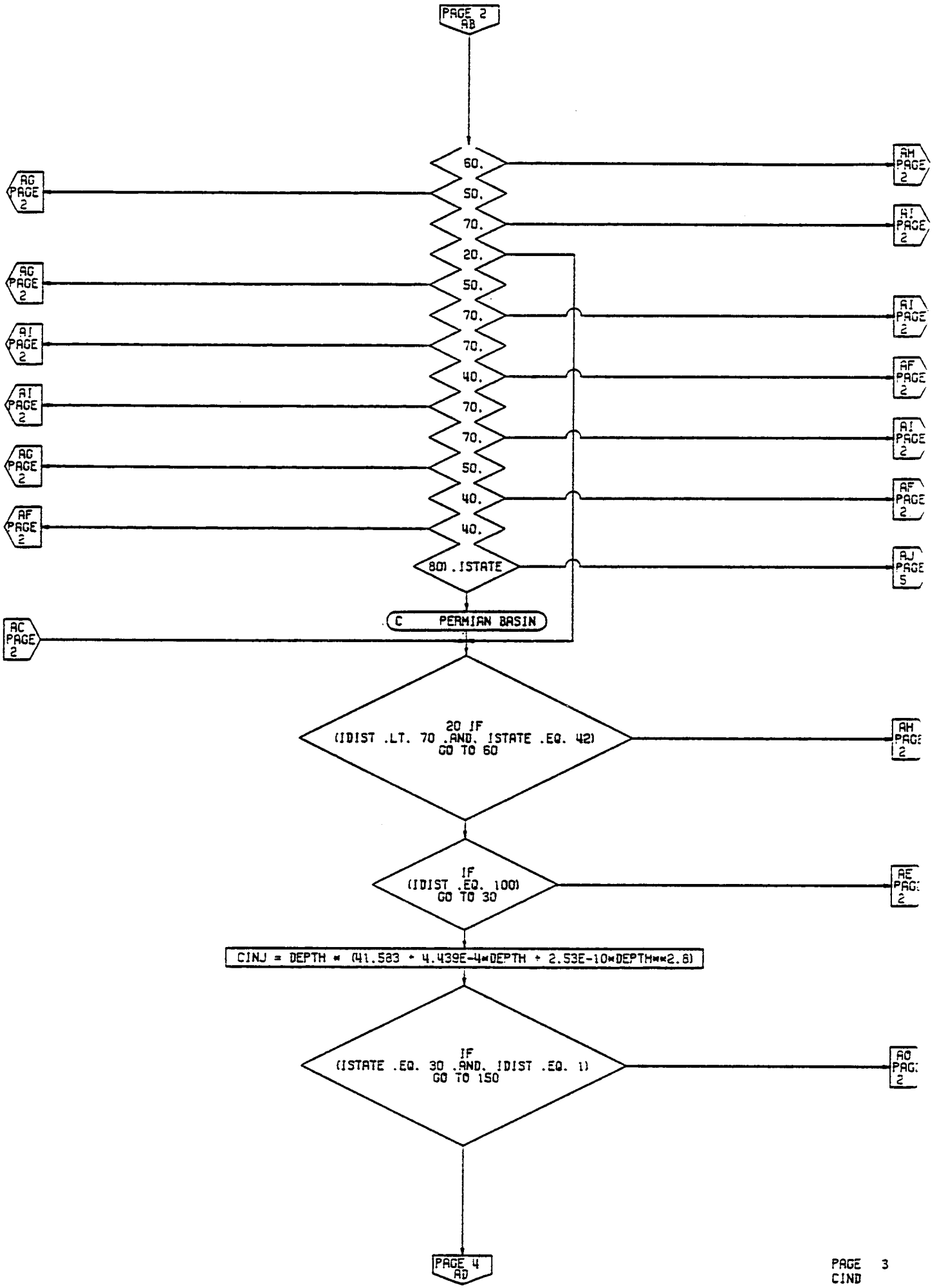
70.
AC PAGE 3
AM PAGE 6
AB PAGE 3
C ROCKIES
50 CINJ = DEPTH * (95.54 - 3.655E-2*DEPTH + 6.3E-3*DEPTH**1.2)
GO TO 150
C ROCKIES
150 CEQP = 15615 + 18.2418*DEPTH
CSEC = 11775 + 22.901*DEPTH
CNVT = 6240 + 6.109*DEPTH
CREP = 23846 + 0.7057*DEPTH + 7.3254E-5*DEPTH**2.
& - 2.6723E-9*DEPTH**3.
CDAO = 19459 + 4.364*DEPTH
GO TO 200
C GULF COAST
60 CINJ = DEPTH * (32.25 + 4.526E-3*DEPTH + 2.255E-10*DEPTH**2.6)
GO TO 100
C PACIFIC COAST
40 CINJ = DEPTH * (77.08 + 4.688E-3*DEPTH + 1.901E-10*DEPTH**2.6)
GO TO 140
C NORTHEAST
70 CINJ = DEPTH * (33.522 + 1.175E-3*DEPTH + 1.502E-8*DEPTH**2.4)
GO TO 130
C MID-CONTINENT-
30 CINJ = DEPTH * (34.483 + 2.472E-3*DEPTH + 2.639E-10*DEPTH**2.8)
GO TO 130
AO PAGE 3
AO PAGE 3
AQ PAGE 5
AM PAGE 3
AF PAGE 3
AK PAGE 5
AI PAGE 3
AE PAGE 3
AM PAGE 3
PAGE 8 AN
PAGE 2 CIND


PAGE 2 AB
60.
50.
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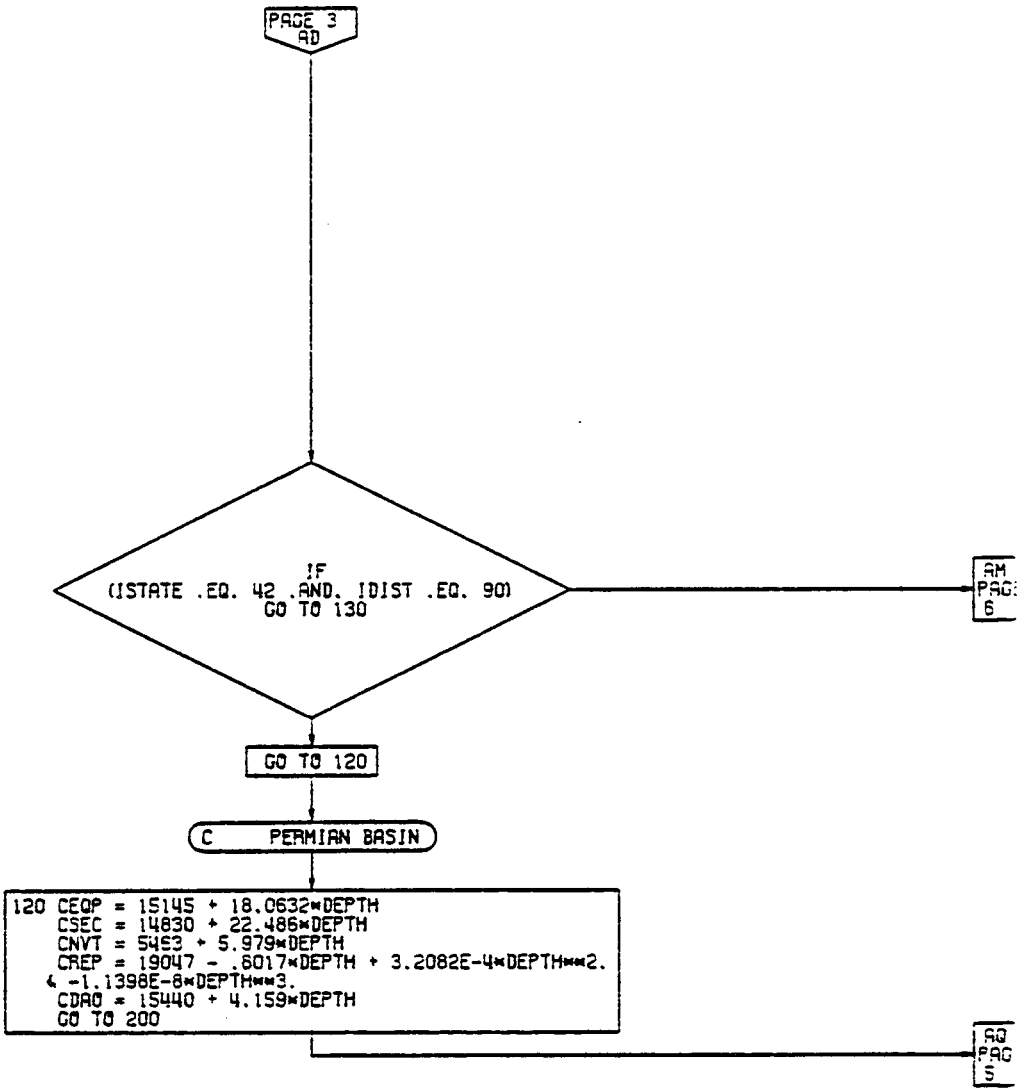
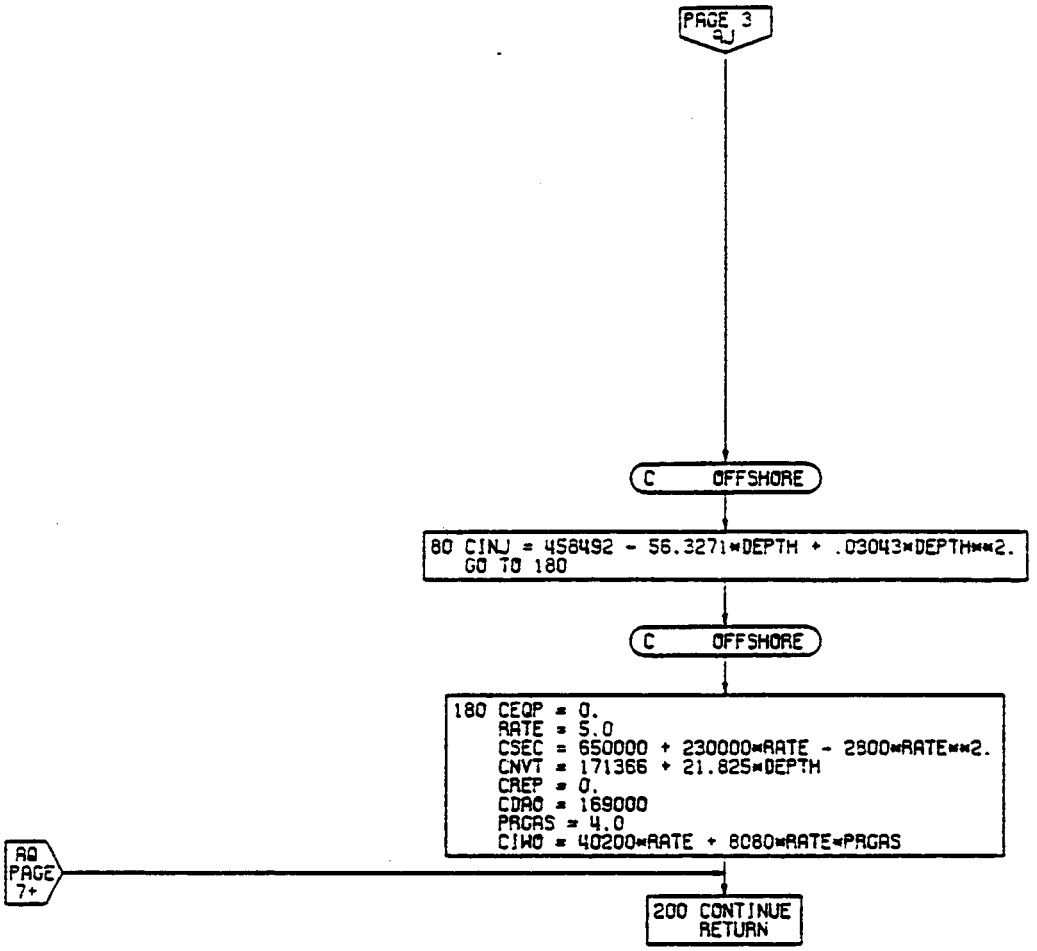
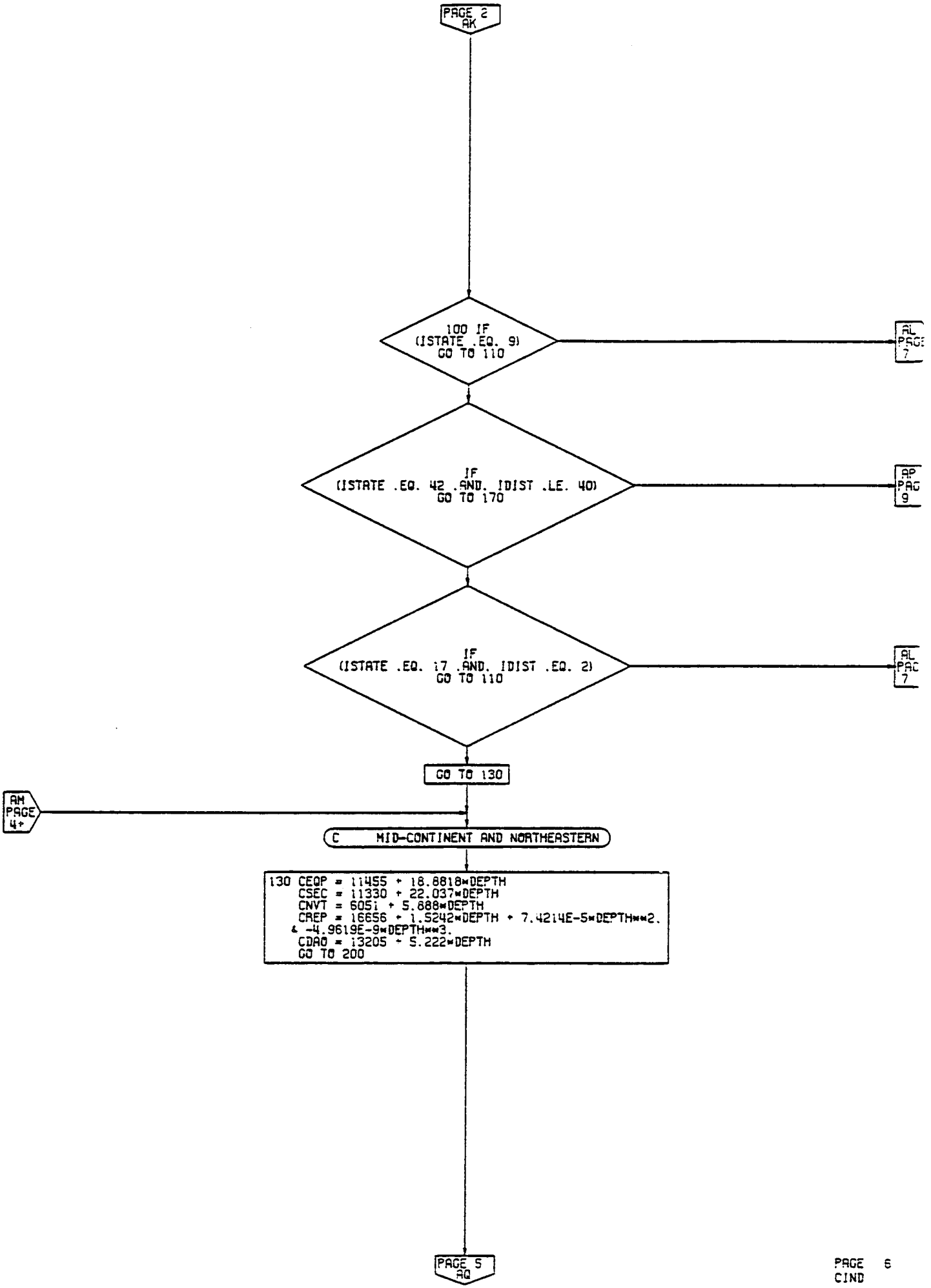
801 .ISTATE
AG PAGE 2
AG PAGE 2
AI PAGE 2
AI PAGE 2
AG PAGE 2
AF PAGE 2
AH PAGE 2
AI PAGE 2
AI PAGE 2
AF PAGE 2
AI PAGE 2
AF PAGE 2
AJ PAGE 5
C PERMIAN BASIN
AC PAGE 2
20 IF
(IDIST .LT. 70 .AND. ISTATE .EQ. 42)
GO TO 60
AH PAGE 2
IF
(IDIST .EQ. 100)
GO TO 30
AE PAGE 2
CINJ = DEPTH * (41.583 + 4.439E-4*DEPTH + 2.53E-10*DEPTH**2.6)
IF
(ISTATE .EQ. 30 .AND. IDIST .EQ. 1)
GO TO 150
AD PAGE 2
PAGE 4 AD


PAGE 3
AD
IF
(ISTATE .EQ. 42 .AND. IDIST .EQ. 90)
GO TO 130
AM
PAG
6
GO TO 120
C PERMIAN BASIN
120 CEQP = 15145 + 18.0632*DEPTH
CSEC = 14830 + 22.486*DEPTH
CNVT = 5453 + 5.979*DEPTH
CREP = 19047 - .6017*DEPTH + 3.2082E-4*DEPTH**2.
& -1.1398E-8*DEPTH**3.
CDAO = 15440 + 4.159*DEPTH
GO TO 200
AQ
PAG
5


PAGE 3
AJ
C OFFSHORE
80 CINJ = 458492 - 56.3271*DEPTH + .03043*DEPTH**2.
GO TO 180
C OFFSHORE
180 CEQP = 0.
RATE = 5.0
CSEC = 650000 + 230000*RATE - 2800*RATE**2.
CNVT = 171366 + 21.825*DEPTH
CREP = 0.
CDAO = 169000
PRGAS = 4.0
CIWO = 40200*RATE + 8080*RATE*PRGAS
AQ
PAGE
7+
200 CONTINUE
RETURN

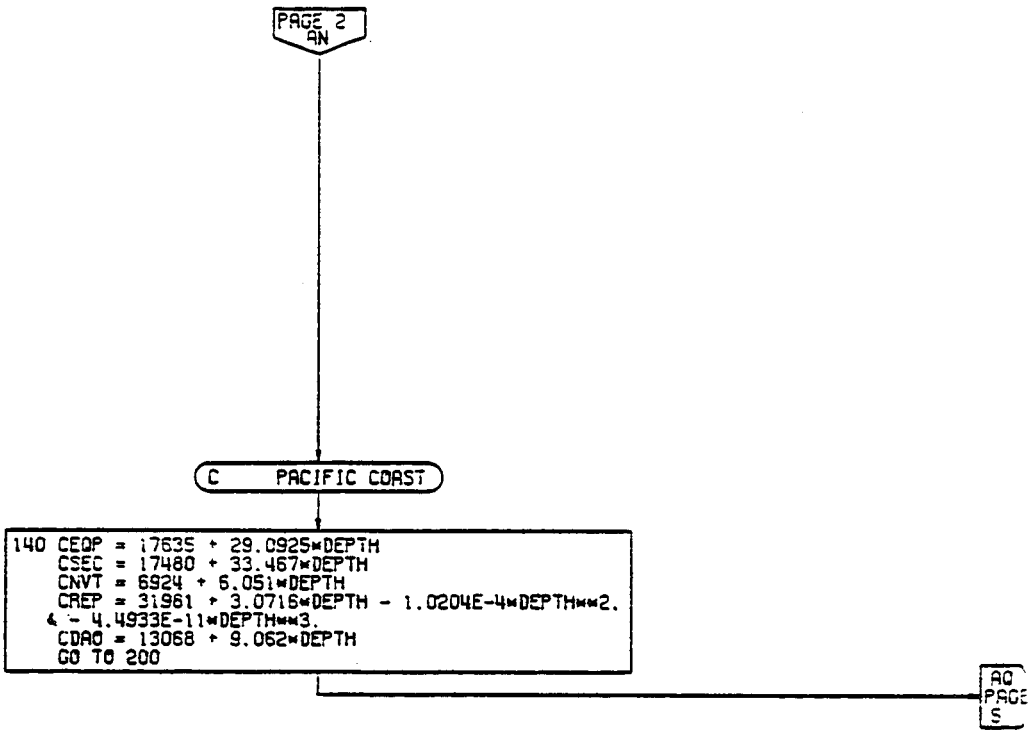

PAGE 2
AK
100 IF
(ISTATE .EQ. 9)
GO TO 110
AL
PAGE
7
IF
(ISTATE .EQ. 42 .AND. IDIST .LE. 40)
GO TO 170
AP
PAG
9
IF
(ISTATE .EQ. 17 .AND. IDIST .EQ. 2)
GO TO 110
AL
PAG
7
GO TO 130
AM
PAGE
4+
C MID-CONTINENT AND NORTHEASTERN
130 CEQP = 11455 + 18.8818*DEPTH
CSEC = 11330 + 22.037*DEPTH
CNVT = 6051 + 5.888*DEPTH
CREP = 16656 + 1.5242*DEPTH + 7.4214E-5*DEPTH**2.
& -4.9619E-9*DEPTH**3.
CDAO = 13205 + 5.222*DEPTH
GO TO 200
PAGE 5
AQ

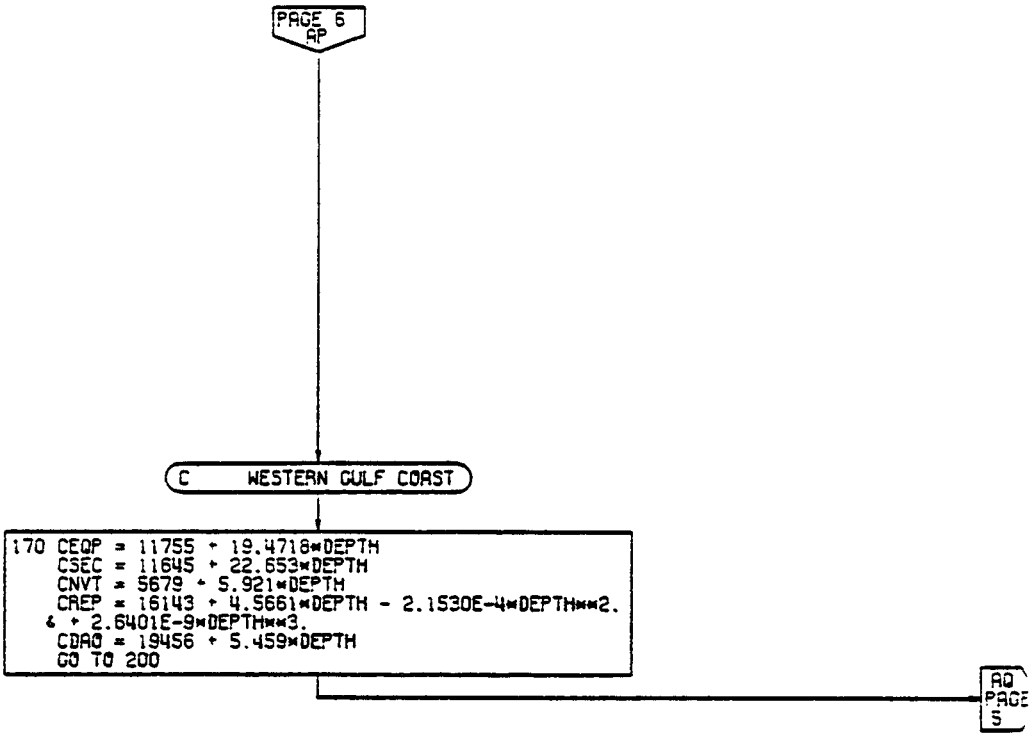
PAGE 6
AL

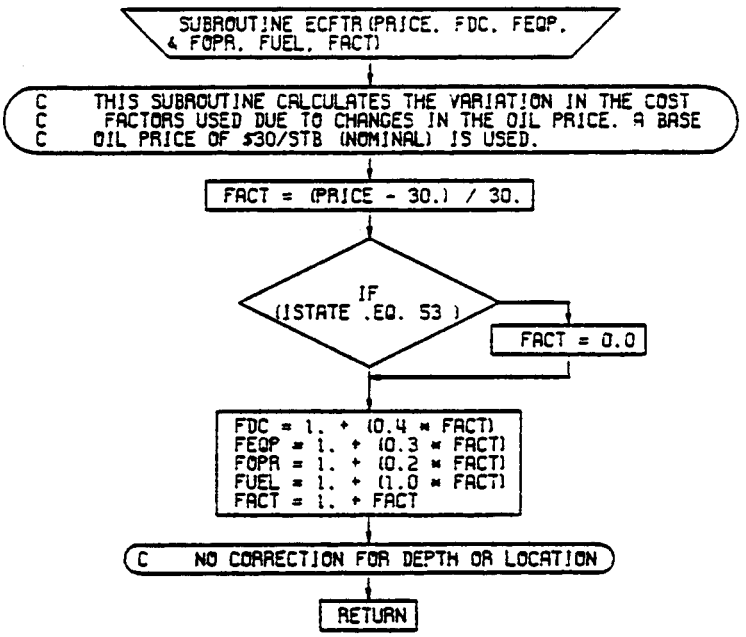
C EASTERN GULF COAST

```
110 CEQP = 12565 + 21.0825*DEPTH
    CSEC = 12460 + 24.234*DEPTH
    CNVT = 6280 + 5.95*DEPTH
    CREP = 16816 + 5.7947*DEPTH - 3.7218E-4*DEPTH**2.
   & + 8.0871E-9*DEPTH**3.
    CDAO = 21570 + 5.597*DEPTH
    GO TO 200
```

AQ
PAGE
5


PAGE 2
AN
C PACIFIC COAST
140 CEOP = 17635 + 29.0925*DEPTH
CSEC = 17480 + 33.467*DEPTH
CNVT = 6924 + 6.051*DEPTH
CREP = 31961 + 3.0716*DEPTH - 1.0204E-4*DEPTH**2.
& - 4.4933E-11*DEPTH**3.
CDAO = 13068 + 9.062*DEPTH
GO TO 200
AQ
PAGE
S


PAGE 6
AP
C WESTERN GULF COAST
170 CEQP = 11755 + 19.4718*DEPTH
CSEC = 11645 + 22.653*DEPTH
CNVT = 5679 + 5.921*DEPTH
CREP = 16143 + 4.5661*DEPTH - 2.1530E-4*DEPTH**2.
& + 2.6401E-9*DEPTH**3.
CDAQ = 19456 + 5.459*DEPTH
GO TO 200
AQ
PAGE
5


SUBROUTINE ECFTR(PRICE, FDC, FEQP,
& FOPR, FUEL, FACT)
C THIS SUBROUTINE CALCULATES THE VARIATION IN THE COST
C FACTORS USED DUE TO CHANGES IN THE OIL PRICE. A BASE
C OIL PRICE OF $30/STB (NOMINAL) IS USED.
FACT = (PRICE - 30.) / 30.
IF
(ISTATE .EQ. 53)
FACT = 0.0
FDC = 1. + (0.4 * FACT)
FEQP = 1. + (0.3 * FACT)
FOPR = 1. + (0.2 * FACT)
FUEL = 1. + (1.0 * FACT)
FACT = 1. + FACT
C NO CORRECTION FOR DEPTH OR LOCATION
RETURN

```
SUBROUTINE ECON(API,PRICE, DISCNT, VALUE,
& FACT, FDC, FEOP, FOPR, FUEL)

C
C      ****** COMPUTE MEAN DISCOUNTED CASH FLOW AND RATE OF RETURN
C

      UNIT = 1000.
      UMM = UNIT*UNIT
      SUMVOM = 0.0
      SUMTD = 0.0

      DO 20 I=1,MYR

      MUVO(I) = (VOL(I)+2.*VOM(I)+VOH(I))/4.
      MUVG(I) = 0.0
      MUVW(I) = VWM(I)
      MUVI(I) = VIM(I)

C     CALCULATE PRICES DETERMINISTICALLY FOR NPC STUDY

      MUPO(I) = POM(I) * FACT

      IF
      (ISTATE .EQ. 501)
      MUPO(I) = ((MUPO(I)/FACT)+9.00)*FACT
      -9.00

      MUPG(I) = PGM(I) * FACT
      MUFO(I) = FOCM(I) * FOPR
      MUOPC(I) = OPCM(I) * FOPR
      MUED(I) = EDPM(I) * FOPR
      MUCT(I) = CTCM(I) * FEOP
      MUCI(I) = CICM(I) * FEOP
      MUWO(I) = WO(I) * FOPR
      SUMVOM = SUMVOM + MUVO(I)/UNIT
      SUMTD = SUMTD + MUCT(I)/UMM
      DEPS(I) = 0.0

C     INITIALIZE DEBT VECTORS

      MUIN(I) = 0.
      MUDB(I) = 0.
      MUPB(I) = 0.
      MURP(I) = 0.

20    CONTINUE

C     ****** COMPUTE VARIANCES OF EACH VARIABLE

      DO 30 I=1,MYR

      SIGVO(I) = (VOH(I)-VOL(I))/2.65
      SIGPO(I) = (POH(I)-POL(I))/2.65/UMM
      SIGPG(I) = (PGH(I)-PGL(I))/2.65/UMM
      SIGFO(I) = (FOCH(I)-FOCL(I))/2.65/UMM
      SIGOPC(I) = (OPCH(I)-OPCL(I))/2.65/UMM
      SIGED(I) = (EDPH(I)-EDPL(I))/2.65/UMM
      SIGCT(I) = (CTCH(I)-CTCL(I))/2.65/UMM
      SIGCI(I) = (CICH(I)-CICL(I))/2.65/UMM

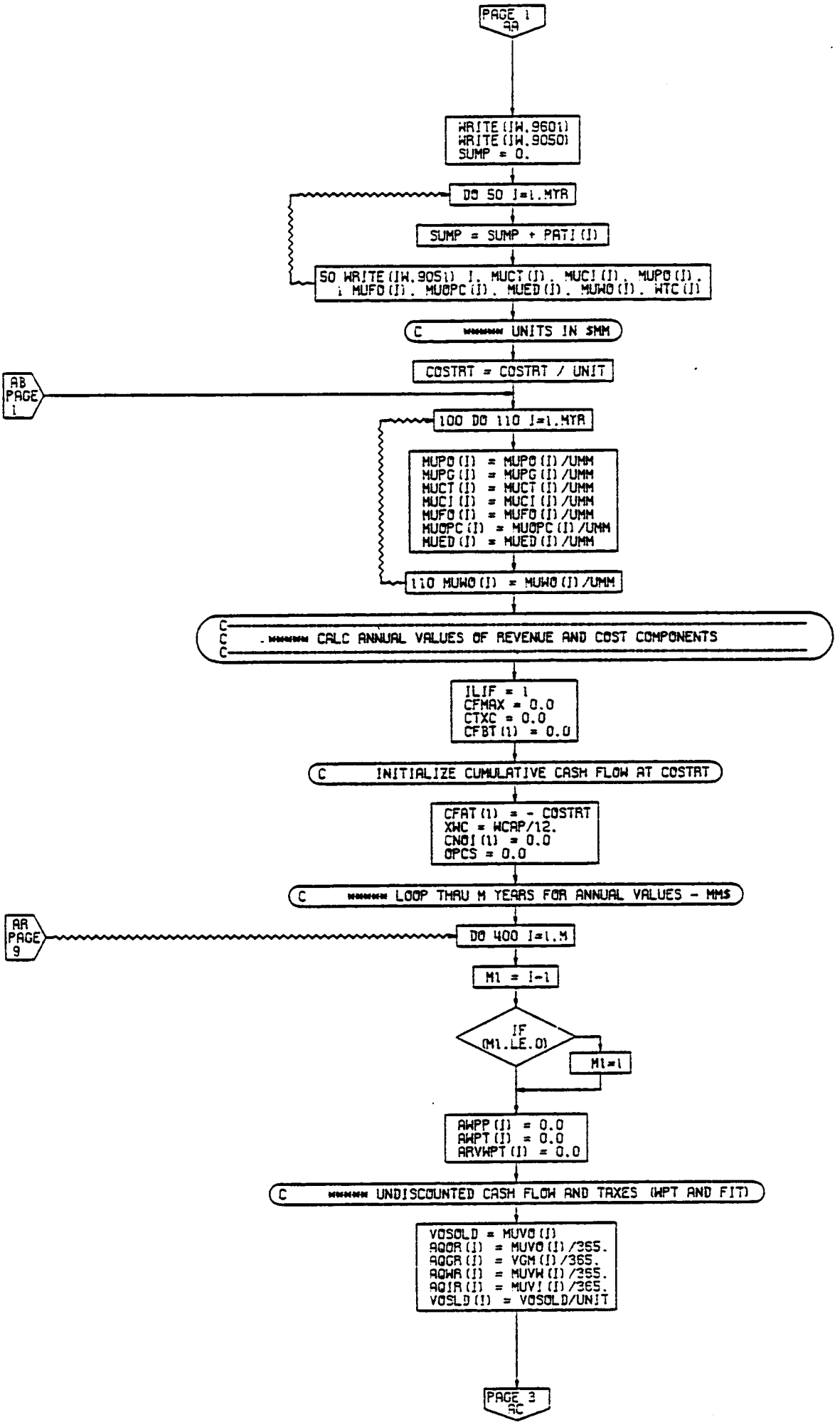
30    CONTINUE

C     ****** WRITE MEAN VALUES - IOUT.GE.2

      IF
      (IOUT.LE.1)
      GO TO 100
```

AB
PAGE
2

PAGE
AA


PAGE 1 AA
WRITE(IW,9601)
WRITE(IW,9050)
SUMP = 0.
DO 50 I=1,MYR
SUMP = SUMP + PATI(I)
50 WRITE(IW,9051) I, MUCT(I), MUCI(I), MUPO(I),
1 MUFO(I), MUOPC(I), MUED(I), MUWO(I), WTC(I)
C ****** UNITS IN $MM
COSTRT = COSTRT / UNIT
AB PAGE 1
100 DO 110 I=1,MYR
MUPO(I) = MUPO(I)/UMM
MUPG(I) = MUPG(I)/UMM
MUCT(I) = MUCT(I)/UMM
MUCI(I) = MUCI(I)/UMM
MUFO(I) = MUFO(I)/UMM
MUOPC(I) = MUOPC(I)/UMM
MUED(I) = MUED(I)/UMM
110 MUWO(I) = MUWO(I)/UMM
C
C ****** CALC ANNUAL VALUES OF REVENUE AND COST COMPONENTS
C
ILIF = 1
CFMAX = 0.0
CTXC = 0.0
CFBT(1) = 0.0
C INITIALIZE CUMULATIVE CASH FLOW AT COSTRT
CFAT(1) = - COSTRT
XWC = WCAP/12.
CNOI(1) = 0.0
OPCS = 0.0
C ****** LOOP THRU M YEARS FOR ANNUAL VALUES - MM$
AR PAGE 9
DO 400 I=1,M
M1 = I-1
IF (M1.LE.0)
M1=1
AWPP(I) = 0.0
AWPT(I) = 0.0
ARVWPT(I) = 0.0
C ****** UNDISCOUNTED CASH FLOW AND TAXES (WPT AND FIT)
VOSOLD = MUVO(I)
AQOR(I) = MUVO(I)/365.
AQGR(I) = VGM(I)/365.
AQWR(I) = MUVW(I)/365.
AQIR(I) = MUVI(I)/365.
VOSLD(I) = VOSOLD/UNIT
PAGE 3 AC

PAGE 2
AC

```
C      ****** ANNUAL REVENUE FOR GROSS OIL (LESS FUEL) AND GAS SOLD
```

```
AREVO(I)  = VOSOLD*MUPO(I)
AREVG(I)  = MUVG(I)*MUPG(I)
AREV(I)   = AREVO(I)  + AREVG(I)
```

```
C      ****** LESS ROYALTY GIVES NET OIL (WORKING INTEREST)
```

```
VONET(I)  = VOSOLD*(1.-XROY)
VGNET(I)  = MUVG(I)*(1.-XROY)/UNIT
AROY(I)   = AREV(I)*XROY
ANET(I)   = AREV(I)  - AROY(I)
```

```
C      ****** SEVERANCE TAX
```

```
ASEV(I)  = ANET(I)*XSEV
```

```
C      ****** ANNUAL OPERATING COST (FIXED, VARIABLE,
C      ****** DRIVER, WATER T/D, AIR COMP, W/O, OVHEAD)
```

```
AFOC(I)  = MUFO(I)
AVOC(I)  = MUVO(I)*MUOPC(I)
AEDP(I)  = QMM(I)  *MUED(I)
AWTC(I)  = MUVW(I)*WTC(I)/UMM * FOPR
AWDC(I)  = VDM(I)  *WDC(I)/UMM * FOPR
ACML(I)  = MUVI(I)*CML(I)/UMM * FOPR
ATIN(I)  = MUVI(I)*CTI(I)/UMM * FOPR
AOVH(I)  = .20 * (AFOC(I)  + AVOC(I)  + AEDP(I)  + AWTC(I)
1 + AWDC(I)  + ACML(I)  + ATIN(I)  + MUWO(I))
2 + .02 * (MUCI(I)  + MUCT(I))  + AOVH(I)  * FDC
ACOST(I)  = AFOC(I)  + AVOC(I)  + AEDP(I)
1 + AWTC(I)  + AWDC(I)  + AOVH(I)
2 + ACML(I)  + ATIN(I)  + MUWO(I)  + ASEV(I)
```

```
C      ****** ANNUAL WORKING CAPITAL
```

```
OPCI = ACOST(I)
```

```
IF
(OPCI.LE.0.)
```

```
OPCI = 0.0
```

```
AWCP(I)  =  (OPCI-OPCS)*XWC
OPCS = OPCI
```

```
C      ****** NET OPERATING INCOME (BEFORE WINDFALL AND FEDERAL TAX)
```

```
ANOI(I)  = ANET(I)  - ACOST(I)
CNOI(I)  = CNOI(M1)  + ANOI(I)
BTINC = ANOI(I)  - MUCI(I)-MUCT(I)-AWCP(I)
CFBT(I)  = CFBT(M1)  + BTINC
```

```
C      ****** WINDFALL PROFIT TAX CALCS
```

```
IF
(XWPT .EQ. 0.0)
GO TO 356
```

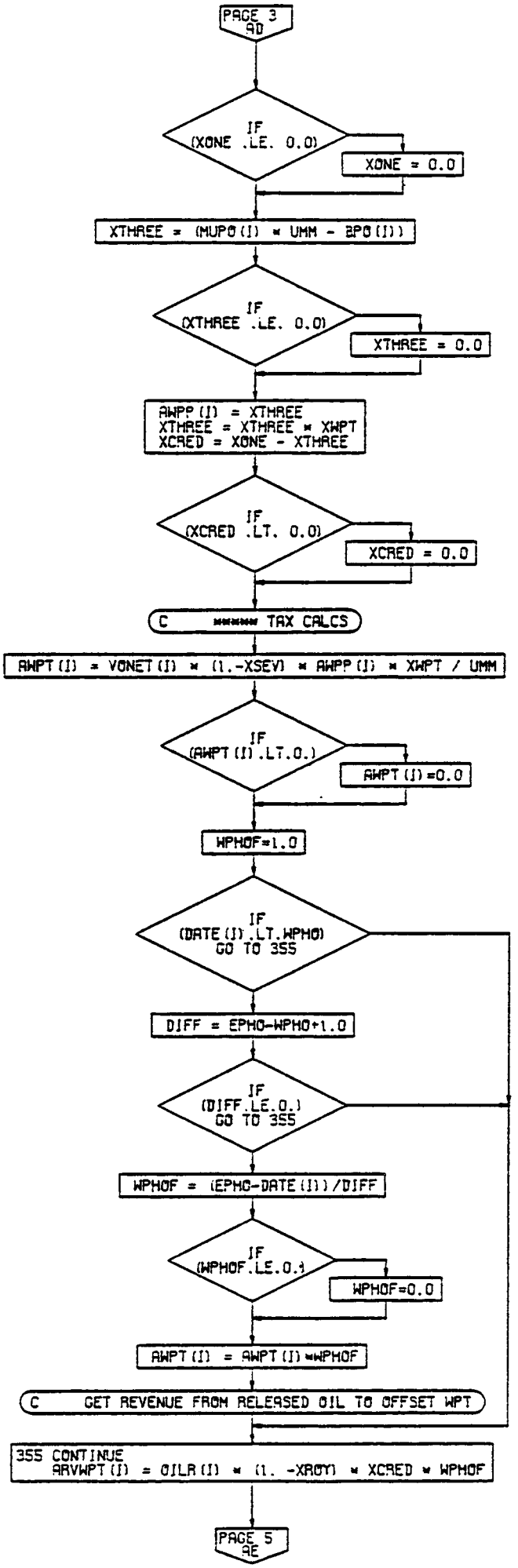
AF
PAC
5

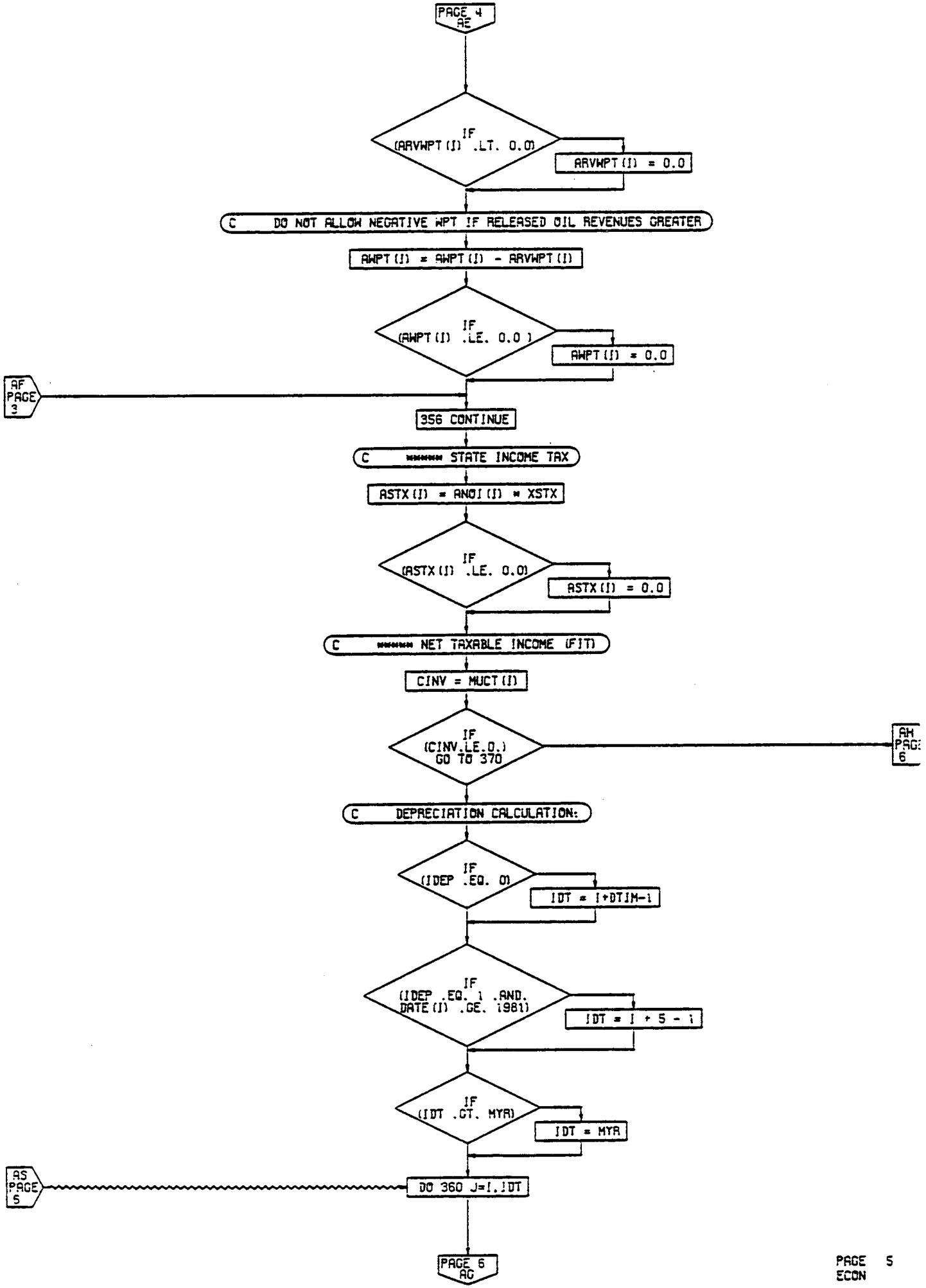
```
IF
(AP1 .LE. 16.0)
GO TO 356
```

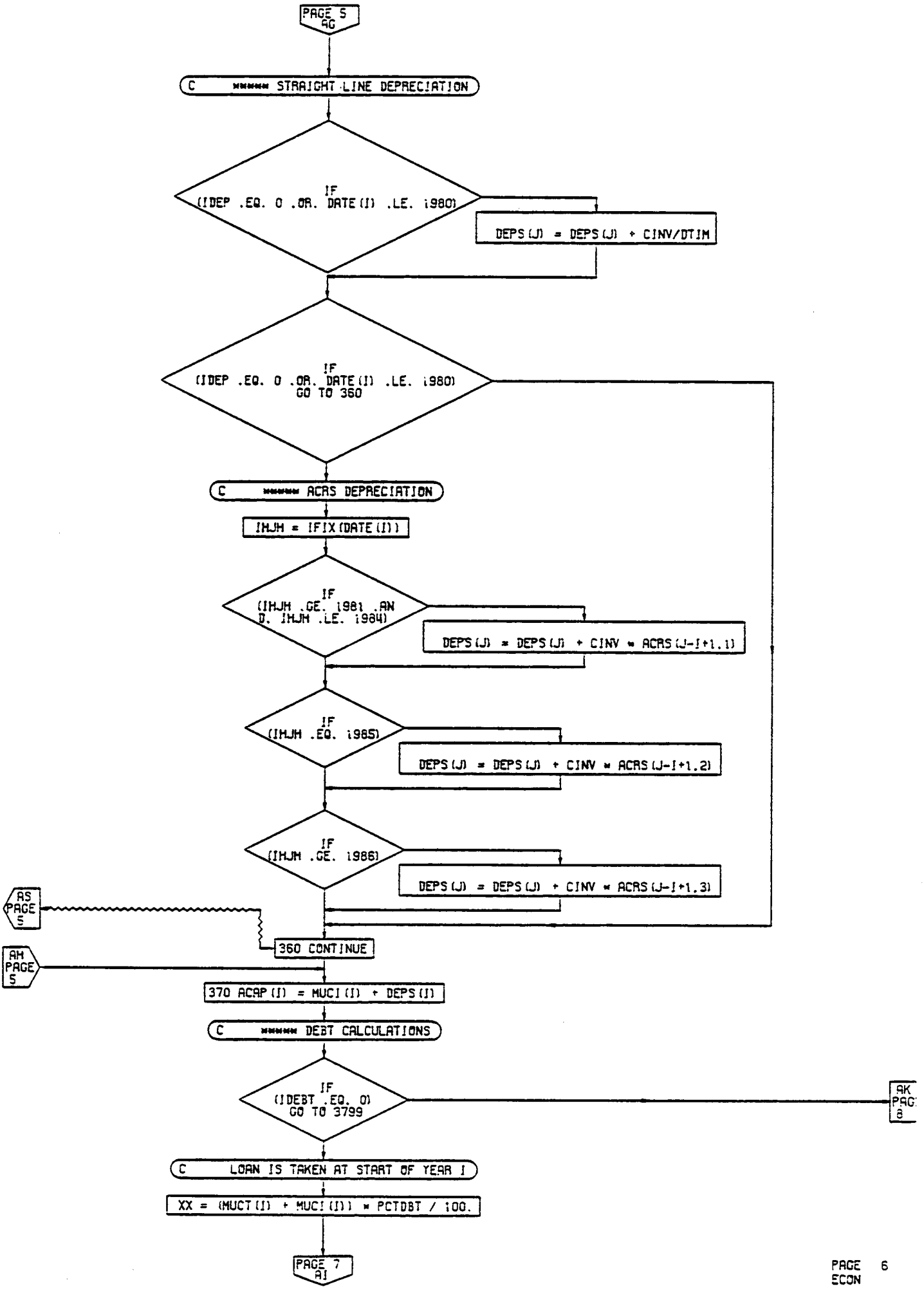
AF
PAC
5

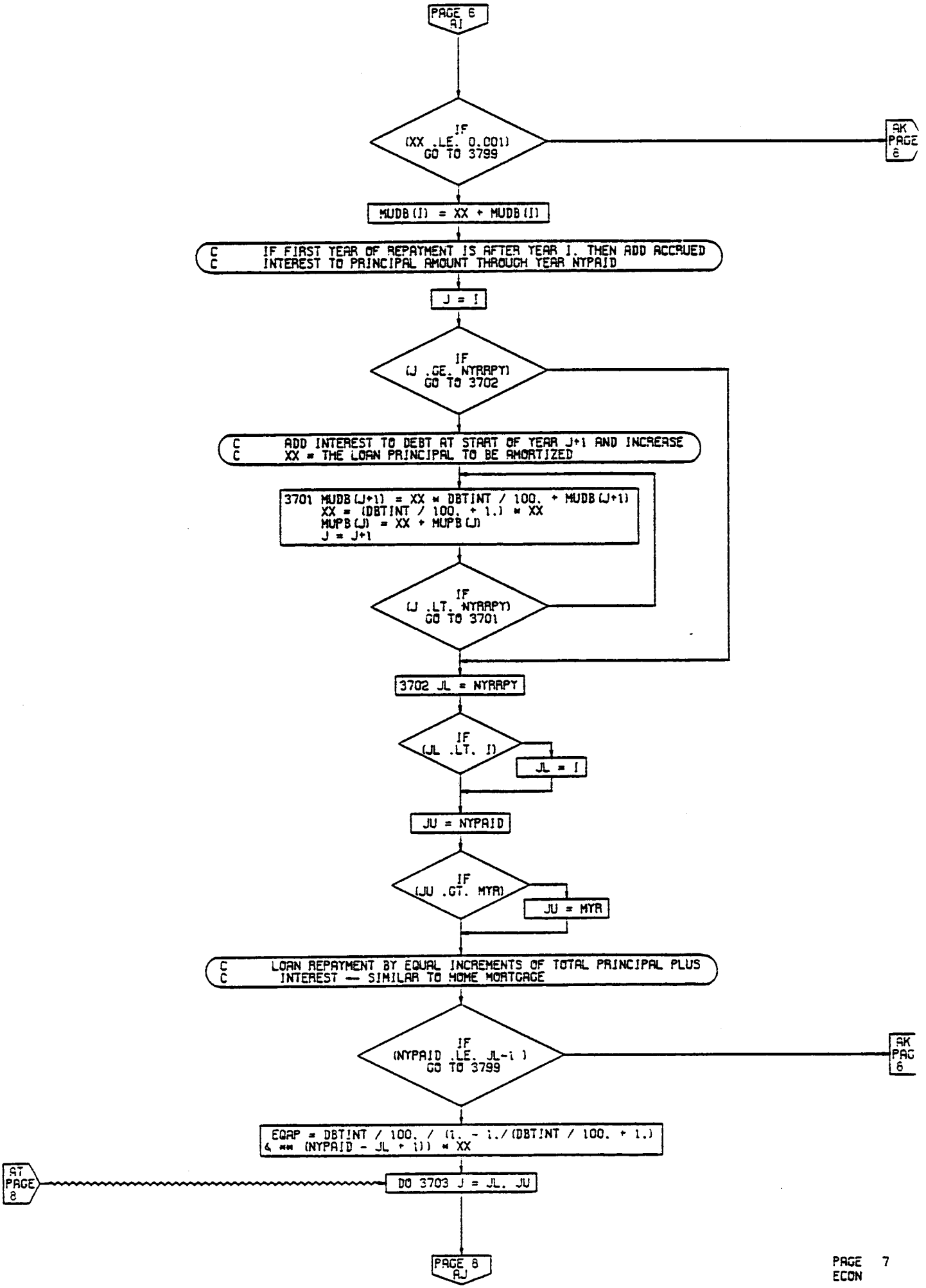
```
BPONE = 16.65
XONE =  (MUPO(I)  * UMM - BPONE)  * 0.70
```

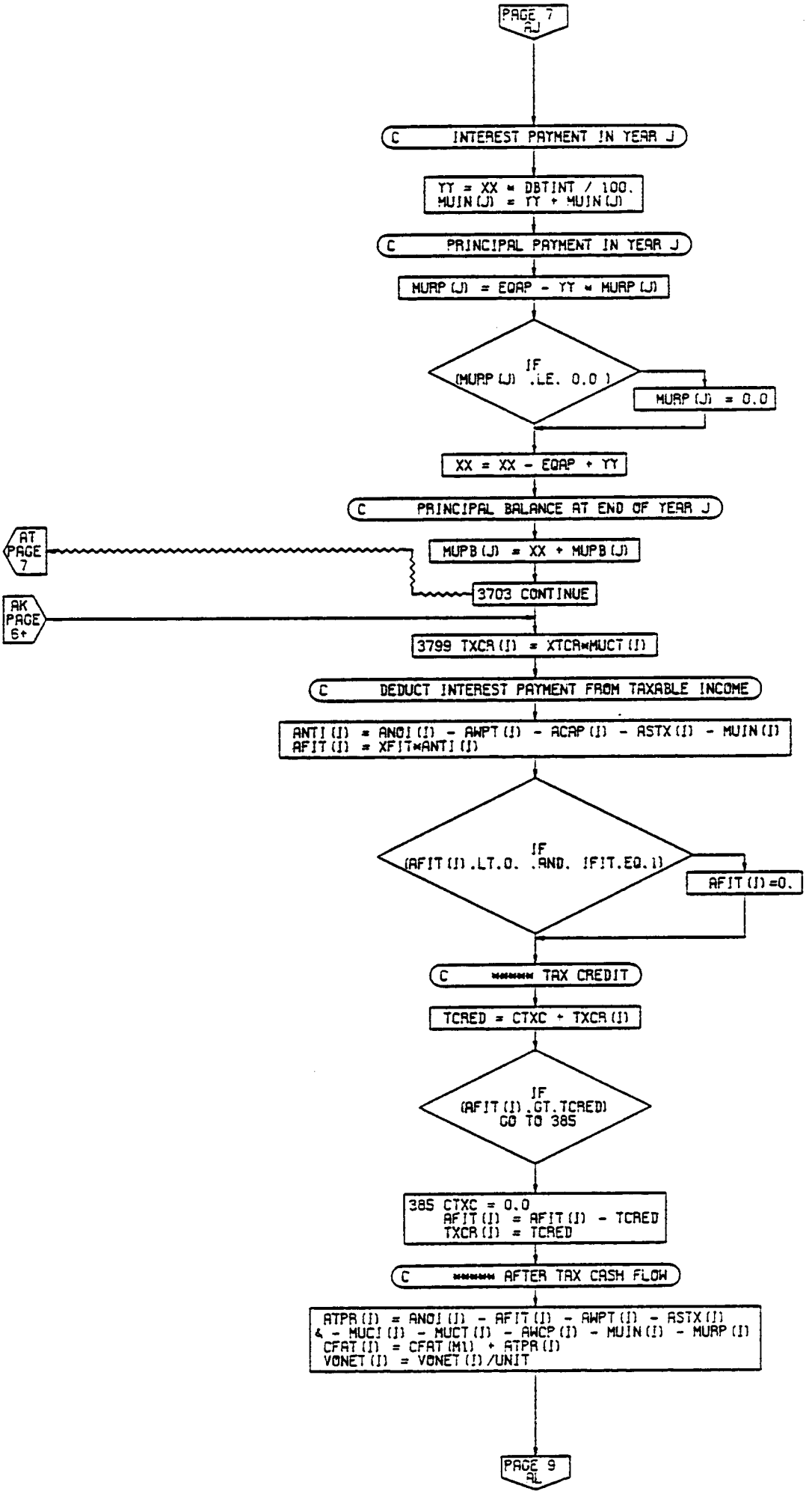
PAGE 4
AD

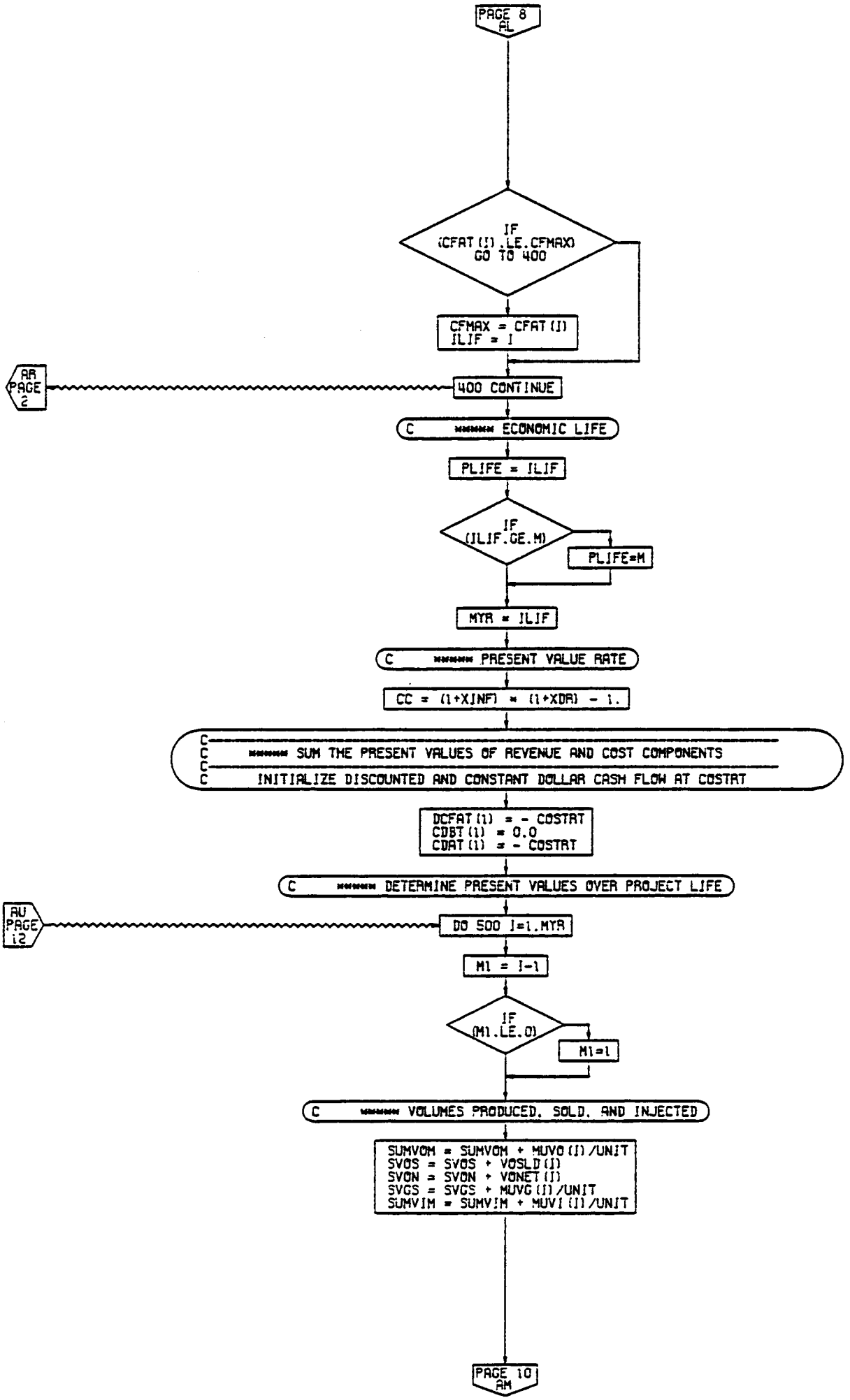

PAGE 3
AD
IF
(XONE .LE. 0.0)
XONE = 0.0
XTHREE = (MUPO(I) * UMM - BPO(I))
IF
(XTHREE .LE. 0.0)
XTHREE = 0.0
AWPP(I) = XTHREE
XTHREE = XTHREE * XWPT
XCRED = XONE - XTHREE
IF
(XCRED .LT. 0.0)
XCRED = 0.0
C ****** TAX CALCS
AWPT(I) = VONET(I) * (1.-XSEV) * AWPP(I) * XWPT / UMM
IF
(AWPT(I).LT.0.)
AWPT(I)=0.0
WPHOF=1.0
IF
(DATE(I).LT.WPHO)
GO TO 355
DIFF = EPHO-WPHO+1.0
IF
(DIFF.LE.0.)
GO TO 355
WPHOF = (EPHO-DATE(I))/DIFF
IF
(WPHOF.LE.0.)
WPHOF=0.0
AWPT(I) = AWPT(I)*WPHOF
C GET REVENUE FROM RELEASED OIL TO OFFSET WPT
355 CONTINUE
ARVWPT(I) = OILR(I) * (1. -XROY) * XCRED * WPHOF
PAGE 5
AE

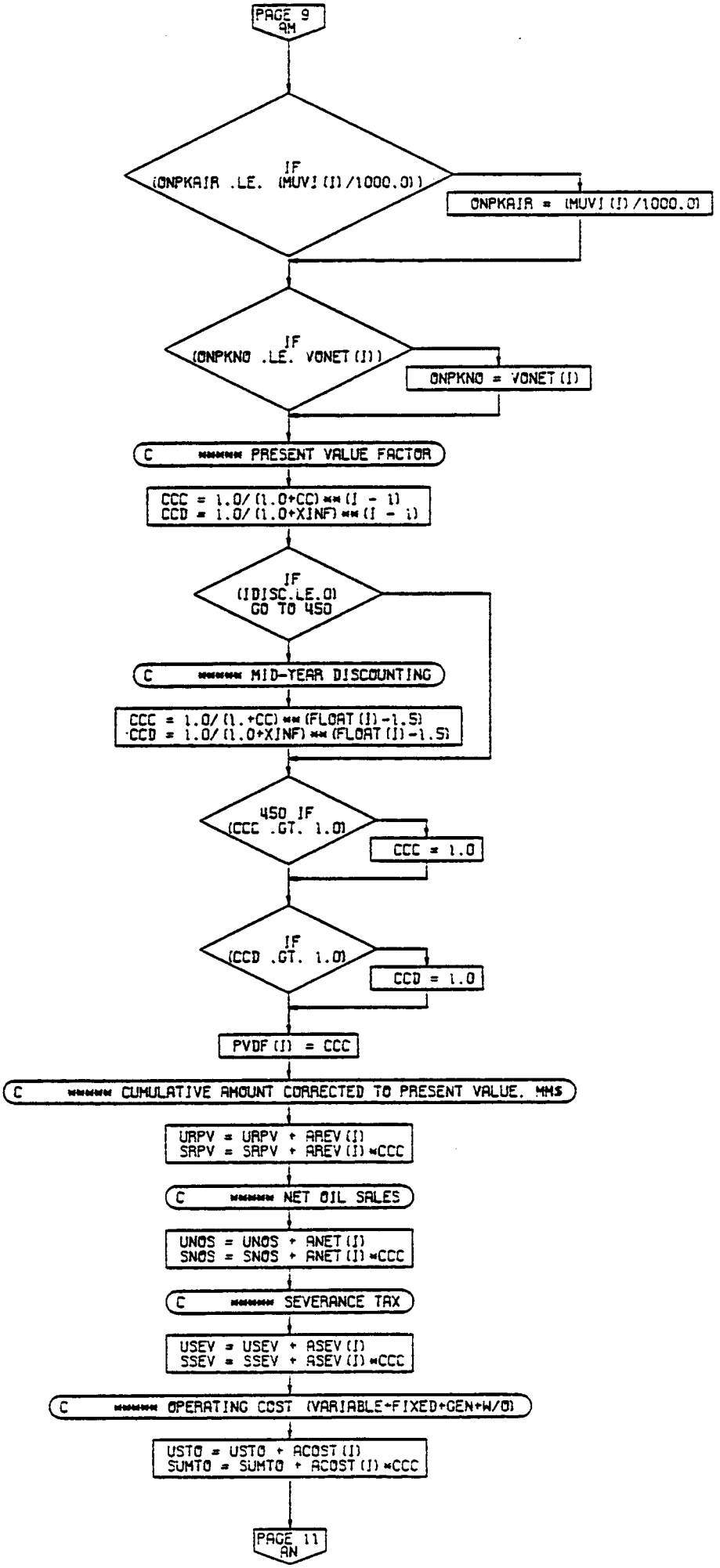

PAGE 4
AE
IF
(ARVWPT(I) .LT. 0.0)
ARVWPT(I) = 0.0
C DO NOT ALLOW NEGATIVE WPT IF RELEASED OIL REVENUES GREATER
AWPT(I) = AWPT(I) - ARVWPT(I)
IF
(AWPT(I) .LE. 0.0)
AWPT(I) = 0.0
AF
PAGE
3
356 CONTINUE
C ****** STATE INCOME TAX
ASTX(I) = ANOI(I) * XSTX
IF
(ASTX(I) .LE. 0.0)
ASTX(I) = 0.0
C ****** NET TAXABLE INCOME (FIT)
CINV = MUCT(I)
IF
(CINV.LE.0.)
GO TO 370
AH
PAGE
6
C DEPRECIATION CALCULATION:
IF
(IDEP .EQ. 0)
IDT = I+DTIM-1
IF
(IDEP .EQ. 1 .AND.
DATE(I) .GE. 1981)
IDT = I + 5 - 1
IF
(IDT .GT. MYR)
IDT = MYR
AS
PAGE
5
DO 360 J=I,IDT
PAGE 6
AG

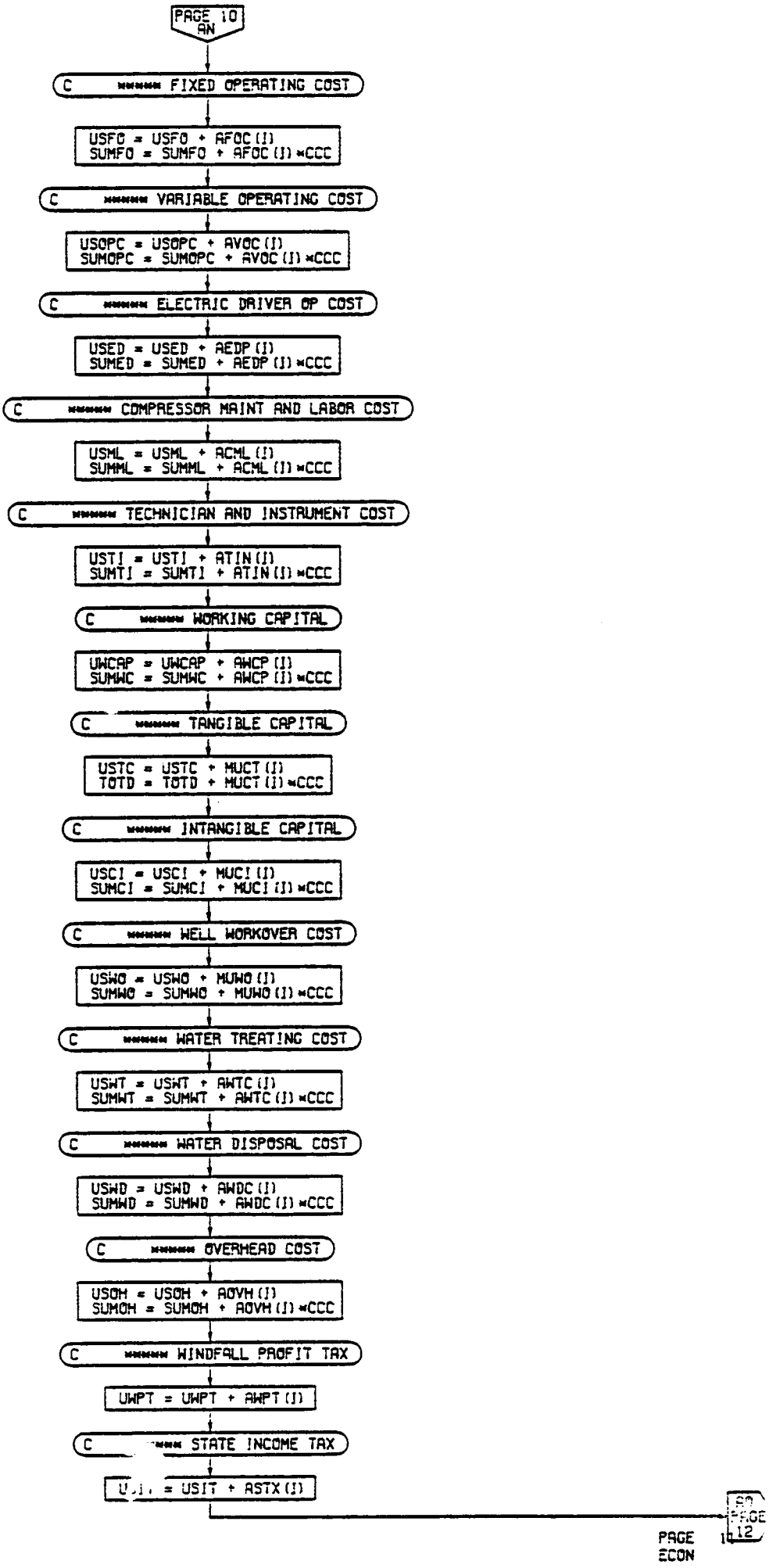

PAGE 5
AG
C ****** STRAIGHT LINE DEPRECIATION
IF
(IDEP .EQ. 0 .OR. DATE(I) .LE. 1980)
DEPS(J) = DEPS(J) + CINV/DTIM
IF
(IDEP .EQ. 0 .OR. DATE(I) .LE. 1980)
GO TO 360
C ****** ACRS DEPRECIATION
IHJH = IFIX(DATE(I))
IF
(IHJH .GE. 1981 .AN
D. IHJH .LE. 1984)
DEPS(J) = DEPS(J) + CINV * ACRS(J-I+1,1)
IF
(IHJH .EQ. 1985)
DEPS(J) = DEPS(J) + CINV * ACRS(J-I+1,2)
IF
(IHJH .GE. 1986)
DEPS(J) = DEPS(J) + CINV * ACRS(J-I+1,3)
AS
PAGE
5
360 CONTINUE
AH
PAGE
5
370 ACAP(I) = MUCI(I) + DEPS(I)
C ****** DEBT CALCULATIONS
IF
(IDEBT .EQ. 0)
GO TO 3799
AK
PAG
8
C LOAN IS TAKEN AT START OF YEAR I
XX = (MUCT(I) + MUCI(I)) * PCTDBT / 100.
PAGE 7
AI

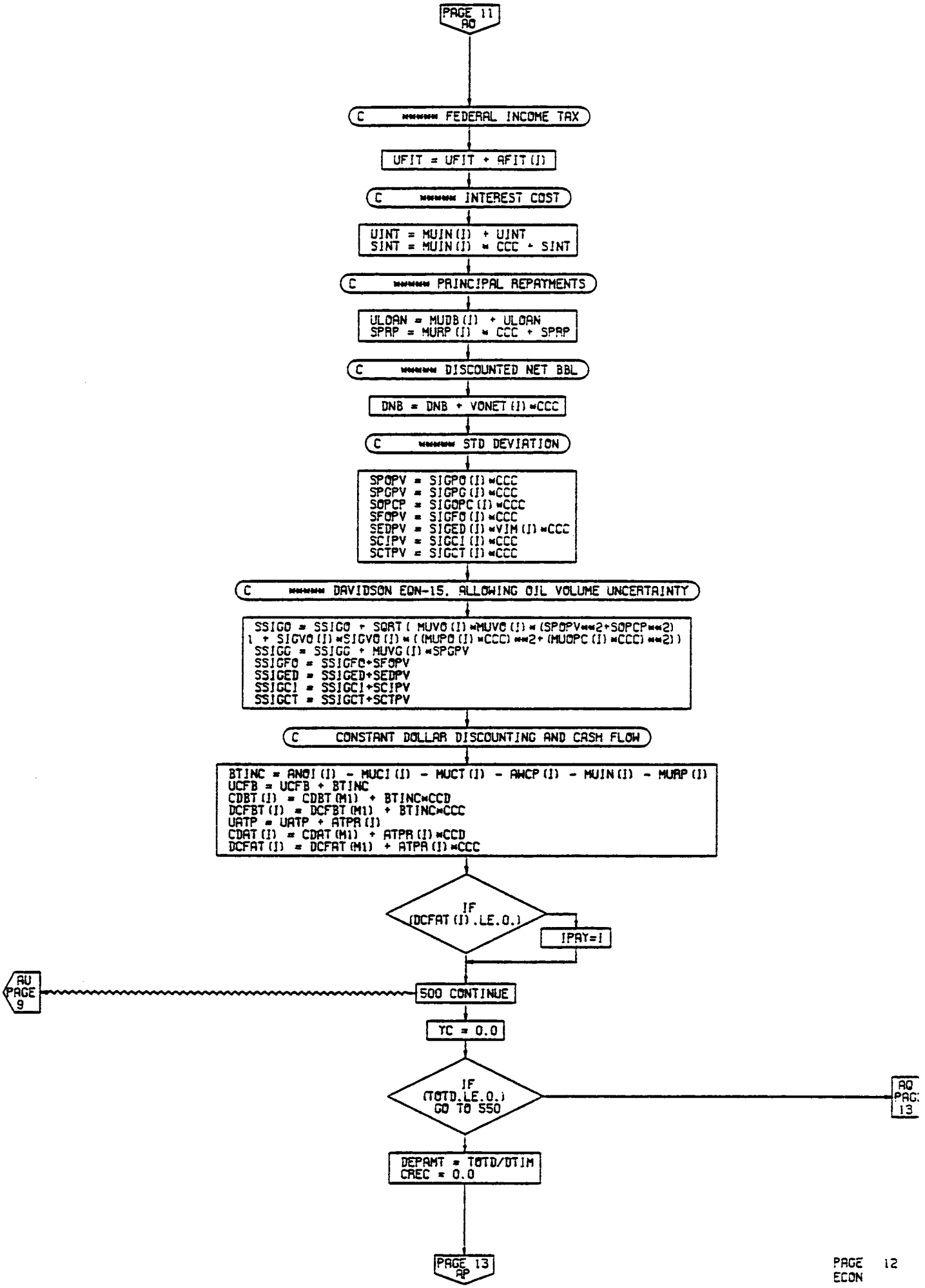

PAGE 6
AI
IF
(XX .LE. 0.001)
GO TO 3799
AK
PAGE
6
MUDB(I) = XX + MUDB(I)
C IF FIRST YEAR OF REPAYMENT IS AFTER YEAR I, THEN ADD ACCRUED
C INTEREST TO PRINCIPAL AMOUNT THROUGH YEAR NYPAID
J = I
IF
(J .GE. NYRRPY)
GO TO 3702
C ADD INTEREST TO DEBT AT START OF YEAR J+1 AND INCREASE
C XX = THE LOAN PRINCIPAL TO BE AMORTIZED
3701 MUDB(J+1) = XX * DBTINT / 100. + MUDB(J+1)
XX = (DBTINT / 100. + 1.) * XX
MUPB(J) = XX + MUPB(J)
J = J+1
IF
(J .LT. NYRRPY)
GO TO 3701
3702 JL = NYRRPY
IF
(JL .LT. I)
JL = I
JU = NYPAID
IF
(JU .GT. MYR)
JU = MYR
C LOAN REPAYMENT BY EQUAL INCREMENTS OF TOTAL PRINCIPAL PLUS
C INTEREST — SIMILAR TO HOME MORTGAGE
IF
(NYPAID .LE. JL-1)
GO TO 3799
AK
PAG
6
EQAP = DBTINT / 100. / (1. - 1./(DBTINT / 100. + 1.)
& ** (NYPAID - JL + 1)) * XX
AT
PAGE
8
DO 3703 J = JL, JU
PAGE 8
AJ

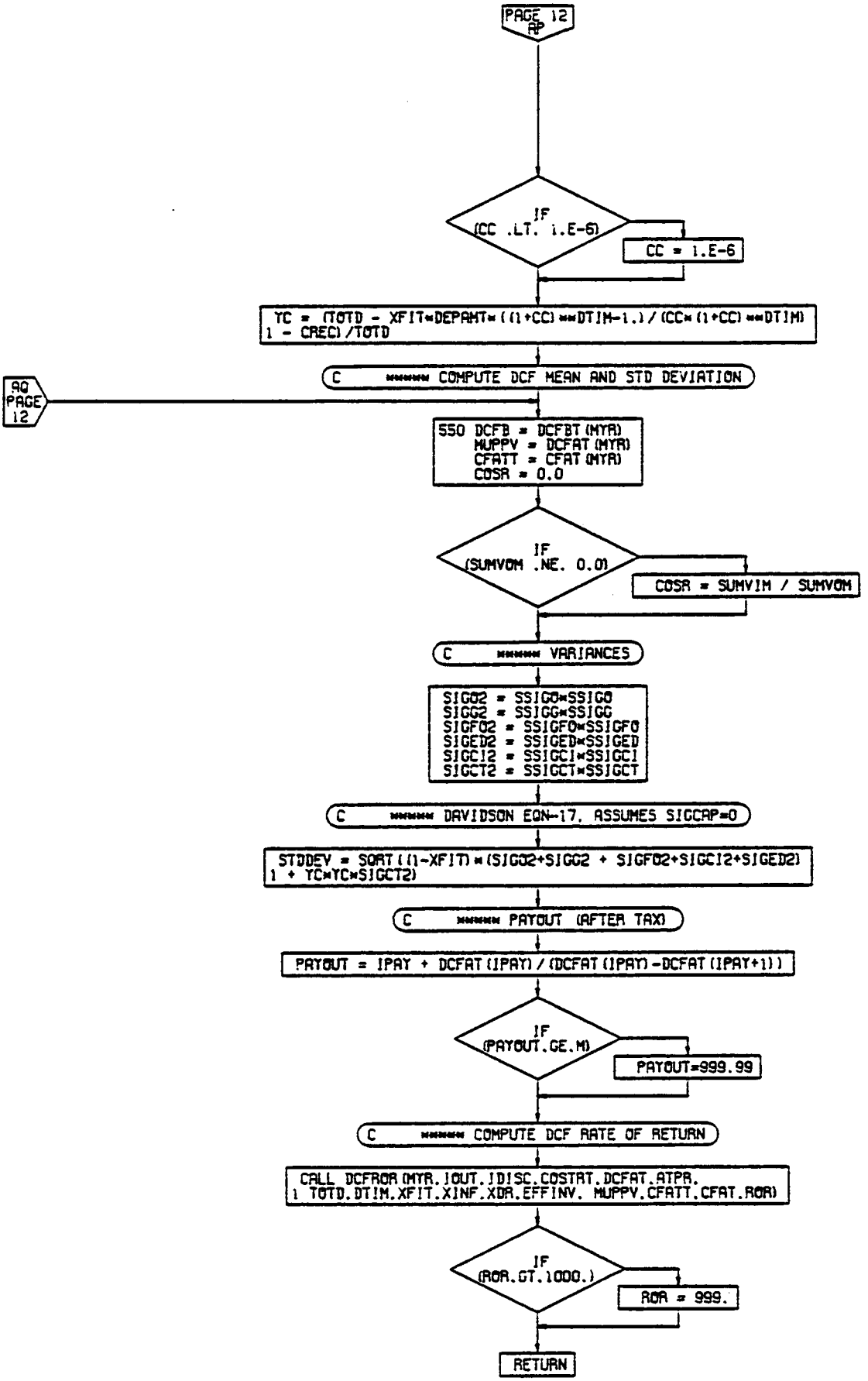

PAGE 7
AJ
C INTEREST PAYMENT IN YEAR J
YY = XX * DBTINT / 100.
MUIN(J) = YY + MUIN(J)
C PRINCIPAL PAYMENT IN YEAR J
MURP(J) = EQAP - YY * MURP(J)
IF
(MURP(J) .LE. 0.0)
MURP(J) = 0.0
XX = XX - EQAP + YY
C PRINCIPAL BALANCE AT END OF YEAR J
AT
PAGE
7
MUPB(J) = XX + MUPB(J)
3703 CONTINUE
AK
PAGE
6+
3799 TXCR(I) = XTCR*MUCT(I)
C DEDUCT INTEREST PAYMENT FROM TAXABLE INCOME
ANTI(I) = ANOI(I) - AWPT(I) - ACAP(I) - ASTX(I) - MUIN(I)
AFIT(I) = XFIT*ANTI(I)
IF
(AFIT(I).LT.0. .AND. IFIT.EQ.1)
AFIT(I)=0.
C ****** TAX CREDIT
TCRED = CTXC + TXCR(I)
IF
(AFIT(I).GT.TCRED)
GO TO 385
385 CTXC = 0.0
AFIT(I) = AFIT(I) - TCRED
TXCR(I) = TCRED
C ****** AFTER TAX CASH FLOW
ATPR(I) = ANOI(I) - AFIT(I) - AWPT(I) - ASTX(I)
& - MUCI(I) - MUCT(I) - AWCP(I) - MUIN(I) - MURP(I)
CFAT(I) = CFAT(M1) + ATPR(I)
VONET(I) = VONET(I)/UNIT
PAGE 9
AL

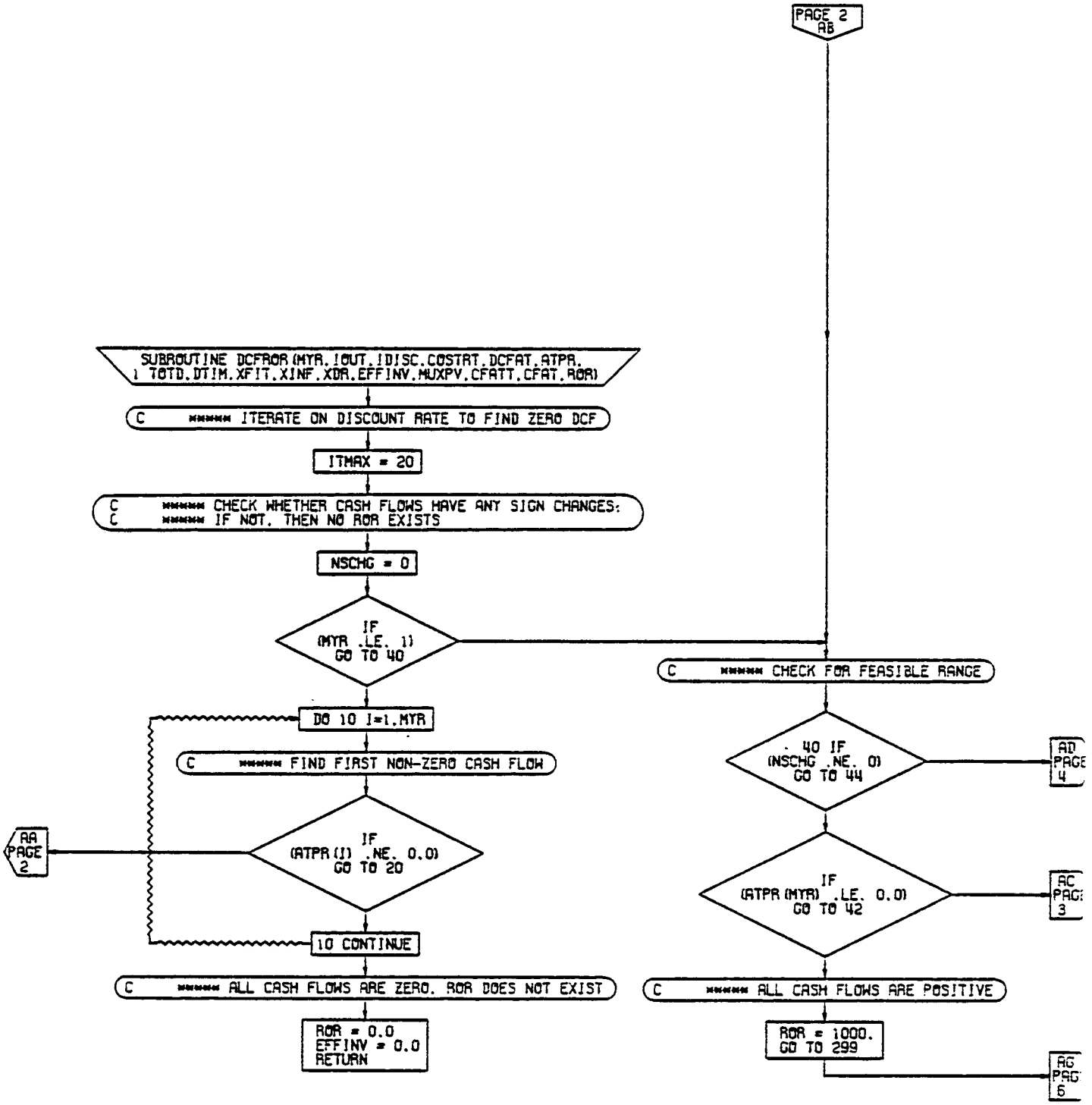

PAGE 8
AL
IF
(CFAT(I).LE.CFMAX)
GO TO 400
CFMAX = CFAT(I)
ILIF = I
AR
PAGE
2
400 CONTINUE
C ****** ECONOMIC LIFE
PLIFE = ILIF
IF
(ILIF.GE.M)
PLIFE=M
MYR = ILIF
C ****** PRESENT VALUE RATE
CC = (1+XINF) * (1+XDR) - 1.
C
C ****** SUM THE PRESENT VALUES OF REVENUE AND COST COMPONENTS
C
C INITIALIZE DISCOUNTED AND CONSTANT DOLLAR CASH FLOW AT COSTRT
DCFAT(1) = - COSTRT
CDBT(1) = 0.0
CDAT(1) = - COSTRT
C ****** DETERMINE PRESENT VALUES OVER PROJECT LIFE
AU
PAGE
12
DO 500 I=1,MYR
M1 = I-1
IF
(M1.LE.0)
M1=1
C ****** VOLUMES PRODUCED, SOLD, AND INJECTED
SUMVOM = SUMVOM + MUVO(I)/UNIT
SVOS = SVOS + VOSLD(I)
SVON = SVON + VONET(I)
SVGS = SVGS + MUVG(I)/UNIT
SUMVIM = SUMVIM + MUVI(I)/UNIT
PAGE 10
AM

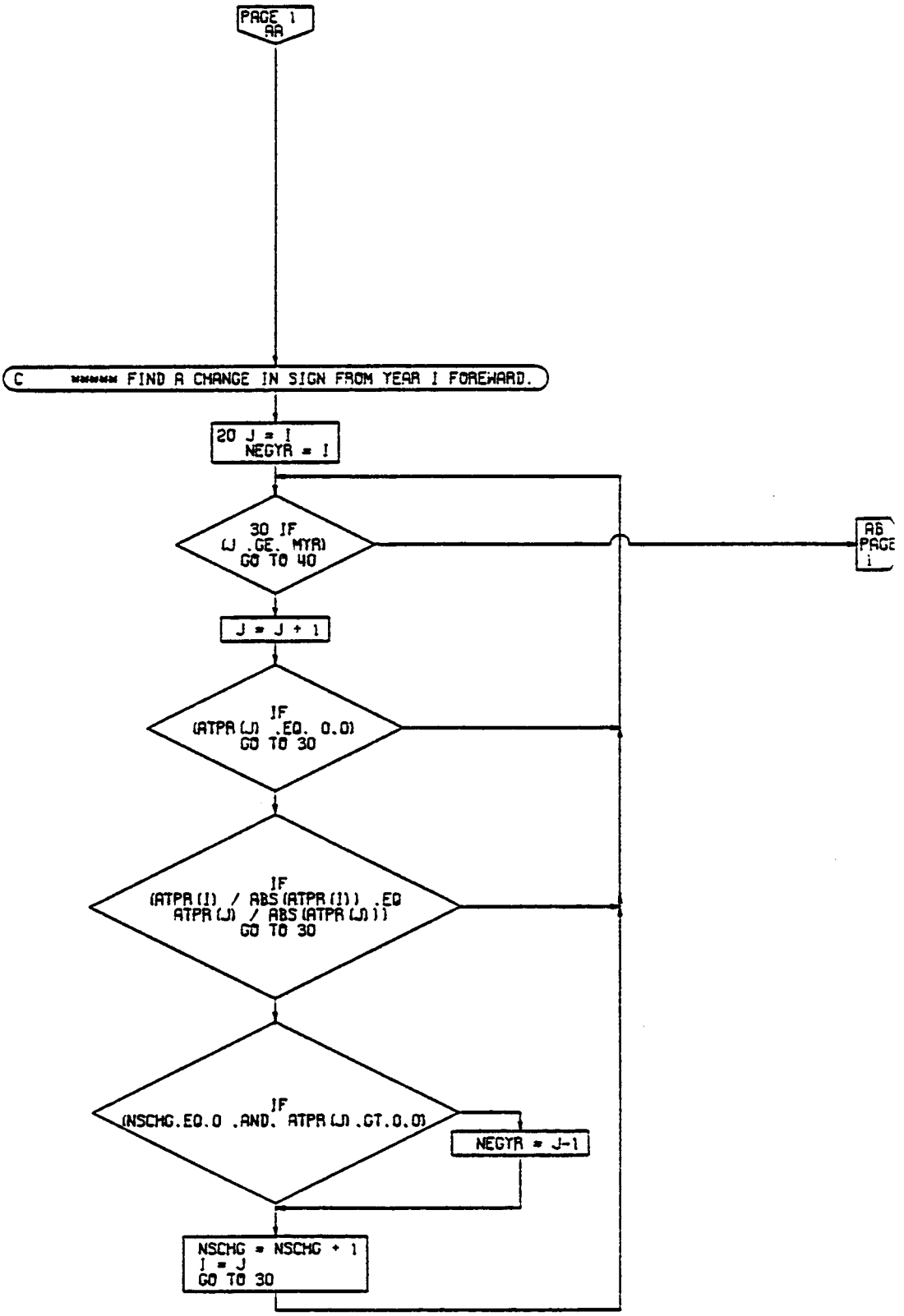

PAGE 9
AM
IF
(ONPKAIR .LE. (MUVI(I)/1000.0))
ONPKAIR = (MUVI(I)/1000.0)
IF
(ONPKNO .LE. VONET(I))
ONPKNO = VONET(I)
C ****** PRESENT VALUE FACTOR
CCC = 1.0/(1.0+CC)**(I - 1)
CCD = 1.0/(1.0+XINF)**(I - 1)
IF
(IDISC.LE.0)
GO TO 450
C ****** MID-YEAR DISCOUNTING
CCC = 1.0/(1.+CC)**(FLOAT(I)-1.5)
CCD = 1.0/(1.0+XINF)**(FLOAT(I)-1.5)
450 IF
(CCC .GT. 1.0)
CCC = 1.0
IF
(CCD .GT. 1.0)
CCD = 1.0
PVDF(I) = CCC
C ****** CUMULATIVE AMOUNT CORRECTED TO PRESENT VALUE. MM$
URPV = URPV + AREV(I)
SRPV = SRPV + AREV(I)*CCC
C ****** NET OIL SALES
UNOS = UNOS + ANET(I)
SNOS = SNOS + ANET(I)*CCC
C ****** SEVERANCE TAX
USEV = USEV + ASEV(I)
SSEV = SSEV + ASEV(I)*CCC
C ****** OPERATING COST (VARIABLE+FIXED+GEN+W/O)
USTO = USTO + ACOST(I)
SUMTO = SUMTO + ACOST(I)*CCC
PAGE 11
AN

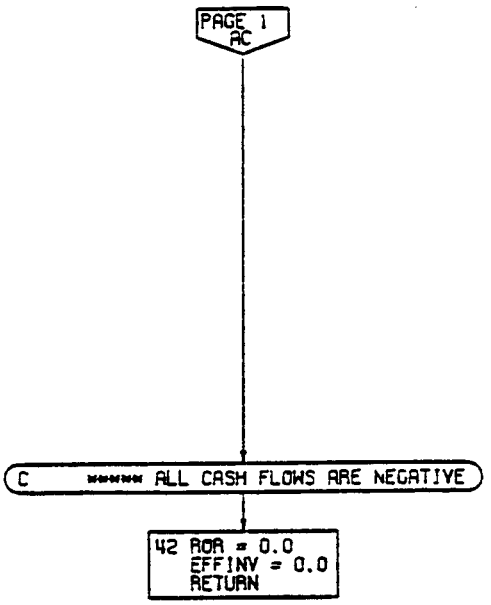

PAGE 10
AN
C ****** FIXED OPERATING COST
USFO = USFO + AFOC(I)
SUMFO = SUMFO + AFOC(I)*CCC
C ****** VARIABLE OPERATING COST
USOPC = USOPC + AVOC(I)
SUMOPC = SUMOPC + AVOC(I)*CCC
C ****** ELECTRIC DRIVER OP COST
USED = USED + AEDP(I)
SUMED = SUMED + AEDP(I)*CCC
C ****** COMPRESSOR MAINT AND LABOR COST
USML = USML + ACML(I)
SUMML = SUMML + ACML(I)*CCC
C ****** TECHNICIAN AND INSTRUMENT COST
USTI = USTI + ATIN(I)
SUMTI = SUMTI + ATIN(I)*CCC
C ****** WORKING CAPITAL
UWCAP = UWCAP + AWCP(I)
SUMWC = SUMWC + AWCP(I)*CCC
C ****** TANGIBLE CAPITAL
USTC = USTC + MUCT(I)
TOTD = TOTD + MUCT(I)*CCC
C ****** INTANGIBLE CAPITAL
USCI = USCI + MUCI(I)
SUMCI = SUMCI + MUCI(I)*CCC
C ****** WELL WORKOVER COST
USWO = USWO + MUWO(I)
SUMWO = SUMWO + MUWO(I)*CCC
C ****** WATER TREATING COST
USWT = USWT + AWTC(I)
SUMWT = SUMWT + AWTC(I)*CCC
C ****** WATER DISPOSAL COST
USWD = USWD + AWDC(I)
SUMWD = SUMWD + AWDC(I)*CCC
C ****** OVERHEAD COST
USOH = USOH + AOVH(I)
SUMOH = SUMOH + AOVH(I)*CCC
C ****** WINDFALL PROFIT TAX
UWPT = UWPT + AWPT(I)
C ****** STATE INCOME TAX
USIT = USIT + ASTX(I)
GO PAGE 12
PAGE 11
ECON

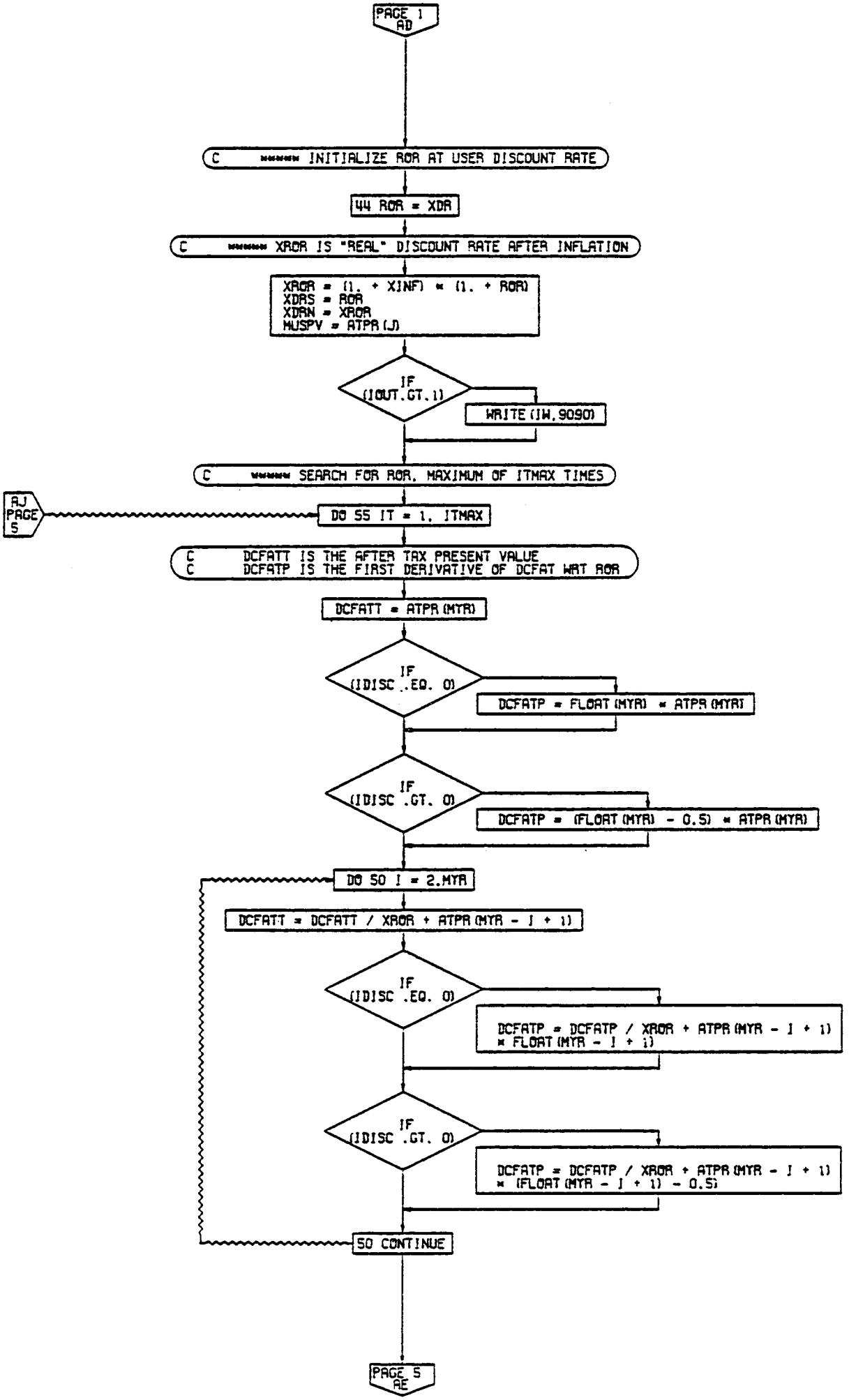

PAGE 11
AO
C ****** FEDERAL INCOME TAX
UFIT = UFIT + AFIT(I)
C ****** INTEREST COST
UINT = MUIN(I) + UINT
SINT = MUIN(I) * CCC + SINT
C ****** PRINCIPAL REPAYMENTS
ULOAN = MUDB(I) + ULOAN
SPRP = MURP(I) * CCC + SPRP
C ****** DISCOUNTED NET BBL
DNB = DNB + VONET(I)*CCC
C ****** STD DEVIATION
SPOPV = SIGPO(I)*CCC
SPGPV = SIGPG(I)*CCC
SOPCP = SIGOPC(I)*CCC
SFOPV = SIGFO(I)*CCC
SEDPV = SIGED(I)*VIM(I)*CCC
SCIPV = SIGCI(I)*CCC
SCTPV = SIGCT(I)*CCC
C ****** DAVIDSON EQN-15, ALLOWING OIL VOLUME UNCERTAINTY
SSIGO = SSIGO + SQRT(MUVO(I)*MUVO(I)*(SPOPV**2+SOPCP**2)
1 + SIGVO(I)*SIGVO(I)*((MUPO(I)*CCC)**2+(MUOPC(I)*CCC)**2))
SSIGG = SSIGG + MUVG(I)*SPGPV
SSIGFO = SSIGFO+SFOPV
SSIGED = SSIGED+SEDPV
SSIGCI = SSIGCI+SCIPV
SSIGCT = SSIGCT+SCTPV
C CONSTANT DOLLAR DISCOUNTING AND CASH FLOW
BTINC = ANOI(I) - MUCI(I) - MUCT(I) - AWCP(I) - MUIN(I) - MURP(I)
UCFB = UCFB + BTINC
CDBT(I) = CDBT(M1) + BTINC*CCD
DCFBT(I) = DCFBT(M1) + BTINC*CCC
UATP = UATP + ATPR(I)
CDAT(I) = CDAT(M1) + ATPR(I)*CCD
DCFAT(I) = DCFAT(M1) + ATPR(I)*CCC
IF
(DCFAT(I).LE.0.)
IPAY=1
AU
PAGE
9
500 CONTINUE
YC = 0.0
IF
(TOTD.LE.0.)
GO TO 550
AQ
PAGE
13
DEPAMT = TOTD/DTIM
CREC = 0.0
PAGE 13
AP

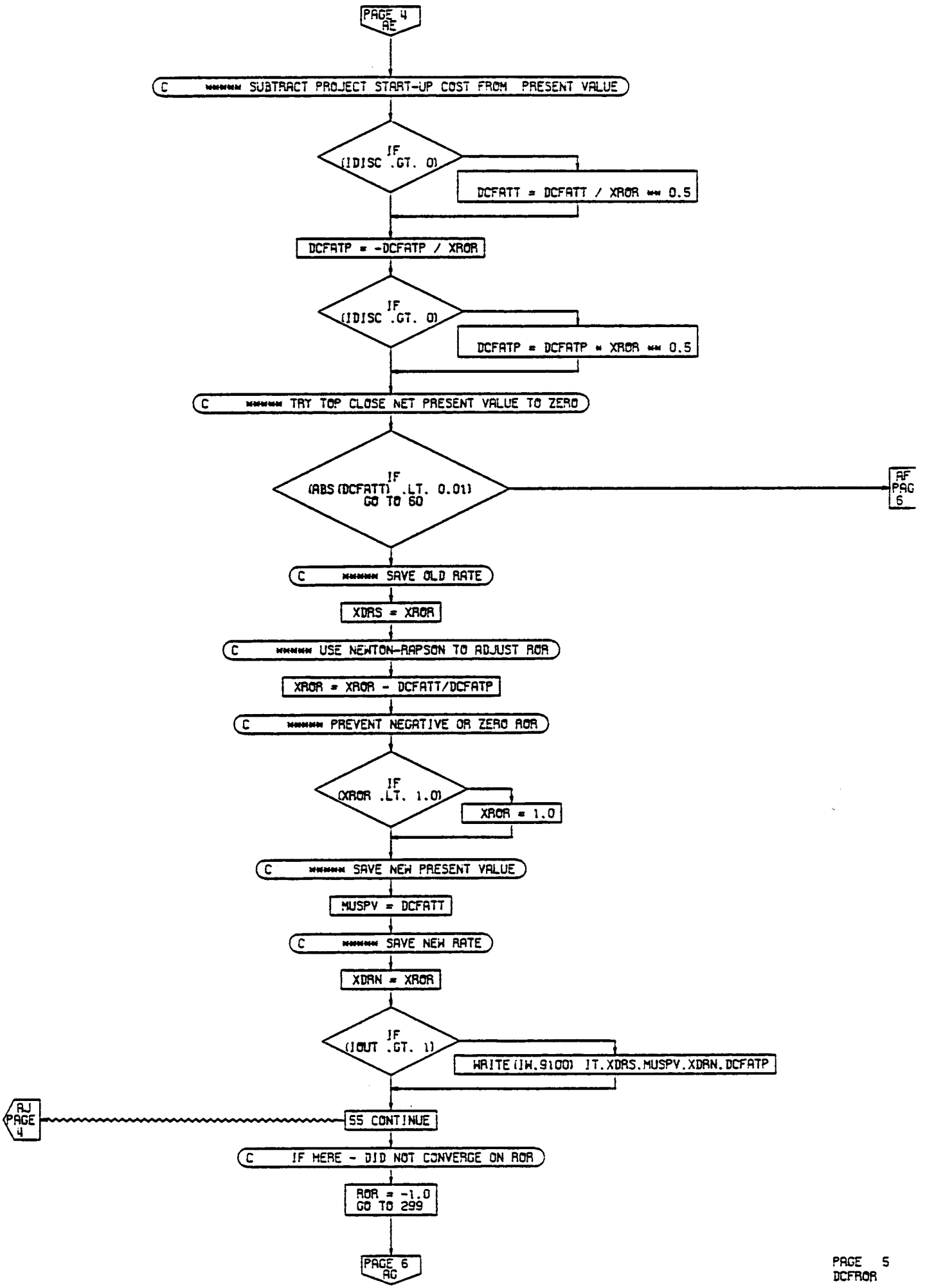

PAGE 12 AP
IF (CC .LT. 1.E-6)
CC = 1.E-6
TC = (TOTD - XFIT*DEPAMT*((1+CC)**DTIM-1.)/(CC*(1+CC)**DTIM)
1 - CREC)/TOTD
C ****** COMPUTE DCF MEAN AND STD DEVIATION
AQ PAGE 12
550 DCFB = DCFBT(MYR)
MUPPV = DCFAT(MYR)
CFATT = CFAT(MYR)
COSR = 0.0
IF (SUMVOM .NE. 0.0)
COSR = SUMVIM / SUMVOM
C ****** VARIANCES
SIGO2 = SSIGO*SSIGO
SIGG2 = SSIGG*SSIGG
SIGFO2 = SSIGFO*SSIGFO
SIGED2 = SSIGED*SSIGED
SIGCI2 = SSIGCI*SSIGCI
SIGCT2 = SSIGCT*SSIGCT
C ****** DAVIDSON EQN-17, ASSUMES SIGCAP=0
STDDEV = SQRT((1-XFIT)*(SIGO2+SIGG2 + SIGFO2+SIGCI2+SIGED2)
1 + TC*TC*SIGCT2)
C ****** PAYOUT (AFTER TAX)
PAYOUT = IPAY + DCFAT(IPAY)/(DCFAT(IPAY)-DCFAT(IPAY+1))
IF (PAYOUT.GE.M)
PAYOUT=999.99
C ****** COMPUTE DCF RATE OF RETURN
CALL DCFROR(MYR,IOUT,IDISC,COSTAT,DCFAT,ATPR,
1 TOTD,DTIM,XFIT,XINF,XDR,EFFINV, MUPPV,CFATT,CFAT,ROR)
IF (ROR.GT.1000.)
ROR = 999.
RETURN

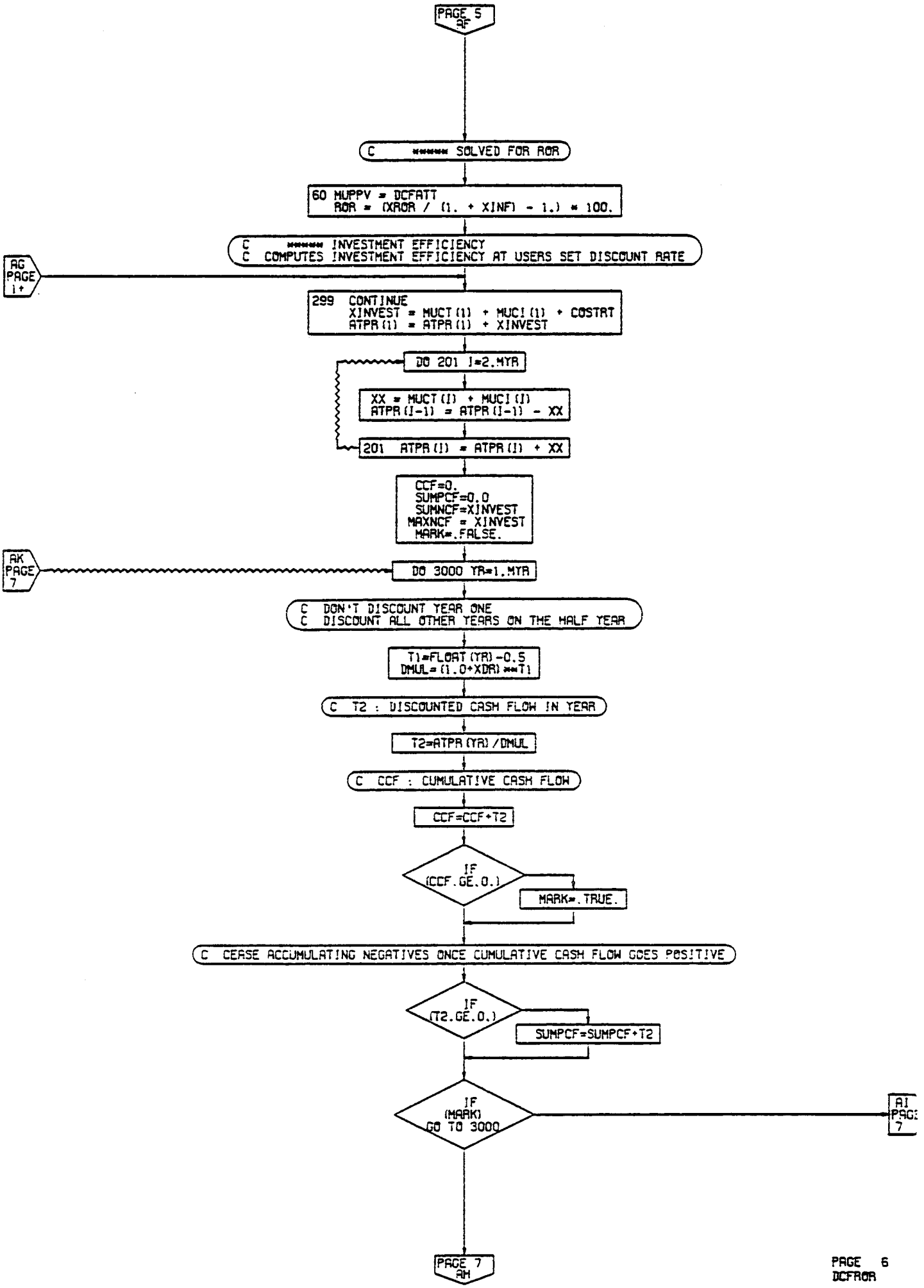

PAGE 2
AB
SUBROUTINE DCFROR(MYR,IOUT,IDISC,COSTRT,DCFAT,ATPR,
1 TOTD,DTIM,XFIT,XINF,XDR,EFFINV,MUXPV,CFATT,CFAT,ROR)
C ****** ITERATE ON DISCOUNT RATE TO FIND ZERO DCF
ITMAX = 20
C ****** CHECK WHETHER CASH FLOWS HAVE ANY SIGN CHANGES:
C ****** IF NOT, THEN NO ROR EXISTS
NSCHG = 0
IF
(MYR .LE. 1)
GO TO 40
DO 10 I=1,MYR
C ****** FIND FIRST NON-ZERO CASH FLOW
AA
PAGE
2
IF
(ATPR(I) .NE. 0.0)
GO TO 20
10 CONTINUE
C ****** ALL CASH FLOWS ARE ZERO. ROR DOES NOT EXIST
ROR = 0.0
EFFINV = 0.0
RETURN
C ****** CHECK FOR FEASIBLE RANGE
40 IF
(NSCHG .NE. 0)
GO TO 44
AD
PAGE
4
IF
(ATPR(MYR) .LE. 0.0)
GO TO 42
AC
PAGE
3
C ****** ALL CASH FLOWS ARE POSITIVE
ROR = 1000.
GO TO 299
AG
PAGE
6

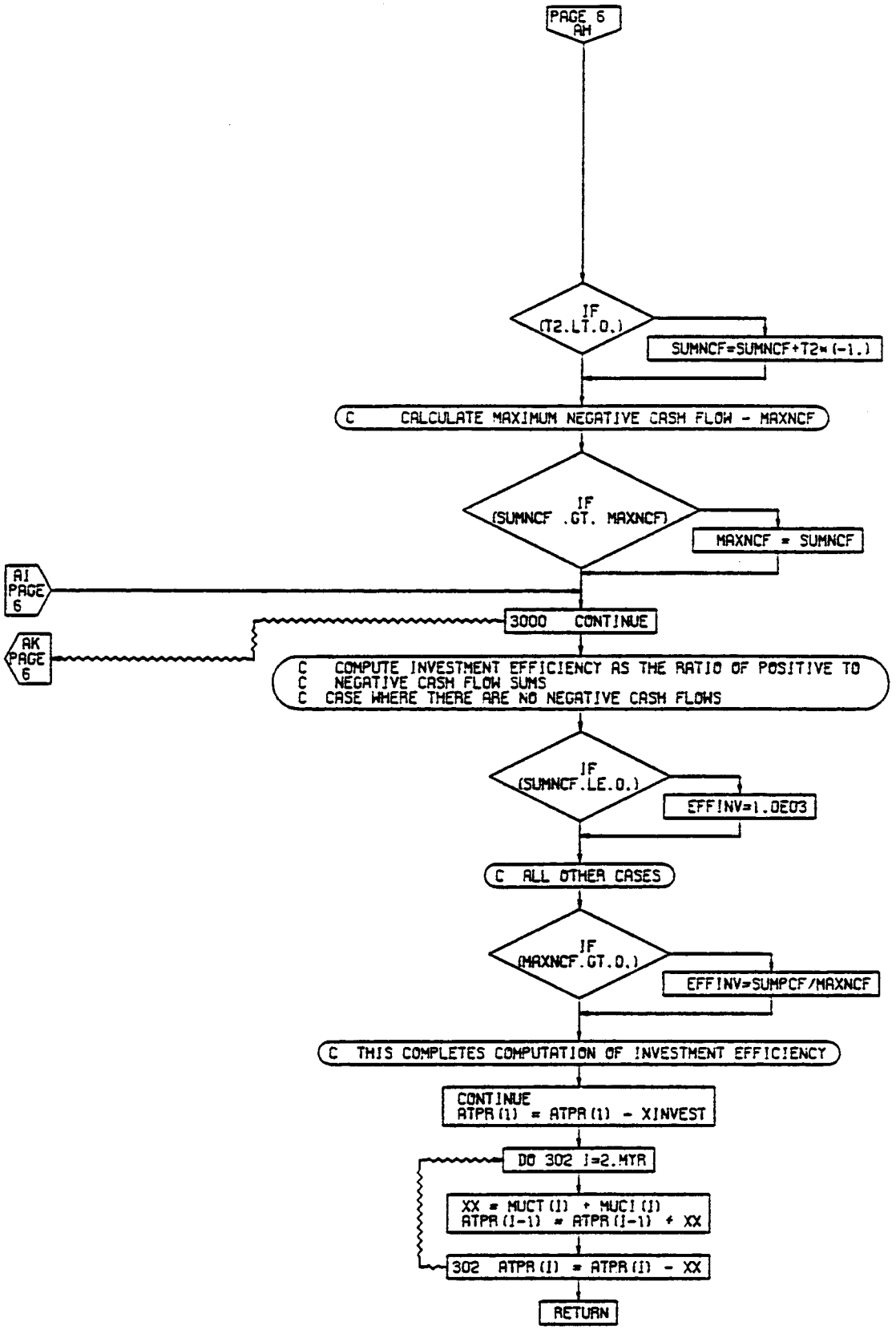

PAGE 1
AA
C FIND A CHANGE IN SIGN FROM YEAR I FOREWARD.
20 J = I
NEGYR = I
30 IF
(J .GE. MYR)
GO TO 40
AG
PAGE
1
J = J + 1
IF
(ATPR (J) .EQ. 0.0)
GO TO 30
IF
(ATPR (I) / ABS (ATPR (I)) .EQ
ATPR (J) / ABS (ATPR (J)))
GO TO 30
IF
(NSCHG.EQ.0 .AND. ATPR (J) .GT.0.0)
NEGYR = J-1
NSCHG = NSCHG + 1
I = J
GO TO 30

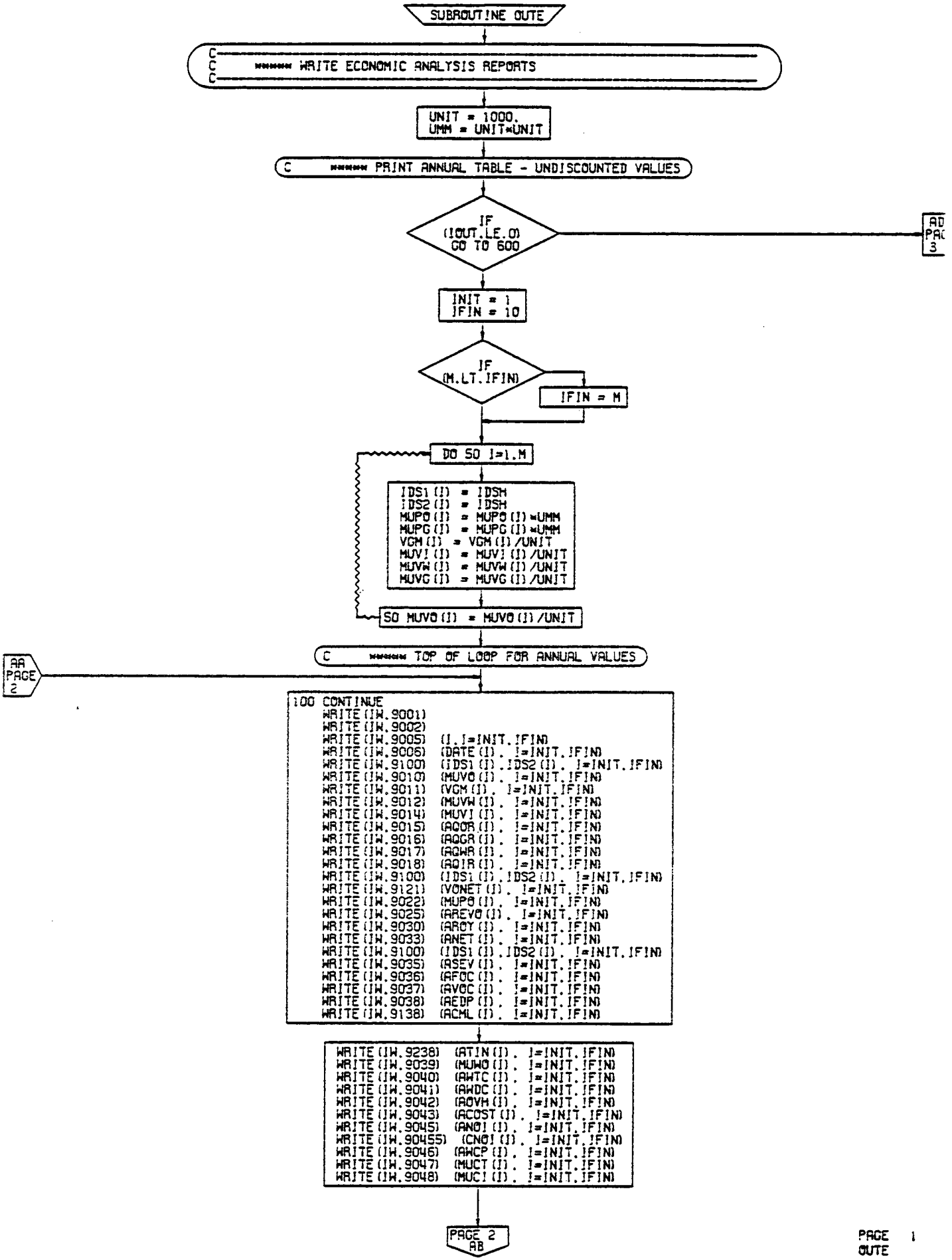

PAGE 1
AC
C ****** ALL CASH FLOWS ARE NEGATIVE
42 ROR = 0.0
EFFINV = 0.0
RETURN

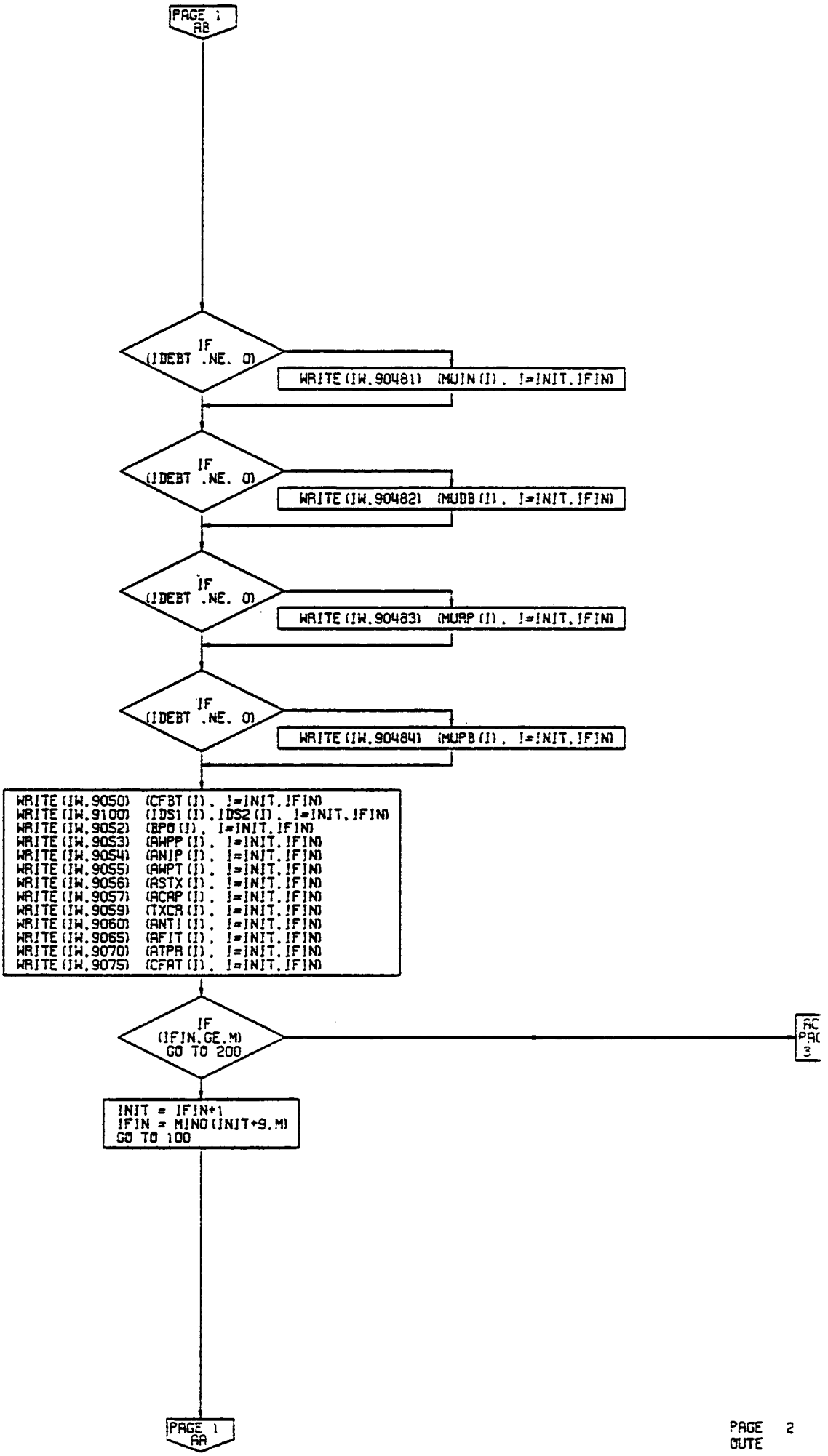

PAGE 1
AD
C ****** INITIALIZE ROR AT USER DISCOUNT RATE
44 ROR = XDR
C ****** XROR IS "REAL" DISCOUNT RATE AFTER INFLATION
XROR = (1. + XINF) * (1. + ROR)
XDRS = ROR
XDRN = XROR
MUSPV = ATPR(J)
IF (IOUT.GT.1)
WRITE(IW,9090)
C ****** SEARCH FOR ROR, MAXIMUM OF ITMAX TIMES
AJ PAGE 5
DO 55 IT = 1, ITMAX
C DCFATT IS THE AFTER TAX PRESENT VALUE
C DCFATP IS THE FIRST DERIVATIVE OF DCFAT WRT ROR
DCFATT = ATPR(MYR)
IF (IDISC .EQ. 0)
DCFATP = FLOAT(MYR) * ATPR(MYR)
IF (IDISC .GT. 0)
DCFATP = (FLOAT(MYR) - 0.5) * ATPR(MYR)
DO 50 I = 2,MYR
DCFATT = DCFATT / XROR + ATPR(MYR - I + 1)
IF (IDISC .EQ. 0)
DCFATP = DCFATP / XROR + ATPR(MYR - I + 1)
* FLOAT(MYR - I + 1)
IF (IDISC .GT. 0)
DCFATP = DCFATP / XROR + ATPR(MYR - I + 1)
* (FLOAT(MYR - I + 1) - 0.5)
50 CONTINUE
PAGE 5
AE

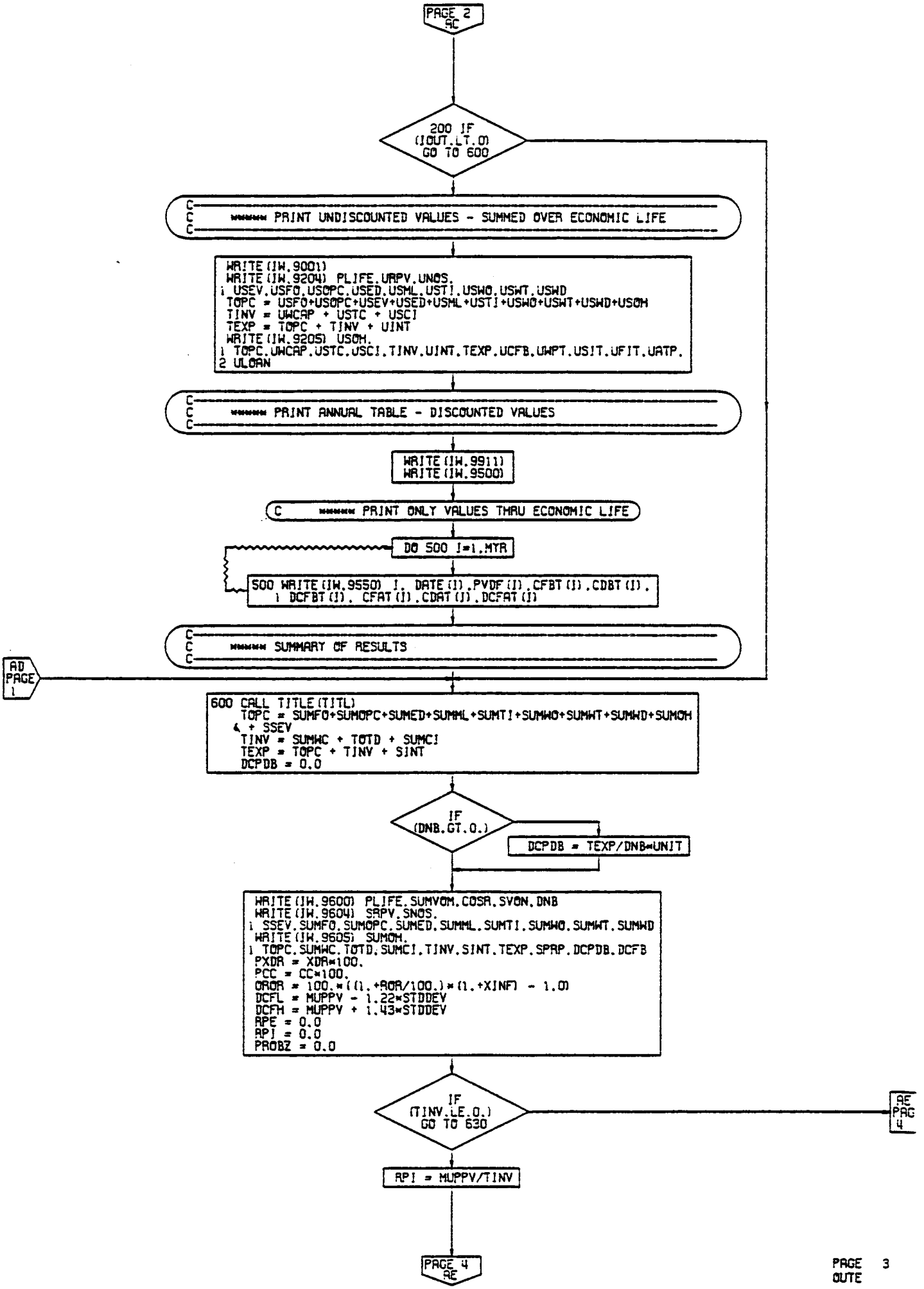

PAGE 4 AE
C ****** SUBTRACT PROJECT START-UP COST FROM PRESENT VALUE
IF (IDISC .GT. 0)
DCFATT = DCFATT / XROR ** 0.5
DCFATP = -DCFATP / XROR
IF (IDISC .GT. 0)
DCFATP = DCFATP * XROR ** 0.5
C ****** TRY TOP CLOSE NET PRESENT VALUE TO ZERO
IF (ABS(DCFATT) .LT. 0.01) GO TO 60
AF PAG 6
C ****** SAVE OLD RATE
XDRS = XROR
C ****** USE NEWTON-RAPSON TO ADJUST ROR
XROR = XROR - DCFATT/DCFATP
C ****** PREVENT NEGATIVE OR ZERO ROR
IF (XROR .LT. 1.0)
XROR = 1.0
C ****** SAVE NEW PRESENT VALUE
MUSPV = DCFATT
C ****** SAVE NEW RATE
XDRN = XROR
IF (IOUT .GT. 1)
WRITE(IW,9100) IT,XDRS,MUSPV,XDRN,DCFATP
AJ PAGE 4
55 CONTINUE
C IF HERE - DID NOT CONVERGE ON ROR
ROR = -1.0
GO TO 299
PAGE 6 AG

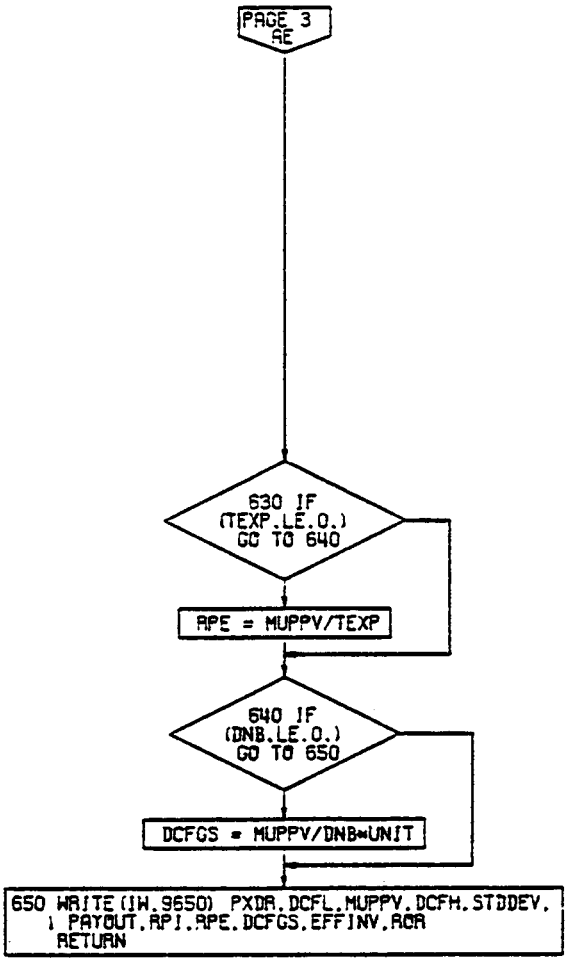

PAGE 5
AF
C ****** SOLVED FOR ROR
60 MUPPV = DCFATT
ROR = (XROR / (1. + XINF) - 1.) * 100.
C ****** INVESTMENT EFFICIENCY
C COMPUTES INVESTMENT EFFICIENCY AT USERS SET DISCOUNT RATE
AG
PAGE
1+
299 CONTINUE
XINVEST = MUCT(1) + MUCI(1) + COSTRT
ATPR(1) = ATPR(1) + XINVEST
DO 201 I=2,MYR
XX = MUCT(I) + MUCI(I)
ATPR(I-1) = ATPR(I-1) - XX
201 ATPR(I) = ATPR(I) + XX
CCF=0.
SUMPCF=0.0
SUMNCF=XINVEST
MAXNCF = XINVEST
MARK=.FALSE.
AK
PAGE
7
DO 3000 YR=1,MYR
C DON'T DISCOUNT YEAR ONE
C DISCOUNT ALL OTHER YEARS ON THE HALF YEAR
T1=FLOAT(YR)-0.5
DMUL=(1.0+XDR)**T1
C T2 : DISCOUNTED CASH FLOW IN YEAR
T2=ATPR(YR)/DMUL
C CCF : CUMULATIVE CASH FLOW
CCF=CCF+T2
IF
(CCF.GE.0.)
MARK=.TRUE.
C CEASE ACCUMULATING NEGATIVES ONCE CUMULATIVE CASH FLOW GOES POSITIVE
IF
(T2.GE.0.)
SUMPCF=SUMPCF+T2
IF
(MARK)
GO TO 3000
AI
PAGE
7
PAGE 7
AH


PAGE 6
AH
IF
(T2.LT.0.)
SUMNCF=SUMNCF+T2*(-1.)
C CALCULATE MAXIMUM NEGATIVE CASH FLOW - MAXNCF
IF
(SUMNCF .GT. MAXNCF)
MAXNCF = SUMNCF
AI
PAGE
6
3000 CONTINUE
AK
PAGE
6
C COMPUTE INVESTMENT EFFICIENCY AS THE RATIO OF POSITIVE TO
C NEGATIVE CASH FLOW SUMS
C CASE WHERE THERE ARE NO NEGATIVE CASH FLOWS
IF
(SUMNCF.LE.0.)
EFFINV=1.0E03
C ALL OTHER CASES
IF
(MAXNCF.GT.0.)
EFFINV=SUMPCF/MAXNCF
C THIS COMPLETES COMPUTATION OF INVESTMENT EFFICIENCY
CONTINUE
ATPR(1) = ATPR(1) - XINVEST
DO 302 I=2,MYR
XX = MUCT(I) + MUCI(I)
ATPR(I-1) = ATPR(I-1) + XX
302 ATPR(I) = ATPR(I) - XX
RETURN


SUBROUTINE OUTE
C
C ****** WRITE ECONOMIC ANALYSIS REPORTS
C
UNIT = 1000.
UMM = UNIT*UNIT
C ****** PRINT ANNUAL TABLE - UNDISCOUNTED VALUES
IF (IOUT.LE.0) GO TO 600
AD PAG 3
INIT = 1
IFIN = 10
IF (M.LT.IFIN)
IFIN = M
DO 50 I=1,M
IDS1(I) = IDSM
IDS2(I) = IDSM
MUPO(I) = MUPO(I)*UMM
MUPG(I) = MUPG(I)*UMM
VGM(I) = VGM(I)/UNIT
MUVI(I) = MUVI(I)/UNIT
MUVW(I) = MUVW(I)/UNIT
MUVG(I) = MUVG(I)/UNIT
50 MUVO(I) = MUVO(I)/UNIT
C ****** TOP OF LOOP FOR ANNUAL VALUES
AA PAGE 2
100 CONTINUE
WRITE(IW,9001)
WRITE(IW,9002)
WRITE(IW,9005) (I,I=INIT,IFIN)
WRITE(IW,9006) (DATE(I), I=INIT,IFIN)
WRITE(IW,9100) (IDS1(I),IDS2(I), I=INIT,IFIN)
WRITE(IW,9010) (MUVO(I), I=INIT,IFIN)
WRITE(IW,9011) (VGM(I), I=INIT,IFIN)
WRITE(IW,9012) (MUVW(I), I=INIT,IFIN)
WRITE(IW,9014) (MUVI(I), I=INIT,IFIN)
WRITE(IW,9015) (AQOR(I), I=INIT,IFIN)
WRITE(IW,9016) (AQGR(I), I=INIT,IFIN)
WRITE(IW,9017) (AQWR(I), I=INIT,IFIN)
WRITE(IW,9018) (AQIR(I), I=INIT,IFIN)
WRITE(IW,9100) (IDS1(I),IDS2(I), I=INIT,IFIN)
WRITE(IW,9121) (VONET(I), I=INIT,IFIN)
WRITE(IW,9022) (MUPO(I), I=INIT,IFIN)
WRITE(IW,9025) (AREVO(I), I=INIT,IFIN)
WRITE(IW,9030) (AROY(I), I=INIT,IFIN)
WRITE(IW,9033) (ANET(I), I=INIT,IFIN)
WRITE(IW,9100) (IDS1(I),IDS2(I), I=INIT,IFIN)
WRITE(IW,9035) (ASEV(I), I=INIT,IFIN)
WRITE(IW,9036) (AFOC(I), I=INIT,IFIN)
WRITE(IW,9037) (AVOC(I), I=INIT,IFIN)
WRITE(IW,9038) (AEDP(I), I=INIT,IFIN)
WRITE(IW,9138) (ACML(I), I=INIT,IFIN)
WRITE(IW,9238) (ATIN(I), I=INIT,IFIN)
WRITE(IW,9039) (MUWO(I), I=INIT,IFIN)
WRITE(IW,9040) (AWTC(I), I=INIT,IFIN)
WRITE(IW,9041) (AWDC(I), I=INIT,IFIN)
WRITE(IW,9042) (AOVH(I), I=INIT,IFIN)
WRITE(IW,9043) (ACOST(I), I=INIT,IFIN)
WRITE(IW,9045) (ANOI(I), I=INIT,IFIN)
WRITE(IW,90455) (CNOI(I), I=INIT,IFIN)
WRITE(IW,9046) (AWCP(I), I=INIT,IFIN)
WRITE(IW,9047) (MUCT(I), I=INIT,IFIN)
WRITE(IW,9048) (MUCI(I), I=INIT,IFIN)
PAGE 2 AB


PAGE 1
AB
IF
(IDEBT .NE. 0)
WRITE (IW,90481) (MUIN(I), I=INIT,IFIN)
IF
(IDEBT .NE. 0)
WRITE (IW,90482) (MUDB(I), I=INIT,IFIN)
IF
(IDEBT .NE. 0)
WRITE (IW,90483) (MUAP(I), I=INIT,IFIN)
IF
(IDEBT .NE. 0)
WRITE (IW,90484) (MUPB(I), I=INIT,IFIN)
WRITE (IW,9050) (CFBT(I), I=INIT,IFIN)
WRITE (IW,9100) (IDS1(I),IDS2(I), I=INIT,IFIN)
WRITE (IW,9052) (BPO(I), I=INIT,IFIN)
WRITE (IW,9053) (AWPP(I), I=INIT,IFIN)
WRITE (IW,9054) (ANIP(I), I=INIT,IFIN)
WRITE (IW,9055) (AWPT(I), I=INIT,IFIN)
WRITE (IW,9056) (ASTX(I), I=INIT,IFIN)
WRITE (IW,9057) (ACAP(I), I=INIT,IFIN)
WRITE (IW,9059) (TXCR(I), I=INIT,IFIN)
WRITE (IW,9060) (ANTI(I), I=INIT,IFIN)
WRITE (IW,9065) (AFIT(I), I=INIT,IFIN)
WRITE (IW,9070) (ATPR(I), I=INIT,IFIN)
WRITE (IW,9075) (CFAT(I), I=INIT,IFIN)
IF
(IFIN.GE.M)
GO TO 200
AC
PAC
3
INIT = IFIN+1
IFIN = MINO(INIT+9,M)
GO TO 100
PAGE 1
AB


PAGE 2
AC
200 IF
(IOUT.LT.0)
GO TO 600
C ****** PRINT UNDISCOUNTED VALUES - SUMMED OVER ECONOMIC LIFE
WRITE(IW,9001)
WRITE(IW,9204) PLIFE,URPV,UNOS,
1 USEV,USFO,USOPC,USED,USML,USTI,USWO,USWT,USWD
TOPC = USFO+USOPC+USEV+USED+USML+USTI+USWO+USWT+USWD+USOM
TINV = UWCAP + USTC + USCI
TEXP = TOPC + TINV + UINT
WRITE(IW,9205) USOM,
1 TOPC,UWCAP,USTC,USCI,TINV,UINT,TEXP,UCFB,UWPT,USIT,UFIT,UATP,
2 ULOAN
C ****** PRINT ANNUAL TABLE - DISCOUNTED VALUES
WRITE(IW,9911)
WRITE(IW,9500)
C ****** PRINT ONLY VALUES THRU ECONOMIC LIFE
DO 500 I=1,MYR
500 WRITE(IW,9550) I, DATE(I),PVDF(I),CFBT(I),CDBT(I),
1 DCFBT(I), CFAT(I),CDAT(I),DCFAT(I)
C ****** SUMMARY OF RESULTS
AD
PAGE
1
600 CALL TITLE(TITL)
TOPC = SUMFO+SUMOPC+SUMED+SUMML+SUMTI+SUMWO+SUMWT+SUMWD+SUMOM
+ SSEV
TINV = SUMWC + TOTD + SUMCI
TEXP = TOPC + TINV + SINT
DCPDB = 0.0
IF
(DNB.GT.0.)
DCPDB = TEXP/DNB*UNIT
WRITE(IW,9600) PLIFE,SUMVOM,COSR,SVON,DNB
WRITE(IW,9604) SRPV,SNOS,
1 SSEV,SUMFO,SUMOPC,SUMED,SUMML,SUMTI,SUMWO,SUMWT,SUMWD
WRITE(IW,9605) SUMOM,
1 TOPC,SUMWC,TOTD,SUMCI,TINV,SINT,TEXP,SPRP,DCPDB,DCFB
PXDR = XDR*100.
PCC = CC*100.
OROR = 100.*((1.+ROR/100.)*(1.+XINF) - 1.0)
DCFL = MUPPV - 1.22*STDDEV
DCFH = MUPPV + 1.43*STDDEV
RPE = 0.0
RPI = 0.0
PROBZ = 0.0
IF
(TINV.LE.0.)
GO TO 630
AE
PAG
4
RPI = MUPPV/TINV
PAGE 4
AE


PAGE 3
RE
630 IF
(TEXP.LE.0.)
GO TO 640
RPE = MUPPV/TEXP
640 IF
(DNB.LE.0.)
GO TO 650
DCFGS = MUPPV/DNB*UNIT
650 WRITE(IW,9650) PXDR,DCFL,MUPPV,DCFH,STDDEV,
1 PAYOUT,RPI,RPE,DCFGS,EFFINV,ROR
RETURN

SECTION 8
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C                                                                        MAIN   9
C           DEVELOPED FOR NATIONAL PETROLEUM COUNCIL BY                  LKT1   1
C                                                                        MAIN  11
C                                                                       *MAIN  12
C                    SCIENTIFIC SOFTWARE - INTERCOMP                     LKT1   2
C                    1801 CALIFORNIA ST, SUITE 400                      *MAIN  14
C                    DENVER, COLORADO  80202                            *MAIN  15
C                    (303)  292-1111                                    *MAIN  16
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C                                                                       *MAIN  18
C           RELEASE:  1.4.0  (APRIL, 1985)                               LKT3   1
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C           ABSTRACT: ICPM COMPUTES THE RECOVERY AND PROFITABILITY      *MAIN  21
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C               OUT3    -  WRITES FLUID PROPERTIES                       LKT3   8
C               OUTE    -  WRITES ECONOMIC ANALYSIS REPORT               LKT3   9
C               SDINT   -  SINGLE DIMENSIONAL LINEAR INTERPOLATION       LKT3  10
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C                                                                        MAIN  57
C-------------------------------------------------------------------MAIN  58
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C-------------------------------------------------------------------MAIN  60
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     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                       FLAGS  5
      COMMON /RESVR/                                                    RESVR  2
     1 DEPTH,  PFORM,  TFORM,  TNET,                                    RESVR  3
     2 PERM,   POROS,  VISO,   VISW,   BOI,   BWI,                      RESVR  4
     3 AREA,   WELLSP, SOI,    SWI,    SGI,   BRNMX,                    RESVR  5
     4 OIP,    WIP,    GIP,    TOTOIL, TVP,   SWEEP,                    RESVR  6
     5 ARIN,   ARINJ,  PINJ,   WELLSI, HPP,   PDP,                      RESVR  7
     6 AREAP,  FWA,    OILBF,  PATVOL, AFR,   AR                        RESVR  8
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     1 CUMOIL(200), CUMGAS(200), CUMWAT(200), CUMOB(200),               REPORT 3
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     2 CUMIA(200),  CUMIW(200),  CUMAW(200),  FOSC(200),   FOSI(200),   REPORT 4
     3 PROIL(200),  PRGAS(200),  PRWAT(200),  AIRQ(200),   WATQ(200),   REPORT 5
     4 TIME(200),   DTIME(200),  FRVS(200),   RECOV(200),               REPORT 6
     6 PRODS(200)                                                       REPORT 7
C                                                                       REPORT 8
      COMMON /FPROP/                                                    FPROP  2
     * API, RS, VIS80, VIS100, VIS210, VIS1, VIS2, SGO, SGW, SGG,       FPROP  3
     1 BB(42)                                                           FPROP  4
C                                                                       FPROP  5
      COMMON /ECI/ M,MYR,IOUT,ISTATE,IDIST,IFIT,IDISC,IFUL,ISO,IDEP,    ECI    2
     1 PCTDBT, DBTINT, NYRRPY, NYPAID, IDEBT,                           ECI    3
     1 CCOST,  GTRT,   WTRT,   CTACR, DCE,   PLANT,                     ECI    4
     1 WOCOST, WTCOST, WDCOST,COSTML,COSTTI,                            ECI    5
     1 WCAP,   UNCO,   WPP,    COSTRT, FOCPL, FOCPM, FOCPH,             ECI    6
     1 WPP1,   WPP2,   WPP3,   WPP4,   POBASE, OILB, OILC, DECL,        ECI    7
     1 XDR,    XINF,   XROY,   XSEV,   XWPT, XFIT, XTCR, DTIM, XSTX,    ECI    8
     1 WPHO,   EPHO,   BTIM,   BPOW,                                    ECI    9
     1 ESCPO,  ESCPG,  ESCPF, ESCFO, ESCED,                             ECI   10
     1 ESCCT,  ESCCI,  ESCWO, ESCWT, ESCWI, ESCBP,                      ECI   11
     1 OILR(50), VOS(50),                                               ECI   12
     1 POL(50),  POM(50),  POH(50), PGL(50), PGM(50),  PGH(50),         ECI   13
     2 FOCL(50), FOCM(50), FOCH(50),OPCL(50),OPCM(50), OPCH(50),        ECI   14
     3 EDPL(50), EDPM(50), EDPH(50),WTC(50), WDC(50),  CML(50),         ECI   15
     4 CTPL(50), CTPM(50), CTPH(50),CIPL(50),CIPM(50), CIPH(50),        ECI   16
     4 CTCL(50), CTCM(50), CTCH(50),CICL(50),CICM(50), CICH(50),        ECI   17
     5 VOL(50),  VOM(50),  VOH(50), WO(50),  BPO(50),  CTI(50),         ECI   18
     6 VGM(50),  VWM(50),  VIM(50), GNUM(50),GENC(50), TITL(20),        ECI   19
     6 QHM(50),  VHM(50),  VDM(50), QHP(50), VHP(50),                   ECI   20
     7 VOP(50),  VGP(50),  VWP(50), VIP(50), PATI(50), PATIOX(50)       ECI   21
C                                                                       ECI   22
      COMMON /ECC/                                                      ECC    2
     1 MUVO(50), MUVG(50), MUVW(50), MUVI(50),                          ECC    3
     1 MUPO(50), MUPG(50), MUWO(50),                                    ECC    4
     2 MUFO(50), MUOPC(50),MUED(50), MUCT(50), MUCI(50),                ECC    5
     2 MUDB(50), MURP(50), MUIN(50), MUPB(50),                          ECC    6
     3 SIGVO(50),SIGPO(50),SIGPG(50),SIGPF(50),SIGFO(50),               ECC    7
     4 SIGED(50),SIGCT(50),SIGCI(50),SIGOPC(50)                         ECC    8
      REAL                                                              ECC    9
     1 MUVO,MUVG,MUVW,MUVI,MUDB,MURP,MUIN,MUPB,                         ECC   10
     2 MUPO,MUPG,MUFO,MUED,MUWO,MUCT,MUCI,                              ECC   11
     3 MUOPC                                                            ECC   12
C                                                                       ECC   13
      COMMON /ECS/                                                      ECS    2
     1 SUMVOM, COSR,  TOTD, SUMCI, SVOS, SVGS, SVPS, SVIS, SUMWT,       ECS    3
     1 CINJ,   CEQP,  CSEC, CNVT,  CREP, CDAO, CIWO,                    ECS    4
     1 URPV,   UNOS,  USEV, USFO, USOPC, USED, USWO, USTO,              ECS    5
     1 UWCAP,  USWT,  USWD, USOH,  USTC, USCI, UCFB, USML, USTI,        ECS    6
     1 UWPT,   USIT,  UFIT, UATP,  UINT, ULOAN,SINT, SPRP,              ECS    7
     2 SRPV,   SNOS,  SSEV, SUMFO,SUMOPC,SUMED,SUMWO,SUMWD,             ECS    8
     2 SUMOH,  SUMML, SUMTI, DCFB,                                      ECS    9
     3 MUPPV, STDDEV, PAYOUT, PLIFE, ROR,  CC,                          ECS   10
     4 SUMIN,  SUMWC, DNB, SVON, EFFINV                                 ECS   11
C                                                                       ECS   12
      REAL MUPPV                                                        ECS   13
C                                                                       ECS   14
      COMMON /ECO/                                                      ECO    2
     1 DATE(50), VOSLD(50),VONET(50),AOVH(50),  AOVH1,                  ECO    3
     1 VGNET(50),AREVO(50),AREVG(50),ARVWPT(50),AREV(50),               ECO    4
     2 AROY(50), ANET(50), ASEV(50), AWTC(50),  AWDC(50),               ECO    5
     2 ACML(50), ATIN(50), AINJ(50),                                    ECO    6
     3 AFOC(50), AVOC(50), AEDP(50), ACOST(50), ACAP(50),               ECO    7
     4 AWPP(50), ANIP(50), TXCR(50), DEPS(50),  AWCP(50),               ECO    8
     4 AQOR(50), AQGR(50), AQWR(50), AQIR(50),                          ECO    9
     5 ANOI(50), ASTX(50), AWPT(50), ANTI(50),  AFIT(50), ATPR(50),     ECO   10
     6 CFAT(50), CDAT(50), DCFAT(50),PVDF(50),  CNOI(50),               ECO   11
     7 CFBT(50), CDBT(50), DCFBT(50)                                    ECO   12
C                                                                       ECO   13
C                                                                       MAIN  69
      DATA XHEND / 4HEND /                                              LKT2   1
      DIMENSION CARD(20)                                                MAIN  70
C                                                                       MAIN  71
C     THIS PROGRAM IS THE MASTER ROUTINE WHICH INITIALIZES VARIABLES,   MAIN  72
C     CALLS VARIOUS SUBROUTINES, CHECKS SWITCHES AND UPDATES TIME       MAIN  73
```

```
C     INCREMENTS.                                                       MAIN  74
C                                                                       MAIN  75
C                                                                       MAIN  76
C     ***** UNIT ASSIGNMENTS                                            MAIN  77
      IR     = 7                                                        MAIN  78
      IW     = 6                                                        MAIN  79
      IP     = 15                                                       MAIN  80
      IMAX   = 50                                                       LKT1   7
C                                                                       MAIN  81
C                                                                       MAIN  82
C-----------------------------------------------------------------------MAIN  83
C     ***** ECHO PRINT INPUT DECK                                       MAIN  84
C-----------------------------------------------------------------------MAIN  85
C                                                                       MAIN  86
  101 REWIND IR                                                         LKT2   2
      I= 0                                                              LKT2   3
 2    READ (5, 7204,END=9999) CARD                                      LKT2   4
      IF (I .EQ. 0 ) WRITE(IW, 7000)                                    LKT2   5
 7000 FORMAT(1H1 / 10X,15HINPUT DECK ECHO / 10X,15(1H-) )               LKT2   6
      I = I + 1                                                         LKT2   7
      WRITE(IW, 9204)          I, CARD                                  LKT2   8
      IF( CARD(1) .EQ. XHEND ) GO TO 7020                               LKT2   9
      WRITE(IR, 7204)       CARD                                        LKT2  10
 7204 FORMAT(20A4)                                                      LKT2  11
 9204 FORMAT(1X,I4,2X,20A4)                                             LKT2  12
      GO TO 2                                                           LKT2  13
C                                                                       LKT2  14
 7020 REWIND IR                                                         LKT2  15
C                                                                       LKT2  16
C-----------------------------------------------------------------------LKT2  17
C     EXECUTABLE CODE STARTS HERE.  RETURN TO HERE FOR NEW CASE.        LKT2  18
C      BEGIN BY ZEROING SELECTED VARIABLES.                             LKT2  19
C-----------------------------------------------------------------------LKT2  20
C                                                                       LKT2  21
      IJ1    = 0                                                       MAIN 103
      MAXO   = 100                                                     MAIN 104
      IERR   = 0                                                       MAIN 105
      UNIT   = 1000.                                                   MAIN 106
      PII    = 3.14159265                                              MAIN 107
C     SPECIAL INITIALIZATION FOR MULTIPLE RUNS                          MAIN 108
C                                                                      MAIN 109
      DO 2100 I=1,200                                                  MAIN 110
      CUMOIL(I) = 0.0                                                  MAIN 111
      CUMIA(I) = 0.0                                                   MAIN 112
      CUMGAS(I) = 0.0                                                  MAIN 113
      CUMWAT(I) = 0.0                                                  MAIN 114
      CUMOB(I) = 0.0                                                   MAIN 115
      CUMIW(I) = 0.0                                                   MAIN 116
      CUMAW(I) = 0.0                                                   MAIN 117
      FOSC(I) = 0.0                                                    MAIN 118
      FOSI(I) = 0.0                                                    MAIN 119
      PROIL(I) = 0.0                                                   MAIN 120
      PRGAS(I) = 0.0                                                   MAIN 121
      PRWAT(I) = 0.0                                                   MAIN 122
      AIRQ(I) = 0.0                                                    MAIN 123
      WATQ(I) = 0.0                                                    MAIN 124
      TIME(I) = 0.0                                                    MAIN 125
      DTIME(I) = 0.0                                                   MAIN 126
      FRVS(I) = 0.0                                                    MAIN 127
      RECOV(I) = 0.0                                                   MAIN 128
      PRODS(I) = 0.0                                                   MAIN 129
 2100 CONTINUE                                                         MAIN 130
C                                                                      MAIN 131
C -----------------------------------------------------------------------MAIN 132
C       ZERO COMMON                                                    MAIN 133
C -----------------------------------------------------------------------MAIN 134
C                                                                      MAIN 135
      PRODS(MAXO) = 99999.                                             MAIN 137
      DCFBT(50)   = 99999.                                             MAIN 138
      PATI(50)    = 99999.                                             MAIN 139
      SIGOPC(50)  = 99999.                                             MAIN 140
      I=1                                                              LKT2  22
    5 POL(I) = 0.0                                                     LKT2  23
```

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      J = 50                                                            LKT2  24
      IF( PATI(J) .EQ. 0.0) GO TO 6                                     LKT2  25
      I= I + 1                                                          LKT2  26
      GO TO 5                                                           LKT2  27
C                                                                       LKT2  28
    6 I= 1                                                              LKT2  29
   66 MUVO(I) = 0.0                                                     LKT2  30
      J = 50                                                            LKT2  31
      IF( SIGOPC(J) .EQ. 0.0) GO TO 11                                  LKT2  32
      I = I + 1                                                         LKT2  33
      GO TO 66                                                          LKT2  34
C                                                                       LKT2  35
   11 I =1                                                              LKT2  36
   30 CUMOIL(I) = 0.0                                                   LKT2  37
      J = MAXO                                                          LKT2  38
      IF(PRODS(J).LE.0.) GO TO 35                                       LKT2  39
      I = I + 1                                                         LKT2  40
      GO TO 30                                                          LKT2  41
C                                                                       LKT2  42
   35 I = 1                                                             LKT2  43
   40 DATE(I) = 0.0                                                     LKT2  44
      J = 50                                                            LKT2  45
      IF(DCFBT(J).LE.0.) GO TO 45                                       LKT2  46
      I =  I + 1                                                        LKT2  47
      GO TO 40                                                          LKT2  48
C                                                                       MAIN 159
C-----------------------------------------------------------------------MAIN 160
C     CARD 1 ***** READ TITLE, BEGIN INPUT DATA HERE FOR EACH CASE      MAIN 161
C-----------------------------------------------------------------------MAIN 162
  45  READ(IR,8004,END=9999) TITL                                       MAIN 163
 8004 FORMAT(20A4)                                                      MAIN 164
C                                                                       MAIN 165
C     ***** PRINT HEADING, RELEASE NUMBER, AND TITLE.                   MAIN 166
      CALL TITLE(TITL)                                                  MAIN 167
C                                                                       MAIN 168
C-----------------------------------------------------------------------MAIN 169
C     ***** READ CASE INPUT DATA                                        MAIN 170
C-----------------------------------------------------------------------MAIN 171
      CALL INPUT                                                        MAIN 172
C                                                                       MAIN 174
C       IERR IF NOT ZERO INDICATES THAT AN ERROR WAS FOUND IN CHECKING  MAIN 175
C        THE INPUT DATA IN SUBROUTINE CHEKR, GO TO ECONOMIC READS       MAIN 176
      IF(IERR.GT.0) GO TO 999                                           MAIN 177
C                                                                       MAIN 178
C                                                                       MAIN 179
C -----------------------------------------------------------------------MAIN 180
C     ***** COMPUTE RESERVOIR PERFORMANCE                               MAIN 181
C -----------------------------------------------------------------------MAIN 182
      CALL RESV                                                         MAIN 183
C                                                                       MAIN 184
C                                                                       MAIN 185
C-----------------------------------------------------------------------MAIN 186
C     ***** WRITE RESERVOIR SUMMARY REPORTS                             MAIN 187
C-----------------------------------------------------------------------MAIN 188
C                                                                       MAIN 189
  999 CALL OUTR                                                         MAIN 190
C                                                                       MAIN 191
      IF(IECON.LE.0) GO TO 101                                          MAIN 192
C                                                                       MAIN 193
C-----------------------------------------------------------------------MAIN 194
C     ***** COMPUTE DISCOUNTED CASH FLOW AND RATE OF RETURN             MAIN 195
C-----------------------------------------------------------------------MAIN 196
C                                                                       MAIN 197
C     CARD E1 ***** READ TITLE FOR ECONOMIC ANALYSIS, END IF EOF        MAIN 198
C                                                                       MAIN 199
      READ(IR,8004,END=9999) TITL                                       MAIN 200
 9990 CALL INEC (IJ1,PRICEI,FDC,FEQP,FOPR,FUEL,FACT)                    LKT7   2
C                                                                       MAIN 202
      CALL ECON(API,PRICEI, 0.1, VALUE, 1., FDC,FEQP,FOPR,FUEL)         LKT7   3
C                                                                       MAIN 204
C-----------------------------------------------------------------------MAIN 205
C     ***** WRITE ECONOMICS SUMMARY REPORTS                             MAIN 206
C-----------------------------------------------------------------------MAIN 207
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C                                                                       MAIN 208
      CALL OUTE                                                         MAIN 209
C                                                                       MAIN 210
C     ***** GO TO TOP FOR NEW CASE                                      MAIN 211
      GO TO 101                                                         MAIN 212
C                                                                       MAIN 213
 9999 WRITE(IW,9001)                                                    MAIN 214
 9001 FORMAT(1H1)                                                       MAIN 215
      STOP 'NORMAL STOP'                                                MAIN 216
      END                                                               MAIN 217
      SUBROUTINE TITLE(TITL)                                            TITLE  2
C                                                                       TITLE  3
C     ***** PRINT TITLE                                                 TITLE  4
C                                                                       TITLE  5
C-----------------------------------------------------------------------TITLE  6
C     COMMON STATEMENTS.                                                TITLE  7
C-----------------------------------------------------------------------TITLE  8
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                       FLAGS  5
C                                                                       TITLE 10
      DIMENSION TITL(20)                                                TITLE 11
C                                                                       TITLE 12
      WRITE(IW,9000)                                                    TITLE 13
 9000 FORMAT(1H1/                                                       TITLE 14
     1 2X, 42H******************************************** /           TITLE 15
     1 2X, 42H*                                           * /           TITLE 16
     1 2X, 42H*      NATIONAL PETROLEUM COUNCIL           * /           TITLE 17
     1 2X, 42H*  INSITU COMBUSTION PREDICTIVE MODEL       * /           LKT1   8
     1 2X, 42H*         (ICPM - RELEASE 1.4.0)            * /           LKT1   9
     1 2X, 42H*            ( APRIL ,1985 )                * /           LKT1  10
     1 2X, 42H******************************************** / )         TITLE 21
C                                                                       TITLE 22
      WRITE(IW,9004) TITL                                               TITLE 23
 9004 FORMAT(1X,20A4)                                                   TITLE 24
C                                                                       TITLE 25
      RETURN                                                            TITLE 26
      END                                                               TITLE 27
      SUBROUTINE INPUT                                                  INPUT  2
C                                                                       INPUT  3
C                                                                       INPUT  4
C-----------------------------------------------------------------------INPUT  5
C     COMMON STATEMENTS.                                                INPUT  6
C-----------------------------------------------------------------------INPUT  7
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                       FLAGS  5
      COMMON /RESVR/                                                    RESVR  2
     1 DEPTH,  PFORM,  TFORM,  TNET,                                    RESVR  3
     2 PERM,   POROS,  VISO,   VISW,   BOI,   BWI,                      RESVR  4
     3 AREA,   WELLSP, SOI,    SWI,    SGI,   BRNMX,                    RESVR  5
     4 OIP,    WIP,    GIP,    TOTOIL, TVP,   SWEEP,                    RESVR  6
     5 ARIN,   ARINJ,  PINJ,   WELLSI, HPP,   PDP,                      RESVR  7
     6 AREAP,  FWA,    OILBF,  PATVOL, AFR,   AR                        RESVR  8
C                                                                       RESVR  9
      COMMON /FPROP/                                                    FPROP  2
     * API, RS, VIS80, VIS100, VIS210, VIS1, VIS2, SGO, SGW, SGG,       FPROP  3
     1 BB(42)                                                           FPROP  4
C                                                                       FPROP  5
      COMMON /ECI/ M,MYR,IOUT,ISTATE,IDIST,IFIT,IDISC,IFUL,ISO,IDEP,    ECI    2
     1 PCTDBT, DBTINT, NYRRPY, NYPAID, IDEBT,                           ECI    3
     1 CCOST,  GTRT,   WTRT,   CTACR, DCE,  PLANT,                      ECI    4
     1 WOCOST, WTCOST, WDCOST,COSTML,COSTTI,                            ECI    5
     1 WCAP,   UNCO,   WPP,    COSTRT, FOCPL, FOCPM, FOCPH,             ECI    6
     1 WPP1,   WPP2,   WPP3,   WPP4,  POBASE, OILB, OILC, DECL,         ECI    7
     1 XDR,    XINF,   XROY,   XSEV,  XWPT, XFIT, XTCR, DTIM, XSTX,     ECI    8
     1 WPHO,   EPHO,   BTIM,   BPOW,                                    ECI    9
     1 ESCPO,  ESCPG,  ESCPF, ESCFO, ESCED,                             ECI   10
     1 ESCCT,  ESCCI,  ESCWO, ESCWT, ESCWI, ESCBP,                      ECI   11
     1 OILR(50), VOS(50),                                               ECI   12
     1 POL(50),  POM(50),  POH(50), PGL(50), PGM(50),  PGH(50),         ECI   13
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     2 FOCL(50), FOCM(50), FOCH(50),OPCL(50),OPCM(50), OPCH(50),        ECI    14
     3 EDPL(50), EDPM(50), EDPH(50),WTC(50), WDC(50),  CML(50),         ECI    15
     4 CTPL(50), CTPM(50), CTPH(50),CIPL(50),CIPM(50), CIPH(50),        ECI    16
     4 CTCL(50), CTCM(50), CTCH(50),CICL(50),CICM(50), CICH(50),        ECI    17
     5 VOL(50),  VOM(50),  VOH(50), WO(50),  BPO(50),  CTI(50),         ECI    18
     6 VGM(50),  VWM(50),  VIM(50), GNUM(50),GENC(50), TITL(20),        ECI    19
     6 QHM(50),  VHM(50),  VDM(50), QHP(50), VHP(50),                   ECI    20
     7 VOP(50),  VGP(50),  VWP(50), VIP(50), PATI(50), PATIOX(50)        ECI    21
C                                                                       ECI    22
C                                                                       INPUT 12
C-----------------------------------------------------------------------INPUT 13
C     ***** INPUT SUBROUTINE, READS CASE CONTROLS AND RESERVOIR         INPUT 14
C     PERFORMANCE INPUT DATA ONLY (ECONOMIC INPUT DATA READ LATER)      INPUT 15
C-----------------------------------------------------------------------INPUT 16
C                                                                       INPUT 17
C   CARD 2 ***** RUN CONTROLS                                           INPUT 18
      READ(IR,*) IRES,IPAT,IWRIT,IECON                                  INPUT 19
      IF(IRES.LE.0) IRES = 0                                            LKT5   1
      IF(IPAT.LE.0) IPAT = 0                                            LKT5   2
      IF(ILIT.LE.1)ILIT=1                                               INPUT 23
C                                                                       INPUT 24
C   CARD R3 ***** READ RESERVOIR DESCRIPTION DATA                       LKT1  11
      READ(IR,*) DEPTH,PFORM,TFORM                                      INPUT 26
C                                                                       INPUT 27
C   CARD R4 ***** READ RESERVOIR DESCRIPTION DATA                       INPUT 28
      READ(IR,*) TNET,PERM,POROS                                        INPUT 29
C                                                                       INPUT 30
C   CARD R5 ***** READ INITIAL CONDITION DATA                           INPUT 31
      READ(IR,*) SOI,SGI,SWI                                            INPUT 32
C                                                                       INPUT 33
C   CARD R6 ***** READ FLUID PROPERTY DATA                              LKT3  12
      READ(IR,*) API,VISO,BOI,BWI                                       INPUT 35
C                                                                       INPUT 36
C   CARD R7 ***** READ CASE DATA                                        INPUT 37
C                                                                       INPUT 38
C   MODIFY READ TO INPUT A MAXIMUM BURN ZONE THICKNESS, BRNMX           INPUT 39
C     BRNMX DEFAULTS TO 150 FEET, DISABLED BY -1.0                      INPUT 40
C                                                                       INPUT 41
      READ(IR,*) AREA,WELLSP,ARIN,FWA,SWEEP,BRNMX                       INPUT 42
C                                                                       INPUT 43
C                                                                       INPUT 44
C                                                                       INPUT 45
C -----------------------------------------------------------------------INPUT 46
C     END OF DATA INPUT (EXCEPT FOR LATER ECONOMIC DATA)                INPUT 47
C -----------------------------------------------------------------------INPUT 48
C                                                                       INPUT 49
C     ***** CHECK INPUT DATA FOR DEFAULTS                               LKT3  13
      CALL CHEKR(KAS)                                                   INPUT 51
C                                                                       INPUT 52
C     ***** PRINT FORMATION INPUT                                       INPUT 53
      CALL OUT1                                                         INPUT 54
C                                                                       INPUT 55
      IF(IERR.GT.0) GO TO 109                                           INPUT 56
      RETURN                                                            INPUT 57
C                                                                       INPUT 58
  109 IF(IERR.NE.2) GO TO 110                                           INPUT 59
      IERR=1                                                            INPUT 60
      RETURN                                                            INPUT 61
C                                                                       INPUT 62
  110 WRITE(IW,9314) IERR                                               INPUT 63
 9314 FORMAT(1H0,46H   ***** REQUIRED INPUT PARAMETER(S) NOT FOUND,/    INPUT 64
     & 41H   ***** PREDICTION RUN TERMINATED, IERR=,I8)                 INPUT 65
      IERR = 1                                                          INPUT 66
C                                                                       INPUT 67
      RETURN                                                            INPUT 68
      END                                                               INPUT 69
      SUBROUTINE CHEKR(KAS)                                             CHEKR  2
C                                                                       CHEKR  3
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                       FLAGS  5
      COMMON /RESVR/                                                    RESVR  2
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```
     1 DEPTH,  PFORM,  TFORM,  TNET,                                    RESVR  3
     2 PERM,   POROS,  VISO,   VISW,   BOI,    BWI,                     RESVR  4
     3 AREA,   WELLSP, SOI,    SWI,    SGI,    BRNMX,                   RESVR  5
     4 OIP,    WIP,    GIP,    TOTOIL, TVP,    SWEEP,                   RESVR  6
     5 ARIN,   ARINJ,  PINJ,   WELLSI, HPP,    PDP,                     RESVR  7
     6 AREAP,  FWA,    OILBF,  PATVOL, AFR,    AR                       RESVR  8
C                                                                       RESVR  9
      COMMON /FPROP/                                                    FPROP  2
     * API, RS, VIS80, VIS100, VIS210, VIS1, VIS2, SGO, SGW, SGG,       FPROP  3
     1 BB(42)                                                           FPROP  4
C                                                                       FPROP  5
      COMMON /SPECPR/ TNETOR                                            LKT7   1
C                                                                       SPECPAR3
C                                                                       CHEKR  8
C-----------------------------------------------------------------------CHEKR  9
C     ***** DEFAULT CHECKING - FORMATION, AND CASE DATA                 CHEKR 10
C                                                                       CHEKR 11
C    REQUIRED DATA ARE :  API - API GRAVITY OF OIL                      LKT1  12
C                         DEPTH - RESERVOIR DEPTH                       LKT1  13
C                         TNET - NET PAY THICKNESS                      LKT1  14
C                         PERM - AVERAGE FORMATION PERMEABILITY         CHEKR 15
C                         POROS - AVERAGE FORMATION POROSITY            CHEKR 16
C                         AREA - DEVELOPED AREA                         LKT1  15
C                         WELLSP - NO. PRODUCING WELLS                  LKT3  14
C                                                                       CHEKR 17
C     PROGRAM WILL TERMINATE IF ABOVE DATA ARE NOT INPUT                LKT1  17
C                                                                       CHEKR 19
C-----------------------------------------------------------------------CHEKR 20
C                                                                       CHEKR 21
C                                                                       CHEKR 22
      ERROR = 99999.99999                                               CHEKR 23
      UNIT  = 1000.                                                     CHEKR 24
C                                                                       CHEKR 25
C     ***** CHECK API GRAVITY                                           CHEKR 26
C                                                                       CHEKR 27
      IF(API .NE. 0.0) GO TO 100                                        CHEKR 28
      IERR = 3                                                          CHEKR 29
      API  = ERROR                                                      CHEKR 30
      WRITE(IW,9001)                                                    CHEKR 31
 9001 FORMAT( 5X,42H***** REQUIRED OIL GRAVITY NOT INPUT *****)         CHEKR 32
C                                                                       CHEKR 33
  100 SGO = 141.5/(API + 131.5)                                         CHEKR 34
      SGW = 1.0                                                         CHEKR 35
      SGG = 0.8                                                         CHEKR 36
C                                                                       CHEKR 37
C     ***** CHECK DEPTH                                                 CHEKR 38
C                                                                       CHEKR 39
      IF(DEPTH .GT. 0.0) GO TO 150                                      CHEKR 40
      DEPTH = ERROR                                                     CHEKR 41
      IERR  = 4                                                         CHEKR 42
      WRITE(IW,9101)                                                    CHEKR 43
 9101 FORMAT( 5X,46H***** REQUIRED FORMATION DEPTH NOT INPUT *****)     CHEKR 44
C                                                                       CHEKR 45
C     ***** CHECK FOR INITIAL TEMPERATURE AND PRESSURE                  CHEKR 46
C                                                                       CHEKR 47
  150 TGRG = 70.0                                                       CHEKR 48
      IF(TFORM .GT. 0.0) GO TO 175                                      CHEKR 49
      GGRAD=0.011                                                       LKT5   3
      TFORM = TGRG + DEPTH*GGRAD                                        CHEKR 51
C                                                                       CHEKR 52
C     ***** ASSUME PARTIALLY DEPLETED RESERVOIR                         CHEKR 53
C                                                                       CHEKR 54
  175 PGRAD = 0.433 / 2.0                                               CHEKR 55
      IF(PFORM .LE. 0.0) PFORM = 14.7 + DEPTH*PGRAD                     CHEKR 56
C                                                                       CHEKR 57
C     ***** CHECK NET PAY THICKNESS                                     CHEKR 58
C                                                                       CHEKR 59
      IF(TNET .GT. 0.0) GO TO 300                                       CHEKR 60
      TNET = ERROR                                                      CHEKR 61
      IERR = 5                                                          CHEKR 62
      WRITE(IW,201)                                                     CHEKR 63
  201 FORMAT( 5X,44H***** REQUIRED NET THICKNESS NOT INPUT *****)       CHEKR 64
C                                                                       CHEKR 65
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C                                                                       CHEKR 66
C   CALCULATE AND CHECK MAXIMUM BURN THICKNESS AND NUMBER               CHEKR 67
C    OF BURN ZONES IN THE RESERVOIR                                     CHEKR 68
C                                                                       CHEKR 69
  300 NZONE = 1                                                         CHEKR 70
      IF(BRNMX.LT.0.0) GO TO 3001                                       CHEKR 71
      IF(BRNMX .LE. 1.0) BRNMX = 150.0                                  CHEKR 72
      XZONE = TNET/BRNMX                                                LKT4   1
      NZONE = XZONE                                                     LKT4   2
      IF( NZONE .LT. XZONE ) NZONE = NZONE + 1                          LKT4   3
      IF (XZONE .LT. 1. ) NZONE = 1                                     LKT4   4
 3001 CONTINUE                                                          LKT2  49
      TNETOR = TNET                                                     LKT7   4
      XZONE = NZONE                                                     CHEKR 76
      TNET = TNET / XZONE                                               CHEKR 77
C                                                                       CHEKR 79
      IF(PERM .NE. 0.0) GO TO 400                                       CHEKR 80
C                                                                       CHEKR 81
C                                                                       CHEKR 82
C                                                                       CHEKR 83
C     ***** CHECK FORMATION PERMEABILITY                                CHEKR 84
C                                                                       CHEKR 85
      PERM = ERROR                                                      CHEKR 86
      IERR = 6                                                          CHEKR 87
      WRITE(IW,301)                                                     CHEKR 88
  301 FORMAT( 5X,43H***** REQUIRED PERMEABILITY NOT INPUT *****)        CHEKR 89
C                                                                       CHEKR 90
C     ***** CHECK FORMATION POROSITY                                    CHEKR 91
C                                                                       CHEKR 92
  400 IF(POROS .GT. 0.0) GO TO 500                                      CHEKR 93
      POROS = ERROR                                                     CHEKR 94
      IERR  = 7                                                         CHEKR 95
      WRITE(IW,9401)                                                    CHEKR 96
 9401 FORMAT( 5X,39H***** REQUIRED POROSITY NOT INPUT *****)            CHEKR 97
C                                                                       CHEKR 98
C     ***** CHECK DEVELOPED AREA                                        CHEKR 99
C                                                                       CHEKR100
  500 IF(AREA .GT. 0.0) GO TO 600                                       CHEKR101
      AREA  = ERROR                                                     CHEKR102
      IERR  = 8                                                         CHEKR103
      WRITE(IW,9501)                                                    CHEKR104
 9501 FORMAT( 5X,45H***** REQUIRED DEVELOPED AREA NOT INPUT *****)      CHEKR105
C                                                                       CHEKR106
C     ***** CHECK NUMBER OF PRODUCING WELLS                             CHEKR107
C                                                                       CHEKR108
  600 IF(WELLSP .GT. 0.0) GO TO 900                                     CHEKR109
      WELLSP = 1                                                        CHEKR110
      IERR   = 9                                                        CHEKR111
      WRITE(IW,9601)                                                    CHEKR112
 9601 FORMAT( 5X,43H***** REQUIRED NO. OF WELLS NOT INPUT ***** )       CHEKR113
C                                                                       CHEKR114
C     ***** CALCULATE DEFAULT VALUES FOR VIS100 AND VIS210              CHEKR115
C                                                                       CHEKR116
  900 RS = 100.                                                         CHEKR117
      IF(API .LT. 10.) GO TO 970                                        CHEKR118
      VIS100 = BB(1) * API + BB(2) + (( (BB(6)/API + BB(5))/API         CHEKR119
     1  + BB(4))/API + BB(3))/ API                                      CHEKR120
      VIS100 = EXP ( VIS100 )                                           CHEKR121
C                                                                       CHEKR122
      VIS210 = BB(7) * API + BB(8) + (( (BB(12)/API + BB(11))/API       CHEKR123
     1  + BB(10))/API + BB(9))/API                                      CHEKR124
      VIS210 = EXP ( VIS210 )                                           CHEKR125
      GO TO 990                                                         CHEKR126
  970 VIS100 = 10.**(8.35928 - .37539 * API)                            CHEKR127
      VIS210 = 10.**(3.15424 - .11862 * API)                            CHEKR128
  990 CONTINUE                                                          CHEKR129
C                                                                       CHEKR130
C     ***** GET VISCOSITIES                                             CHEKR131
      IF(VISO .LE. 0.0) CALL VISC(PFORM,TFORM,VISO,VISW)                CHEKR132
C                                                                       CHEKR133
C     ***** GET FORMATION VOLUME FACTORS                                CHEKR134
      CALL FVF(TFORM,PFORM,BOIS,BWIS)                                   CHEKR135
      IF(BOI .LE. 0.0) BOI = BOIS                                       CHEKR136
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      IF(BWI .LE. 0.0) BWI = BWIS                                       CHEKR137
C                                                                       CHEKR138
C     ***** SET UP INITIAL SATURATIONS                                  LKT1  18
      SGI = 0.                                                          CHEKR140
      IF(SWI .LE. 0.) SWI = 1. - SOI                                    CHEKR141
      IF(SOI .LE. 0.) SOI = 1. - SWI - SGI                              CHEKR142
C                                                                       CHEKR143
C     ***** CALCULATE TOTAL INITIAL OIL IN PLACE (MSTB)                 LKT3  15
C           AND TOTAL PORE VOLUME (M. RESV.BBLS.)                       CHEKR145
C                                                                       CHEKR146
      TVP = 43560. * AREA * TNET * POROS / 5.614 / UNIT / UNIT          CHEKR147
      TOTOIL = TVP * SOI / BOI                                          CHEKR148
C                                                                       CHEKR149
      RETURN                                                            CHEKR150
      END                                                               CHEKR151
      SUBROUTINE OUT1                                                   OUT1   2
C                                                                       OUT1   3
C                                                                       OUT1   4
C-----------------------------------------------------------------------OUT1   5
C     COMMON STATEMENTS.                                                OUT1   6
C-----------------------------------------------------------------------OUT1   7
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                       FLAGS  5
      COMMON /RESVR/                                                    RESVR  2
     1 DEPTH,  PFORM,  TFORM,  TNET,                                    RESVR  3
     2 PERM,   POROS,  VISO,   VISW,   BOI,   BWI,                      RESVR  4
     3 AREA,   WELLSP, SOI,    SWI,    SGI,   BRNMX,                    RESVR  5
     4 OIP,    WIP,    GIP,    TOTOIL, TVP,   SWEEP,                    RESVR  6
     5 ARIN,   ARINJ,  PINJ,   WELLSI, HPP,   PDP,                      RESVR  7
     6 AREAP,  FWA,    OILBF,  PATVOL, AFR,   AR                        RESVR  8
C                                                                       RESVR  9
      COMMON /FPROP/                                                    FPROP  2
     * API, RS, VIS80, VIS100, VIS210, VIS1, VIS2, SGO, SGW, SGG,       FPROP  3
     1 BB(42)                                                           FPROP  4
C                                                                       FPROP  5
      COMMON /SPECPR/ TNETOR                                            LKT7   1
C                                                                       SPECPAR3
C                                                                       OUT1  12
C-----------------------------------------------------------------------OUT1  13
C     ***** THIS SUBROUTINE OUTPUTS THE CASE CONTROL AND RESERVOIR      OUT1  14
C            INPUT DATA                                                 OUT1  15
C-----------------------------------------------------------------------OUT1  16
C                                                                       OUT1  17
C     ***** WRITE CASE CONTROLS                                         OUT1  18
      WRITE(IW,9300)                                                    OUT1  19
 9300 FORMAT(// 2X, 13HCASE CONTROLS / 2X,13(1H-) )                     OUT1  20
      WRITE(IW,9305) IRES,IPAT,IWRIT,IECON                              OUT1  21
 9305 FORMAT(                                                           OUT1  22
     1 3X,37HRECOVERY PREDICTION METHOD ........., I8, 8H  IRES    /    OUT1  23
     1 3X,37HPATTERN CONTROL ....................., I8, 8H  IPAT    /   OUT1  24
     1 3X,37HPRINT CONTROL ......................., I8, 8H  IWRIT   /   LKT1  19
     1 3X,37HECONOMIC ANALYSIS CONTROL ..........., I8, 8H  IECON   )   OUT1  26
C                                                                       OUT1  27
C     ***** WRITE FORMATION PROPERTIES AND INITIAL CONDITIONS           OUT1  28
      WRITE(IW,9340)                                                    OUT1  29
 9340 FORMAT(/ 2X, 21HFORMATION PROPERITIES / 2X,21(1H-) )              OUT1  30
      WRITE(IW,9350) DEPTH,PFORM,TFORM                                  OUT1  31
 9350 FORMAT(                                                           OUT1  32
     1 3X,37HFORMATION DEPTH ....................,F10.1, 6H  FEET     /OUT1  33
     1 3X,37HINITIAL PRESSURE ...................,F10.1, 6H  PSIA     /OUT1  34
     1 3X,37HINITIAL TEMPERATURE ................,F10.1,10H  DEG.F    )OUT1  35
      WRITE(IW,9360) TNETOR,TNET,PERM,POROS                             LKT7   5
 9360 FORMAT(                                                           OUT1  37
     1 3X,37HFORMATION NET THICKNESS (PAY) .......,F10.1,10H  FEET     /OUT1  38
     1 3X,37HBURN ZONE THICKNESS (PAY) ...........,F10.1,10H  FEET    / LKT2  50
     1 3X,37HFORMATION PERMEABILITY ..............,F10.1, 6H  MD       /OUT1  40
     1 3X,37HFORMATION POROSITY ..................,F10.4,10H  FRACTION )OUT1  41
C                                                                       OUT1  42
C     ***** WRITE INITIAL CONDITIONS                                    OUT1  43
      WRITE(IW,9400)                                                    OUT1  44
 9400 FORMAT(/ 2X, 18HINITIAL CONDITIONS  / 2X,18(1H-) )                OUT1  45
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      WRITE(IW,9405) SOI,SGI,SWI,API,                                   OUT1   46
     1 VISO, BOI, BWI                                                   OUT1   47
 9405 FORMAT(                                                           OUT1   48
     1 3X,37HINITIAL OIL SATURATION ...............,F10.4,10H  FRACTION/ OUT1   49
     1 3X,37HINITIAL GAS SATURATION ...............,F10.4,10H  FRACTION/ OUT1   50
     1 3X,37HINITIAL WATER SATURATION .............,F10.4,10H  FRACTION/ OUT1   51
     1 3X,37HOIL GRAVITY ..........................,F10.2,10H  DEG.API / LKT1   20
     1 3X,37HDEAD OIL VISCOSITY ...................,F10.2, 6H  CP      / OUT1   53
     1 3X,37HOIL FORMATION VOLUME FACTOR ..........,F10.4,10H  RB/STB  / OUT1   54
     1 3X,37HWATER FORMATION VOLUME FACTOR ........,F10.4,10H  RB/STB  /)OUT1   55
      XZONE =NZONE                                                      LKT1   21
      WRITE(IW,9410) AREA, WELLSP, TOTOIL, TVP , XZONE                  LKT5    4
 9410 FORMAT(                                                           OUT1   57
     1 3X,37HTOTAL DEVELOPED AREA .................,F10.2,10H  ACRES    /OUT1   58
     1 3X,37HNO. OF PRODUCING WELLS ...............,F10.2,10H  WELLSP   /OUT1   59
     1 3X,37HTOTAL INITIAL OIL IN PLACE/BURN ZONE.,F10.1,10H  MM.STB   /LKT1   23
     1 3X,37HINITIAL PORE VOLUME/BURN ZONE ........,F10.1,10H  MM.RES.B /LKT1   24
     1 3X,37HNO. BURN ZONES .......................,F10.1)              LKT1   25
C                                                                       OUT1   64
C                                                                       OUT1   65
      RETURN                                                            OUT1   66
      END                                                               OUT1   67
      SUBROUTINE RESV                                                   RESV    2
C                                                                       RESV    3
C                                                                       RESV    4
C-----------------------------------------------------------------------RESV    5
C     COMMON STATEMENTS.                                                RESV    6
C-----------------------------------------------------------------------RESV    7
      COMMON /FLAGS/  IJ1,                                              FLAGS   2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS   3
     2 IR, IW, IP, NZONE                                                FLAGS   4
C                                                                       FLAGS   5
      COMMON /RESVR/                                                    RESVR   2
     1 DEPTH,  PFORM,  TFORM,  TNET,                                    RESVR   3
     2 PERM,   POROS,  VISO,   VISW,   BOI,    BWI,                     RESVR   4
     3 AREA,   WELLSP, SOI,    SWI,    SGI,    BRNMX,                   RESVR   5
     4 OIP,    WIP,    GIP,    TOTOIL, TVP,    SWEEP,                   RESVR   6
     5 ARIN,   ARINJ,  PINJ,   WELLSI, HPP,    PDP,                     RESVR   7
     6 AREAP,  FWA,    OILBF,  PATVOL, AFR,    AR                       RESVR   8
C                                                                       RESVR   9
      COMMON /FPROP/                                                    FPROP   2
     * API, RS, VIS80, VIS100, VIS210, VIS1, VIS2, SGO, SGW, SGG,       FPROP   3
     1 BB(42)                                                           FPROP   4
C                                                                       FPROP   5
      COMMON /REPORT/                                                   REPORT  2
     1 CUMOIL(200), CUMGAS(200), CUMWAT(200), CUMOB(200),               REPORT  3
     2 CUMIA(200),  CUMIW(200),  CUMAW(200),  FOSC(200),   FOSI(200),   REPORT  4
     3 PROIL(200),  PRGAS(200),  PRWAT(200),  AIRQ(200),   WATQ(200),   REPORT  5
     4 TIME(200),   DTIME(200),  FRVS(200),   RECOV(200),               REPORT  6
     6 PRODS(200)                                                       REPORT  7
C                                                                       REPORT  8
C                                                                       RESV   12
C-----------------------------------------------------------------------RESV   13
C     ***** CALCULATE RESERVOIR PERFORMANCE                             RESV   14
C-----------------------------------------------------------------------RESV   15
C                                                                       RESV   16
      CALL COEF1 (IRES, WELLSP, AREA, TNET, PERM, VISO, PFORM,          RESV   17
     1           SWEEP, ARINJ, PINJ, AREAP, WELLSI, FWA)                RESV   18
      IF(ARIN .GT. 0.0) ARINJ = ARIN                                    RESV   19
      CALL COMB                                                         RESV   20
C                                                                       RESV   21
C                                                                       RESV   22
      RETURN                                                            RESV   23
      END                                                               RESV   24
      SUBROUTINE COEF1 (IRES, WELLSP, AREA, TNET, PERM, VISO, PRES,     COEF1   2
     1                  SWEEP, ARINJ, PINJ, AREAP, WELLSI, FWA)         COEF1   3
C                                                                       COEF1   4
C-----------------------------------------------------------------------COEF1   5
C     ***** CALC INPUT PARAMETERS FOR INSITU COMBUSTION                 COEF1   6
C-----------------------------------------------------------------------COEF1   7
C                                                                       COEF1   8
C     INPUT VARIABLES                                                   COEF1   9
C     ---------------                                                   COEF1  10
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C       IRES      = PREDICTION METHOD                                   COEF1  11
C       WELLSP    = NUMBER OF PRODUCING WELLS IN DEVELOPED AREA         COEF1  12
C       AREA      = DEVELOPED AREA, ACRES                               COEF1  13
C       TNET      = RESERVOIR THICKNESS, FT                             LKT1   26
C       PERM      = RESERVOIR PERMEABILITY, MD                          COEF1  15
C       VISO      = DEAD OIL VISCOSITY AT STP, CP                       COEF1  16
C       PRES      = INITIAL RESERVOIR PRESSURE, PSIA                    COEF1  17
C                                                                       COEF1  18
C      OUTPUT VARIABLES                                                 COEF1  19
C      ----------------                                                 COEF1  20
C       ARINJ     = AIR INJECTION RATE, MSCF/D                          COEF1  21
C       PINJ      = AIR INJECTION PRESSURE, PSIA                        COEF1  22
C       AREAP     = PATTERN AREA, ACRES                                 COEF1  23
C       WELLSI    = NUMBER OF INJECTION WELLS IN DEVELOPED AREA         COEF1  24
C       FWA       = WATER / AIR RATIO, STB/MSCF                         COEF1  25
C                                                                       COEF1  26
C      ***** CALC NUMBER OF INJECTORS                                   COEF1  27
       WELLSI = WELLSP/2.0                                              COEF1  28
C                                                                       COEF1  29
C      ***** CALC PATTERN AREA                                          COEF1  30
       AREAP  = AREA / WELLSI                                           COEF1  31
       PATVOL = AREAP * TNET                                            COEF1  32
       IF(PATVOL .LT. 200.) PATVOL = 200.                               COEF1  33
       AREAP  = PATVOL / TNET                                           COEF1  34
       IF(PATVOL .LE. 200.) WELLSI = AREA/AREAP                         COEF1  35
       IWELLS = IFIX(WELLSI)                                            COEF1  36
C                                                                       COEF1  37
C      ***** DETERMINE IF WET COMBUSTION (FWA.LT.0 FOR DEFAULT)         COEF1  38
       IF(FWA.GE.0.0) GO TO 10                                          COEF1  39
       FWA    = 0.0                                                     COEF1  40
       IF(PERM.GE.100. .AND. VISO.GE.10.) FWA = 1.0                     COEF1  41
C                                                                       COEF1  42
C      ***** CALC AIR REQUIREMENT:  MSCF/FT3 RESV                       COEF1  43
C      ***** GARON/WYGOL DATA                                           COEF1  44
   10  AR     = 0.073 * ALOG10(VISO) + 0.20 - 0.100 * FWA               COEF1  45
C                                                                       COEF1  46
C      ***** CALC SWEEP BASED ON PATTERN AREA                           LKT1   27
       IF(SWEEP.GT.0.0) GO TO 20                                        COEF1  48
       SWEEP  = 0.40                                                    COEF1  49
       IF(AREAP.LT.20.) SWEEP = 0.50                                    COEF1  50
       IF(AREAP.LT.5.0) SWEEP = 0.60                                    COEF1  51
C                                                                       COEF1  52
C      ***** CALC AIR INJECTION RATE BASED ON                           COEF1  53
C      ***** 60 PCNT BURNED OVER 10 YEAR LIFE                           COEF1  54
   20  PLIFE  = 10.0                                                    COEF1  55
       ARINJ  = 43560. * PATVOL * SWEEP * AR /365./PLIFE                COEF1  56
C                                                                       COEF1  57
C      ***** MODIFIED RADIAL FLOW                                       LKT1   28
       PINJ   = (ARINJ * ALOG(626.*AREAP**0.5) / (2.2*10.**(-5.0-FWA)   COEF1  59
      1         * PERM * TNET) + PRES * PRES) **0.5                     COEF1  60
       IF(PINJ .LT. PRES) PINJ = PRES + 200.                            COEF1  61
C                                                                       COEF1  62
       RETURN                                                           COEF1  63
       END                                                              COEF1  64
       SUBROUTINE COMB                                                  COMB    2
C                                                                       COMB    3
C-----------------------------------------------------------------------COMB    4
C      ***** PREDICT COMBUSTION PERFORMANCE                             COMB    5
C      ***** BRIGHAM, SATMAN, AND SOLIMAN  (JPT - DEC,1980)             COMB    6
C-----------------------------------------------------------------------COMB    8
C                                                                       COMB    9
C      INPUT VARIABLES                                                  COMB   10
C      ---------------                                                  COMB   11
C       SOI       = INITIAL OIL SATURATION, FRACTION                    COMB   12
C       TNET      = RESERVOIR THICKNESS, FT.                            COMB   13
C       POROS     = RESERVOIR POROSITY, FRACTION                        COMB   14
C       AREAP     = PATTERN AREA, ACRES                                 COMB   15
C       VISO      = DEAD OIL VISCOSITY AT STP, CP                       COMB   16
C       FWA       = WATER / AIR RATIO, STB/MSCF                         COMB   17
C       ARINJ     = AIR INJECTION RATE, MSCF/D                          COMB   18
C       PINJ      = AIR INJECTION PRESSURE, PSIA                        COMB   19
C                                                                       COMB   20
C      OUTPUT VARIABLES                                                 COMB   21
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C     ----------------                                                  COMB  22
C      CUMOB     = CUMULATIVE OIL BURNED AS FUEL,   MSTB                LKT1  29
C      CUMIA     = CUMULATIVE AIR INJECTED, MMSCF                       COMB  24
C      CUMIW     = CUMULATIVE WATER INJECTED, MSTB                      LKT3  16
C      CUMAW     = CUMULATIVE EQUIV AIR INJECTED FOR WET COMB, MMSCF    COMB  26
C      CUMOIL    = CUMULATIVE INCREMENTAL OIL PROD, MSTB                LKT1  30
C      CUMGAS    = CUMULATIVE INCREMENTAL GAS PROD, MMSCF               COMB  28
C      CUMWAT    = CUMULATIVE INCREMENTAL WTR PROD, MSTB                LKT1  31
C                                                                       COMB  30
C      AIRQ      = AIR  INJECTION  RATE, MSCF/D                         COMB  31
C      WATQ      = WATR INJECTION  RATE, STB/D                          COMB  32
C      PROIL     = OIL  PRODUCTION RATE, STB/D                          COMB  33
C      PRGAS     = GAS  PRODUCTION RATE, MSCF/D                         COMB  34
C      PRWAT     = WATR PRODUCTION RATE, STB/D                          COMB  35
C                                                                       COMB  36
C      TOPK      = OIL PEAK TIME, YEARS                                 COMB  37
C      TIME      = TIME ARRAY, YEARS                                    COMB  38
C      HPP       = COMPRESSOR HORSEPOWER PER PATTERN                    COMB  39
C      AR        = AIR REQUIREMENT, MSCF/FT3 RESV                       COMB  40
C                                                                       COMB  41
C                                                                       COMB  42
C-----------------------------------------------------------------------COMB  43
C     COMMON STATEMENTS.                                                COMB  44
C-----------------------------------------------------------------------COMB  45
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                       FLAGS  5
      COMMON /RESVR/                                                    RESVR  2
     1 DEPTH,  PFORM,  TFORM,  TNET,                                    RESVR  3
     2 PERM,   POROS,  VISO,   VISW,   BOI,   BWI,                      RESVR  4
     3 AREA,   WELLSP, SOI,    SWI,    SGI,   BRNMX,                    RESVR  5
     4 OIP,    WIP,    GIP,    TOTOIL, TVP,   SWEEP,                    RESVR  6
     5 ARIN,   ARINJ,  PINJ,   WELLSI, HPP,   PDP,                      RESVR  7
     6 AREAP,  FWA,    OILBF,  PATVOL, AFR,   AR                        RESVR  8
C                                                                       RESVR  9
      COMMON /REPORT/                                                   REPORT 2
     1 CUMOIL(200), CUMGAS(200), CUMWAT(200), CUMOB(200),               REPORT 3
     2 CUMIA(200),  CUMIW(200),  CUMAW(200),  FOSC(200),   FOSI(200),   REPORT 4
     3 PROIL(200),  PRGAS(200),  PRWAT(200),  AIRQ(200),   WATQ(200),   REPORT 5
     4 TIME(200),   DTIME(200),  FRVS(200),   RECOV(200),               REPORT 6
     6 PRODS(200)                                                       REPORT 7
C                                                                       REPORT 8
C                                                                       COMB  49
C     ***** INITIALIZE                                                  COMB  50
      AIROLD    = 0.0                                                   COMB  51
      WATOLD    = 0.0                                                   COMB  52
      OILOLD    = 0.0                                                   COMB  53
      GASOLD    = 0.0                                                   COMB  54
      WAPOLD    = 0.0                                                   COMB  55
      DTS       = 0.50                                                  COMB  56
      TOPK      = 1.0                                                   COMB  57
      UNIT      = 1000.                                                 COMB  58
C                                                                       COMB  59
C     ***** PATTERN HORSEPOWER                                          COMB  60
      XXL       = DEPTH + 1500.                                         COMB  61
      PDP       = 1.2 * (1.81E-6*XXL*ARINJ*ARINJ + PINJ*PINJ) ** 0.5    COMB  62
      HPP       = ARINJ/UNIT * 48.13 * PDP**0.25                        COMB  63
C                                                                       COMB  64
C     ***** CALC BRIGHAM CORRELATION CONSTANTS                          COMB  65
C           C1  = DIMENSIONLESS                                         COMB  66
C           C2  = INVERSE BBLS                                          COMB  67
C           OIP = OIL IN PLACE AT START, MSTB                           LKT1  32
C                                                                       COMB  69
C     ***** OXYGEN UTILIZATION OF 95% IS ASSUMED FOR C2 CALC            COMB  70
      C1        = 0.427 * SOI - 0.00135 * TNET + 2.196/VISO**0.25       COMB  71
      C2        = 0.95/((AREAP * TNET * 7758./BOI) * (1.-POROS))        COMB  72
      OIP       = 7758. * POROS * SOI * AREAP * TNET                    COMB  73
     &            / BOI / UNIT                                          COMB  74
C                                                                       COMB  75
C     ***** CORRELATION - NPC                                           LKT1  33
C     ***** OILBF =  FINAL OIL BURNED: STB/ACRE-FT                      LKT1  34
C     ***** AR    =  AIR REQUIREMENT:  MSCF/FT3 RESV                    COMB  78
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C     ***** AFR   =  AIR / FUEL RATIO: MSCF/STB OIL BURNED
C
      OILBF     = 45.20 * ALOG10(VISO) + 125.0 - 62.25 * FWA
      AR        = 0.073 * ALOG10(VISO) + 0.20 - 0.100 * FWA
      AFR       = 70.0
C
C     ***** MAIN LOOP FOR INJECTION AND PRODUCTION CALC
C
      DO 100 I = 2,200
C
      DT        = DTS
      IF(TIME(I-1) .LT. TOPK) DT = DTS/2.
      TIME(I)   = TIME(I-1)  + DT
C
C     ***** CHECK FOR EARLY TIME FILL-UP
      AINJ      = ARINJ
      IF(TIME(I) .LT. TOPK) AINJ = ARINJ*TIME(I)/TOPK
C
C     ***** CALC CUM INJECTED
      CUMIA(I) = CUMIA(I-1) + AINJ * DT * 365.25 / UNIT
      CUMIW(I) = CUMIW(I-1) + 0.5 * FWA * AINJ * DT * 365.25 / UNIT
      CUMAW(I) = CUMIA(I)   + CUMIW(I)
C
C     ***** CALC OIL BURNED THIS STEP
      CUMOB(I) = CUMIA(I) / AFR
C
C     ***** VS = BURNED VOLUME, FRACTION OF PATTERN VOLUME
C     ***** VB = INCREMENTAL BURNED VOLUME, ACRE-FT.
      VS        = CUMIA(I) * UNIT / AR / (TNET * AREAP * 43560.)
      VB        = (CUMIA(I) - CUMIA(I-1)) * UNIT / AR / 43560.
C
C     ***** CALC OIL PRODUCTION USING FIT TO BRIGHAMS 2ND GRAPH
C     ***** CORRELATION EXTRAPOLATED TO 100 PCNT RECOVERY
C     ***** ASSUME NO INITIAL GAS SATURATION
C     ***** SWR = RESIDUAL WATER SATURATION AFTER BURN
C
      SWR       = 0.20
      X         = C1 * C2 * CUMAW(I) * UNIT
      DUMMY     = 0.581 * X**0.82
C
      CUMOIL(I) = OIP * 0.64 * ATAN(DUMMY)  - CUMOB(I)
C
C     ***** GAS PRODUCED = AIR INJECTED - GAS IN BURN VOLUME
C     ***** ASSUMES 800 DEG.R FOR BURN VOLUME AT PINJ
      CUMGAS(I) = CUMGAS(I-1) + (0.93 * AINJ * DT * 365.25
     1  - (1.-SWR*FWA) * 1.93 * VB * PINJ * POROS) / UNIT
      IF(CUMGAS(I) .LT. 0.0) CUMGAS(I) = 0.0
C
C     ***** WAT PRODUCED = WAT INJECTED - WATER IN BURN VOLUME
      CUMWAT(I) = CUMWAT(I-1) +  (FWA * AINJ * DT * 365.25
     1  + (1. - SWR*FWA - SOI) * VB * 7758. * POROS / BWI) / UNIT
      IF(CUMWAT(I) .LT. 0.0) CUMWAT(I) = 0.0
C
C     ***** CALC RATES AND RECOVERY AT THIS TIME
      AIRQ(I)  = (CUMIA(I)  - AIROLD) / (365.25*DT) * UNIT
      WATQ(I)  = (CUMIW(I)  - WATOLD) / (365.25*DT) * UNIT
      PROIL(I) = (CUMOIL(I) - OILOLD) / (365.25*DT) * UNIT
      PRGAS(I) = (CUMGAS(I) - GASOLD) / (365.25*DT) * UNIT
      PRWAT(I) = (CUMWAT(I) - WAPOLD) / (365.25*DT) * UNIT
      RECOV(I) = CUMOIL(I) / OIP
      FOSC(I)  = 0.0
      IF(CUMOIL(I).GT.0.0) FOSC(I)  = CUMIA(I) / CUMOIL(I)
      FOSI(I)  = PROIL(I)  / AIRQ(I)
      FRVS(I)  = VS
C
C     ***** SAVE OLD VALUES
      AIROLD   = CUMIA(I)
      WATOLD   = CUMIW(I)
      OILOLD   = CUMOIL(I)
      GASOLD   = CUMGAS(I)
      WAPOLD   = CUMWAT(I)
C
C     ***** CHECK IF DONE - VOLUME SWEPT (BURNED)
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      IF(VS .GE. SWEEP) GO TO 3000                                      COMB 152
C                                                                       COMB 153
  100 CONTINUE                                                          COMB 154
      OIP = OIP * FLOAT(NZONE)                                          COMB 155
      I = 200                                                           COMB 156
C                                                                       COMB 157
 3000 IJ1 = I                                                           COMB 158
      RETURN                                                            COMB 159
      END                                                               COMB 160
      SUBROUTINE OUTR                                                   OUTR   2
C                                                                       OUTR   3
C                                                                       OUTR   4
C-----------------------------------------------------------------------OUTR   5
C     COMMON STATEMENTS.                                                OUTR   6
C-----------------------------------------------------------------------OUTR   7
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                       FLAGS  5
      COMMON /RESVR/                                                    RESVR  2
     1 DEPTH,  PFORM,  TFORM,  TNET,                                    RESVR  3
     2 PERM,   POROS,  VISO,   VISW,   BOI,   BWI,                      RESVR  4
     3 AREA,   WELLSP, SOI,    SWI,    SGI,   BRNMX,                    RESVR  5
     4 OIP,    WIP,    GIP,    TOTOIL, TVP,   SWEEP,                   RESVR  6
     5 ARIN,   ARINJ,  PINJ,   WELLSI, HPP,   PDP,                     RESVR  7
     6 AREAP,  FWA,    OILBF,  PATVOL, AFR,   AR                       RESVR  8
C                                                                       RESVR  9
      COMMON /REPORT/                                                   REPORT 2
     1 CUMOIL(200), CUMGAS(200), CUMWAT(200), CUMOB(200),               REPORT 3
     2 CUMIA(200),  CUMIW(200),  CUMAW(200),  FOSC(200),   FOSI(200),   REPORT 4
     3 PROIL(200),  PRGAS(200),  PRWAT(200),  AIRQ(200),   WATQ(200),   REPORT 5
     4 TIME(200),   DTIME(200),  FRVS(200),   RECOV(200),               REPORT 6
     6 PRODS(200)                                                       REPORT 7
C                                                                       REPORT 8
C                                                                       OUTR  11
C-----------------------------------------------------------------------OUTR  12
C     ***** WRITE RESERVOIR RECOVERY AND PRODUCTION REPORTS             OUTR  13
C-----------------------------------------------------------------------OUTR  14
C                                                                       OUTR  15
      UNIT  = 1000.0                                                    OUTR  16
      WRITE(IW,9001)                                                    OUTR  17
 9001 FORMAT(1H1)                                                       OUTR  18
C                                                                       OUTR  19
      RECO = RECOV(IJ1)                                                 OUTR  20
      WRITE(IW,9075) PINJ, ARINJ, AR, AFR, FWA,                         OUTR  21
     1 SWEEP, PDP, HPP, OIP, AREAP, RECO                                OUTR  22
 9075 FORMAT(2X,14HPATTERN REPORT / 2X,14(1H-) /                        OUTR  23
     1 3X,35HINJECTION PRESSURE ................,F10.1,10H  PSIA     /  OUTR  24
     1 3X,35HAIR INJECTION RATE ................,F10.1,10H  MSCF/D   /  OUTR  25
     1 3X,35HAIR REQUIREMENT ...................,F10.4,10H  MSCF/FT3 /  OUTR  26
     1 3X,35HAIR / FUEL RATIO ..................,F10.1,10H  MSCF/STB /  OUTR  27
     1 3X,35HWATER / AIR RATIO .................,F10.1,10H  STB/MSCF /  OUTR  28
     1 3X,35HMAXIMUM VOLUME SWEPT ..............,F10.4, 8H  FRACTN   /  OUTR  29
     1 3X,35HDISCHARGE PRESSURE ................,F10.1,10H  PSIA     /  OUTR  30
     1 3X,35HCOMPRESSOR HORSEPOWER .............,F10.1,10H  HP       /  OUTR  31
     1 3X,35HINITIAL OIL IN PLACE/BURN ZONE ....,F10.1,10H  MSTB    /   LKT1  35
     1 3X,35HPATTERN AREA ......................,F10.2, 8H  ACRES    /  LKT1  36
     1 3X,35HOIL RECOVERY ......................,F10.4, 8H  FRACTN //)  OUTR  34
C                                                                       OUTR  35
      IF(IWRIT.LE.0) GO TO 900                                          OUTR  36
C                                                                       OUTR  37
C     ***** WRITE PATTERN REPORT                                        OUTR  38
      WRITE(IW,9101)                                                    OUTR  39
 9101 FORMAT(25X,54HCOMBUSTION PATTERN RECOVERY REPORT (FOR ONE BURN ZONLKT1  37
     1E) / 25X, 54(1H-)  )                                              LKT1  38
      WRITE(IW,9102)                                                    OUTR  42
 9102 FORMAT(                                                           OUTR  43
     1 5X, 110H  TIME  OIL RATE  CUM OIL  CUM WASTE CUM WATER  CUM AIR  OUTR  44
     1 CUM WATER  CUM RATIO  FRAC PAT   OIL RECV            /          LKT5   5
     2 5X, 110H YEARS    STB/D  PROD,MSTB GAS,MMSCF PROD,MSTB INJ,MMSCF OUTR  46
     2  INJ,MSTB   AIR/OIL  VOL BURNED  FRACTION            /          LKT5   6
     3 5X, 110H -----  -------- --------- --------- --------- --------- OUTR  48
     3 ---------  ---------  --------   --------            )          OUTR  49
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      DO 150 I=1,IJ1                                                    OUTR  50
      WRITE(IW,9103) I,TIME(I),PROIL(I),CUMOIL(I),CUMGAS(I),CUMWAT(I),  OUTR  51
     1 CUMIA(I), CUMIW(I), FOSC(I), FRVS(I), RECOV(I)                   OUTR  52
 9103 FORMAT(1X,I3,F7.2,F9.1,F10.0, 1X,2F10.0, F9.0, 1X,F10.0,          OUTR  53
     1 F10.2, 1X,F10.4, 1X,F10.4 )                                      OUTR  54
  150 CONTINUE                                                          OUTR  55
C                                                                       OUTR  56
C     ***** PRODUCTION/INJECTION REPORT                                 OUTR  57
      WRITE(IW,9001)                                                    OUTR  58
  900 WRITE(IW,9901)                                                    OUTR  59
 9901 FORMAT(15X,55HPATTERN PRODUCTION/INJECTION REPORT (FOR ONE BURN ZOLKT1  39
     1NE) / 15X, 55(1H-) /)                                             LKT1  40
      WRITE(IW,9902)                                                    OUTR  62
 9902 FORMAT(                                                           OUTR  63
     1 6X,  80H  TIME    OIL    WASTE GAS  WATER PROD  AIR INJ  WAT INJ LKT5   7
     1  CUM OIL   RECOVERY            /                                 OUTR  65
     2 6X,  80H YEARS   STB/D     MSCF/D     STB/D     MSCF/D    STB/D  OUTR  66
     2    MBBL    FRACTION           /                                 OUTR  67
     3 6X,  80H -----  -------  ---------  ---------  --------  ------- OUTR  68
     3 ---------  --------            )                                 OUTR  69
      DO 950 I=1,IJ1                                                    OUTR  70
      WRITE(IW,9903) I,TIME(I),PROIL(I),PRGAS(I),PRWAT(I),AIRQ(I),      OUTR  71
     1 WATQ(I), CUMOIL(I),RECOV(I)                                      OUTR  72
 9903 FORMAT(1X,I3,F8.2, F9.1, F10.1, 1X,2F10.1, F9.1,                  OUTR  73
     1 2X,F9.1, 2X,F9.4, 2X,F9.1, 2X,F9.1 )                             OUTR  74
  950 CONTINUE                                                          OUTR  75
C                                                                       OUTR  76
      RETURN                                                            OUTR  77
      END                                                               OUTR  78
      SUBROUTINE FVF(TEMP,PRES,BO,BW)                                   FVF    2
C                                                                       FVF    3
      COMMON /FPROP/                                                    FPROP  2
     * API, RS, VIS80, VIS100, VIS210, VIS1, VIS2, SGO, SGW, SGG,       FPROP  3
     1 BB(42)                                                           FPROP  4
C                                                                       FPROP  5
C                                                                       FVF    5
C-----------------------------------------------------------------------FVF    6
C *******  ESTIMATE OIL, GAS AND WATER FORMATION VOLUME FACTORS         FVF    7
C-----------------------------------------------------------------------FVF    8
C                                                                       FVF    9
C     ESTIMATE OIL VOLUME FACTORS                                       FVF   10
C       REF: VAZQUEZ & BEGGS,JPT (6/1980) PG. 968-970                   FVF   11
C       CORRELATIONS FOR UNDERSATURATED OILS USED                       FVF   12
C                                                                       FVF   13
      RSS = RS                                                          FVF   14
      IF(API.GT.30.0) GO TO 670                                         FVF   15
      C1=4.677E-4                                                       FVF   16
      C2=1.751E-5                                                       FVF   17
      C3=-1.811E-8                                                      FVF   18
      GO TO 680                                                         FVF   19
  670 C1=4.67E-4                                                        FVF   20
      C2=1.1E-5                                                         FVF   21
      C3=1.337E-9                                                       FVF   22
C                                                                       FVF   23
C     ***** CALC BO IN UNITS OF RES BBLS/STB                            FVF   24
  680 IF(TEMP.LT.60.) TEMP = 60.                                        FVF   25
      BO = 1.0+C1*RS+(C2+C3*RS)*(TEMP-60.0)*(API/SGG)                   FVF   26
C                                                                       FVF   27
C     ***** BW IN UNITS OF RES BBLS/STB                                 FVF   28
      BW = 1.0+1.2E-4*(TEMP-60.0)+1.E-6*(TEMP-60.0)**2.0                FVF   29
     &            -3.33E-6*PRES                                         FVF   30
C                                                                       FVF   31
C     ***** CALC DENSITIES                                              FVF   32
      RHOIL = 62.4*SGO/BO                                               FVF   33
      RHWAT = 62.4*SGW/BW                                               FVF   34
      RS    = RSS                                                       FVF   35
C                                                                       FVF   36
      RETURN                                                            FVF   37
      END                                                               FVF   38
      SUBROUTINE VISC(PRES,TEMP,VISO,VISW)                              VISC   2
C                                                                       VISC   3
      COMMON /FPROP/                                                    FPROP  2
     * API, RS, VIS80, VIS100, VIS210, VIS1, VIS2, SGO, SGW, SGG,       FPROP  3
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     1 BB(42)                                                           FPROP  4
C                                                                       FPROP  5
C                                                                       VISC   5
C-----------------------------------------------------------------------VISC   6
C     ***** THIS SUBROUTINE CALCULATES THE VISCOSITY OF                 VISC   7
C     ***** OIL AND WATER                                               VISC   8
C-----------------------------------------------------------------------VISC   9
C                                                                       VISC  10
C     ***** OIL VISCOSITY CALCULATION AT CONSTANT COMPOSITION           VISC  11
C                                                                       VISC  12
      YINT=1.0                                                          VISC  13
      SLOPE=1.0                                                         VISC  14
      IF(TEMP.LE.0.) RETURN                                             VISC  15
      IF(VIS100.LE.0.) GO TO 300                                        VISC  16
      VIS = VIS100*(TEMP/100.)**(1.345*ALOG(VIS210/VIS100))             VISC  17
C                                                                       VISC  18
      YINT = 1. - (0.0025 * RS)                                         VISC  19
      SLOPE = 1.0 - (0.00175 * RS)                                      VISC  20
      IF(RS.LT.20.) GO TO 140                                           VISC  21
      IF(RS.GE.100.) GO TO 138                                          VISC  22
      YINT = BB(13) * RS + BB(14) + (( (BB(18)/RS + BB(17)) / RS        VISC  23
     1 + BB(16)) / RS  + BB(15)) / RS                                   VISC  24
      SLOPE = BB(25) * RS + BB(26) + BB(27) / RS + BB(28) / RS ** 2     VISC  25
     1 + BB(29) / RS **3 + BB(30) / RS ** 4                             VISC  26
      GO TO 140                                                         VISC  27
  138 CONTINUE                                                          VISC  28
      YINT = BB(19) * RS + BB(20) + BB(21) / RS + BB(22) / RS ** 2      VISC  29
     1 + BB(23) / RS ** 3 + BB(24) / RS ** 4                            VISC  30
      SLOPE = BB(31) * RS + BB(32) + BB(33) / RS + BB(34) / RS ** 2     VISC  31
     1 +BB(35) / RS ** 3 + BB(36) / RS ** 4                             VISC  32
  140 VISO = YINT * (VIS**SLOPE)                                        VISC  33
C                                                                       VISC  34
C     ***** CHECK MINIMUM OIL VISCOSITY OF 0.2 CPS                      VISC  35
 300  IF(VISO .LT. 0.2) VISO = 0.2                                      VISC  36
C                                                                       VISC  37
C                                                                       VISC  38
C     CALCULATE WATER VISCOSITY                                         VISC  39
      TAV = TEMP                                                        VISC  40
      VISW = BB(37)*TAV + BB(38) + (( (BB(42)/TAV + BB(41))/TAV         VISC  41
     1 + BB(40))/TAV + BB(39))/TAV                                      VISC  42
C                                                                       VISC  43
      RETURN                                                            VISC  44
      END                                                               VISC  45
      FUNCTION SDINT (XARG,YARG,N,XVAL)                                 SDINT  2
C     ***** SINGLE DIMENSIONAL LINEAR INTERPOLATION                     SDINT  3
      DIMENSION XARG(200), YARG(200)                                    SDINT  4
C                                                                       SDINT  5
      THESIN=1.                                                         SDINT  6
      IF(XARG(1).GE.XARG(N)) THESIN=-1.                                 SDINT  7
C                                                                       SDINT  8
C     ***** SEARCH FOR BOUNDING TABLE VALUES                            SDINT  9
      DO 10 I=1,N                                                       SDINT 10
      J = I                                                             SDINT 11
      IF( (THESIN*XARG(I)) - (THESIN*XVAL) ) 10,15,16                   SDINT 12
   10 CONTINUE                                                          SDINT 13
C                                                                       SDINT 14
   15 SDINT = YARG(J)                                                   SDINT 15
      RETURN                                                            SDINT 16
C                                                                       SDINT 17
   16 IF(J.LE.1) GO TO 15                                               SDINT 18
      SLOPE = (YARG(J)-YARG(J-1))/(XARG(J)-XARG(J-1))                   SDINT 19
      SDINT = YARG(J) - SLOPE*(XARG(J)-XVAL)                            SDINT 20
      RETURN                                                            SDINT 21
      END                                                               SDINT 22
      SUBROUTINE INEC (ITIM,PRICEI,FDC,FEQP,FOPR,FUEL,FACT)             LKT7   6
C                                                                       INEC   3
C                                                                       INEC   4
C-----------------------------------------------------------------------INEC   5
C     COMMON STATEMENTS.                                                INEC   6
C-----------------------------------------------------------------------INEC   7
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
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C                                                                       FLAGS  5
      COMMON /ECI/ M,MYR,IOUT,ISTATE,IDIST,IFIT,IDISC,IFUL,ISO,IDEP,    ECI    2
     1 PCTDBT, DBTINT, NYRRPY, NYPAID, IDEBT,                           ECI    3
     1 CCOST,  GTRT,   WTRT,   CTACR, DCE,  PLANT,                      ECI    4
     1 WOCOST, WTCOST, WDCOST,COSTML,COSTTI,                            ECI    5
     1 WCAP,   UNCO,   WPP,    COSTRT, FOCPL, FOCPM, FOCPH,             ECI    6
     1 WPP1,   WPP2,   WPP3,   WPP4,  POBASE, OILB, OILC, DECL,         ECI    7
     1 XDR,    XINF,   XROY,   XSEV,  XWPT, XFIT, XTCR, DTIM, XSTX,     ECI    8
     1 WPHO,   EPHO,   BTIM,   BPOW,                                    ECI    9
     1 ESCPO,  ESCPG,  ESCPF, ESCFO, ESCED,                             ECI   10
     1 ESCCT,  ESCCI,  ESCWO, ESCWT, ESCWI, ESCBP,                      ECI   11
     1 OILR(50), VOS(50),                                               ECI   12
     1 POL(50),  POM(50),  POH(50), PGL(50), PGM(50),  PGH(50),         ECI   13
     2 FOCL(50), FOCM(50), FOCH(50),OPCL(50),OPCM(50), OPCH(50),        ECI   14
     3 EDPL(50), EDPM(50), EDPH(50),WTC(50), WDC(50),  CML(50),         ECI   15
     4 CTPL(50), CTPM(50), CTPH(50),CIPL(50),CIPM(50), CIPH(50),        ECI   16
     4 CTCL(50), CTCM(50), CTCH(50),CICL(50),CICM(50), CICH(50),        ECI   17
     5 VOL(50),  VOM(50),  VOH(50), WO(50),  BPO(50),  CTI(50),         ECI   18
     6 VGM(50),  VWM(50),  VIM(50), GNUM(50),GENC(50), TITL(20),        ECI   19
     6 QHM(50),  VHM(50),  VDM(50), QHP(50), VHP(50),                   ECI   20
     7 VOP(50),  VGP(50),  VWP(50), VIP(50), PATI(50), PATIOX(50)       ECI   21
C                                                                       ECI   22
      COMMON /ECC/                                                      ECC    2
     1 MUVO(50), MUVG(50), MUVW(50), MUVI(50),                          ECC    3
     1 MUPO(50), MUPG(50), MUWO(50),                                    ECC    4
     2 MUFO(50), MUOPC(50),MUED(50), MUCT(50), MUCI(50),                ECC    5
     2 MUDB(50), MURP(50), MUIN(50), MUPB(50),                          ECC    6
     3 SIGVO(50),SIGPO(50),SIGPG(50),SIGPF(50),SIGFO(50),               ECC    7
     4 SIGED(50),SIGCT(50),SIGCI(50),SIGOPC(50)                         ECC    8
      REAL                                                              ECC    9
     1 MUVO,MUVG,MUVW,MUVI,MUDB,MURP,MUIN,MUPB,                         ECC   10
     2 MUPO,MUPG,MUFO,MUED,MUWO,MUCT,MUCI,                              ECC   11
     3 MUOPC                                                            ECC   12
C                                                                       ECC   13
      COMMON /ECS/                                                      ECS    2
     1 SUMVOM, COSR,  TOTD, SUMCI, SVOS, SVGS, SVPS, SVIS, SUMWT,       ECS    3
     1 CINJ,   CEQP,  CSEC, CNVT,  CREP, CDAO, CIWO,                    ECS    4
     1 URPV,   UNOS,  USEV, USFO, USOPC, USED, USWO, USTO,              ECS    5
     1 UWCAP,  USWT,  USWD, USOH,  USTC, USCI, UCFB, USML, USTI,        ECS    6
     1 UWPT,   USIT,  UFIT, UATP,  UINT, ULOAN,SINT, SPRP,              ECS    7
     2 SRPV,   SNOS,  SSEV, SUMFO,SUMOPC,SUMED,SUMWO,SUMWD,             ECS    8
     2 SUMOH,  SUMML, SUMTI, DCFB,                                      ECS    9
     3 MUPPV, STDDEV, PAYOUT, PLIFE, ROR,  CC,                          ECS   10
     4 SUMIN,  SUMWC, DNB, SVON, EFFINV                                 ECS   11
C                                                                       ECS   12
      REAL MUPPV                                                        ECS   13
C                                                                       ECS   14
      COMMON /ECO/                                                      ECO    2
     1 DATE(50), VOSLD(50),VONET(50),AOVH(50),  AOVH1,                  ECO    3
     1 VGNET(50),AREVO(50),AREVG(50),ARVWPT(50),AREV(50),               ECO    4
     2 AROY(50), ANET(50), ASEV(50), AWTC(50),  AWDC(50),               ECO    5
     2 ACML(50), ATIN(50), AINJ(50),                                    ECO    6
     3 AFOC(50), AVOC(50), AEDP(50), ACOST(50), ACAP(50),               ECO    7
     4 AWPP(50), ANIP(50), TXCR(50), DEPS(50),  AWCP(50),               ECO    8
     4 AQOR(50), AQGR(50), AQWR(50), AQIR(50),                          ECO    9
     5 ANOI(50), ASTX(50), AWPT(50), ANTI(50),  AFIT(50), ATPR(50),     ECO   10
     6 CFAT(50), CDAT(50), DCFAT(50),PVDF(50),  CNOI(50),               ECO   11
     7 CFBT(50), CDBT(50), DCFBT(50)                                    ECO   12
C                                                                       ECO   13
      COMMON /RESVR/                                                    RESVR  2
     1 DEPTH,  PFORM,  TFORM,  TNET,                                    RESVR  3
     2 PERM,   POROS,  VISO,   VISW,   BOI,   BWI,                      RESVR  4
     3 AREA,   WELLSP, SOI,    SWI,    SGI,   BRNMX,                    RESVR  5
     4 OIP,    WIP,    GIP,    TOTOIL, TVP,   SWEEP,                    RESVR  6
     5 ARIN,   ARINJ,  PINJ,   WELLSI, HPP,   PDP,                      RESVR  7
     6 AREAP,  FWA,    OILBF,  PATVOL, AFR,   AR                        RESVR  8
C                                                                       RESVR  9
      COMMON /REPORT/                                                   REPORT 2
     1 CUMOIL(200), CUMGAS(200), CUMWAT(200), CUMOB(200),               REPORT 3
     2 CUMIA(200),  CUMIW(200),  CUMAW(200),  FOSC(200),   FOSI(200),   REPORT 4
     3 PROIL(200),  PRGAS(200),  PRWAT(200),  AIRQ(200),   WATQ(200),   REPORT 5
     4 TIME(200),   DTIME(200),  FRVS(200),   RECOV(200),               REPORT 6
     6 PRODS(200)                                                       REPORT 7
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C                                                                       REPORT 8
      COMMON /FPROP/                                                    FPROP  2
     * API, RS, VIS80, VIS100, VIS210, VIS1, VIS2, SGO, SGW, SGG,       FPROP  3
     1 BB(42)                                                           FPROP  4
C                                                                       FPROP  5
C                                                                       INEC  16
C***********************************************************************INEC  17
C                                                                       INEC  18
C                                                                       INEC  19
C     CAPITAL COSTS                                                     INEC  20
C     -------------                                                     INEC  21
C     CCOST  - AIR COMPRESSORS COST,            $/HP                    INEC  22
C     GTRT   - WASTE GAS TREATMENT COST,        $/MSCF/D                INEC  23
C     WTRT   - WATER TREATMENT COST,            $/BBL/D                 INEC  24
C     CTACR  - AIR DIST, VAP REC, AND SURFACE   $/ACRE                  INEC  25
C     DCE    - WELL DRILLING/COMPLETION/EQUIP   $/FOOT                  INEC  26
C     PLANT  - CENTRAL PLANT FACILITIES COST,   $/STB/D                 INEC  27
C                                                                       INEC  28
C     OPERATING COSTS                                                   INEC  29
C     ---------------                                                   INEC  30
C     WOCOST - WELL WORKOVER COST               $/WELL                  INEC  31
C     WTCOST - PRODUCED WATER TREATING COST,    $/BBL                   INEC  32
C     WDCOST - WATER DISPOSAL COST,             $/BBL                   INEC  33
C     COSTML - MAINTENANCE AND LABOR COST,      $/MSCF                  INEC  34
C     COSTTI - TECHNICIAN AND INSTRUMENT COST,  $/MSCF                  LKT1  41
C                                                                       INEC  36
C     CASE VARIABLES                                                    INEC  37
C     --------------                                                    INEC  38
C     MYR    - NUMBER OF YEARS OF PRODUCTION                            INEC  39
C     WCAP   - NUMBER OF MONTHS WORKING CAPITAL                         INEC  40
C     UNCO   - OIL RATE UNCERTAINTY                                     INEC  41
C     WPP    - NUMBER OF WELLS DRILLED PER PATTERN (=2 FOR FULL 5-SPOT) INEC  42
C     XDR    - DISCOUNT RATE                                            INEC  43
C     XINF   - INFLATION RATE                                           INEC  44
C     XROY   - ROYALTY RATE                                             INEC  45
C     XSEV   - SEVERANCE TAX RATE                                       INEC  46
C     XFIT   - FEDERAL INCOME TAX RATE                                  INEC  47
C     XTCR   - INVESTMENT TAX CREDIT RATE                               INEC  48
C     XSTX   - STATE INCOME TAX RATE                                    INEC  49
C     XWPT   - WINDFALL PROFIT TIER I TAX RATE                          INEC  50
C     WPHO   - WPT STARTING PHASE OUT DATE                              INEC  51
C     BTIM   - BASE TIME FOR PROJECT START                              INEC  52
C     BPOW   - BASE PRICE OF OIL FOR WPT, $/BBL                         INEC  53
C     PCTDBT - PERCENT OF TOTAL TANGIBLE AND INTANGIBLE COSTS           INEC  54
C              THAT WILL BE BORROWED                                    INEC  55
C     DBTINT - DEBT INTEREST RATE                                       INEC  56
C     NYRRPY - STARTING YEAR OF PRINCIPAL REPAYMENT                     INEC  57
C     NYPAID - LAST YEAR OF ANY PRINCIPAL REPAYMENT ON LOANS            INEC  58
C     ESCPO  - ESCALATION OF OIL PRICE                                  INEC  59
C     ESCED  - ESCALATION OF ELECTRIC DRIVER OP COST                    INEC  60
C     ESCFO  - ESCALATION OF FIXED OPERATING COSTS                      INEC  61
C     WPP1   - INJECTION WELLS DRILLED PER PATTERN                      INEC  62
C     WPP2   - PRODUCTION WELLS DRILLED PER PATTERN                     INEC  63
C     WPP3   - PRIMARY PRODUCERS CONVERTED TO SECONDARY PRODUCERS PER   INEC  64
C              PATTERN                                                  INEC  65
C     WPP4   - PRODUCERS CONVERTED TO INJECTORS PER PATTERN             INEC  66
C                                                                       INEC  67
C     PRICE AND COST VARIABLES                                          INEC  68
C     ------------------------                                          INEC  69
C     IN ALL OF THE FOLLOWING ARRAYS, THE LAST LETTER (H,M, OR L) MEANS INEC  70
C     HIGH, MOST-LIKELY OR LOW VALUES FOR THE PARAMETERS IN A GIVEN YEARINEC  71
C     THE HIGH AND LOW VALUES SHOULD BE CHOSEN TO REPRESENT A CONFIDENCEINEC  72
C     LEVEL OF 80 PERCENT. LOW PRICE HAS 90% CHANCE BEING OBTAINED, AND INEC  73
C     HIGH PRICE HAS ONLY 10% CHANCE OF BEING REACHED.                  INEC  74
C                                                                       INEC  75
C     POL  - PRICE OF OIL , LOW                                         INEC  76
C     POM  - PRICE OF OIL , MOST-LIKELY ,  $/BBL                        INEC  77
C     POH  - PRICE OF OIL , HIGH                                        INEC  78
C     FOCM - FIXED OPERATING COSTS , MOST-LIKELY , $/YR                 LKT1  42
C            NOTE: INCLUDES MAINTENANCE, ETC THAT DO NOT                INEC  80
C                  DEPEND ON OIL RATE                                   INEC  81
C     OPCM - OPERATING VARIABLE COSTS , MOST-LIKELY , $/BBL             INEC  82
C            NOTE: INCLUDES LIFTING AND OTHER COSTS THAT DEPEND ON      INEC  83
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C                    OIL PRODUCTION DIRECTLY, BUT NOT ROYALTY OR SEVERANCEINEC  84
C     EDPM - COMPRESSOR ELECTRIC DRIVE COST , MOST-LIKELY , $/KWHR       INEC  85
C            NOTE: COST BASED ON 94 PCNT DRIVE EFFIC AND $0.07/KWHR      INEC  86
C     CTCM - CAPITAL TANGIBLE COSTS , MOST-LIKELY                        INEC  87
C            NOTE: FLOW LINES, WELLS, ROADS, AND PRODUCTION              INEC  88
C                  FACILITIES,  BUT NOT COMPRESSORS.                     INEC  89
C     CICM - CAPITAL INTANGIBLE COSTS , MOST-LIKELY                      INEC  90
C            NOTE: CAPITAL EXPENSED IN GIVEN YEAR                        INEC  91
C     VOM  - OIL PRODUCTION , MOST LIKELY , STB/YEAR                     INEC  92
C     VOM  - WASTE GAS PRODUCTION , MOST LIKELY , MMSCF/YEAR             INEC  93
C     VWM  - WTR PRODUCTION , MOST LIKELY , STB/YEAR                     INEC  94
C     VIM  - AIR INJECTED ,  MOST LIKELY , MMSCF/YEAR                    INEC  95
C     VHM  - WATER INJECTED , MOST LIKELY , STB/YEAR                     INEC  96
C     VDM  - WATER DISPOSAL , MOST LIKELY , STB/YEAR                     INEC  97
C                                                                        INEC  98
C     OTHER VARIABLES                                                    INEC  99
C     ---------------                                                    INEC 100
C     TOTD  - TOTAL CAPITAL INVESTMENT                                   INEC 101
C     MUPPV - MEAN OF THE DISCOUNTED CASH FLOW                           INEC 102
C     STDDEV- STD DEVIATION OF THE DISCOUNTED CASH FLOW                  INEC 103
C     PAYOUT- YEARS REQUIRED FOR PAYOUT                                  INEC 104
C     RPI   - PROFIT/INVESTMENT RATIO                                    INEC 105
C     ROR   - DCF RATE OF RETURN                                         INEC 106
C                                                                        INEC 107
      COS = 0.                                                           INEC 108
      CGS = 0.                                                           INEC 109
      CWS = 0.                                                           INEC 110
      CIS = 0.                                                           INEC 111
      CHS = 0.                                                           INEC 112
C                                                                        INEC 113
C     INITIALIZE ECONOMIC ARRAYS FOR MULTIPLE PROCESSING                 INEC 114
C                                                                        INEC 115
      PCTDBT = 0.0                                                      LKT2  51
      DBTINT = 0.0                                                      LKT2  52
      NYRRPY = 0                                                        LKT2  53
      NYPAID = 0                                                        LKT2  54
      DO 19 K=1,50                                                       INEC 116
      MUVO(K) = 0.0                                                      INEC 117
      MUVG(K) = 0.0                                                      INEC 118
      MUVW(K) = 0.0                                                      INEC 119
      MUVI(K) = 0.0                                                      INEC 120
      MUPO(K) = 0.0                                                      INEC 121
      MUPG(K) = 0.0                                                      INEC 122
      MUWO(K) = 0.0                                                      INEC 123
      MUFO(K) = 0.0                                                      INEC 124
      MUOPC(K) = 0.0                                                     INEC 125
      MUED(K) = 0.0                                                      INEC 126
      MUCT(K) = 0.0                                                      INEC 127
      MUCI(K) = 0.0                                                      INEC 128
      MUDB(K) = 0.0                                                      INEC 129
      MURP(K) = 0.0                                                      INEC 130
      MUIN(K) = 0.0                                                      INEC 131
      MUPB(K) = 0.0                                                      INEC 132
      SIGVO(K) = 0.0                                                     INEC 133
      SIGPO(K) = 0.0                                                     INEC 134
      SIGPG(K) = 0.0                                                     INEC 135
      SIGPF(K) = 0.0                                                     INEC 136
      SIGFO(K) = 0.0                                                     INEC 137
      SIGED(K) = 0.0                                                     INEC 138
      SIGCT(K) = 0.0                                                     INEC 139
      SIGCI(K) = 0.0                                                     INEC 140
      SIGOPC(K) = 0.0                                                    INEC 141
 19   CONTINUE                                                           INEC 142
      DO 10 I=1,50                                                       INEC 143
      VOL(I) = 0.0                                                       INEC 144
      VOM(I) = 0.0                                                       INEC 145
      VOH(I) = 0.0                                                       INEC 146
      VGM(I) = 0.0                                                       INEC 147
      VWM(I) = 0.0                                                       INEC 148
      VIM(I) = 0.0                                                       INEC 149
      QHM(I) = 0.0                                                       INEC 150
      VHM(I) = 0.0                                                       INEC 151
      VDM(I) = 0.0                                                       INEC 152
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      FOCL(I) = 0.0                                                     INEC 153
      FOCM(I) = 0.0                                                     INEC 154
      FOCH(I) = 0.0                                                     INEC 155
      CTCL(I) = 0.0                                                     INEC 156
      CTCM(I) = 0.0                                                     INEC 157
      CTCH(I) = 0.0                                                     INEC 158
      CICL(I) = 0.0                                                     INEC 159
      CICM(I) = 0.0                                                     INEC 160
      CICH(I) = 0.0                                                     INEC 161
      CTPL(I) = 0.0                                                     INEC 162
      CTPM(I) = 0.0                                                     INEC 163
      CTPH(I) = 0.0                                                     INEC 164
      CIPL(I) = 0.0                                                     INEC 165
      CIPM(I) = 0.0                                                     INEC 166
      CIPH(I) = 0.0                                                     INEC 167
      GENC(I) = 0.0                                                     INEC 168
      WO(I)   = 0.0                                                     INEC 169
      OILR(I) = 0.0                                                     INEC 170
      VOS(I)  = 0.0                                                     INEC 171
      POL(I) = 0.0                                                      INEC 172
      POM(I) = 0.0                                                      INEC 173
      POH(I) = 0.0                                                      INEC 174
      PGL(I) = 0.0                                                      INEC 175
      PGM(I) = 0.0                                                      INEC 176
      PGH(I) = 0.0                                                      INEC 177
      FOCL(I) = 0.0                                                     INEC 178
      FOCM(I) = 0.0                                                     INEC 179
      FOCH(I) = 0.0                                                     INEC 180
      OPCL(I) = 0.0                                                     INEC 181
      OPCM(I) = 0.0                                                     INEC 182
      OPCH(I) = 0.0                                                     INEC 183
      EDPL(I) = 0.0                                                     INEC 184
      EDPM(I) = 0.0                                                     INEC 185
      EDPH(I) = 0.0                                                     INEC 186
      AOVH(I) = 0.0                                                     INEC 187
      VOP(I) = 0.0                                                      INEC 188
      VGP(I) = 0.0                                                      INEC 189
      VWP(I) = 0.0                                                      INEC 190
      VIP(I) = 0.0                                                      INEC 191
      VHP(I) = 0.0                                                      INEC 192
      PATI(I) = 0.0                                                     INEC 193
      QHP(I) = 0.0                                                      INEC 194
      PATIOX(I) = 0.0                                                   INEC 195
   10 CONTINUE                                                          INEC 196
C***********************************************************************INEC 197
C                                                                       INEC 198
C     ***** PRINT TITLE OF ECONOMIC ANALYSIS                            INEC 199
      UNIT = 1000.                                                      INEC 200
      CALL TITL(TITL)                                                   LKT5   8
C                                                                       INEC 202
C-----------------------------------------------------------------------INEC 203
C     ***** READ CASE INPUT DATA AND CHECK FOR DEFAULTS                 INEC 204
C-----------------------------------------------------------------------INEC 205
C                                                                       INEC 206
C   CARD E2 ***** READ CASE CONTROLS                                    INEC 207
      READ(IR,*) M,ISTATE,IDIST,IOUT,IFIT,IDAT,NCT,NCI,                 INEC 208
     *           IDISC,ISO,IDEBT                                        INEC 209
C                                                                       INEC 210
C   CARD E3 ***** READ DEBT CONTROLS (READ IF IDEBT .NE. 0)             INEC 211
      IF(IDEBT .NE. 0) READ(IR,*) PCTDBT,DBTINT,NYRRPY,NYPAID           INEC 212
C                                                                       INEC 213
C   CARD E4 ***** READ CAPITAL COST DATA                                INEC 214
      READ(IR,*) CCOST, GTRT, WTRT, CTACR, DCE, PLANT                   INEC 215
C                                                                       INEC 216
C   CARD E5 ***** READ OPERATING DATA                                   INEC 217
      READ(IR,*) WOCOST,WTCOST,WDCOST,COSTML,COSTTI                     INEC 218
C                                                                       INEC 219
C   CARD E6 ***** READ OPERATING DATA                                   INEC 220
      READ(IR,*) WCAP,COSTRT,UNCO                                       INEC 221
C                                                                       INEC 222
C   CARD E7 ***** READ WELL DATA                                        INEC 223
      READ(IR,*) WPP1, WPP2, WPP3, WPP4                                 LKT5   9
C                                                                       INEC 226
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C     CARD E8 ***** READ TAXES AND ESCALATION FACTORS                    LKT3  17
        READ(IR,*) XDR,XINF,XROY,XSEV,XFIT,XTCR,DTIM,XSTX                INEC 228
C                                                                        INEC 229
C     CARD E9 ***** READ WINDFALL EXCISE TAX DATA                        INEC 230
        READ(IR,*) XWPT,WPHO,EPHO,BTIM,BPOW                              INEC 231
C                                                                        INEC 232
C       IF ISO SET TO 1, READ SECONDARY PRODUCTION CURVE (VOS, MB/YR),   INEC 233
C      OTHERWISE USE DECLINE DATA TO CONSTRUCT A SECONDARY CURVE UNLESS  INEC 234
C      BASE PERIOD PRODUCTION RATE (OILB) SET TO ZERO                    INEC 235
C                                                                        INEC 236
C     CARD E10 ***** READ SECONDARY PRODUCTION DATA                      INEC 237
        READ(IR,*) OILB, OILC, DECL                                      INEC 238
        IF(ISO .EQ. 1) READ(IR,*) (VOS(I), I=1,M)                        INEC 239
C                                                                        INEC 240
C     CARD E12 ***** READ ESCALATION DATA                                LKT1  43
        READ(IR,*) ESCPO,ESCFO,ESCED,                                    INEC 242
       1       ESCCT,ESCCI,ESCWO                                         INEC 243
C                                                                        INEC 244
C     CARD E13 ***** PROJECT PATTERN SCHEDULE                            LKT1  44
        READ(IR,*) (PATI(I), I=1,M)                                      INEC 246
C                                                                        INEC 247
        IF(IDAT.LE.0) GO TO 35                                           INEC 253
C                                                                        INEC 254
C     CARD E14 ***** READ OIL PRICE DATA                                 LKT3  18
        READ(IR,*) POL(1),POM(1),POH(1)                                  INEC 256
C                                                                        INEC 257
C     CARD E15 ***** READ FIXED ANNUAL OPERATING COST DATA               LKT3  19
        READ(IR,*) FOCL(1),FOCM(1),FOCH(1)                               INEC 259
C                                                                        INEC 260
C     CARD E16 ***** READ VARIABLE ANNUAL OPERATING COST DATA            LKT3  20
        READ(IR,*) OPCL(1),OPCM(1),OPCH(1)                               INEC 262
C                                                                        INEC 263
C     CARD E17 ***** READ ELECTRIC DRIVER OPERATING COST DATA            LKT3  21
        READ(IR,*) EDPL(1),EDPM(1),EDPH(1)                               INEC 265
C                                                                        INEC 266
C     CARD E18 ***** READ TANGIBLE INVESTMENT SCHEDULE                   LKT3  22
   35 IF(NCT.LE.0) GO TO 44                                              INEC 268
        DO 40 I=1,NCT                                                    INEC 269
   40 READ(IR,*) ICT,CTPL(ICT),CTPM(ICT),CTPH(ICT)                       INEC 270
   44 IF(NCI .LE. 0) GO TO 50                                            INEC 271
C                                                                        INEC 272
C     CARD E19 ***** READ INTANGIBLE INVESTMENT SCHEDULE                 LKT3  23
        DO 45 I=1,NCI                                                    INEC 274
   45 READ(IR,*) ICI,CIPL(ICI),CIPM(ICI),CIPH(ICI)                       INEC 275
C                                                                        INEC 276
   50 CONTINUE                                                           INEC 277
C                                                                        INEC 278
C       ***** COMPUTE ANNUAL PATTERN VOLUMES                             INEC 279
        DO 100 I=1,M                                                     INEC 280
        YR = I                                                           INEC 281
        CO = SDINT(TIME,CUMOIL,ITIM,YR)                                  INEC 282
        CG = SDINT(TIME,CUMGAS,ITIM,YR)                                  INEC 283
        CW = SDINT(TIME,CUMWAT,ITIM,YR)                                  INEC 284
        CI = SDINT(TIME,CUMIA, ITIM,YR)                                  INEC 285
        CH = SDINT(TIME,CUMIW, ITIM,YR)                                  INEC 286
C       ***** ANNUAL PRODUCTION VOLUMES, MB/YR/PATTERN                   INEC 287
        VOP(I) = CO-COS                                                  INEC 288
        VGP(I) = CG-CGS                                                  INEC 289
        VWP(I) = CW-CWS                                                  INEC 290
C       ***** ANNUAL INJECTION VOLUME, MMSCF/YR/PATTERN                  INEC 291
        VIP(I) = CI-CIS                                                  INEC 292
        VHP(I) = CH-CHS                                                  INEC 293
C       ***** ANNUAL COMPRESSOR HORSEPOWER, KW-HR - PATTERN              INEC 294
        DEFF   = 0.94                                                    INEC 295
        QHP(I) = HPP*365.*24./DEFF*0.746                                 INEC 296
C                                                                        INEC 297
        CHS = CH                                                         INEC 298
        COS = CO                                                         INEC 299
        CGS = CG                                                         INEC 300
        CWS = CW                                                         INEC 301
  100 CIS = CI                                                           INEC 302
C                                                                        INEC 303
C       ***** CHECK FOR DEFAULT VALUES                                   INEC 304
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      PRICEI = POM(1)                                                   LKT7   7
      IF(PRICEI .LE. 0.0) PRICEI = 30.00                                LKT7   8
      CALL ECFTR(PRICEI,FDC,FEQP,FOPR,FUEL,FACT,ISTATE)                 LKT7   9
      CALL CHEKE(ITIM,NCT,NCI,DEPTH,AREAP,API)                          INEC 308
C                                                                       INEC 309
C     ***** WRITE CASE CONDITIONS                                       INEC 310
      WRITE(IW,9350)                                                    INEC 311
 9350 FORMAT(/ 2X,13HECONOMIC DATA / 2X, 13(1H-) )                      INEC 312
      CALL STCDE (JST,ISTATE)                                           LKT1  52
      WSUM = WPP1 + WPP2 + WPP3 + WPP4                                  LKT4   5
      IF ( WSUM .EQ. 0 ) GO TO 9012                                     LKT4   6
      WRITE(IW,9351) M,JST,IDIST,IFIT,IDISC,IDEP,                       LKT1  53
     1 ISO,DEPTH,WPP1,WPP2,WPP3,WPP4                                    INEC 314
      GO TO 9013                                                        LKT4   7
 9012 CONTINUE                                                          LKT4   8
      WRITE(IW,93519) M,JST,IDIST,IFIT,IDISC,IDEP,                      LKT4   9
     1 ISO,DEPTH                                                        LKT4  10
93519 FORMAT(                                                           LKT4  11
     1 3X,37HNUMBER OF PROJECT YEARS ............., I8              /   LKT4  12
     1 3X,37HSTATE CODE ........................., 4X,A4            /   LKT5  11
     1 3X,37HDISTRICT CODE ......................, I8              /   LKT4  14
     1 3X,37HFEDERAL INCOME TAX OPTION ..........., I8              /   LKT4  15
     1 3X,37HDISCOUNTING METHOD .................., I8              /   LKT4  16
     1 3X,37HDEPRECIATION METHOD ................., I8              /   LKT4  17
     1 3X,37HSECONDARY OIL DECLINE DATA FLAG  ...., I8              /   LKT4  18
     1 3X,37HRESERVOIR DEPTH ....................,F10.1,6H  FEET    )  LKT4  19
 9013 CONTINUE                                                          LKT4  20
      WRITE(IW,93510)                                                   INEC 315
     1 CCOST,GTRT,WTRT,CTACR,DCE,PLANT,                                 INEC 316
     1 WCAP,COSTRT,UNCO                                                 INEC 317
 9351 FORMAT(                                                           INEC 318
     1 3X,37HNUMBER OF PROJECT YEARS ............., I8              /   INEC 319
     1 3X,37HSTATE CODE ........................., 4X,A4            /   LKT5  12
     1 3X,37HDISTRICT CODE ......................, I8              /   INEC 321
     1 3X,37HFEDERAL INCOME TAX OPTION ..........., I8              /   INEC 322
     1 3X,37HDISCOUNTING METHOD .................., I8              /   INEC 323
     1 3X,37HDEPRECIATION METHOD ................., I8              /   INEC 324
     1 3X,37HSECONDARY OIL DECLINE DATA FLAG  ...., I8              /   LKT1  55
     1 3X,37HRESERVOIR DEPTH ....................,F10.1,6H  FEET    /   INEC 326
     1 3X,37HINJECTORS DRILLED PER PATTERN (WPP1).,F10.2             /   LKT5  13
     1 3X,37HPRODUCERS DRILLED PER PATTERN (WPP2).,F10.2             /   LKT5  14
     1 3X,37HCONVTD PRIMARY PROD PER PAT (WPP3)...,F10.2             /   LKT5  15
     1 3X,37HCONVTD PROD TO INJ PER PAT (WPP4) ...,F10.2             )   LKT5  16
93510 FORMAT(                                                           INEC 331
     1 3X,37HCOMPRESSOR CAPITAL COST ............,F10.1,10H  $/HP    / INEC 332
     1 3X,37HWASTE GAS TREATMENT CAPITAL ........,F10.1,10H  $/MSCF/D/ LKT1  56
     1 3X,37HWATER TREATMENT/RECYCLE CAPITAL ....,F10.1,10H  $/BBL/D / LKT1  57
     1 3X,37HAIR DIST, VAPOR REC, SURFACE FACIL...,F10.1,10H  $/ACRE  / LKT1  58
     1 3X,37HWELL DRILL/COMP/EQUIP CAPITAL ......,F10.1,10H  $/FOOT  / INEC 336
     1 3X,37HCENTRAL PLANT FACILITIES ...........,F10.1,10H  $/STB/D / INEC 337
     1 3X,37HNO. OF MONTHS WORKING CAPITAL ......,F10.2,10H          / INEC 338
     1 3X,37HPROJECT STARTUP COSTS...............,F10.1,10H  $1000   / INEC 339
     1 3X,37HOIL RATE UNCERTAINTY ...............,F10.4,10H  FRACTION )INEC 340
      IF(IDEBT .EQ. 0) WRITE(IW,93511)                                  INEC 341
93511 FORMAT(                                                           INEC 342
     1 3X,37HPERCENT OF CAPITAL BORROWED ........,9X,1H0,10H  PERCENT )INEC 343
      IF(IDEBT .NE. 0) WRITE(IW,93512) PCTDBT,DBTINT,NYRRPY,NYPAID      INEC 344
93512 FORMAT(                                                           INEC 345
     1 3X,37HPERCENT OF CAPITAL BORROWED ........,F10.3,10H  PERCENT  /INEC 346
     1 3X,37HINTEREST RATE ON DEBT ..............,F10.3,10H  PERCENT  /INEC 347
     1 3X,37HFIRST YEAR OF PRINCIPAL REPAYMENT ...,I10,               /INEC 348
     1 3X,37HLAST YEAR OF PRINCIPAL REPAYMENT ....,I10               )INEC 349
      WRITE(IW,9352) XDR,XINF,XROY,XSEV,XFIT,XTCR,XSTX,                 INEC 350
     1 XWPT,WPHO,BTIM,BPOW,ESCPO,ESCFO,ESCED                            INEC 351
 9352 FORMAT(/ 2X,20HTAXES AND ESCALATION / 2X,20(1H-) /                INEC 352
     1 3X,37HAVERAGE DISCOUNT RATE ..............,F10.3,10H  FRACTION/ INEC 353
     1 3X,37HAVERAGE INFLATION RATE .............,F10.3,10H  FRACTION/ INEC 354
     1 3X,37HROYALTY RATE .......................,F10.3,10H  FRACTION/ INEC 355
     1 3X,37HSEVERANCE TAX RATE .................,F10.3,10H  FRACTION/ INEC 356
     1 3X,37HFEDERAL INCOME TAX RATE ............,F10.3,10H  FRACTION/ INEC 357
     1 3X,37HINVESTMENT TAX CREDIT ..............,F10.3,10H  FRACTION/ INEC 358
     1 3X,37HSTATE INCOME TAX RATE ..............,F10.3,10H  FRACTION/ INEC 359
     1 3X,37HWINDFALL EXCISE TAX RATE ...........,F10.3,10H  FRACTION/ INEC 360
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     1 3X,37HWINDFALL PHASE OUT DATE .............,F10.0,10H          / INEC 361
     1 3X,37HBASE PROJECT START DATE .............,F10.0,10H          / INEC 362
     1 3X,37HBASE OIL PRICE FOR WINDFALL TAX .....,F10.2,10H  $/BBL   / INEC 363
     1 3X,37HOIL PRICE ESCALATION RATE ...........,F10.3,10H  FRACTION/ INEC 364
     1 3X,37HOPERATING COSTS ESCALATION RATE .....,F10.3,10H  FRACTION/ LKT1  59
     1 3X,37HDRIVR OPN COST ESCALATION RATE ......,F10.3,10H  FRACTION )INEC 366
      IF(IDEP .EQ. 0) WRITE(IW,9353) DTIM                                INEC 367
 9353 FORMAT(                                                            INEC 368
     1 3X,37HDEPRECIATION TIME (STRAIGHT LINE) ...,F10.2,10H  YEARS   ) INEC 369
      IF(IDEP .GT. 0) WRITE(IW,9354)                                     INEC 370
 9354 FORMAT(                                                            INEC 371
     1 3X,56HACRS DEPRECIATION SCHEDULE USED .....     5.00  YEARS    ) INEC 372
C                                                                       INEC 373
C     ***** WRITE MOST LIKELY VALUES                                    INEC 374
      WRITE(IW,9450)                                                    INEC 375
 9450 FORMAT(1H1 // 2X,16HPRICES AND COSTS ,                            INEC 376
     1 36X,7H  LOW  , 13H  MOST-LIKELY, 10H    HIGH   /                 INEC 377
     2 2X,16(1H-),                                                      INEC 378
     3 36X,7H-------, 13H  -----------, 10H  -------- )                 INEC 379
      WRITE(IW,9451)                                                    INEC 380
     1 POL(1), POM(1), POH(1),                                          INEC 381
     4 FOCL(1)*FOPR, FOCM(1)*FOPR, FOCH(1)*FOPR,                        INEC 382
     5 OPCL(1)*FOPR, OPCM(1)*FOPR, OPCH(1)*FOPR,                        INEC 383
     6 EDPL(1)*FOPR, EDPM(1)*FOPR, EDPH(1)*FOPR,                        INEC 384
     9 WO(1)*FOPR,WTC(1)*FOPR,WDC(1)*FOPR,CML(1)*FOPR,CTI(1)*FOPR       INEC 385
 9451 FORMAT(                                                           INEC 386
     1 3X,37HOIL PRICE ...........................,10H  $/BBL   ,3F11.2/INEC 387
     1 3X,37HFIXED OPERATING COST PER PATTERN ....,10H  $/YR    ,3F11.0/INEC 388
     1 3X,37HVARIABLE OPERATING COST .............,10H  $/BBL   ,3F11.3/INEC 389
     1 3X,37HELECTRIC DRIVER OPERATING COST ......,10H  $/KWHR  ,3F11.3/INEC 390
     1 3X,37HWELL WORKOVER COST PER PATTERN ......,10H  $/YR    ,       INEC 391
     1 11X, F11.0 /                                                     INEC 392
     1 3X,37HPROD WATER TREATING COST ............,10H  $/BBL    ,      INEC 393
     1 11X, F11.3 /                                                     INEC 394
     1 3X,37HPROD WATER DISPOSAL COST ............,10H  $/BBL    ,      INEC 395
     1 11X, F11.3 /                                                     INEC 396
     1 3X,37HCOMPR MAINT AND LABOR COST ..........,10H  $/MCF    ,      INEC 397
     1 11X, F11.3 /                                                     INEC 398
     1 3X,37HTECHNICIAN AND INSTRUMENT COST ......,10H  $/MCF    ,      LKT5  17
     1 11X, F11.3 )                                                     INEC 400
C                                                                       INEC 401
      DO 470 J=1,MYR                                                    INEC 402
      AOVH(J) = AOVH(J) + AOVH1 * FDC * PATI(J)                         INEC 403
  470 CONTINUE                                                          INEC 404
C                                                                       LKT4  21
      IF (NCT .EQ. 0 ) GO TO 4701                                       LKT4  22
      WRITE (IW,4702)                                                   LKT4  23
 4702 FORMAT (//,20X,'TANGIBLE CAPITAL INVESTMENT SCHEDULE, $'          LKT5  18
     X      // 10X,'YEAR        LOW         MOST LIKELY       HIGH '   LKT5  19
     X       / 10X,'----     ----------     -----------   -----------') LKT4  26
      DO 4710 I=1,NCT                                                   LKT4  27
      WRITE (IW,4703) I,CTPL(I),CTPM(I),CTPH(I)                         LKT4  28
 4710 CONTINUE                                                          LKT4  29
 4703 FORMAT (9X,I5,3F15.2)                                             LKT5  20
C                                                                       LKT4  31
 4701 CONTINUE                                                          LKT4  32
      IF (NCI .EQ. 0 ) GO TO 4801                                       LKT4  33
      WRITE (IW,4802)                                                   LKT4  34
 4802 FORMAT (//,20X,'INTANGIBLE CAPITAL INVESTMENT SCHEDULE, $'        LKT5  21
     X      // 10X,'YEAR        LOW         MOST LIKELY       HIGH '   LKT5  22
     X       / 10X,'----     ----------     -----------   -----------') LKT4  37
      DO 4810 I=1,NCI                                                   LKT4  38
      WRITE (IW,4803) I,CIPL(I),CIPM(I),CIPH(I)                         LKT4  39
 4810 CONTINUE                                                          LKT4  40
 4803 FORMAT (9X,I5,3F15.2)                                             LKT5  23
 4801 CONTINUE                                                          LKT4  42
C                                                                       INEC 405
C     ***** ESTIMATE INDIVIDUAL PATTERN LIFE, LPAT                      INEC 406
      LPAT = 0                                                          INEC 407
      DO 490 J=1,MYR                                                    INEC 408
C      ESTIMATE DIRECT REVENUES, M$                                     LKT1  60
      REV = (POM(1) * VOP(J)) * (1. - XROY) * (1. - XSEV)               INEC 410
C      ESTIMATE DIRECT COSTS INCLUDING OVERHEAD OF 20%, M$              INEC 411
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      COST = 1.2 * (WTC(1)*VWP(J)*FOPR                                  INEC 412
     1 + EDPM(1)*QHP(J)*FOPR/UNIT + OPCM(1)*VOP(J)                      INEC 413
     2 + (CML(1) + CTI(1))*VIP(J)*FOPR                                  INEC 414
     3 + FOCM(1)*FOPR/UNIT + WOCOST*FOPR/UNIT) + AOVH1*FDC              INEC 415
      IF(REV.GE.COST ) LPAT = J                                         INEC 416
  490 CONTINUE                                                          INEC 417
C                                                                       INEC 418
C     ***** CALCULATE PROJECT PERFORMANCE FROM PATTERN DATA             INEC 419
      FOCPL = FOCL(1)                                                   INEC 420
      FOCPM = FOCM(1)                                                   INEC 421
      FOCPH = FOCH(1)                                                   INEC 422
      WWO = WO(1)                                                       INEC 423
      FOCL(1) = 0.0                                                     INEC 424
      FOCM(1) = 0.0                                                     INEC 425
      FOCH(1) = 0.0                                                     INEC 426
      OMAX = 0.0                                                        INEC 427
      AMAX = 0.0                                                        INEC 428
      DMAX = 0.0                                                        INEC 429
      WMAX = 0.0                                                        INEC 430
C                                                                       INEC 431
      DO 550 J = 1, MYR                                                 INEC 432
      SUMP = PATI(J)                                                    INEC 433
      K = 0                                                             INEC 434
      LYR = J + LPAT - 1                                                INEC 435
      IF(LYR .GT. MYR) LYR = MYR                                        INEC 436
      DO 500 I = J, LYR                                                 INEC 437
      K = K+1                                                           INEC 438
      VOL(I) = VOL(I) + VOP(K)*SUMP * (1. - UNCO)                       INEC 439
      VOM(I) = VOM(I) + VOP(K)*SUMP                                     INEC 440
      VOH(I) = VOH(I) + VOP(K)*SUMP * (1. + UNCO)                       INEC 441
      VGM(I) = VGM(I) + VGP(K)*SUMP                                     INEC 442
      VWM(I) = VWM(I) + VWP(K)*SUMP                                     INEC 443
      VIM(I) = VIM(I) + VIP(K)*SUMP                                     INEC 444
      QHM(I) = QHM(I) + QHP(K)*SUMP                                     INEC 445
      VHM(I) = VHM(I) + VHP(K)*SUMP                                     INEC 446
      FOCL(I) = FOCL(I) + FOCPL*SUMP                                    INEC 447
      FOCM(I) = FOCM(I) + FOCPM*SUMP                                    INEC 448
      FOCH(I) = FOCH(I) + FOCPH*SUMP                                    INEC 449
      WO(I) = WO(I) + WOCOST*SUMP                                       INEC 450
C                                                                       INEC 451
C     ***** DETERMINE PROJECT TANGIBLE AND INTANGIBLE CAPITAL COST      INEC 452
      CTCL(I) = CTCL(I) + CTPL(K)*SUMP*FDC/FEQP                         INEC 453
      CTCM(I) = CTCM(I) + CTPM(K)*SUMP*FDC/FEQP                         INEC 454
      CTCH(I) = CTCH(I) + CTPH(K)*SUMP*FDC/FEQP                         INEC 455
      CICL(I) = CICL(I) + CIPL(K)*SUMP*FDC/FEQP                         INEC 456
      CICM(I) = CICM(I) + CIPM(K)*SUMP*FDC/FEQP                         INEC 457
  500 CICH(I) = CICH(I) + CIPH(K)*SUMP*FDC/FEQP                         INEC 458
C                                                                       INEC 459
C   ADD A LITTLE FIXED COSTS TO CAUSE A NEGATIVE CASH FLOW              INEC 460
C    AT THE END OF THE PROJECT ---                                      INEC 461
      FOCM(J) = FOCM(J) + 1.0                                           INEC 462
C                                                                       INEC 463
      IF(VHM(J) .GT. WMAX) WMAX = VHM(J)                                INEC 464
      IF(VIM(J) .GT. AMAX) AMAX = VIM(J)                                INEC 465
      IF(VOM(J) .GT. OMAX) OMAX = VOM(J)                                INEC 466
  550 CONTINUE                                                          INEC 467
C                                                                       INEC 468
C  MODIFY PROJECT PERFORMANCE IF MULTIPLE ZONES BURNED                  INEC 469
C                                                                       INEC 470
C   SKIP IF ONLY ONE BURN ZONE                                          INEC 471
      IF(NZONE .LE. 1) GO TO 8000                                       INEC 472
C                                                                       INEC 473
C     CALCULATE NUMBER OF DEVELOPMENT YEARS                             INEC 474
      IDEVT = 0                                                         INEC 475
      DO 6998 JR = 1,MYR                                                INEC 476
      IF(PATI(JR) .GT. 1.0E-2) IDEVT = IDEVT + 1                        INEC 477
 6998 CONTINUE                                                          INEC 478
      NSEQ = 1                                                          INEC 479
      WOPCT = 0.5                                                       INEC 480
 7000 NSEQ = NSEQ + 1                                                   INEC 481
      IF(NSEQ .GT. NZONE) GO TO 8000                                    INEC 482
C                                                                       INEC 483
      LSTRT = IDEVT * (NSEQ-1) + 1                                      INEC 484
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      IF(IDEVT .LE. LPAT) LSTRT = (LPAT * (NSEQ - 1)) + 1                INEC 485
      IF(LSTRT .GT. MYR) GO TO 8000                                      INEC 486
      DO 7800 I2 = LSTRT, MYR                                            INEC 487
      I3 = I2 - LSTRT + 1                                                INEC 488
      SUMP = PATI(I3)                                                    INEC 489
      K = 0                                                              INEC 490
C                                                                        INEC 491
      KYR = I2 + LPAT - 1                                                INEC 492
      IF(KYR .GT. MYR) KYR = MYR                                         INEC 493
      DO 7600 I = I2, KYR                                                INEC 494
      K = K+1                                                            INEC 495
      VOL(I) = VOL(I) + VOP(K)*SUMP * (1. - UNCO)                        INEC 496
      VOM(I) = VOM(I) + VOP(K)*SUMP                                      INEC 497
      VOH(I) = VOH(I) + VOP(K)*SUMP * (1. + UNCO)                        INEC 498
      VGM(I) = VGM(I) + VGP(K)*SUMP                                      INEC 499
      VWM(I) = VWM(I) + VWP(K)*SUMP                                      INEC 500
      VIM(I) = VIM(I) + VIP(K)*SUMP                                      INEC 501
      QHM(I) = QHM(I) + QHP(K)*SUMP                                      INEC 502
      VHM(I) = VHM(I) + VHP(K)*SUMP                                      INEC 503
      FOCL(I) = FOCL(I) + FOCPL*SUMP                                     INEC 504
      FOCM(I) = FOCM(I) + FOCPM*SUMP                                     INEC 505
      FOCH(I) = FOCH(I) + FOCPH*SUMP                                     INEC 506
      PATIOX(I) =  SUMP                                                  INEC 507
      WO(I) = WO(I) + WOCOST*SUMP                                        INEC 508
 7600 CONTINUE                                                           INEC 509
      WO(I2) = WO(I2) + WOPCT * DCE * SUMP * 3.0 * DEPTH                 INEC 510
 7800 CONTINUE                                                           INEC 511
      GO TO 7000                                                         INEC 512
 8000 CONTINUE                                                           INEC 513
C                                                                        INEC 514
C                                                                        INEC 515
C                                                                        INEC 516
C     ***** CAPITAL FOR WATER RECYCLING AND OIL TREATING FACILITIES      INEC 517
      CAPW     = WTRT  * WMAX / 365.                                     INEC 518
      CAPG     = GTRT  * AMAX / 365.                                     INEC 519
      CAPP     = PLANT * OMAX / 365.                                     INEC 520
      CAPT     = CAPW + CAPG + CAPP                                      INEC 521
      CAP      = CAPT * UNIT                                             INEC 522
      IF(NCT .NE. 0) GO TO 560                                           INEC 523
      CTCL(1) = CTCL(1) + CAP * 0.8                                      INEC 524
      CTCM(1) = CTCM(1) + CAP * 1.0                                      INEC 525
      CTCH(1) = CTCH(1) + CAP * 1.2                                      INEC 526
  560 CONTINUE                                                           INEC 527
C                                                                        INEC 528
C     ***** COMPRESSOR CAPITAL COST AND WATER DISPOSAL VOLUME            INEC 529
      HPMAX    = 0.0                                                     INEC 530
      DO 600 I=1,MYR                                                     INEC 531
      VDM(I)   = VWM(I)-VHM(I)                                           INEC 532
      IF(VDM(I) .GT. DMAX) DMAX = VDM(I)                                 INEC 533
      AQIR(I) = VIM(I)*UNIT/365.                                         INEC 534
      AHP      = QHM(I)/365./24.*DEFF/0.746                              INEC 535
      GENC(I) = 0.0                                                      INEC 536
      IF(AHP .LT. HPMAX) GO TO 600                                       INEC 537
      GENC(I) = (AHP-HPMAX)*CCOST                                        INEC 538
      HPMAX    = AHP                                                     INEC 539
  600 CONTINUE                                                           INEC 540
C                                                                        INEC 541
C    CALCULATE RELEASED OIL FROM SECONDARY OIL RATE AND STATUTORY DECLININEC 542
C                                                                        INEC 543
      FACTOR = 1.0 - .12 * (BTIM - 1979.)                                INEC 544
      IF(FACTOR .LT. 0.0) FACTOR = 0.0                                   INEC 545
      IF(FACTOR .GT. 1.0) FACTOR = 1.0                                   INEC 546
C    OILC IS BASE RATE AT BEGINNING OF PROJECT ADJUSTED FROM BASE RATE   INEC 547
      OILC = OILB * FACTOR                                               INEC 548
C    OILD DEFINED AS ANNUAL REDUCTION IN BASE RATE ONCE PROJECT BEGINS   INEC 549
      OILD = OILB * 12. * 0.025                                          INEC 550
C    CORRECT OILC FOR MID-YEAR VALUE                                     INEC 551
      OILC = OILC + OILD / 2.                                            INEC 552
C                                                                        INEC 553
C    CALCUALTE OIL VOLUME RELEASED, (OILR,BBLS)                          INEC 554
      DO 645 I=1,MYR                                                     INEC 555
      OILC = OILC - OILD                                                 INEC 556
      IF(OILC .LE. 0.0) OILC = 0.0                                       INEC 557
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      OILR(I) = VOS(I) + VOM(I) - OILC                                  INEC 558
      IF(OILR(I) .LE. 0.0) OILR(I) = 0.0                                INEC 559
  645 CONTINUE                                                          INEC 560
C                                                                       INEC 561
C     ***** WRITE PATTERN/PROJECT SCHEDULE                              INEC 562
      IF(IOUT.LE.0) GO TO 751                                           INEC 563
      WRITE(IW,9601)                                                    INEC 564
 9601 FORMAT(/1H0,15X,42HPATTERN VOLUMES AND SCHEDULE - MOST LIKELY ,   LKT1  61
     1  20H(FOR ONE BURN ZONE) /                                        LKT1  62
     1 16X,62(1H-) /)                                                   LKT1  63
      WRITE(IW,9599) LPAT                                               INEC 567
 9599 FORMAT(5X,16HPATTERN LIFE IS:,I4,6H YEARS)                        INEC 568
      WRITE(IW,9650)                                                    INEC 569
 9650 FORMAT(                                                           INEC 570
     1 14X,16H----  PROD  ----, 10X,15H----  INJ  ----,                 INEC 571
     1  3X,8HPATTERNS,10H  PATTERNS  /                                  INEC 572
     2 2X,4HYEAR, 10H   OIL,MB , 10H  GAS,MMCF, 10H  WATER,MB ,         INEC 573
     2 10H  AIR,MMCF, 10H  WATER,MB ,                                   INEC 574
     2 10H  INITIATD, 10H    TOTAL   /                                  INEC 575
     5 2X,4H----,4(10H  --------),3(10H  --------)  )                   INEC 576
      SUMP = 0.                                                         INEC 577
      DO 650 I=1,MYR                                                    INEC 578
      SUMP = SUMP + PATI(I) + PATIOX(I)                                 INEC 579
      IF(I.GT.LPAT) SUMP = SUMP - PATI(I-LPAT) - PATIOX(I-LPAT)         INEC 580
  650 WRITE(IW,9651) I,VOP(I),VGP(I),VWP(I),VIP(I),                     INEC 581
     1                   VHP(I),PATI(I),SUMP                            INEC 582
 9651 FORMAT(2X,I3, 4F10.1, 3F10.1 )                                    INEC 583
C                                                                       INEC 584
C     ***** PROJECT PRODUCTION/INJECTION REPORT                         INEC 585
      WRITE(IW,9901)                                                    INEC 586
      WRITE(IW,9602)                                                    INEC 587
 9602 FORMAT(1H0,15X,42HPROJECT VOLUMES AND SCHEDULE - MOST LIKELY ,    LKT1  64
     1  25H(ALL PATTERNS, ALL ZONES) /                                  LKT1  65
     1 16X,67(1H-) /)                                                   LKT1  66
      WRITE(IW,9660)                                                    INEC 590
 9660 FORMAT(                                                           INEC 591
     1  6X,10H  PATTERNS,                                               INEC 592
     1  8X,16H----  PROD  ----, 10X,15H----  INJ  ---- /                INEC 593
     2 2X,4HYEAR,     10H    TOTAL ,                                    INEC 594
     2 10H   OIL,MB , 10H  GAS,MMCF, 10H  WATER,MB ,                    INEC 595
     2 10H  AIR,MMCF, 10H  WATER,MB, 12H WAT DISP,MB ,                  LKT5  24
     2 9H COMPR,HP,                                                     LKT5  25
     2 11H SEC.OIL,MB,11H REL.OIL,MB /                                  INEC 598
     5 2X,4H----,4(10H  --------),6(10H  --------) )                    INEC 599
      SUMP = 0.                                                         INEC 600
      DO 660 I=1,MYR                                                    INEC 601
      AHP     = QHM(I)/365./24.*DEFF/0.746                              INEC 602
      SUMP    = SUMP + PATI(I) + PATIOX(I)                              INEC 603
      IF(I.GT.LPAT) SUMP = SUMP - PATI(I-LPAT) - PATIOX(I-LPAT)         INEC 604
  660 WRITE(IW,9661) I,SUMP, VOM(I),VGM(I),VWM(I),VIM(I),               INEC 605
     1 VHM(I),VDM(I), AHP, VOS(I),OILR(I)                               INEC 606
 9661 FORMAT(2X,I3, 4F10.1, 6F10.1)                                     INEC 607
C                                                                       INEC 608
      WRITE(IW,9701)                                                    INEC 609
 9701 FORMAT(/1H0,14X,35HPROJECT PRODUCTION/INJECTION REPORT   ,        LKT1  67
     1  25H(ALL PATTERNS, ALL ZONES) /                                  LKT1  68
     1 15X, 60(1H-) /)                                                  LKT1  69
      WRITE(IW,9702)                                                    INEC 612
 9702 FORMAT(                                                           INEC 613
     1 6X,  80H  TIME    OIL    WASTE GAS    WATER    AIR INJ   WAT INJ INEC 614
     1  CUM OIL   OIL RECV            /                                 LKT5  26
     2 6X,  80H YEARS   STB/D     MSCF/D     STB/D     MSCF/D    STB/D  INEC 616
     2     MBBL    FRACTION           /                                INEC 617
     3 6X,  80H -----  -------  ---------  ---------  --------  ------- INEC 618
     3 ---------  --------            )                                 INEC 619
      CUMOX   = 0.0                                                     INEC 620
      TIMX    = BTIM - 1.0                                              LKT2  55
      DO 700 I=1,MYR                                                    INEC 622
      TIMX    = TIMX + 1                                                LKT2  56
      QOX     = VOM(I)*UNIT/365.                                        INEC 624
      QGX     = VGM(I)*UNIT/365.                                        INEC 625
      QWX     = VWM(I)*UNIT/365.                                        INEC 626
      QIX     = VIM(I)*UNIT/365.                                        INEC 627
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      QHX      = VHM(I)*UNIT/365.                                        INEC 628
      CUMOX    = CUMOX + VOM(I)                                          INEC 629
      RECOX    = CUMOX / TOTOIL / UNIT / FLOAT(NZONE)                    INEC 630
      WRITE(IW,9703) I,TIMX, QOX, QGX, QWX,                              INEC 631
     1 QIX, QHX, CUMOX, RECOX                                            INEC 632
 9703 FORMAT(1X,I3,F8.0, F9.1, F10.1, 1X,2F10.1, F10.1,                  INEC 633
     1 F10.1, 1X,F9.4 )                                                  INEC 634
  700 CONTINUE                                                           INEC 635
C                                                                        INEC 636
C     ***** PROJECT CAPITAL SCHEDULE                                     INEC 637
      WSUM = WPP1 + WPP2 + WPP3 + WPP4                                   LKT5  27
      IF (WSUM .EQ.0) GO TO 8801                                         LKT5  28
      WRITE(IW,9901)                                                     INEC 638
 9901 FORMAT(1H1)                                                        INEC 639
      DPP1 = CINJ                                                        LKT5  29
      IF (WPP1 .EQ. 0.0 ) DPP1 = 0.0                                     LKT5  30
      DPP2 = CEQP                                                        LKT5  31
      IF (WPP2 .EQ. 0.0 ) DPP2 = 0.0                                     LKT5  32
      DPP3 = CSEC                                                        LKT5  33
      IF (WPP3 .EQ. 0.0 ) DPP3 = 0.0                                     LKT5  34
      DPP4 = CNVT                                                        LKT5  35
      IF (WPP4 .EQ. 0.0 ) DPP4 = 0.0                                     LKT5  36
      WRITE(IW,9740) DPP1,DPP2,DPP3,DPP4,CREP, CAPW,CAPG,CAPP,CAPT       LKT5  37
 9740 FORMAT(1H0,19HMAJOR CAPITAL ITEMS / 1X,19(1H-) /                   INEC 641
     1 3X,37HINJECTOR DRILLING  COST ..............,F10.0,10H  $/WELL  / INEC 642
     1 3X,37HPRODUCER EQUIPMENT COST ..............,F10.0,10H  $/WELL  / INEC 643
     1 3X,37HCOST TO UPGRADE SECONDARY PROD .......,F10.0,10H  $/WELL  / INEC 644
     1 3X,37HCOST TO CONVERT PROD TO INJ ..........,F10.0,10H  $/WELL  / INEC 645
     1 3X,37HCOST TO UPGRADE TO SEC. OPERATIONS ..,F10.0,10H  $/WELL  / INEC 646
     1 3X,37HWATER TREATMENT CAPITAL ..............,F10.1,10H  M$      / LKT5  38
     1 3X,37HWASTE GAS TREATMENT CAPITAL ..........,F10.1,10H  M$      / LKT5  39
     1 3X,37HCENTRAL PLANT FACILITIES .............,F10.1,10H  M$      / INEC 649
     1 3X,37HTOTAL FACILITIES CAPITAL .............,F10.1,10H  M$      ) INEC 650
 8801 CONTINUE                                                           LKT5  40
      WRITE(IW,9751)                                                     INEC 651
 9751 FORMAT(1H0,25X,38HPROJECT CAPITAL SCHEDULE - MOST LIKELY /         INEC 652
     1 26X, 38(1H-) /)                                                   INEC 653
      WRITE(IW,9752)                                                     INEC 654
 9752 FORMAT(                                                            INEC 655
     1 9X,15H--- PATTERN ---, 4X,8HPATTERNS,1X,10H    AIR    ,            INEC 656
     2 10H    HP     , 6X,18H--- PROJECT M$ ---  /                       INEC 657
     3 2X,4HYEAR, 10H  TANGIBLE, 10H  INTANGBL, 10H  INITIATD,           INEC 658
     4 10H   MSCF/D , 10H  COMPRESS, 10H  COMPRESS,                      INEC 659
     5 10H  TANGIBLE, 10H  INTANGBL /                                    INEC 660
     5 2X,4H----,4(10H  --------),4(10H  --------) )                     INEC 661
      DO 750 I=1,MYR                                                     INEC 662
      AHP      = QHM(I)/365./24.*DEFF/0.746                              INEC 663
      GENCX    = GENC(I)/UNIT                                            INEC 664
      CTCMX    = CTCM(I)/UNIT                                            INEC 665
      CICMX    = CICM(I)/UNIT                                            INEC 666
      XXPAT = PATI(I) + PATIOX(I)                                        INEC 667
  750 WRITE(IW,9753) I,CTPM(I),CIPM(I),XXPAT,                            INEC 668
     1 AQIR(I), AHP, GENCX,CTCMX,CICMX                                   INEC 669
 9753 FORMAT(2X,I3, 1X, 2F10.0, 2F10.1, 4F10.0)                          INEC 670
  751 CONTINUE                                                           INEC 671
C                                                                        INEC 672
C     ***** ESCALATE EACH VARIABLE                                       INEC 673
      SUMP = 0.0                                                         INEC 674
      DO 800 I=1,MYR                                                     INEC 675
      VOL(I) = VOL(I)*UNIT                                               INEC 676
      VOH(I) = VOH(I)*UNIT                                               INEC 677
      VOM(I) = VOM(I)*UNIT                                               INEC 678
      VGM(I) = VGM(I)*UNIT                                               INEC 679
      VWM(I) = VWM(I)*UNIT                                               INEC 680
      VIM(I) = VIM(I)*UNIT                                               INEC 681
      VHM(I) = VHM(I)*UNIT                                               INEC 682
      VDM(I) = VDM(I)*UNIT                                               INEC 683
      SUMP = SUMP + PATI(I) + PATIOX(I)                                  INEC 684
      IF(I.GT.LPAT) SUMP = SUMP - PATI(I-LPAT) - PATIOX(I-LPAT)          INEC 685
      POL(I) = POL(1)*(1+ESCPO)**(I-1)                                   INEC 686
      POM(I) = POM(1)*(1+ESCPO)**(I-1)                                   INEC 687
      POH(I) = POH(1)*(1+ESCPO)**(I-1)                                   INEC 688
      PGL(I) = PGL(1)*(1+ESCPG)**(I-1)                                   INEC 689
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      PGM(I) = PGM(1)*(1+ESCPG)**(I-1)                                  INEC 690
      PGH(I) = PGH(1)*(1+ESCPG)**(I-1)                                  INEC 691
      OPCL(I) = OPCL(1)*(1+ESCFO)**(I-1)                                INEC 692
      OPCM(I) = OPCM(1)*(1+ESCFO)**(I-1)                                INEC 693
      OPCH(I) = OPCH(1)*(1+ESCFO)**(I-1)                                INEC 694
      EDPL(I) = EDPL(1)*(1+ESCED)**(I-1)                                INEC 695
      EDPM(I) = EDPM(1)*(1+ESCED)**(I-1)                                INEC 696
      EDPH(I) = EDPH(1)*(1+ESCED)**(I-1)                                INEC 697
C                                                                       INEC 698
C      SPLIT GENERATOR COSTS AS 75% TANGIBLE AND 25% INTANGIBLE         INEC 699
      CTCL(I) = (CTCL(I) + .75 * GENC(I)) * (1. + ESCCT)**(I - 1)       INEC 700
      CTCM(I) = (CTCM(I) + .75 * GENC(I)) * (1. + ESCCT)**(I - 1)       INEC 701
      CTCH(I) = (CTCH(I) + .75 * GENC(I)) * (1. + ESCCT)**(I - 1)       INEC 702
      CICL(I) = (CICL(I) + .25 * GENC(I)) * (1. + ESCCI)**(I - 1)       INEC 703
      CICM(I) = (CICM(I) + .25 * GENC(I)) * (1. + ESCCI)**(I - 1)       INEC 704
      CICH(I) = (CICH(I) + .25 * GENC(I)) * (1. + ESCCI)**(I - 1)       INEC 705
C                                                                       INEC 706
      WO(I) = WO(I)*(1+ESCWO)**(I-1)                                    INEC 707
      BPO(I) = BPO(1)*(1+ESCBP)**(I-1)                                  INEC 708
      FOCL(I) = FOCL(I)*(1+ESCFO)**(I-1)                                INEC 709
      FOCM(I) = FOCM(I)*(1+ESCFO)**(I-1)                                INEC 710
      FOCH(I) = FOCH(I)*(1+ESCFO)**(I-1)                                INEC 711
      AOVH(I) = AOVH(I)*(1+ESCFO)**(I-1)                                INEC 712
      WTC(I)  = WTC(1)*(1+ESCFO)**(I-1)                                 INEC 713
      WDC(I)  = WDC(1)*(1+ESCFO)**(I-1)                                 INEC 714
      CML(I)  = CML(1)*(1+ESCFO)**(I-1)                                 INEC 715
      CTI(I)  = CTI(1)*(1+ESCFO)**(I-1)                                 INEC 716
      IF(I .EQ. 1) GO TO 800                                            INEC 717
      DATE(I) = DATE(I-1) + 1.0                                         INEC 718
  800 CONTINUE                                                          INEC 719
C                                                                       INEC 720
      RETURN                                                            INEC 721
      END                                                               INEC 722
      SUBROUTINE STCDE(ST,IST)                                          STCDE  2
C                                                                       STCDE  3
C     ***** GIVEN STATE ALPHA (ST), COMPUTE STATE CODE (IST)            STCDE  4
C     ***** GIVEN STATE CODE (IST), COMPUTE STATE ALPHA (ST)            STCDE  5
C                                                                       STCDE  6
      INTEGER ST,IST                                                    STCDE  7
      INTEGER STATE(53)                                                 LKT5  41
C                                                                       STCDE  9
      DATA (STATE(K),K= 1, 6)/4H  AL,4H  AZ,4H  AR,4H  CA,4H  CO,4H  CT/LKT5  42
      DATA (STATE(K),K= 7,12)/4H  DE,4H  DC,4H  FL,4H  GA,4H  ID,4H  IL/LKT5  43
      DATA (STATE(K),K=13,18)/4H  IN,4H  IA,4H  KS,4H  KY,4H  LA,4H  ME/LKT5  44
      DATA (STATE(K),K=19,24)/4H  MD,4H  MA,4H  MI,4H  MN,4H  MS,4H  MO/LKT5  45
      DATA (STATE(K),K=25,30)/4H  MT,4H  NE,4H  NV,4H  NH,4H  NJ,4H  NM/LKT5  46
      DATA (STATE(K),K=31,36)/4H  NY,4H  NC,4H  ND,4H  OH,4H  OK,4H  OR/LKT5  47
      DATA (STATE(K),K=37,42)/4H  PA,4H  RI,4H  SC,4H  SD,4H  TN,4H  TX/LKT5  48
      DATA (STATE(K),K=43,48)/4H  UT,4H  VT,4H  VA,4H  WA,4H  WV,4H  WI/LKT5  49
      DATA (STATE(K),K=49,53)/4H  WY,4H  AK,4H  HI,4H  PO,4HNONE /      LKT5  50
C                                                                       STCDE 19
      IF(IST .LE. 0) GO TO 100                                          STCDE 20
C                                                                       STCDE 21
C     ***** COMPUTE STATE ALPHA                                         STCDE 22
      ST = STATE(IST)                                                   STCDE 23
      GO TO 999                                                         STCDE 24
C                                                                       STCDE 25
C     ***** COMPUTE STATE CODE                                          STCDE 26
  100 IST = 0                                                           STCDE 27
      DO 150 I=1,52                                                     STCDE 28
      IF(ST.EQ.STATE(I)) IST = I                                        STCDE 29
  150 CONTINUE                                                          STCDE 30
C                                                                       STCDE 31
  999 RETURN                                                            STCDE 32
      END                                                               STCDE 33
      SUBROUTINE CHEKE(ITIM,NCT,NCI,DEPTH,ACRES,API)                    CHEKE  2
C                                                                       CHEKE  3
C                                                                       CHEKE  4
C-----------------------------------------------------------------------CHEKE  5
C     COMMON STATEMENTS.                                                CHEKE  6
C-----------------------------------------------------------------------CHEKE  7
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
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      2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                        FLAGS  5
       COMMON /ECI/ M,MYR,IOUT,ISTATE,IDIST,IFIT,IDISC,IFUL,ISO,IDEP,    ECI    2
      1 PCTDBT, DBTINT, NYRRPY, NYPAID, IDEBT,                           ECI    3
      1 CCOST,  GTRT,   WTRT,  CTACR, DCE,  PLANT,                       ECI    4
      1 WOCOST, WTCOST, WDCOST,COSTML,COSTTI,                            ECI    5
      1 WCAP,   UNCO,   WPP,   COSTRT, FOCPL, FOCPM, FOCPH,              ECI    6
      1 WPP1,   WPP2,   WPP3,  WPP4,  POBASE, OILB, OILC, DECL,          ECI    7
      1 XDR,    XINF,   XROY,  XSEV,  XWPT, XFIT, XTCR, DTIM, XSTX,      ECI    8
      1 WPHO,   EPHO,   BTIM,  BPOW,                                     ECI    9
      1 ESCPO,  ESCPG,  ESCPF, ESCFO, ESCED,                             ECI   10
      1 ESCCT,  ESCCI,  ESCWO, ESCWT, ESCWI, ESCBP,                      ECI   11
      1 OILR(50), VOS(50),                                               ECI   12
      1 POL(50),  POM(50),  POH(50), PGL(50), PGM(50),  PGH(50),         ECI   13
      2 FOCL(50), FOCM(50), FOCH(50),OPCL(50),OPCM(50), OPCH(50),        ECI   14
      3 EDPL(50), EDPM(50), EDPH(50),WTC(50), WDC(50),  CML(50),         ECI   15
      4 CTPL(50), CTPM(50), CTPH(50),CIPL(50),CIPM(50), CIPH(50),        ECI   16
      4 CTCL(50), CTCM(50), CTCH(50),CICL(50),CICM(50), CICH(50),        ECI   17
      5 VOL(50),  VOM(50),  VOH(50), WO(50),  BPO(50),  CTI(50),         ECI   18
      6 VGM(50),  VWM(50),  VIM(50), GNUM(50),GENC(50), TITL(20),        ECI   19
      6 QHM(50),  VHM(50),  VDM(50), QHP(50), VHP(50),                   ECI   20
      7 VOP(50),  VGP(50),  VWP(50), VIP(50), PATI(50), PATIOX(50)       ECI   21
C                                                                        ECI   22
       COMMON /ECS/                                                      ECS    2
      1 SUMVOM, COSR,  TOTD, SUMCI, SVOS, SVGS, SVPS, SVIS, SUMWT,       ECS    3
      1 CINJ,   CEQP,  CSEC, CNVT,  CREP, CDAO, CIWO,                    ECS    4
      1 URPV,   UNOS,  USEV, USFO, USOPC, USED, USWO, USTO,              ECS    5
      1 UWCAP,  USWT,  USWD, USOH,  USTC, USCI, UCFB, USML, USTI,        ECS    6
      1 UWPT,   USIT,  UFIT, UATP,  UINT, ULOAN,SINT, SPRP,              ECS    7
      2 SRPV,   SNOS,  SSEV, SUMFO,SUMOPC,SUMED,SUMWO,SUMWD,             ECS    8
      2 SUMOH,  SUMML, SUMTI, DCFB,                                      ECS    9
      3 MUPPV, STDDEV, PAYOUT, PLIFE, ROR,  CC,                          ECS   10
      4 SUMIN,  SUMWC, DNB, SVON, EFFINV                                 ECS   11
C                                                                        ECS   12
       REAL MUPPV                                                        ECS   13
C                                                                        ECS   14
       COMMON /ECO/                                                      ECO    2
      1 DATE(50), VOSLD(50),VONET(50),AOVH(50),  AOVH1,                  ECO    3
      1 VGNET(50),AREVO(50),AREVG(50),ARVWPT(50),AREV(50),               ECO    4
      2 AROY(50), ANET(50), ASEV(50), AWTC(50),  AWDC(50),               ECO    5
      2 ACML(50), ATIN(50), AINJ(50),                                    ECO    6
      3 AFOC(50), AVOC(50), AEDP(50), ACOST(50), ACAP(50),               ECO    7
      4 AWPP(50), ANIP(50), TXCR(50), DEPS(50),  AWCP(50),               ECO    8
      4 AQOR(50), AQGR(50), AQWR(50), AQIR(50),                          ECO    9
      5 ANOI(50), ASTX(50), AWPT(50), ANTI(50),  AFIT(50), ATPR(50),     ECO   10
      6 CFAT(50), CDAT(50), DCFAT(50),PVDF(50),  CNOI(50),               ECO   11
      7 CFBT(50), CDBT(50), DCFBT(50)                                    ECO   12
C                                                                        ECO   13
C                                                                        CHEKE 12
C      PRICE REDUCTION FACTORS FOR API GRAVITY                           CHEKE 13
C       OILP1 FOR ALL STATES BUT CALIFORNIA, OILP2 FOR CALIFORNIA        CHEKE 14
C                                                                        CHEKE 15
       DIMENSION API1(5),OILP1(5),API2(5),OILP2(5)                       CHEKE 16
       DATA API1/  40.,  30.,   20.,   10.,  -16./                       CHEKE 17
       DATA OILP1/ 1.0, .9383, .8383, .605,   0.0/                       CHEKE 18
       DATA API2/   40.,  34.,  20.,    8.,  -37./                       CHEKE 19
       DATA OILP2/ .875, .855, .7617, .6017,  0.0/                       CHEKE 20
C                                                                        CHEKE 21
C                                                                        CHEKE 22
C-----------------------------------------------------------------------CHEKE 23
C      ***** DEFAULT CHECKING - ECONOMIC DATA                            CHEKE 24
C-----------------------------------------------------------------------CHEKE 25
       UNIT = 1000.                                                      CHEKE 26
C                                                                        CHEKE 27
C      ***** DEFAULT OVERALL PRICES AND COSTS IF MEAN VALUES NOT GIVEN   CHEKE 28
C                                                                        CHEKE 29
C      ***** OIL PRICE DEFAULT, $/STB                                    CHEKE 30
       IF(POM(1) .LE. 0.00) POM(1) = 30.00                               CHEKE 31
       XPRICE = POM(1)                                                   LKT7  10
C       USE GRAVITY CORRELATION FOR OIL PRICE                            CHEKE 33
       IF (ISTATE .EQ. 53 ) FACTOR = 1.0                                 LKT5  51
       IF (ISTATE .LT. 53 ) FACTOR = SDINT(API1,OILP1,5,API)             LKT5  52
       IF(ISTATE .EQ. 4) FACTOR = SDINT(API2,OILP2,6,API)                CHEKE 35
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      POM(1) = FACTOR * POM(1)                                          CHEKE 36
      IF(ISTATE .EQ. 50) POM(1) = POM(1) - 9.00                         CHEKE 37
      POL(1) = POM(1) * 0.8                                             CHEKE 38
      POH(1) = POM(1) * 1.2                                             CHEKE 39
C                                                                       CHEKE 40
C     ***** GAS PRICE DEFAULT, $/MCF                                    CHEKE 41
      IF(PGM(1).GT.0.) GO TO 520                                        CHEKE 42
      PGM(1) = XPRICE / 6.00                                            LKT7  11
      PGL(1) = PGM(1)*0.8                                               CHEKE 44
      PGH(1) = PGM(1)*1.2                                               CHEKE 45
C                                                                       CHEKE 46
C     ***** VARIABLE OPERATING COST DEFAULT, $/STB OIL PRODUCED         CHEKE 47
  520 IF(OPCM(1).GT.0.) GO TO 530                                       CHEKE 48
      OPCL(1) = 2.50                                                    CHEKE 49
      OPCM(1) = 3.00                                                    CHEKE 50
      OPCH(1) = 3.50                                                    CHEKE 51
C                                                                       CHEKE 52
C     ***** ELECTRIC DRIVER OPERATING COST, $/KWHR                      CHEKE 53
  530 IF(EDPM(1).GT.0.) GO TO 550                                       CHEKE 54
      EDPL(1) = 0.05                                                    CHEKE 55
      EDPM(1) = 0.07                                                    CHEKE 56
      EDPH(1) = 0.09                                                    CHEKE 57
C                                                                       CHEKE 58
  550 CONTINUE                                                          CHEKE 59
      IF(ESCPO.LE.0.) ESCPO = 0.0                                       CHEKE 60
      ESCPG = 0.0                                                       LKT2  57
      IF(ESCED.LE.0.) ESCED = 0.0                                       CHEKE 62
      IF(ESCFO.LE.0.) ESCFO = 0.0                                       CHEKE 63
      IF(ESCWO.LE.0.) ESCWO = 0.0                                       CHEKE 64
      IF(ESCCI.LE.0.) ESCCI = 0.0                                       CHEKE 65
      IF(ESCCT.LE.0.) ESCCT = 0.0                                       CHEKE 66
      ESCBP = XINF + 0.02                                               CHEKE 67
C                                                                       CHEKE 68
C   CALCULATE PROCESS INDEPENDENT COST DEFAULTS                         CHEKE 69
      CALL CIND(ISTATE,IDIST,DEPTH,WMAX,PGM(1),CINJ,CEQP,CSEC,CNVT,     CHEKE 70
     & CREP,CDAO,CIWO)                                                  CHEKE 71
C                                                                       CHEKE 72
C  DEFAULT WELL COSTS HERE - IF WELL COSTS ARE INCLUDED IN THE PATTERN  CHEKE 73
C   CAPITAL COSTS (NCT & NCI), INPUT WPP1=WPP2=WPP3=WPP4=0              LKT1  70
C  THESE COSTS (IF ANY) WILL BE ADDED TO NCT & NCI LATER                CHEKE 75
C                                                                       CHEKE 76
C USE NPC CORRELATION FOR TOTAL WELL DRILLING, COMPLETION, AND EQUIPMENTCHEKE 77
C  AND DOE CORRELATION TO FIND TANGIBLE AND INTANGIBLE SPLIT            CHEKE 78
C                                                                       CHEKE 79
      IF(DCE .LE. 0.0) DCE = 100.                                       CHEKE 80
      DCE1 = DCE * DEPTH * (WPP1+WPP2)                                  CHEKE 81
C                                                                       CHEKE 82
C  IGNORE UPGRADE TO SECONDARY OPERATIONS IF NO PRIMARY WELLS           CHEKE 83
C   CONVERTED TO SECONDARY BY WPP4                                      CHEKE 84
C                                                                       CHEKE 85
      IF(WPP4 .LE. 0.0) CREP = 0.0                                      CHEKE 86
      CAP = (CINJ * WPP1 + (CINJ + CEQP) * WPP2 + CSEC * WPP3 +         CHEKE 87
     &       CNVT * WPP4 + CREP)                                        CHEKE 88
C                                                                       CHEKE 89
C  WCI IS INTANGIBLE WELL INVESTMENT PER PATTERN                        CHEKE 90
      WCI = 0.60 * CAP                                                  CHEKE 91
      IF(WCI .LT. 0.0) WCI = 0.0                                        CHEKE 92
C                                                                       CHEKE 93
C  WCT IS TANGIBLE WELL INVESTMENT PER PATTERN                          CHEKE 94
      WCT = DCE1 - WCI                                                  CHEKE 95
      IF(WCT .LT. 0.0) WCT = 0.0                                        CHEKE 96
C                                                                       CHEKE 97
C     ***** ESCALATE THESE COSTS AT 1983 TO PROJECT START YEAR (BTIM)   CHEKE 98
C      AT ESCALATION RATES OF CAPITAL, ESCCI AND ESCCT, WITH DEFAULT    LKT3  24
C      TO INFLATION RATE AND PROJECT START IN 1983                      CHEKE100
      IF(XINF .LE. 0.0) XINF = 0.0                                      CHEKE101
      ESC  = 1. +  XINF                                                 CHEKE102
      IF(ESCCI .GT. 0.0) ESC = 1. + ESCCI                               CHEKE103
      IF(BTIM .LE. 0.0 )  BTIM = 1985.                                  LKT7  12
      WCI  = WCI  * (ESC ** (BTIM - 1983.))                             CHEKE104
      IF(ESCCT .GT. 0.0) ESC = 1. + ESCCT                               CHEKE105
      WCT  = WCT  * (ESC ** (BTIM - 1983.))                             CHEKE106
C                                                                       CHEKE107
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C     WELL WORKOVER COSTS EQUAL COST TO CONVERT A WELL                  CHEKE108
C                                                                       CHEKE109
C   ASSUME ONE WORKOVER PER PATTERN EACH FOUR YEARS                     CHEKE110
      IF(WOCOST .LE. 0.0)                                               CHEKE111
     &   WOCOST = 0.25 * CNVT                                           CHEKE112
      WO(1) = WOCOST                                                    CHEKE113
C                                                                       CHEKE114
C     ***** FIXED OPERATING COST DEFAULT, $/PATTERN/YR                  CHEKE115
      IF(FOCM(1).GT.0.) GO TO 720                                       CHEKE116
      FOCL(1) = 18000.                                                  CHEKE117
      FOCM(1) = 20000.                                                  CHEKE118
      FOCH(1) = 22000.                                                  CHEKE119
C                                                                       CHEKE120
C     ***** CAPITAL COST                                                CHEKE121
C                                                                       CHEKE122
C     ***** COMPRESSOR COST  - $1000/HP                                 CHEKE123
  720 IF(CCOST.LE.0.) CCOST = 1000.                                     CHEKE124
C                                                                       CHEKE125
C     ***** WASTE GAS TREATMENT - $50/MCF/D                             CHEKE126
      IF(GTRT .LE. 0.) GTRT = 50.                                       CHEKE127
C                                                                       CHEKE128
C     ***** PROD WATER TREATMENT - $75/BBL/D                            CHEKE129
      IF(WTRT .LE. 0.) WTRT = 75.                                       CHEKE130
C                                                                       CHEKE131
C     ***** CENTRAL PLANT FACILITIES - $500/B/D                         CHEKE132
      IF(PLANT .LE. 0.) PLANT = 500.                                    CHEKE133
C                                                                       CHEKE134
C     ***** AIR DISTRIBUTION, VAPOR RECOVERY LINES, AND                 CHEKE135
C           SURFACE PRODUCTION - DEFAULT = 26500 $/ACRE                 CHEKE136
      IF(CTACR .LE. 0.0) CTACR = 26500.                                 CHEKE137
C                                                                       CHEKE138
      IF(CTPM(1).GT.0.) GO TO 730                                       CHEKE139
      CTPL(1) = (WCT + CTACR * ACRES) * 0.8                             CHEKE140
      CTPM(1) = (WCT + CTACR * ACRES) * 1.0                             CHEKE141
      CTPH(1) = (WCT + CTACR * ACRES) * 1.2                             CHEKE142
  730 IF(CIPM(1).GT.0.) GO TO 740                                       CHEKE143
      CIPL(1) = WCI * 0.8                                               CHEKE144
      CIPM(1) = WCI * 1.0                                               CHEKE145
      CIPH(1) = WCI * 1.2                                               CHEKE146
  740 CONTINUE                                                          CHEKE147
C                                                                       CHEKE148
C    INITIALIZE OVERHEAD ON D&C+E TO 3% OF WELL COST (WITH 2% ADDED     CHEKE149
C    LATER) ONLY FOR FIRST YEAR OF EACH PATTERN                         CHEKE150
      AOVH1 = .03 * (CTPM(1) + CIPM(1)) / UNIT / UNIT                   CHEKE151
C                                                                       CHEKE152
C                                                                       CHEKE153
C     ***** OTHER DEFAULT VALUES                                        CHEKE154
      MYR = M                                                           CHEKE155
      IF(WTCOST .LE. 0.0) WTCOST = 0.125                                CHEKE156
      IF(WDCOST .LE. 0.0) WDCOST = 0.10                                 CHEKE157
      IF(COSTML .LE. 0.0) COSTML = 0.03                                 CHEKE158
      IF(COSTTI .LE. 0.0) COSTTI = 0.04                                 CHEKE159
      IF(XDR  .LE. 0.) XDR=0.10                                         CHEKE160
      IF(XSEV .LE. 0.) XSEV=0.0                                         LKT1  72
      IF(XROY .LE. 0.) XROY = 0.0                                       LKT1  73
      IF(UNCO .LE. 0.) UNCO=0.001                                       CHEKE163
      IF(XFIT .LE. 0.) XFIT=0.0                                         LKT1  74
      IF(XTCR .LE. 0.) XTCR=0.0                                         LKT1  75
      IF(XSTX .LE. 0.) XSTX = 0.0                                       LKT1  76
      IF(WCAP .LE. 0.) WCAP = 0.0                                       CHEKE169
      IF(WPHO .LE. 0.) WPHO=1991.                                       CHEKE171
      IF(EPHO .LE. 0.) EPHO = 1993.                                     CHEKE172
      IF (BPOW .LE. 0 ) BPOW = 23.07  * (1. + XINF ) ** (BTIM -1983)    LKT3  25
      BPO(1)  = BPOW                                                    CHEKE174
      WTC(1)  = WTCOST                                                  CHEKE175
      WDC(1)  = WDCOST                                                  CHEKE176
      CML(1)  = COSTML                                                  CHEKE177
      CTI(1)  = COSTTI                                                  CHEKE178
      DATE(1) = BTIM                                                    CHEKE179
C      DEFINE DEPRECIATION SCHEME: IF DTIM = 0, ACRS SCHEDULE           CHEKE180
C                                  IF DTIM > 0, STRAIGHT LINE           CHEKE181
      IDEP = 1                                                          CHEKE182
      IF(DTIM .GT. 0.0) IDEP = 0                                        CHEKE183
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      IF(DTIM .LE. 0.0) DTIM = 5.0                                      CHEKE184
C                                                                       CHEKE185
C     ***** DEBT DEFAULTS, NOT USED UNLESS IDEBT = 1                    CHEKE186
      IF(PCTDBT .LE. 0.0) PCTDBT = 20.0                                 CHEKE187
      IF(DBTINT .LE. 0.0) DBTINT = 15.0                                 CHEKE188
      IF(NYRRPY .LE. 0.0) NYRRPY = 1.0                                  CHEKE189
      IF(NYPAID .LE. 0.0) NYPAID = 5.0                                  CHEKE190
C                                                                       CHEKE191
C                                                                       CHEKE192
C     CALCULATE SECONDARY OIL PRODUCTION RATE (VOS, MB/YR) IF ISO NOT 1,CHEKE193
C    AND DEFAULT DECLC TO 15% IF NOT INPUT                              CHEKE194
      IF(ISO .EQ. 1) GO TO 900                                          CHEKE195
      IF(DECL. LE. 0.0) DECL = 15.0                                     CHEKE196
      DECL = DECL / 100.                                                CHEKE197
      IF(OILB .GT. 0.0) GO TO 840                                       CHEKE198
      OILB = 0.0                                                        CHEKE199
      OILC = 0.0                                                        CHEKE200
C                                                                       CHEKE201
C     DEFAULT CURRENT SECONDARY PRODUCTION RATE TO BASE PRODUCTION RATE CHEKE202
C    USING CURRENT DECLINE RATE                                         CHEKE203
  840 IF(OILC .LE. 0.0) OILC = OILB * (1. - DECL)**(BTIM - 1979.)       CHEKE204
C                                                                       CHEKE205
C     ***** CALCULATE SECONDARY OIL PRODUCTION RATE, VOS                CHEKE206
      DO 860 I=1,MYR                                                    CHEKE207
  860 VOS(I) = OILC * (1. - DECL)**(FLOAT(I) - 0.5)                     CHEKE208
  900 CONTINUE                                                          CHEKE209
      RETURN                                                            CHEKE210
      END                                                               CHEKE211
      SUBROUTINE CIND(ISTATE,IDIST,DEPTH,RATE,PRGAS,                    CIND   2
     & CINJ,CEQP,CSEC,CNVT,CREP,CDAO,CIWO)                              CIND   3
C*********************************************************************** CIND   4
C                                                                       CIND   5
C     THIS SUBROUTINE DEFINES THE PROCESS INDEPENDENT COST PARAMETER    LKT1  78
C      DEFAULT VALUES. THESE COSTS INCLUDE:                             CIND   7
C                                                                       CIND   8
C      CINJ   - COST OF D&C FOR AN INJECTION WELL ($/WELL)              CIND   9
C      CEQP   - COST TO EQUIP NEW PRODUCING WELL ($/NEW PRODUCER)       CIND  10
C               ADDED TO CINJ FOR D&C NEW PRODUCING WELL                CIND  11
C      CSEC   - COST OF ADDITIONAL SECONDARY PRODUCTION EQUIPMENT       LKT1  79
C               FOR A PRIMARY WELL CONVERTED TO A SECONDARY             CIND  13
C *** THE COST OF ADDITIONAL SECONDARY RECOVERY EQUIPMENT (CSEC) ASSUME LKT1  80
C      CNVT   - COST TO CONVERT AN EXISTING PRODUCER TO AN INJECTION    CIND  15
C               WELL ($/CONVERTED WELL)                                 CIND  16
C      CREP   - COST TO UPGRADE SURFACE PROCESSING EQUIPMENT            LKT1  81
C               AND LEASE FACILITIES FOR SECONDARY RECOVERY OPERATIONS CIND  18
C               ($/PRODUCER)                                            CIND  19
C      CDAO   - DIRECT ANNUAL OPERATING COSTS FOR SECONDARY RECOVERY    CIND  20
C               OPERATIONS ($/PRODUCING WELL/YEAR)                      CIND  21
C      CIWO   - ADDITIONAL ANNUAL OPERATING COST FOR OFFSHORE WATER     CIND  22
C               INJECTION ($/YEAR)                                      CIND  23
C                                                                       CIND  24
C     THESE COSTS DEFINED BY:                                           CIND  25
C                                                                       CIND  26
C       U.S. DEPT. OF ENERGY, EIA                                       CIND  27
C       DALLAS FIELD OFFICE                                             CIND  28
C       1114 COMMERCE ST. ROOM 804                                      CIND  29
C       DALLAS, TEXAS 75242                                             CIND  30
C       (214) 767-2200                                                  CIND  31
C                                                                       CIND  32
C *** THE INPUT PARAMETERS REQUIRED ARE:                                CIND  33
C      ISTATE - STATE CODE                                              CIND  34
C      IDIST  - DISTRICT CODE WITHIN STATE                              CIND  35
C      DEPTH  - VERTICAL DEPTH TO RESERVOIR (FT)                        CIND  36
C      RATE   - OFFSHORE DAILY WATER INJECTION RATE (MBBL/D)            CIND  37
C      PRGAS  - PRICE OF NATURAL GAS OFFSHORE ($/MCF)                   CIND  38
C                                                                       CIND  39
C *** THE DRILLING COSTS ARE DEFINED AS FUNCTIONS OF DEPTH AND REGION.  CIND  40
C   THE U.S. IS DIVIDED INTO SEVEN REGIONS AS FOLLOWS:                  CIND  41
C    1 PACIFIC COAST                                                    CIND  42
C    2 ROCKY MOUNTAINS                                                  CIND  43
C    3 PERMIAN BASIN                                                    CIND  44
C    4 GULF COAST                                                       CIND  45
C    5 MID-CONTINENT                                                    CIND  46
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C     6 NORTHEASTERN                                                    CIND  47
C     7 OFFSHORE                                                        CIND  48
C                                                                       CIND  49
C *** THESE COSTS INCLUDE THE COST OF DRILLING AND COMPLETING WELLS     CIND  50
C   THROUGH THE WELLHEAD, INCLUDING TUBING, AND REPRESENT THE COSTS OF  CIND  51
C   NEW INJECTION WELLS. (NEW PRODUCING WELLS HAVE ADDITIONAL COSTS     CIND  52
C   THAT ARE ADDED TO THESE COSTS LATER)                                CIND  53
C                                                                       CIND  54
C*********************************************************************CIND  55
      CINJ = 0.0                                                        CIND  56
      CEQP = 0.0                                                        CIND  57
      CSEC = 0.0                                                        CIND  58
      CNVT = 0.0                                                        CIND  59
      CREP = 0.0                                                        CIND  60
      CDAO = 0.0                                                        CIND  61
      CIWO = 0.0                                                        CIND  62
C                                                                       CIND  63
      GO TO (60,50,60,40,50,70,70,70,60,60,50,70,70,70,30,70,60,70,     CIND  64
     & 70,70,70,70,60,70,50,30,40,70,70,20,70,70,50,70,30,40,70,70,     CIND  65
     & 60,50,70,20,50,70,70,40,70,70,50,40,40,80),ISTATE                CIND  66
C                                                                       CIND  67
C     PERMIAN BASIN                                                     CIND  68
   20 IF(IDIST .LT. 70 .AND. ISTATE .EQ. 42) GO TO 60                   CIND  69
      IF(IDIST .EQ. 100) GO TO 30                                       CIND  70
      CINJ = DEPTH * (41.583 + 4.439E-4*DEPTH + 2.53E-10*DEPTH**2.8)    CIND  71
      IF(ISTATE .EQ. 30 .AND. IDIST .EQ.  1) GO TO 150                  CIND  72
      IF(ISTATE .EQ. 42 .AND. IDIST .EQ. 90) GO TO 130                  CIND  73
      GO TO 120                                                         CIND  74
C                                                                       CIND  75
C     MID-CONTINENT                                                     CIND  76
   30 CINJ = DEPTH * (34.483 + 2.472E-3*DEPTH + 2.839E-10*DEPTH**2.8)   CIND  77
      GO TO 130                                                         CIND  78
C                                                                       CIND  79
C     PACIFIC COAST                                                     CIND  80
   40 CINJ = DEPTH * (77.08 + 4.688E-3*DEPTH + 1.901E-10*DEPTH**2.8)    CIND  81
      GO TO 140                                                         CIND  82
C                                                                       CIND  83
C     ROCKIES                                                           CIND  84
   50 CINJ = DEPTH * (95.54 - 3.855E-2*DEPTH + 6.3E-3*DEPTH**1.2)       CIND  85
      GO TO 150                                                         CIND  86
C                                                                       CIND  87
C     GULF COAST                                                        CIND  88
   60 CINJ = DEPTH * (32.25 + 4.526E-3*DEPTH + 2.255E-10*DEPTH**2.8)    CIND  89
      GO TO 100                                                         CIND  90
C                                                                       CIND  91
C     NORTHEAST                                                         CIND  92
   70 CINJ = DEPTH * (33.522 + 1.175E-3*DEPTH + 1.502E-8*DEPTH**2.4)    CIND  93
      GO TO 130                                                         CIND  94
C                                                                       CIND  95
C     OFFSHORE                                                          CIND  96
   80 CINJ = 458492 - 56.3271*DEPTH + .03043*DEPTH**2.                  CIND  97
      GO TO 180                                                         CIND  98
C                                                                       CIND  99
C  CHECK GULF COAST LOCATION TO ASSIGN TO PROPER REGION FOR EQUIPMENT   LKT1  82
C   AND OPERATING COSTS. THESE REGIONS ARE:                             CIND 101
C                                                                       CIND 102
C     1 PERMIAN BASIN                                                   CIND 103
C     2 PACIFIC COAST                                                   CIND 104
C     3 ROCKY MOUNTAINS                                                 CIND 105
C     4 WESTERN GULF COAST                                              CIND 106
C     5 EASTERN GULF COAST                                              CIND 107
C     6 MID-CONTINENT AND NORTHEASTERN                                  CIND 108
C     7 OFFSHORE                                                        CIND 109
C                                                                       CIND 110
C *** THE COST TO EQUIP A NEW PRODUCTION WELL (CEQP) INCLUDES ALL THE   CIND 111
C   ADDITIONAL EQUIPMENT FOR SECONDARY RECOVERY WITH THE COST OF        LKT1  83
C   TUBING LEFT OUT (TUBING IS INCLUDED IN D&C COSTS)                   CIND 113
C *** THE COST OF ADDITIONAL SECONDARY RECOVERY EQUIPTMENT (CSEC) ASSUMECIND 114
C   THAT THE EXISTING PROCESSING AND LEASE FACILITIES WOULD NOT BE      CIND 115
C   REPLACED BUT OLD PRODUCING WELL EQUIPMENT IS REPLACED. THESE COSTS  LKT1  84
C   INCLUDE DRILLING AND EQUIPPING WATER SUPPLY WELLS.                  CIND 117
C *** THE CONVERSION OF A PRODUCING WELL TO AN INJECTION WELL (CNVT)    CIND 118
C   INCLUDES REMOVAL OF PRODUCING EQUIPMENT (INCLUDING TUBING),         LKT1  85
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C   CLEANING OUT THE WELLBORE, INSTALLING PC TUBING AND PACKER          CIND 120
C *** THE REPLACEMENT COST OF EXISTING PROCESSING EQUIPMENT AND         LKT1  86
C   LEASE FACILITIES (CREP) INCLUDES FLOWLINES, MANIFOLDS, SEPARATORS,  CIND 122
C   TREATERS, TANKS, LACT UNIT, DISPOSAL SYSTEM AND ACCESSORIES         CIND 123
C *** THE DIRECT ANNUAL OPERATING COSTS FOR SECONDARY RECOVERY (CDAO)   CIND 124
C   INCLUDES COST ASSOCIATED WITH OPERATING AND MAINTAINING PRODUCTION, CIND 125
C   INJECTION AND DISPOSAL WELLS                                        CIND 126
C                                                                       CIND 127
C                                                                       CIND 128
  100 IF(ISTATE .EQ. 9) GO TO 110                                       CIND 129
      IF(ISTATE .EQ. 42 .AND. IDIST .LE. 40) GO TO 170                  CIND 130
      IF(ISTATE .EQ. 17 .AND. IDIST .EQ.  2) GO TO 110                  CIND 131
      GO TO 130                                                         CIND 132
C                                                                       CIND 133
C     EASTERN GULF COAST                                                CIND 134
  110 CEQP = 12585 + 21.0825*DEPTH                                      CIND 135
      CSEC = 12460 + 24.234*DEPTH                                       CIND 136
      CNVT = 6280 + 5.95*DEPTH                                          CIND 137
      CREP = 16816 + 5.7947*DEPTH - 3.7218E-4*DEPTH**2.                 CIND 138
     &     + 8.0871E-9*DEPTH**3.                                        CIND 139
      CDAO = 21570 + 5.597*DEPTH                                        CIND 140
      GO TO 200                                                         CIND 141
C                                                                       CIND 142
C     PERMIAN BASIN                                                     CIND 143
  120 CEQP = 15145 + 18.0632*DEPTH                                      CIND 144
      CSEC = 14830 + 22.486*DEPTH                                       CIND 145
      CNVT = 5463 + 5.979*DEPTH                                         CIND 146
      CREP = 19047 - .8017*DEPTH + 3.2082E-4*DEPTH**2.                  CIND 147
     &     -1.1398E-8*DEPTH**3.                                         CIND 148
      CDAO = 15440 + 4.159*DEPTH                                        CIND 149
      GO TO 200                                                         CIND 150
C                                                                       CIND 151
C     MID-CONTINENT AND NORTHEASTERN                                    CIND 152
  130 CEQP = 11455 + 18.8818*DEPTH                                      CIND 153
      CSEC = 11330 + 22.037*DEPTH                                       CIND 154
      CNVT = 6051 + 5.888*DEPTH                                         CIND 155
      CREP = 16656 + 1.5242*DEPTH + 7.4214E-5*DEPTH**2.                 CIND 156
     &     -4.9619E-9*DEPTH**3.                                         CIND 157
      CDAO = 13205 + 5.222*DEPTH                                        CIND 158
      GO TO 200                                                         CIND 159
C                                                                       CIND 160
C     PACIFIC COAST                                                     CIND 161
  140 CEQP = 17635 + 29.0925*DEPTH                                      CIND 162
      CSEC = 17480 + 33.467*DEPTH                                       CIND 163
      CNVT = 6924 + 6.051*DEPTH                                         CIND 164
      CREP = 31981 + 3.0716*DEPTH - 1.0204E-4*DEPTH**2.                 CIND 165
     &     - 4.4933E-11*DEPTH**3.                                       CIND 166
      CDAO = 13068 + 9.062*DEPTH                                        CIND 167
      GO TO 200                                                         CIND 168
C                                                                       CIND 169
C     ROCKIES                                                           CIND 170
  150 CEQP = 15615 + 18.2418*DEPTH                                      CIND 171
      CSEC = 11775 + 22.901*DEPTH                                       CIND 172
      CNVT = 6240 + 6.109*DEPTH                                         CIND 173
      CREP = 23846 + 0.7057*DEPTH + 7.3254E-5*DEPTH**2.                 CIND 174
     &     - 2.6723E-9*DEPTH**3.                                        CIND 175
      CDAO = 19459 + 4.384*DEPTH                                        CIND 176
      GO TO 200                                                         CIND 177
C                                                                       CIND 178
C     WESTERN GULF COAST                                                CIND 179
  170 CEQP = 11755 + 19.4718*DEPTH                                      CIND 180
      CSEC = 11645 + 22.653*DEPTH                                       CIND 181
      CNVT = 5679 + 5.921*DEPTH                                         CIND 182
      CREP = 16143 + 4.5661*DEPTH - 2.1530E-4*DEPTH**2.                 CIND 183
     &     + 2.6401E-9*DEPTH**3.                                        CIND 184
      CDAO = 19456 + 5.459*DEPTH                                        CIND 185
      GO TO 200                                                         CIND 186
C                                                                       CIND 187
C     OFFSHORE                                                          CIND 188
  180 CEQP = 0.                                                         CIND 189
      CSEC = 650000 + 230000*RATE - 2800*RATE**2.                       CIND 190
      CNVT = 171366 + 21.825*DEPTH                                      CIND 191
      CREP = 0.                                                         CIND 192
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      CDAO = 169000                                                     CIND 193
      CIWO = 40200*RATE + 8080*RATE*PRGAS                               CIND 194
C                                                                       CIND 195
  200 CONTINUE                                                          CIND 196
      RETURN                                                            CIND 197
      END                                                               CIND 198
      SUBROUTINE ECFTR(PRICE, FDC, FEQP,                                ECFTR  2
     &                 FOPR, FUEL, FACT, ISTATE)                        LKT5  54
C                                                                       ECFTR  4
C    THIS SUBROUTINE CALCULATES THE VARIATION IN THE COST               ECFTR  5
C     FACTORS USED DUE TO CHANGES IN THE OIL PRICE. A BASE              ECFTR  6
C    OIL PRICE OF $30/STB (NOMINAL) IS USED.                            ECFTR  7
C                                                                       ECFTR  8
C        FACT    OIL PRICE FACTOR                                       ECFTR  9
C        FDC    DRILLING & COMPLETION FACTOR                            ECFTR 10
C        FEQP    EQUIPMENT FACTOR                                       LKT1  89
C        FOPR    OPERATING COSTS FACTOR                                 ECFTR 12
C        FUEL    FUEL FACTOR                                            ECFTR 13
C                                                                       ECFTR 14
C                                                                       ECFTR 15
      FACT = (PRICE - 30.) / 30.                                        ECFTR 16
      IF (ISTATE .EQ. 53 ) FACT = 0.0                                   LKT5  55
      FDC  = 1. + (0.4 * FACT)                                          ECFTR 17
      FEQP = 1. + (0.3 * FACT)                                          ECFTR 18
      FOPR = 1. + (0.2 * FACT)                                          ECFTR 19
      FUEL = 1. + (1.0 * FACT)                                          ECFTR 20
      FACT = 1. + FACT                                                  ECFTR 21
C                                                                       ECFTR 22
C    NO CORRECTION FOR DEPTH OR LOCATION                                ECFTR 23
C                                                                       ECFTR 24
      RETURN                                                            ECFTR 25
      END                                                               ECFTR 26
      SUBROUTINE ECON(API,PRICE, DISCNT, VALUE,                         ECON   2
     &                FACT, FDC, FEQP, FOPR, FUEL)                      ECON   3
C                                                                       ECON   4
C                                                                       ECON   5
C-----------------------------------------------------------------------ECON   6
C     COMMON STATEMENTS.                                                ECON   7
C-----------------------------------------------------------------------ECON   8
      LOGICAL CHKR1,CHKR2                                               ECON   9
C                                                                       ECON  10
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                       FLAGS  5
      COMMON /REPORT/                                                   REPORT 2
     1 CUMOIL(200), CUMGAS(200), CUMWAT(200), CUMOB(200),               REPORT 3
     2 CUMIA(200),  CUMIW(200),  CUMAW(200),  FOSC(200),   FOSI(200),   REPORT 4
     3 PROIL(200),  PRGAS(200),  PRWAT(200),  AIRQ(200),   WATQ(200),   REPORT 5
     4 TIME(200),   DTIME(200),  FRVS(200),   RECOV(200),               REPORT 6
     6 PRODS(200)                                                       REPORT 7
C                                                                       REPORT 8
      COMMON /ECI/ M,MYR,IOUT,ISTATE,IDIST,IFIT,IDISC,IFUL,ISO,IDEP,    ECI    2
     1 PCTDBT, DBTINT, NYRRPY, NYPAID, IDEBT,                           ECI    3
     1 CCOST,  GTRT,   WTRT,  CTACR, DCE,  PLANT,                       ECI    4
     1 WOCOST, WTCOST, WDCOST,COSTML,COSTTI,                            ECI    5
     1 WCAP,   UNCO,   WPP,   COSTRT, FOCPL, FOCPM, FOCPH,              ECI    6
     1 WPP1,   WPP2,   WPP3,  WPP4,  POBASE, OILB, OILC, DECL,          ECI    7
     1 XDR,    XINF,   XROY,  XSEV,  XWPT, XFIT, XTCR, DTIM, XSTX,      ECI    8
     1 WPHO,   EPHO,   BTIM,  BPOW,                                     ECI    9
     1 ESCPO,  ESCPG,  ESCPF, ESCFO, ESCED,                             ECI   10
     1 ESCCT,  ESCCI,  ESCWO, ESCWT, ESCWI, ESCBP,                      ECI   11
     1 OILR(50), VOS(50),                                               ECI   12
     1 POL(50),  POM(50),  POH(50), PGL(50), PGM(50),  PGH(50),         ECI   13
     2 FOCL(50), FOCM(50), FOCH(50),OPCL(50),OPCM(50), OPCH(50),        ECI   14
     3 EDPL(50), EDPM(50), EDPH(50),WTC(50), WDC(50),  CML(50),         ECI   15
     4 CTPL(50), CTPM(50), CTPH(50),CIPL(50),CIPM(50), CIPH(50),        ECI   16
     4 CTCL(50), CTCM(50), CTCH(50),CICL(50),CICM(50), CICH(50),        ECI   17
     5 VOL(50),  VOM(50),  VOH(50), WO(50),  BPO(50),  CTI(50),         ECI   18
     6 VGM(50),  VWM(50),  VIM(50), GNUM(50),GENC(50), TITL(20),        ECI   19
     6 QHM(50),  VHM(50),  VDM(50), QHP(50), VHP(50),                   ECI   20
     7 VOP(50),  VGP(50),  VWP(50), VIP(50), PATI(50), PATIOX(50)       ECI   21
C                                                                       ECI   22
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      COMMON /ECC/                                                      ECC    2
     1 MUVO(50), MUVG(50), MUVW(50), MUVI(50),                          ECC    3
     1 MUPO(50), MUPG(50), MUWO(50),                                    ECC    4
     2 MUFO(50), MUOPC(50),MUED(50), MUCT(50), MUCI(50),                ECC    5
     2 MUDB(50), MURP(50), MUIN(50), MUPB(50),                          ECC    6
     3 SIGVO(50),SIGPO(50),SIGPG(50),SIGPF(50),SIGFO(50),               ECC    7
     4 SIGED(50),SIGCT(50),SIGCI(50),SIGOPC(50)                         ECC    8
      REAL                                                              ECC    9
     1 MUVO,MUVG,MUVW,MUVI,MUDB,MURP,MUIN,MUPB,                         ECC   10
     2 MUPO,MUPG,MUFO,MUED,MUWO,MUCT,MUCI,                              ECC   11
     3 MUOPC                                                            ECC   12
C                                                                       ECC   13
      COMMON /ECS/                                                      ECS    2
     1 SUMVOM, COSR,  TOTD, SUMCI, SVOS, SVGS, SVPS, SVIS, SUMWT,       ECS    3
     1 CINJ,   CEQP,  CSEC, CNVT,  CREP, CDAO, CIWO,                    ECS    4
     1 URPV,   UNOS,  USEV, USFO, USOPC, USED, USWO, USTO,              ECS    5
     1 UWCAP,  USWT,  USWD, USOH,  USTC, USCI, UCFB, USML, USTI,        ECS    6
     1 UWPT,   USIT,  UFIT, UATP,  UINT, ULOAN,SINT, SPRP,              ECS    7
     2 SRPV,   SNOS,  SSEV, SUMFO,SUMOPC,SUMED,SUMWO,SUMWD,             ECS    8
     2 SUMOH,  SUMML, SUMTI, DCFB,                                      ECS    9
     3 MUPPV, STDDEV, PAYOUT, PLIFE, ROR,  CC,                          ECS   10
     4 SUMIN,  SUMWC, DNB, SVON, EFFINV                                 ECS   11
C                                                                       ECS   12
      REAL MUPPV                                                        ECS   13
C                                                                       ECS   14
      COMMON /ECO/                                                      ECO    2
     1 DATE(50), VOSLD(50),VONET(50),AOVH(50),  AOVH1,                  ECO    3
     1 VGNET(50),AREVO(50),AREVG(50),ARVWPT(50),AREV(50),               ECO    4
     2 AROY(50), ANET(50), ASEV(50), AWTC(50),  AWDC(50),               ECO    5
     2 ACML(50), ATIN(50), AINJ(50),                                    ECO    6
     3 AFOC(50), AVOC(50), AEDP(50), ACOST(50), ACAP(50),               ECO    7
     4 AWPP(50), ANIP(50), TXCR(50), DEPS(50),  AWCP(50),               ECO    8
     4 AQOR(50), AQGR(50), AQWR(50), AQIR(50),                          ECO    9
     5 ANOI(50), ASTX(50), AWPT(50), ANTI(50),  AFIT(50), ATPR(50),     ECO   10
     6 CFAT(50), CDAT(50), DCFAT(50),PVDF(50),  CNOI(50),               ECO   11
     7 CFBT(50), CDBT(50), DCFBT(50)                                    ECO   12
C                                                                       ECO   13
C                                                                       ECON  17
C-----------------------------------------------------------------------ECON  18
C     ***** COMPUTE MEAN DISCOUNTED CASH FLOW AND RATE OF RETURN        ECON  19
C-----------------------------------------------------------------------ECON  20
C                                                                       ECON  21
C     INPUT VARIABLES                                                   ECON  22
C     ---------------                                                   ECON  23
C     MYR   - NUMBER OF YEARS OF PRODUCTION                             ECON  24
C     IOUT  - INTERMEDIATE OUTPUT CONTROL                               ECON  25
C     XFIT  - TAX RATE                                                  ECON  26
C     XINF  - INFLATION RATE                                            ECON  27
C     XDR   - DISCOUNT RATE                                             ECON  28
C     XWPT  - WINDFALL PROFIT TIER I TAX RATE                           ECON  29
C     COMMON /ECI/ INCLUDES LOW, MOST LIKELY, AND HIGH VALUES           ECON  30
C                                                                       ECON  31
C     OUTPUT VARIABLES                                                  ECON  32
C     ----------------                                                  ECON  33
C     SUMVOM- TOTAL VOLUME OF OIL PRODUCED, MBBL                        ECON  34
C     COSR  - TOTAL OIL/STEAM RATIO                                     ECON  35
C     TOTD  - TOTAL CAPITAL INVESTMENT                                  ECON  36
C     YC    - CAPITAL RECOVERY COEFFICIENT                              ECON  37
C     SRPV  - TOTAL REVENUE PRESENT VALUE (MOST LIKELY), MM$            ECON  38
C     SUMFO - TOTAL FIXED OPERATING COST(PV), MM$                       ECON  39
C     SUMOPC- TOTAL VARIABLE OPERATING COST(PV), MM$                    ECON  40
C     SUMGC - TOTAL STEAM GENERATION COST(PV), MM$                      ECON  41
C     DCFB  - TOTAL DISCOUNTED CASH FLOW BEFORE TAX                     ECON  42
C     MUPPV - MEAN OF THE DISCOUNTED CASH FLOW, MM$                     ECON  43
C     STDDEV- STD DEVIATION OF THE DISCOUNTED CASH FLOW                 ECON  44
C     PAYOUT- TIME AT WHICH DCFAT=0, YEARS                              ECON  45
C     ROR   - DCF RATE OF RETURN                                        ECON  46
C                                                                       ECON  47
C     CONSTANTS FOR ACCELERATED CAPITAL RECOVERY SYSTEM (ACRS)          LKT5  56
C          DEPRECIATION ACCORDING TO 1981 TAX ACT                       ECON  49
C                         ANNUAL DEPRECIATION                           ECON  50
C          SERVICE    AS A PERCENT OF ASSET VALUE                       ECON  51
C           YEAR      YR 1  YR 2  YR 3  YR 4  YR 5                      ECON  52
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C          -------     ----  ----  ----  ----  ----
C         1981-84       15    22    21    21    21
C          1985         18    33    25    16     8
C          1986+        20    32    24    16     8
C
      DIMENSION ACRS(5,3)
      DATA ACRS/     .15, .22, .21, .21, .21,
     &               .18, .33, .25, .16, .08,
     &               .20, .32, .24, .16, .08/
C
      UNIT = 1000.
      UMM = UNIT*UNIT
C
C
C     ***** COMPUTE THE MEAN VALUE OF EACH VARIABLE
C           MUVO - MEAN OIL VOLUME, BBL
C           MUVG - MEAN GAS VOLUME, MMSCF
C           MUVW - MEAN WATER VOLUME, BBL
C           MUVI - MEAN INJECTED AIR VOLUME, MMSCF
C           MUPO - MEAN OIL PRICE,  MM$/BBL
C           MUPG - MEAN GAS PRICE,  MM$/MSCF
C           MUFO - MEAN FIXED OPERATING COST,  MM$/DAY
C           MUOPC- MEAN VARIABLE OPERATING COST, MM$/BBL OIL
C           MUED - MEAN ELECTRIC DRIVER OP COST, MM$/KWHR
C           MUCT - MEAN TANGIBLE CAPITAL COSTS,  MM$
C           MUCI - MEAN INTANGIBLE CAPITAL COST,  MM$
C           MUDB - MEAN DEBT ADDED, MM$
C           MURP - MEAN PRINCIPAL REPAYMENT, MM$
C           MUIN - MEAN INTEREST PAYMENT, MM$
C           MUPB - MEAN PRINCIPAL BALANCE AT END OF YEAR,
C                  AFTER PRINCIPAL PAYMENT, MM$
C
      SUMVOM = 0.0
      SUMTD = 0.0
      DO 20 I=1,MYR
      MUVO(I) = (VOL(I)+2.*VOM(I)+VOH(I))/4.
      MUVG(I) = 0.0
      MUVW(I) = VWM(I)
      MUVI(I) = VIM(I)
C
C    CALCULATE PRICES DETERMINISTICALLY FOR NPC STUDY
C
      MUPO(I) = POM(I) * FACT
      IF(ISTATE .EQ. 50) MUPO(I)=((MUPO(I)/FACT)+9.00)*FACT
     & -9.00
      MUPG(I) = PGM(I) * FACT
      MUFO(I) = FOCM(I) * FOPR
      MUOPC(I) = OPCM(I) * FOPR
      MUED(I) = EDPM(I) * FOPR
      MUCT(I) = CTCM(I) * FEQP
      MUCI(I) = CICM(I) * FEQP
C
      MUWO(I) = WO(I) * FOPR
      SUMVOM = SUMVOM + MUVO(I)/UNIT
      SUMTD = SUMTD + MUCT(I)/UMM
      DEPS(I) = 0.0
C      INITIALIZE DEBT VECTORS
      MUIN(I) = 0.
      MUDB(I) = 0.
      MUPB(I) = 0.
      MURP(I) = 0.
   20 CONTINUE
C
C     ***** COMPUTE VARIANCES OF EACH VARIABLE
      DO 30 I=1,MYR
      SIGVO(I) = (VOH(I)-VOL(I))/2.65
      SIGPO(I) = (POH(I)-POL(I))/2.65/UMM
      SIGPG(I) = (PGH(I)-PGL(I))/2.65/UMM
      SIGFO(I) = (FOCH(I)-FOCL(I))/2.65/UMM
      SIGOPC(I)= (OPCH(I)-OPCL(I))/2.65/UMM
      SIGED(I) = (EDPH(I)-EDPL(I))/2.65/UMM
      SIGCT(I) = (CTCH(I)-CTCL(I))/2.65/UMM
      SIGCI(I) = (CICH(I)-CICL(I))/2.65/UMM
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   30 CONTINUE                                                          ECON 126
C                                                                       ECON 127
C     ***** WRITE MEAN VALUES - IOUT.GE.2                               ECON 128
      IF(IOUT.LE.1) GO TO 100                                           ECON 129
      WRITE(IW,9601)                                                    ECON 130
 9601 FORMAT(1H1,35X,19HPROJECT MEAN VALUES /                           ECON 131
     1 36X,19(1H-) /)                                                   ECON 132
      WRITE(IW,9050)                                                    ECON 133
 9050 FORMAT(                                                           ECON 134
     1 2X,4H    ,                                                       ECON 135
     1 10H  TANGIBLE, 10H  INTANGBL, 10H     OIL  , 10H   FIXED   ,     ECON 136
     1 10H  VARIABLE, 10H   DRIVER , 10H     WELL ,10H    WATER  /      ECON 137
     2 2X,4H    ,                                                       ECON 138
     2 10H   CAPITAL, 10H   CAPITAL, 10H    PRICE , 10H  OPN COST,      ECON 139
     2 10H  OPN COST, 10H  OPN COST, 10H  WORKOVER ,10H  TREATING /     ECON 140
     3 2X,4HYEAR,                                                       ECON 141
     3 10H    $/YR  , 10H    $/YR  , 10H    $/BBL , 10H    $/YR  ,     ECON 142
     3 10H    $/BBL , 10H   $/KWHR , 10H    $/YR  ,10H    $/BBL  /     ECON 143
     7 2X,4H----,4(10H  --------),2(10H  --------),2(10H  --------) )   ECON 144
 9051 FORMAT(2X,I3, 1X,2F10.0, F10.2, F10.0, 2F10.3, F10.0, F10.3)      ECON 145
      SUMP = 0.                                                         ECON 146
      DO 50 I=1,MYR                                                     ECON 147
      SUMP = SUMP + PATI(I)                                             ECON 148
   50 WRITE(IW,9051) I, MUCT(I), MUCI(I), MUPO(I),                      ECON 149
     1 MUFO(I), MUOPC(I), MUED(I), MUWO(I), WTC(I)                      ECON 150
C                                                                       ECON 151
C     ***** UNITS IN $MM                                                ECON 152
  100 COSTRT = COSTRT / UNIT                                            LKT7  13
      DO 110 I=1,MYR                                                    LKT7  14
      MUPO(I) = MUPO(I)/UMM                                             ECON 155
      MUPG(I) = MUPG(I)/UMM                                             ECON 156
      MUCT(I) = MUCT(I)/UMM                                             ECON 157
      MUCI(I) = MUCI(I)/UMM                                             ECON 158
      MUFO(I) = MUFO(I)/UMM                                             ECON 159
      MUOPC(I) = MUOPC(I)/UMM                                           ECON 160
      MUED(I) = MUED(I)/UMM                                             ECON 161
  110 MUWO(I) = MUWO(I)/UMM                                             ECON 162
C                                                                       ECON 163
C-----------------------------------------------------------------------ECON 164
C     ***** CALC ANNUAL VALUES OF REVENUE AND COST COMPONENTS           ECON 165
C-----------------------------------------------------------------------ECON 166
C           AREV  - ANNUAL REVENUE.     - MM$                           ECON 167
C           ACOST - ANNUAL TOTAL COST   - MM$                           ECON 168
C           ANOI  - ANNUAL NET OPERATING INCOME                         ECON 169
C           CFBT  - CASH FLOW BEFORE TAX                                ECON 170
C           CFAT  - CASH FLOW AFTER TAX                                 ECON 171
C           DCFBT - DISCOUNTED CASH FLOW BEFORE TAX                     ECON 172
C           DCFAT - DISCOUNTED CASH FLOW AFTER TAX                      ECON 173
C                                                                       ECON 174
      ILIF = 1                                                          ECON 175
      CFMAX = 0.0                                                       ECON 176
      CTXC = 0.0                                                        ECON 177
      CFBT(1) = 0.0                                                     ECON 178
C                                                                       ECON 179
C      INITIALIZE CUMULATIVE CASH FLOW AT COSTRT                        ECON 180
      CFAT(1) = - COSTRT                                                ECON 181
      XWC = WCAP/12.                                                    ECON 182
      CNOI(1) = 0.0                                                     ECON 183
      OPCS = 0.0                                                        ECON 184
C                                                                       ECON 185
C     ***** LOOP THRU M YEARS FOR ANNUAL VALUES - MM$                   ECON 186
      DO 400 I=1,M                                                      ECON 187
      M1 = I-1                                                          ECON 188
      IF(M1.LE.0) M1=1                                                  ECON 189
      AWPP(I) = 0.0                                                     ECON 190
      AWPT(I) = 0.0                                                     ECON 191
      ARVWPT(I) = 0.0                                                   ECON 192
C                                                                       ECON 193
C     ***** UNDISCOUNTED CASH FLOW AND TAXES (WPT AND FIT)              ECON 194
      VOSOLD = MUVO(I)                                                  ECON 195
      AQOR(I) = MUVO(I)/365.                                            ECON 196
      AQGR(I) = VGM(I)/365.                                             ECON 197
      AQWR(I) = MUVW(I)/365.                                            ECON 198
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      AQIR(I) = MUVI(I)/365.                                            ECON 199
      VOSLD(I) = VOSOLD/UNIT                                            ECON 200
C                                                                       ECON 201
C     ***** ANNUAL REVENUE FOR GROSS OIL (LESS FUEL) AND GAS SOLD       ECON 202
      AREVO(I) = VOSOLD*MUPO(I)                                         ECON 203
      AREVG(I) = MUVG(I)*MUPG(I)                                        ECON 204
      AREV(I) = AREVO(I) + AREVG(I)                                     ECON 205
C                                                                       ECON 206
C     ***** LESS ROYALTY GIVES NET OIL (WORKING INTEREST)               ECON 207
      VONET(I) = VOSOLD*(1.-XROY)                                       ECON 208
      VGNET(I) = MUVG(I)*(1.-XROY)/UNIT                                 ECON 209
      AROY(I) = AREV(I)*XROY                                            ECON 210
      ANET(I) = AREV(I) - AROY(I)                                       ECON 211
C                                                                       ECON 212
C     ***** SEVERANCE TAX                                               ECON 213
      ASEV(I) = ANET(I)*XSEV                                            ECON 214
C                                                                       ECON 215
C     ***** ANNUAL OPERATING COST (FIXED, VARIABLE,                     ECON 216
C     ***** DRIVER, WATER T/D, AIR COMP, W/O, OVHEAD)                   ECON 217
      AFOC(I) = MUFO(I)                                                 ECON 218
      AVOC(I) = MUVO(I)*MUOPC(I)                                        ECON 219
      AEDP(I) = QHM(I) *MUED(I)                                         ECON 220
      AWTC(I) = MUVW(I)*WTC(I)/UMM * FOPR                               ECON 221
      AWDC(I) = VDM(I) *WDC(I)/UMM * FOPR                               ECON 222
      ACML(I) = MUVI(I)*CML(I)/UMM * FOPR                               ECON 223
      ATIN(I) = MUVI(I)*CTI(I)/UMM * FOPR                               ECON 224
      AOVH(I) = .20 * (AFOC(I) + AVOC(I) + AEDP(I) + AWTC(I)            ECON 225
     1        + AWDC(I) + ACML(I) + ATIN(I) + MUWO(I))                  ECON 226
     2        + .02 * (MUCI(I) + MUCT(I)) + AOVH(I) * FDC               ECON 227
      ACOST(I) = AFOC(I) + AVOC(I) + AEDP(I)                            ECON 228
     1         + AWTC(I) + AWDC(I) + AOVH(I)                            ECON 229
     2         + ACML(I) + ATIN(I) + MUWO(I) + ASEV(I)                  ECON 230
C                                                                       ECON 231
C     ***** ANNUAL WORKING CAPITAL                                      ECON 232
      OPCI = ACOST(I)                                                   ECON 233
      IF(OPCI.LE.0.) OPCI = 0.0                                         ECON 234
      AWCP(I) = (OPCI-OPCS)*XWC                                         ECON 235
      OPCS = OPCI                                                       ECON 236
C                                                                       ECON 237
C     ***** NET OPERATING INCOME (BEFORE WINDFALL AND FEDERAL TAX)      ECON 238
      ANOI(I) = ANET(I) - ACOST(I)                                      ECON 239
      CNOI(I) = CNOI(M1) + ANOI(I)                                      ECON 240
      BTINC = ANOI(I) - MUCI(I)-MUCT(I)-AWCP(I)                         ECON 241
      CFBT(I) = CFBT(M1) + BTINC                                        ECON 242
C                                                                       ECON 243
C     ***** WINDFALL PROFIT TAX CALCS                                   ECON 244
      IF (XWPT .EQ. 0.0) GO TO 356                                      ECON 245
      IF (API .LE. 16.0) GO TO 356                                      ECON 246
      BPONE = 16.65                                                     ECON 247
      XONE = (MUPO(I) * UMM - BPONE) * 0.70                             ECON 248
      IF (XONE .LE. 0.0) XONE = 0.0                                     ECON 249
      XTHREE = (MUPO(I) * UMM - BPO(I))                                 ECON 250
      IF (XTHREE .LE. 0.0) XTHREE = 0.0                                 ECON 251
      AWPP(I) = XTHREE                                                  ECON 252
      XTHREE = XTHREE * XWPT                                            ECON 253
      XCRED = XONE - XTHREE                                             ECON 254
      IF (XCRED .LT. 0.0) XCRED = 0.0                                   ECON 255
C     ***** TAX CALCS                                                   ECON 256
      AWPT(I) = VONET(I) * (1.-XSEV) * AWPP(I) * XWPT / UMM             ECON 257
      IF(AWPT(I).LT.0.) AWPT(I)=0.0                                     ECON 258
      WPHOF=1.0                                                         ECON 259
      IF(DATE(I).LT.WPHO) GO TO 355                                     ECON 260
      DIFF = EPHO-WPHO+1.0                                              ECON 261
      IF(DIFF.LE.0.) GO TO 355                                          ECON 262
      WPHOF = (EPHO-DATE(I))/DIFF                                       ECON 263
      IF(WPHOF.LE.0.) WPHOF=0.0                                         ECON 264
      AWPT(I) = AWPT(I)*WPHOF                                           ECON 265
C     GET REVENUE FROM RELEASED OIL TO OFFSET WPT                       LKT1  90
  355 CONTINUE                                                          ECON 267
      ARVWPT(I) = OILR(I) * (1. -XROY) * XCRED * WPHOF                  ECON 268
      IF(ARVWPT(I) .LT. 0.0) ARVWPT(I) = 0.0                            ECON 269
C     DO NOT ALLOW NEGATIVE WPT IF RELEASED OIL REVENUES GREATER        LKT5  57
      AWPT(I) = AWPT(I) - ARVWPT(I)                                     ECON 271
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      IF(AWPT(I) .LE. 0.0 ) AWPT(I) = 0.0                               LKT5  58
C                                                                       ECON 272
  356 CONTINUE                                                          ECON 273
C                                                                       ECON 274
C     ***** STATE INCOME TAX                                            ECON 275
      ASTX(I) = ANOI(I) * XSTX                                          ECON 276
      IF(ASTX(I) .LE. 0.0) ASTX(I) = 0.0                                ECON 277
C                                                                       ECON 278
C     ***** NET TAXABLE INCOME (FIT)                                    ECON 279
      CINV = MUCT(I)                                                    ECON 280
      IF(CINV.LE.0.) GO TO 370                                          ECON 281
C                                                                       ECON 282
C     DEPRECIATION CALCULATION:                                         ECON 283
C          IDEP = 0 IMPLIES STRAIGHT LINE DEPRECIATION FROM YEAR OF     ECON 284
C                    INVESTMENT OVER DTIM YEARS                         ECON 285
C          IDEP = 1 IMPLIES ACCELERATED CAPITAL RECOVERY SYSTEM (ACRS)  LKT3  27
C                    ACCORDING TO THE RULES OF THE 1981 TAX ACT         ECON 287
C                                                                       ECON 288
      IF(IDEP .EQ. 0) IDT = I+DTIM-1                                    ECON 289
      IF(IDEP .EQ. 1 .AND. DATE(I) .GE. 1981) IDT = I + 5 - 1           ECON 290
      IF(IDT .GT. MYR) IDT = MYR                                        ECON 291
      DO 360 J=I,IDT                                                    ECON 292
C                                                                       ECON 293
C     ***** STRAIGHT LINE DEPRECIATION                                  ECON 294
      IF(IDEP .EQ. 0 .OR. DATE(I) .LE. 1980)                            ECON 295
     & DEPS(J) = DEPS(J) + CINV/DTIM                                    ECON 296
      IF(IDEP .EQ. 0 .OR. DATE(I) .LE. 1980) GO TO 360                  ECON 297
C                                                                       ECON 298
C     ***** ACRS DEPRECIATION                                           ECON 299
      IHJH = IFIX(DATE(I))                                              ECON 300
      IF(IHJH .GE. 1981 .AND. IHJH .LE. 1984)                           ECON 301
     & DEPS(J) = DEPS(J) + CINV * ACRS(J-I+1,1)                         ECON 302
      IF(IHJH .EQ. 1985)                                                ECON 303
     & DEPS(J) = DEPS(J) + CINV * ACRS(J-I+1,2)                         ECON 304
      IF(IHJH .GE. 1986)                                                ECON 305
     & DEPS(J) = DEPS(J) + CINV * ACRS(J-I+1,3)                         ECON 306
  360 CONTINUE                                                          ECON 307
  370 ACAP(I) = MUCI(I) + DEPS(I)                                       ECON 308
C                                                                       ECON 309
C     ***** DEBT CALCULATIONS                                           ECON 310
      IF(IDEBT .EQ. 0) GO TO 3799                                       ECON 311
C      LOAN IS TAKEN AT START OF YEAR I                                 ECON 312
      XX = (MUCT(I) + MUCI(I)) * PCTDBT / 100.                          ECON 313
      IF(XX .LE. 0.001) GO TO 3799                                      ECON 314
      MUDB(I) = XX + MUDB(I)                                            ECON 315
C      IF FIRST YEAR OF REPAYMENT IS AFTER YEAR I, THEN ADD ACCRUED     ECON 316
C      INTEREST TO PRINCIPAL AMOUNT THROUGH YEAR NYPAID                 ECON 317
      J = I                                                             ECON 318
      IF(J .GE. NYRRPY) GO TO 3702                                      ECON 319
C      ADD INTEREST TO DEBT AT START OF YEAR J+1 AND INCREASE           ECON 320
C      XX = THE LOAN PRINCIPAL TO BE AMORTIZED                          ECON 321
 3701 MUDB(J+1) = XX * DBTINT / 100. + MUDB(J+1)                        ECON 322
      XX = (DBTINT / 100. + 1.) * XX                                    ECON 323
      MUPB(J) = XX + MUPB(J)                                            ECON 324
      J = J+1                                                           ECON 325
      IF(J .LT. NYRRPY) GO TO 3701                                      ECON 326
C                                                                       ECON 327
C     REPAYMENT SCHEDULE FOR THIS INCREMENT STARTS AT                   ECON 328
C      THE LATTER OF NYRRPY OR THE CURRENT YEAR.                        ECON 329
C     CALCULATIONS FOR THIS INCREMENT WILL END AT THE EARLIER OF        ECON 330
C      NYPAID OR MYR -- IF NYPAID .GT. MYR THEN LOAN REPAYMENT WILL     ECON 331
C      NOT BE COMPLETED IN THIS ANALYSIS (ASSUMED TO BE PICKED UP       ECON 332
C      ELSEWHERE)                                                       ECON 333
 3702 JL = NYRRPY                                                       ECON 334
      IF(JL .LT. I) JL = I                                              ECON 335
      JU = NYPAID                                                       ECON 336
      IF(JU .GT. MYR) JU = MYR                                          ECON 337
C      LOAN REPAYMENT BY EQUAL INCREMENTS OF TOTAL PRINCIPAL PLUS       ECON 338
C        INTEREST -- SIMILAR TO HOME MORTGAGE                           ECON 339
      IF(NYPAID .LE. JL-1 ) GO TO 3799                                  LKT2  59
      EQAP = DBTINT / 100. / (1. - 1./(DBTINT / 100. + 1.)              ECON 340
     &         ** (NYPAID - JL + 1)) * XX                               ECON 341
      DO 3703 J = JL, JU                                                ECON 342
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C       INTEREST PAYMENT IN YEAR J                                      ECON 343
      YY = XX * DBTINT / 100.                                           ECON 344
      MUIN(J) = YY + MUIN(J)                                            ECON 345
C       PRINCIPAL PAYMENT IN YEAR J                                     ECON 346
      MURP(J) = EQAP - YY * MURP(J)                                     ECON 347
      IF (MURP(J) .LE. 0.0 ) MURP(J) = 0.0                              LKT5  59
      XX = XX - EQAP + YY                                               ECON 348
C       PRINCIPAL BALANCE AT END OF YEAR J                              ECON 349
      MUPB(J) = XX + MUPB(J)                                            ECON 350
 3703 CONTINUE                                                          ECON 351
 3799 TXCR(I) = XTCR*MUCT(I)                                            ECON 352
C                                                                       ECON 353
C       DEDUCT INTEREST PAYMENT FROM TAXABLE INCOME                     ECON 354
      ANTI(I) = ANOI(I) - AWPT(I) - ACAP(I) - ASTX(I) - MUIN(I)         ECON 355
      AFIT(I) = XFIT*ANTI(I)                                            ECON 356
      IF(AFIT(I).LT.0. .AND. IFIT.EQ.1) AFIT(I)=0.                      ECON 357
C                                                                       ECON 358
C     ***** TAX CREDIT                                                  ECON 359
      TCRED = CTXC + TXCR(I)                                            ECON 360
      IF(AFIT(I).GT.TCRED) GO TO 385                                    ECON 361
  385 CTXC = 0.0                                                        ECON 362
      AFIT(I) = AFIT(I) - TCRED                                         ECON 363
      TXCR(I) = TCRED                                                   ECON 364
C                                                                       ECON 365
C     ***** AFTER TAX CASH FLOW                                         ECON 366
      ATPR(I) = ANOI(I) - AFIT(I) - AWPT(I) - ASTX(I)                   ECON 367
     & - MUCI(I) - MUCT(I) - AWCP(I) - MUIN(I) - MURP(I)                ECON 368
      CFAT(I) = CFAT(M1) + ATPR(I)                                      ECON 369
      VONET(I) = VONET(I)/UNIT                                          ECON 370
      IF(CFAT(I).LE.CFMAX) GO TO 400                                    ECON 371
      CFMAX = CFAT(I)                                                   ECON 372
      ILIF = I                                                          ECON 373
C                                                                       ECON 374
  400 CONTINUE                                                          ECON 375
C                                                                       ECON 376
C     ***** ECONOMIC LIFE                                               ECON 377
      PLIFE = ILIF                                                      ECON 378
      IF(ILIF.GE.M) PLIFE=M                                             ECON 379
      MYR = ILIF                                                        ECON 380
C                                                                       ECON 381
C     ***** PRESENT VALUE RATE                                          ECON 382
      CC = (1+XINF) * (1+XDR) - 1.                                      ECON 383
C                                                                       ECON 384
C-----------------------------------------------------------------------ECON 385
C     ***** SUM THE PRESENT VALUES OF REVENUE AND COST COMPONENTS       ECON 386
C-----------------------------------------------------------------------ECON 387
C       DISCOUNTED VALUES                                               ECON 388
C       -----------------                                               ECON 389
C            CCC - PRESENT VALUE FACTOR                                 ECON 390
C            SVOS  - TOTAL GROSS OIL SOLD, MBBL                         ECON 391
C            SVGS  - TOTAL GROSS GAS SOLD, MMSCF                        ECON 392
C            SRPV  - TOTAL GROSS OIL SALES, MM$                         ECON 393
C            SNOS  - TOTAL NET OIL SALES                                ECON 394
C            SSEV  - TOTAL SEVERANCE TAX                                ECON 395
C            SUMTO - TOTAL OPERATING COST (FIXED+VAR+GEN+WO+OVH)        ECON 396
C            SUMFO - TOTAL FIXED OPERATING COSTS                        ECON 397
C            SUMOPC- TOTAL VARIABLE OPERATING COST                      ECON 398
C            SUMED - TOTAL ELECTRIC DRIVER OP COST                      ECON 399
C            SUMML - TOTAL COMPRESSOR MAINT AND LABOR COST              ECON 400
C            SUMTI - TOTAL TECHNICIAN AND INSTRUMENT COST               ECON 401
C            SUMWO - TOTAL WELL WORKOVER COSTS                          ECON 402
C            SUMWT - TOTAL PROD WATER TREATING COST                     ECON 403
C            SUMWD - TOTAL PROD WATER DISPOSAL COST                     ECON 404
C            SUMOH - TOTAL OVERHEAD COSTS                               ECON 405
C            SUMCI - TOTAL INTANGIBLE CAPITAL COSTS                     ECON 406
C            SINT  - TOTAL DEBT INTEREST COST                           ECON 407
C            SPRP  - TOTAL PRINCIPAL REPAYMENT                          ECON 408
C       UNDISCOUNTED VALUES                                             ECON 409
C       -------------------                                             ECON 410
C           URPV   - TOTAL GROSS REVENUE                                ECON 411
C           UNOS   - TOTAL NET SALES                                    ECON 412
C           USEV   - TOTAL SEVERENCE TAX                                ECON 413
C           USFO   - TOTAL FIXED OPERATING COST                         ECON 414
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C           USOPC  - TOTAL VARIABLE OPERATING COST                      ECON 415
C           USED   - TOTAL ELECTRIC DRIVER OP COST                      ECON 416
C           USML   - TOTAL COMPRESSOR MAINT AND LABOR COST              ECON 417
C           USTI   - TOTAL TECHNICIAN AND INSTRUMENT COST               ECON 418
C           USWT   - TOTAL PRODUCED WATER TREATING COST                 ECON 419
C           USWD   - TOTAL PRODUCED WATER DISPOSAL COST                 ECON 420
C           USOH   - TOTAL OVERHEAD COST                                ECON 421
C           UWCAP  - TOTAL WORKING CAPITAL                              ECON 422
C           USTC   - TOTAL TANGIBLE CAPITAL                             ECON 423
C           USCI   - TOTAL INTANGIBLE CAPITAL                           ECON 424
C           UCFB   - TOTAL CASH FLOW BEFORE TAX                         ECON 425
C           UWPT   - TOTAL WINDFALL PROFIT TAX                          ECON 426
C           USIT   - TOTAL STATE INCOME TAX                             ECON 427
C           UFIT   - TOTAL FEDERAL INCOME TAX                           ECON 428
C           UATP   - TOTAL AFTER TAX PROFIT                             ECON 429
C           UINT   - TOTAL INTEREST COST                                ECON 430
C           ULOAN  - TOTAL PRINCIPAL REPAYMENT                          ECON 431
C                                                                       ECON 432
      ONPKNO = 0.                                                       ECON 433
      ONPKAI = 0.                                                       LKT7  15
      SVOS = 0.                                                         ECON 435
      SVON = 0.                                                         ECON 436
      SVGS = 0.                                                         ECON 437
      SRPV = 0.                                                         ECON 438
      SNOS = 0.                                                         ECON 439
      SSEV = 0.                                                         ECON 440
      SUMTO = 0.                                                        ECON 441
      SUMFO = 0.0                                                       ECON 442
      SUMOPC = 0.                                                       ECON 443
      SUMED = 0.                                                        ECON 444
      SUMML = 0.                                                        ECON 445
      SUMTI = 0.                                                        ECON 446
      SUMWO = 0.                                                        ECON 447
      SUMWC = 0.                                                        ECON 448
      SUMCI = 0.                                                        ECON 449
      SUMWT = 0.                                                        ECON 450
      SUMWD = 0.                                                        ECON 451
      SUMOH = 0.                                                        ECON 452
      SINT = 0.                                                         ECON 453
      SPRP = 0.                                                         ECON 454
      DNB = 0.0                                                         ECON 455
      TOTD = 0.                                                         ECON 456
      SSIGFO = 0.                                                       ECON 457
      SSIGCI = 0.                                                       ECON 458
      SSIGED = 0.0                                                      ECON 459
      SSIGCT = 0.                                                       ECON 460
      SSIGO = 0.                                                        ECON 461
      SSIGG = 0.                                                        ECON 462
C                                                                       ECON 463
      URPV = 0.                                                         ECON 464
      UNOS = 0.0                                                        ECON 465
      USEV = 0.0                                                        ECON 466
      USTO = 0.0                                                        ECON 467
      USOPC = 0.0                                                       ECON 468
      USED = 0.0                                                        ECON 469
      USML = 0.0                                                        ECON 470
      USTI = 0.0                                                        ECON 471
      USFO = 0.0                                                        ECON 472
      UWCAP = 0.0                                                       ECON 473
      USTC = 0.0                                                        ECON 474
      USCI = 0.0                                                        ECON 475
      USWO = 0.0                                                        ECON 476
      USWT = 0.0                                                        ECON 477
      USWD = 0.0                                                        ECON 478
      USOH = 0.0                                                        ECON 479
      UCFB = 0.0                                                        ECON 480
      UWPT = 0.0                                                        ECON 481
      USIT = 0.0                                                        ECON 482
      UFIT = 0.0                                                        ECON 483
      UATP = 0.0                                                        ECON 484
      UINT = 0.                                                         ECON 485
      ULOAN = 0.                                                        ECON 486
      SUMVOM = 0.0                                                      ECON 487
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      SUMVIM = 0.0                                                      ECON 488
      DCFBT(1) = 0.0                                                    ECON 489
C      INITIALIZE DISCOUNTED AND CONSTANT DOLLAR CASH FLOW AT COSTRT    ECON 490
      DCFAT(1) = - COSTRT                                               ECON 491
      CDBT(1) = 0.0                                                     ECON 492
      CDAT(1) = - COSTRT                                                ECON 493
C                                                                       ECON 494
C     ***** DETERMINE PRESENT VALUES OVER PROJECT LIFE                  ECON 495
      DO 500 I=1,MYR                                                    ECON 496
      M1 = I-1                                                          ECON 497
      IF(M1.LE.0) M1=1                                                  ECON 498
C                                                                       ECON 499
C     ***** VOLUMES PRODUCED, SOLD, AND INJECTED                        ECON 500
      SUMVOM = SUMVOM + MUVO(I)/UNIT                                    ECON 501
      SVOS = SVOS + VOSLD(I)                                            ECON 502
      SVON = SVON + VONET(I)                                            ECON 503
      SVGS = SVGS + MUVG(I)/UNIT                                        ECON 504
      SUMVIM = SUMVIM + MUVI(I)/UNIT                                    ECON 505
      IF(ONPKAI .LE. (MUVI(I)/1000.0))ONPKAI = (MUVI(I)/1000.0)         LKT7  16
      IF(ONPKNO .LE. VONET(I)) ONPKNO = VONET(I)                        ECON 507
C                                                                       ECON 508
C     ***** PRESENT VALUE FACTOR                                        ECON 509
      CCC = 1.0/(1.0+CC)**(I - 1)                                       ECON 510
      CCD = 1.0/(1.0+XINF)**(I - 1)                                     ECON 511
      IF(IDISC.LE.0) GO TO 450                                          ECON 512
C     ***** MID-YEAR DISCOUNTING                                        ECON 513
      CCC = 1.0/(1.+CC)**(FLOAT(I)-1.5)                                 ECON 514
      CCD = 1.0/(1.0+XINF)**(FLOAT(I)-1.5)                              ECON 515
  450 IF(CCC .GT. 1.0) CCC = 1.0                                        ECON 516
      IF(CCD .GT. 1.0) CCD = 1.0                                        ECON 517
      PVDF(I) = CCC                                                     ECON 518
C                                                                       ECON 519
C     ***** CUMULATIVE AMOUNT CORRECTED TO PRESENT VALUE, MM$           LKT3  28
      URPV   = URPV + AREV(I)                                           ECON 521
      SRPV   = SRPV + AREV(I)*CCC                                       ECON 522
C     ***** NET OIL SALES                                               ECON 523
      UNOS   = UNOS + ANET(I)                                           ECON 524
      SNOS   = SNOS + ANET(I)*CCC                                       ECON 525
C     ***** SEVERANCE TAX                                               ECON 526
      USEV   = USEV + ASEV(I)                                           ECON 527
      SSEV   = SSEV + ASEV(I)*CCC                                       ECON 528
C     ***** OPERATING COST (VARIABLE+FIXED+GEN+W/O)                     ECON 529
      USTO   = USTO + ACOST(I)                                          ECON 530
      SUMTO  = SUMTO + ACOST(I)*CCC                                     ECON 531
C     ***** FIXED OPERATING COST                                        ECON 532
      USFO   = USFO + AFOC(I)                                           ECON 533
      SUMFO  = SUMFO + AFOC(I)*CCC                                      ECON 534
C     ***** VARIABLE OPERATING COST                                     ECON 535
      USOPC  = USOPC + AVOC(I)                                          ECON 536
      SUMOPC = SUMOPC + AVOC(I)*CCC                                     ECON 537
C     ***** ELECTRIC DRIVER OP COST                                     ECON 538
      USED   = USED + AEDP(I)                                           ECON 539
      SUMED  = SUMED + AEDP(I)*CCC                                      ECON 540
C     ***** COMPRESSOR MAINT AND LABOR COST                             ECON 541
      USML   = USML + ACML(I)                                           ECON 542
      SUMML  = SUMML + ACML(I)*CCC                                      ECON 543
C     ***** TECHNICIAN AND INSTRUMENT COST                              ECON 544
      USTI   = USTI + ATIN(I)                                           ECON 545
      SUMTI  = SUMTI + ATIN(I)*CCC                                      ECON 546
C     ***** WORKING CAPITAL                                             ECON 547
      UWCAP  = UWCAP + AWCP(I)                                          ECON 548
      SUMWC  = SUMWC + AWCP(I)*CCC                                      ECON 549
C     ***** TANGIBLE CAPITAL                                            ECON 550
      USTC   = USTC + MUCT(I)                                           ECON 551
      TOTD   = TOTD + MUCT(I)*CCC                                       ECON 552
C     ***** INTANGIBLE CAPITAL                                          ECON 553
      USCI   = USCI + MUCI(I)                                           ECON 554
      SUMCI  = SUMCI + MUCI(I)*CCC                                      ECON 555
C     ***** WELL WORKOVER COST                                          ECON 556
      USWO   = USWO + MUWO(I)                                           ECON 557
      SUMWO  = SUMWO + MUWO(I)*CCC                                      ECON 558
C     ***** WATER TREATING COST                                         ECON 559
      USWT   = USWT + AWTC(I)                                           ECON 560
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      SUMWT  = SUMWT + AWTC(I)*CCC                                      ECON 561
C     ***** WATER DISPOSAL COST                                         ECON 562
      USWD   = USWD + AWDC(I)                                           ECON 563
      SUMWD  = SUMWD + AWDC(I)*CCC                                      ECON 564
C     ***** OVERHEAD COST                                               ECON 565
      USOH   = USOH + AOVH(I)                                           ECON 566
      SUMOH  = SUMOH + AOVH(I)*CCC                                      ECON 567
C     ***** WINDFALL PROFIT TAX                                         ECON 568
      UWPT   = UWPT + AWPT(I)                                           ECON 569
C     ***** STATE INCOME TAX                                            ECON 570
      USIT   = USIT + ASTX(I)                                           ECON 571
C     ***** FEDERAL INCOME TAX                                          ECON 572
      UFIT   = UFIT + AFIT(I)                                           ECON 573
C     ***** INTEREST COST                                               ECON 574
      UINT   = MUIN(I) + UINT                                           ECON 575
      SINT   = MUIN(I) * CCC + SINT                                     ECON 576
C     ***** PRINCIPAL REPAYMENTS                                        ECON 577
      ULOAN  = MUDB(I) + ULOAN                                          ECON 578
      SPRP   = MURP(I) * CCC + SPRP                                     ECON 579
C     ***** DISCOUNTED NET BBL                                          ECON 580
      DNB    = DNB + VONET(I)*CCC                                       ECON 581
C                                                                       ECON 582
C     ***** STD DEVIATION                                               ECON 583
      SPOPV = SIGPO(I)*CCC                                              ECON 584
      SPGPV = SIGPG(I)*CCC                                              ECON 585
      SOPCP = SIGOPC(I)*CCC                                             ECON 586
      SFOPV = SIGFO(I)*CCC                                              ECON 587
      SEDPV = SIGED(I)*VIM(I)*CCC                                       ECON 588
      SCIPV = SIGCI(I)*CCC                                              ECON 589
      SCTPV = SIGCT(I)*CCC                                              ECON 590
C                                                                       ECON 591
C     ***** DAVIDSON EQN-15, ALLOWING OIL VOLUME UNCERTAINTY            ECON 592
      SSIGO = SSIGO + SQRT( MUVO(I)*MUVO(I)*(SPOPV**2+SOPCP**2)         ECON 593
     1 + SIGVO(I)*SIGVO(I)*((MUPO(I)*CCC)**2+(MUOPC(I)*CCC)**2))        ECON 594
      SSIGG = SSIGG + MUVG(I)*SPGPV                                     ECON 595
      SSIGFO = SSIGFO+SFOPV                                             ECON 596
      SSIGED = SSIGED+SEDPV                                             ECON 597
      SSIGCI = SSIGCI+SCIPV                                             ECON 598
      SSIGCT = SSIGCT+SCTPV                                             ECON 599
C                                                                       ECON 600
C     CONSTANT DOLLAR DISCOUNTING AND CASH FLOW                         ECON 601
C                                                                       ECON 602
      BTINC = ANOI(I) - MUCI(I) - MUCT(I) - AWCP(I) - MUIN(I) - MURP(I) ECON 603
      UCFB = UCFB + BTINC                                               ECON 604
      CDBT(I) = CDBT(M1) + BTINC*CCD                                    ECON 605
      DCFBT(I) = DCFBT(M1) + BTINC*CCC                                  ECON 606
      UATP = UATP + ATPR(I)                                             ECON 607
      CDAT(I) = CDAT(M1) + ATPR(I)*CCD                                  ECON 608
      DCFAT(I) = DCFAT(M1) + ATPR(I)*CCC                                ECON 609
      IF(DCFAT(I).LE.0.) IPAY=I                                         ECON 610
C                                                                       ECON 611
  500 CONTINUE                                                          ECON 612
C                                                                       ECON 613
C     ***** COMPUTE TOTAL CAPITAL, DEPRECIATION OVER DTIM,              ECON 614
C     ***** AND CAPITAL COEFFICIENT ASSUMING NO RECOVERY(SALVAGE)       ECON 615
C     ***** AND THAT ALL TANGIBLE CAPITAL IS EXPENDED FIRST YEAR        ECON 616
      YC = 0.0                                                          ECON 617
      IF(TOTD.LE.0.) GO TO 550                                          ECON 618
      DEPAMT = TOTD/DTIM                                                ECON 619
      CREC = 0.0                                                        ECON 620
      IF(CC .LT. 1.E-6) CC = 1.E-6                                      ECON 621
      YC = (TOTD - XFIT*DEPAMT*((1+CC)**DTIM-1.)/(CC*(1+CC)**DTIM)      ECON 622
     1 - CREC)/TOTD                                                     ECON 623
C                                                                       ECON 624
C     ***** COMPUTE DCF MEAN AND STD DEVIATION                          ECON 625
  550 DCFB = DCFBT(MYR)                                                 ECON 626
      MUPPV = DCFAT(MYR)                                                ECON 627
      CFATT = CFAT(MYR)                                                 ECON 628
      COSR = 0.0                                                        ECON 629
      IF(SUMVOM .NE. 0.0) COSR = SUMVIM / SUMVOM                        ECON 630
C                                                                       ECON 631
C     ***** VARIANCES                                                   ECON 632
      SIGO2  = SSIGO*SSIGO                                              ECON 633
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      SIGG2  = SSIGG*SSIGG                                              ECON 634
      SIGFO2 = SSIGFO*SSIGFO                                            ECON 635
      SIGED2 = SSIGED*SSIGED                                            ECON 636
      SIGCI2 = SSIGCI*SSIGCI                                            ECON 637
      SIGCT2 = SSIGCT*SSIGCT                                            ECON 638
C     ***** DAVIDSON EQN-17, ASSUMES SIGCAP=0                           ECON 639
      STDDEV = SQRT((1-XFIT)*(SIGO2+SIGG2 + SIGFO2+SIGCI2+SIGED2)       ECON 640
     1 + YC*YC*SIGCT2)                                                  ECON 641
C                                                                       ECON 642
C     ***** PAYOUT (AFTER TAX)                                          ECON 643
      PAYOUT = IPAY + DCFAT(IPAY)/(DCFAT(IPAY)-DCFAT(IPAY+1))           ECON 644
      IF(PAYOUT.GE.M) PAYOUT=999.99                                     ECON 645
C                                                                       ECON 646
C     ***** COMPUTE DCF RATE OF RETURN                                  ECON 647
      CALL DCFROR(MYR,IOUT,IDISC,COSTRT,DCFAT,ATPR,                     ECON 648
     1 TOTD,DTIM,XFIT,XINF,XDR,EFFINV, MUPPV,CFATT,CFAT,ROR)            ECON 649
      IF(ROR.GT.1000.) ROR = 999.                                       ECON 650
C                                                                       ECON 651
      RETURN                                                            ECON 652
      END                                                               ECON 653
      SUBROUTINE DCFROR(MYR,IOUT,IDISC,COSTRT,DCFAT,ATPR,               DCFROR 2
     1 TOTD,DTIM,XFIT,XINF,XDR,EFFINV,MUXPV,CFATT,CFAT,ROR)             DCFROR 3
C                                                                       DCFROR 4
C                                                                       DCFROR 5
C-----------------------------------------------------------------------DCFROR 6
C     COMMON STATEMENTS.                                                DCFROR 7
C-----------------------------------------------------------------------DCFROR 8
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                       FLAGS  5
      COMMON /ECC/                                                      ECC    2
     1 MUVO(50), MUVG(50), MUVW(50), MUVI(50),                          ECC    3
     1 MUPO(50), MUPG(50), MUWO(50),                                    ECC    4
     2 MUFO(50), MUOPC(50),MUED(50), MUCT(50), MUCI(50),                ECC    5
     2 MUDB(50), MURP(50), MUIN(50), MUPB(50),                          ECC    6
     3 SIGVO(50),SIGPO(50),SIGPG(50),SIGPF(50),SIGFO(50),               ECC    7
     4 SIGED(50),SIGCT(50),SIGCI(50),SIGOPC(50)                         ECC    8
      REAL                                                              ECC    9
     1 MUVO,MUVG,MUVW,MUVI,MUDB,MURP,MUIN,MUPB,                         ECC   10
     2 MUPO,MUPG,MUFO,MUED,MUWO,MUCT,MUCI,                              ECC   11
     3 MUOPC                                                            ECC   12
C                                                                       ECC   13
      REAL MUSPV,MUXPV                                                  DCFROR11
C                                                                       DCFROR12
      DIMENSION ATPR(50), DCFAT(50),CFAT(50)                            DCFROR13
C                                                                       DCFROR14
      LOGICAL MARK                                                      DCFROR15
      INTEGER YR,COUNT                                                  DCFROR16
      REAL MAXNCF                                                       DCFROR17
C                                                                       DCFROR21
C     ***** ITERATE ON DISCOUNT RATE TO FIND ZERO DCF                   DCFROR22
      ITMAX = 20                                                        DCFROR23
C                                                                       DCFROR24
C     ***** CHECK WHETHER CASH FLOWS HAVE ANY SIGN CHANGES;             DCFROR25
C     ***** IF NOT, THEN NO ROR EXISTS                                  DCFROR26
      NSCHG = 0                                                         DCFROR27
      IF(MYR .LE. 1) GO TO 40                                           DCFROR28
      DO 10 I=1,MYR                                                     DCFROR29
C     ***** FIND FIRST NON-ZERO CASH FLOW                               DCFROR30
      IF(ATPR(I) .NE. 0.0) GO TO 20                                     DCFROR31
   10 CONTINUE                                                          DCFROR32
C     ***** ALL CASH FLOWS ARE ZERO, ROR DOES NOT EXIST                 DCFROR33
      ROR = 0.0                                                         DCFROR34
      EFFINV = 0.0                                                      DCFROR35
      RETURN                                                            DCFROR36
C     GO TO 301                                                         DCFROR37
C                                                                       DCFROR38
C     ***** FIND A CHANGE IN SIGN FROM YEAR I FOREWARD.                 DCFROR39
   20 J = I                                                             DCFROR40
      NEGYR = I                                                         DCFROR41
   30 IF(J .GE. MYR) GO TO 40                                           DCFROR42
      J = J + 1                                                         DCFROR43
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      IF(ATPR(J) .EQ. 0.0) GO TO 30                                     DCFROR44
      IF(ATPR(I) / ABS(ATPR(I)) .EQ. ATPR(J) / ABS(ATPR(J))) GO TO 30   DCFROR45
      IF(NSCHG.EQ.0 .AND. ATPR(J).GT.0.0) NEGYR = J-1                   DCFROR46
      NSCHG = NSCHG + 1                                                 DCFROR47
      I = J                                                             DCFROR48
      GO TO 30                                                          DCFROR49
C                                                                       DCFROR50
C     ***** CHECK FOR FEASIBLE RANGE                                    DCFROR51
   40 IF(NSCHG .NE. 0) GO TO 44                                         DCFROR52
      IF(ATPR(MYR) .LE. 0.0) GO TO 42                                   DCFROR53
C                                                                       DCFROR54
C     ***** ALL CASH FLOWS ARE POSITIVE                                 DCFROR55
      ROR = 1000.                                                       DCFROR56
      GO TO 299                                                         DCFROR57
C                                                                       DCFROR58
C     ***** ALL CASH FLOWS ARE NEGATIVE                                 DCFROR59
   42 ROR = 0.0                                                         DCFROR60
      EFFINV = 0.0                                                      DCFROR61
      RETURN                                                            DCFROR62
C                                                                       DCFROR63
C     ***** INITIALIZE ROR AT USER DISCOUNT RATE                        DCFROR64
   44 ROR = XDR                                                         DCFROR65
C     ***** XROR IS "REAL" DISCOUNT RATE AFTER INFLATION                DCFROR66
      XROR = (1. + XINF) * (1. + ROR)                                   DCFROR67
      XDRS = ROR                                                        DCFROR68
      XDRN = XROR                                                       DCFROR69
      MUSPV = ATPR(J)                                                   DCFROR70
C                                                                       DCFROR71
      IF(IOUT.GT.1) WRITE(IW,9090)                                      DCFROR72
 9090 FORMAT(1H0// 2X,16HDCFROR ITERATION / 2X,16(1H-) /                DCFROR73
     1 6X,3H   ,5X,4H OLD,5X,5HDCFAT,6X,4H NEW /                        DCFROR74
     2 6X,3HITR,5X,4HRATE,5X,5H $MM ,6X,4HRATE,6X,6HDCFATP /            DCFROR75
     3 6X,3H---,5X,4H----,5X,5H-----,6X,4H----,6X,6H------ )            DCFROR76
C                                                                       DCFROR77
C     ***** SEARCH FOR ROR, MAXIMUM OF ITMAX TIMES                      DCFROR78
      DO 55 IT = 1, ITMAX                                               DCFROR79
C                                                                       DCFROR80
C      DCFATT IS THE AFTER TAX PRESENT VALUE                            DCFROR81
C      DCFATP IS THE FIRST DERIVATIVE OF DCFAT WRT ROR                  DCFROR82
      DCFATT = ATPR(MYR)                                                DCFROR83
      IF(IDISC .EQ. 0) DCFATP = FLOAT(MYR) * ATPR(MYR)                  DCFROR84
      IF(IDISC .GT. 0) DCFATP = (FLOAT(MYR) - 0.5) * ATPR(MYR)          DCFROR85
      DO 50 I = 2,MYR                                                   DCFROR86
      DCFATT = DCFATT / XROR + ATPR(MYR - I + 1)                        DCFROR87
      IF(IDISC .EQ. 0)                                                  DCFROR88
     &   DCFATP = DCFATP / XROR + ATPR(MYR - I + 1)                     DCFROR89
     &            * FLOAT(MYR - I + 1)                                  DCFROR90
      IF(IDISC .GT. 0)                                                  DCFROR91
     &   DCFATP = DCFATP / XROR + ATPR(MYR - I + 1)                     DCFROR92
     &            * (FLOAT(MYR - I + 1) - 0.5)                          DCFROR93
   50 CONTINUE                                                          DCFROR94
C                                                                       DCFROR95
C     ***** SUBTRACT PROJECT START-UP COST FROM  PRESENT VALUE          DCFROR96
      IF(IDISC .GT. 0)                                                  DCFROR97
     &   DCFATT = DCFATT / XROR ** 0.5                                  DCFROR98
      DCFATP = -DCFATP / XROR                                           DCFROR99
      IF(IDISC .GT. 0)                                                  DCFR0100
     &   DCFATP = DCFATP * XROR ** 0.5                                  DCFR0101
C                                                                       DCFR0102
C     ***** TRY TOP CLOSE NET PRESENT VALUE TO ZERO                     DCFR0103
      IF(ABS(DCFATT) .LT. 0.01) GO TO 60                                DCFR0104
C     ***** SAVE OLD RATE                                               DCFR0105
      XDRS = XROR                                                       DCFR0106
C                                                                       DCFR0107
C     ***** USE NEWTON-RAPSON TO ADJUST ROR                             DCFR0108
      XROR = XROR - DCFATT/DCFATP                                       DCFR0109
C     ***** PREVENT NEGATIVE OR ZERO ROR                                DCFR0110
      IF(XROR .LT. 1.0) XROR = 1.0                                      DCFR0111
C     ***** SAVE NEW PRESENT VALUE                                      DCFR0112
      MUSPV = DCFATT                                                    DCFR0113
C     ***** SAVE NEW RATE                                               DCFR0114
      XDRN = XROR                                                       DCFR0115
C                                                                       DCFR0116
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      IF(IOUT .GT. 1) WRITE(IW,9100) IT,XDRS,MUSPV,XDRN,DCFATP          DCFR0117
 9100 FORMAT(3X,I5,F10.4,F10.2,F10.4,2X,F10.3)                          DCFR0118
C                                                                       DCFR0119
   55 CONTINUE                                                          DCFR0120
C                                                                       DCFR0121
C     IF HERE - DID NOT CONVERGE ON ROR                                 DCFR0122
C                                                                       DCFR0123
      ROR = -1.0                                                        DCFR0124
      GO TO 299                                                         DCFR0125
C                                                                       DCFR0126
C     ***** SOLVED FOR ROR                                              DCFR0127
   60 MUPPV = DCFATT                                                    DCFR0128
      ROR = (XROR / (1. + XINF) - 1.) * 100.                            DCFR0129
C                                                                       DCFR0130
C     ***** INVESTMENT EFFICIENCY                                       DCFR0131
C  COMPUTES INVESTMENT EFFICIENCY AT USERS SET DISCOUNT RATE            DCFR0132
C                                                                       DCFR0133
C  XDR : DISCOUNT RATE FOR RUN                                          DCFR0134
C  CFAT(YR) : UNDISCOUNTED AFTER TAX CASH FLOW IN YEAR 'YR'             LKT1  91
C  MYR : LIFE OF PROJECT                                                DCFR0136
C  SUMPCF : SUM OF DISCOUNTED POSITIVE CASH FLOWS                       DCFR0137
C  SUMNCF : ABSOLUTE VALUE OF SUM OF NEGATIVE CASH FLOWS                DCFR0138
C  DMUL : DISCOUNTING FACTOR                                            DCFR0139
C                                                                       DCFR0140
 299  CONTINUE                                                          DCFR0141
      XINVES = MUCT(1) + MUCI(1) + COSTRT                               LKT7  17
      ATPR(1) = ATPR(1) + XINVES                                        LKT7  18
      DO 201 I=2,MYR                                                    DCFR0144
      XX = MUCT(I) + MUCI(I)                                            DCFR0145
      ATPR(I-1) = ATPR(I-1) - XX                                        DCFR0146
 201  ATPR(I) = ATPR(I) + XX                                            DCFR0147
       CCF=0.                                                           DCFR0148
       SUMPCF=0.0                                                       DCFR0149
       SUMNCF=XINVES                                                    LKT7  19
      MAXNCF = XINVES                                                   LKT7  20
       MARK=.FALSE.                                                     DCFR0152
C                                                                       DCFR0153
        DO 3000 YR=1,MYR                                                DCFR0154
C  DON'T DISCOUNT YEAR ONE                                              DCFR0155
C                                                                       DCFR0156
C                                                                       DCFR0157
C  DISCOUNT ALL OTHER YEARS ON THE HALF YEAR                            DCFR0158
        T1=FLOAT(YR)-0.5                                                DCFR0159
      DMUL=(1.0+XDR)**T1                                                DCFR0160
C                                                                       DCFR0161
C  T2 : DISCOUNTED CASH FLOW IN YEAR                                    DCFR0162
C                                                                       DCFR0163
         T2=ATPR(YR)/DMUL                                               DCFR0164
C  CCF : CUMULATIVE CASH FLOW                                           DCFR0165
       CCF=CCF+T2                                                       DCFR0166
       IF(CCF.GE.0.)MARK=.TRUE.                                         DCFR0167
C  CEASE ACCUMULATING NEGATIVES ONCE CUMULATIVE CASH FLOW GOES POSITIVE DCFR0168
         IF(T2.GE.0.)SUMPCF=SUMPCF+T2                                   DCFR0169
       IF(MARK)GO TO 3000                                               DCFR0170
         IF(T2.LT.0.)SUMNCF=SUMNCF+T2*(-1.)                             DCFR0171
C                                                                       DCFR0172
C     CALCULATE MAXIMUM NEGATIVE CASH FLOW - MAXNCF                     DCFR0173
C                                                                       DCFR0174
      IF(SUMNCF .GT. MAXNCF) MAXNCF = SUMNCF                            DCFR0175
3000     CONTINUE                                                       DCFR0176
C                                                                       DCFR0177
C   COMPUTE INVESTMENT EFFICIENCY AS THE RATIO OF POSITIVE TO           DCFR0178
C   NEGATIVE CASH FLOW SUMS                                             DCFR0179
C                                                                       DCFR0180
C  CASE WHERE THERE ARE NO NEGATIVE CASH FLOWS                          DCFR0181
       IF(SUMNCF.LE.0.)EFFINV=1.0E03                                    DCFR0182
C  ALL OTHER CASES                                                      DCFR0183
C                                                                       DCFR0184
        IF(MAXNCF.GT.0.)EFFINV=SUMPCF/MAXNCF                            DCFR0185
C                                                                       DCFR0186
C  THIS COMPLETES COMPUTATION OF INVESTMENT EFFICIENCY                  DCFR0187
C                                                                       DCFR0188
C                                                                       DCFR0189
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      CONTINUE                                                          DCFR0190
      ATPR(1) = ATPR(1) - XINVES                                        LKT7  21
      DO 302 I=2,MYR                                                    DCFR0192
      XX = MUCT(I) + MUCI(I)                                            DCFR0193
      ATPR(I-1) = ATPR(I-1) + XX                                        DCFR0194
 302  ATPR(I) = ATPR(I) - XX                                            DCFR0195
      RETURN                                                            DCFR0196
      END                                                               DCFR0197
      SUBROUTINE OUTE                                                   OUTE   2
C                                                                       OUTE   3
C                                                                       OUTE   4
C-----------------------------------------------------------------------OUTE   5
C     COMMON STATEMENTS.                                                OUTE   6
C-----------------------------------------------------------------------OUTE   7
      COMMON /FLAGS/  IJ1,                                              FLAGS  2
     1 IRES, IPAT, IWRIT, IECON, IERR,                                  FLAGS  3
     2 IR, IW, IP, NZONE                                                FLAGS  4
C                                                                       FLAGS  5
      COMMON /ECI/ M,MYR,IOUT,ISTATE,IDIST,IFIT,IDISC,IFUL,ISO,IDEP,    ECI    2
     1 PCTDBT, DBTINT, NYRRPY, NYPAID, IDEBT,                           ECI    3
     1 CCOST,  GTRT,   WTRT,  CTACR, DCE,  PLANT,                       ECI    4
     1 WOCOST, WTCOST, WDCOST,COSTML,COSTTI,                            ECI    5
     1 WCAP,   UNCO,   WPP,   COSTRT, FOCPL, FOCPM, FOCPH,              ECI    6
     1 WPP1,   WPP2,   WPP3,  WPP4,  POBASE, OILB, OILC, DECL,          ECI    7
     1 XDR,    XINF,   XROY,  XSEV,  XWPT, XFIT, XTCR, DTIM, XSTX,      ECI    8
     1 WPHO,   EPHO,   BTIM,  BPOW,                                     ECI    9
     1 ESCPO,  ESCPG,  ESCPF, ESCFO, ESCED,                             ECI   10
     1 ESCCT,  ESCCI,  ESCWO, ESCWT, ESCWI, ESCBP,                      ECI   11
     1 OILR(50), VOS(50),                                               ECI   12
     1 POL(50),  POM(50),  POH(50), PGL(50), PGM(50),  PGH(50),         ECI   13
     2 FOCL(50), FOCM(50), FOCH(50),OPCL(50),OPCM(50), OPCH(50),        ECI   14
     3 EDPL(50), EDPM(50), EDPH(50),WTC(50), WDC(50),  CML(50),         ECI   15
     4 CTPL(50), CTPM(50), CTPH(50),CIPL(50),CIPM(50), CIPH(50),        ECI   16
     4 CTCL(50), CTCM(50), CTCH(50),CICL(50),CICM(50), CICH(50),        ECI   17
     5 VOL(50),  VOM(50),  VOH(50), WO(50),  BPO(50),  CTI(50),         ECI   18
     6 VGM(50),  VWM(50),  VIM(50), GNUM(50),GENC(50), TITL(20),        ECI   19
     6 QHM(50),  VHM(50),  VDM(50), QHP(50), VHP(50),                   ECI   20
     7 VOP(50),  VGP(50),  VWP(50), VIP(50), PATI(50), PATIOX(50)       ECI   21
C                                                                       ECI   22
      COMMON /ECC/                                                      ECC    2
     1 MUVO(50), MUVG(50), MUVW(50), MUVI(50),                          ECC    3
     1 MUPO(50), MUPG(50), MUWO(50),                                    ECC    4
     2 MUFO(50), MUOPC(50),MUED(50), MUCT(50), MUCI(50),                ECC    5
     2 MUDB(50), MURP(50), MUIN(50), MUPB(50),                          ECC    6
     3 SIGVO(50),SIGPO(50),SIGPG(50),SIGPF(50),SIGFO(50),               ECC    7
     4 SIGED(50),SIGCT(50),SIGCI(50),SIGOPC(50)                         ECC    8
      REAL                                                              ECC    9
     1 MUVO,MUVG,MUVW,MUVI,MUDB,MURP,MUIN,MUPB,                         ECC   10
     2 MUPO,MUPG,MUFO,MUED,MUWO,MUCT,MUCI,                              ECC   11
     3 MUOPC                                                            ECC   12
C                                                                       ECC   13
      COMMON /ECS/                                                      ECS    2
     1 SUMVOM, COSR,  TOTD, SUMCI, SVOS, SVGS, SVPS, SVIS, SUMWT,       ECS    3
     1 CINJ,   CEQP,  CSEC, CNVT,  CREP, CDAO, CIWO,                    ECS    4
     1 URPV,   UNOS,  USEV, USFO, USOPC, USED, USWO, USTO,              ECS    5
     1 UWCAP,  USWT,  USWD, USOH,  USTC, USCI, UCFB, USML, USTI,        ECS    6
     1 UWPT,   USIT,  UFIT, UATP,  UINT, ULOAN,SINT, SPRP,              ECS    7
     2 SRPV,   SNOS,  SSEV, SUMFO,SUMOPC,SUMED,SUMWO,SUMWD,             ECS    8
     2 SUMOH,  SUMML, SUMTI, DCFB,                                      ECS    9
     3 MUPPV, STDDEV, PAYOUT, PLIFE, ROR,  CC,                          ECS   10
     4 SUMIN,  SUMWC, DNB, SVON, EFFINV                                 ECS   11
C                                                                       ECS   12
      REAL MUPPV                                                        ECS   13
C                                                                       ECS   14
      COMMON /ECO/                                                      ECO    2
     1 DATE(50), VOSLD(50),VONET(50),AOVH(50),  AOVH1,                  ECO    3
     1 VGNET(50),AREVO(50),AREVG(50),ARVWPT(50),AREV(50),               ECO    4
     2 AROY(50), ANET(50), ASEV(50), AWTC(50),  AWDC(50),               ECO    5
     2 ACML(50), ATIN(50), AINJ(50),                                    ECO    6
     3 AFOC(50), AVOC(50), AEDP(50), ACOST(50), ACAP(50),               ECO    7
     4 AWPP(50), ANIP(50), TXCR(50), DEPS(50),  AWCP(50),               ECO    8
     4 AQOR(50), AQGR(50), AQWR(50), AQIR(50),                          ECO    9
     5 ANOI(50), ASTX(50), AWPT(50), ANTI(50),  AFIT(50), ATPR(50),     ECO   10
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     6 CFAT(50), CDAT(50), DCFAT(50),PVDF(50),  CNOI(50),                ECO   11
     7 CFBT(50), CDBT(50), DCFBT(50)                                     ECO   12
C                                                                        ECO   13
C                                                                        OUTE  13
      DIMENSION IDS1(50),IDS2(50)                                        OUTE  14
      DATA IDSH / 3H--- /                                                OUTE  15
C                                                                        OUTE  16
C-----------------------------------------------------------------------OUTE  17
C     ***** WRITE ECONOMIC ANALYSIS REPORTS                              OUTE  18
C-----------------------------------------------------------------------OUTE  19
      UNIT = 1000.                                                       OUTE  20
      UMM = UNIT*UNIT                                                    OUTE  21
C                                                                        OUTE  22
C     ***** PRINT ANNUAL TABLE - UNDISCOUNTED VALUES                     OUTE  23
      IF(IOUT.LE.0) GO TO 600                                            OUTE  24
      INIT = 1                                                           OUTE  25
      IFIN = 10                                                          OUTE  26
      IF(M.LT.IFIN) IFIN = M                                             OUTE  27
      DO 50 I=1,M                                                        OUTE  28
      IDS1(I) = IDSH                                                     OUTE  29
      IDS2(I) = IDSH                                                     OUTE  30
      MUPO(I) = MUPO(I)*UMM                                              OUTE  31
      MUPG(I) = MUPG(I)*UMM                                              OUTE  32
      VGM(I)  = VGM(I)/UNIT                                              OUTE  33
      MUVI(I) = MUVI(I)/UNIT                                             OUTE  34
      MUVW(I) = MUVW(I)/UNIT                                             OUTE  35
      MUVG(I) = MUVG(I)/UNIT                                             OUTE  36
   50 MUVO(I) = MUVO(I)/UNIT                                             OUTE  37
C                                                                        OUTE  38
C     ***** TOP OF LOOP FOR ANNUAL VALUES                                OUTE  39
  100 CONTINUE                                                           OUTE  40
      WRITE(IW,9001)                                                     OUTE  41
 9001 FORMAT(1H1)                                                        OUTE  42
      WRITE(IW,9002)                                                     OUTE  43
 9002 FORMAT(60X,49HECONOMIC ANALYSIS OF AN INSITU COMBUSTION PROJECT    OUTE  44
     1 / 60X,49(1H-) )                                                   OUTE  45
      WRITE(IW,9005) (I,I=INIT,IFIN)                                     OUTE  46
 9005 FORMAT(1H0,24HUNDISCOUNTED MEAN VALUES / 1X,24(1H-),15X,10I8)      OUTE  47
      WRITE(IW,9006) (DATE(I),  I=INIT,IFIN)                             OUTE  48
      WRITE(IW,9100) (IDS1(I),IDS2(I), I=INIT,IFIN)                      OUTE  49
      WRITE(IW,9010) (MUVO(I),  I=INIT,IFIN)                             OUTE  50
      WRITE(IW,9011) (VGM(I),   I=INIT,IFIN)                             OUTE  51
      WRITE(IW,9012) (MUVW(I),  I=INIT,IFIN)                             OUTE  52
      WRITE(IW,9014) (MUVI(I),  I=INIT,IFIN)                             OUTE  53
      WRITE(IW,9015) (AQOR(I),  I=INIT,IFIN)                             OUTE  54
      WRITE(IW,9016) (AQGR(I),  I=INIT,IFIN)                             OUTE  55
      WRITE(IW,9017) (AQWR(I),  I=INIT,IFIN)                             OUTE  56
      WRITE(IW,9018) (AQIR(I),  I=INIT,IFIN)                             OUTE  57
      WRITE(IW,9100) (IDS1(I),IDS2(I), I=INIT,IFIN)                      OUTE  58
      WRITE(IW,9121) (VONET(I), I=INIT,IFIN)                             OUTE  59
C      WRITE(IW,9122) (VGNET(I), I=INIT,IFIN)                            OUTE  60
      WRITE(IW,9022) (MUPO(I),  I=INIT,IFIN)                             OUTE  61
C      WRITE(IW,9023) (MUPG(I),  I=INIT,IFIN)                            OUTE  62
      WRITE(IW,9025) (AREVO(I), I=INIT,IFIN)                             OUTE  63
C      WRITE(IW,9026) (AREVG(I), I=INIT,IFIN)                            OUTE  64
C      WRITE(IW,9027) (AREV(I),  I=INIT,IFIN)                            OUTE  65
      WRITE(IW,9030) (AROY(I),  I=INIT,IFIN)                             OUTE  66
      WRITE(IW,9033) (ANET(I),  I=INIT,IFIN)                             OUTE  67
      WRITE(IW,9100) (IDS1(I),IDS2(I), I=INIT,IFIN)                      OUTE  68
      WRITE(IW,9035) (ASEV(I),  I=INIT,IFIN)                             OUTE  69
      WRITE(IW,9036) (AFOC(I),  I=INIT,IFIN)                             OUTE  70
      WRITE(IW,9037) (AVOC(I),  I=INIT,IFIN)                             OUTE  71
      WRITE(IW,9038) (AEDP(I),  I=INIT,IFIN)                             OUTE  72
      WRITE(IW,9138) (ACML(I),  I=INIT,IFIN)                             OUTE  73
      WRITE(IW,9238) (ATIN(I),  I=INIT,IFIN)                             OUTE  74
      WRITE(IW,9039) (MUWO(I),  I=INIT,IFIN)                             OUTE  75
      WRITE(IW,9040) (AWTC(I),  I=INIT,IFIN)                             OUTE  76
      WRITE(IW,9041) (AWDC(I),  I=INIT,IFIN)                             OUTE  77
      WRITE(IW,9042) (AOVH(I),  I=INIT,IFIN)                             OUTE  78
      WRITE(IW,9043) (ACOST(I), I=INIT,IFIN)                             OUTE  79
      WRITE(IW,9045) (ANOI(I),  I=INIT,IFIN)                             OUTE  80
      WRITE(IW,90455) (CNOI(I), I=INIT,IFIN)                             OUTE  81
      WRITE(IW,9046) (AWCP(I),  I=INIT,IFIN)                             OUTE  82
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      WRITE(IW,9047) (MUCT(I),  I=INIT,IFIN)                            OUTE  83
      WRITE(IW,9048) (MUCI(I),  I=INIT,IFIN)                            OUTE  84
      IF(IDEBT .NE. 0) WRITE(IW,90481) (MUIN(I), I=INIT,IFIN)           OUTE  85
      IF(IDEBT .NE. 0) WRITE(IW,90482) (MUDB(I), I=INIT,IFIN)           OUTE  86
      IF(IDEBT .NE. 0) WRITE(IW,90483) (MURP(I), I=INIT,IFIN)           OUTE  87
      IF(IDEBT .NE. 0) WRITE(IW,90484) (MUPB(I), I=INIT,IFIN)           OUTE  88
      WRITE(IW,9050) (CFBT(I),  I=INIT,IFIN)                            OUTE  89
      WRITE(IW,9100) (IDS1(I),IDS2(I), I=INIT,IFIN)                     OUTE  90
      WRITE(IW,9052) (BPO(I),   I=INIT,IFIN)                            OUTE  91
      WRITE(IW,9053) (AWPP(I),  I=INIT,IFIN)                            OUTE  92
      WRITE(IW,9054) (ANIP(I),  I=INIT,IFIN)                            OUTE  93
      WRITE(IW,9055) (AWPT(I),  I=INIT,IFIN)                            OUTE  94
      WRITE(IW,9056) (ASTX(I),  I=INIT,IFIN)                            OUTE  95
      WRITE(IW,9057) (ACAP(I),  I=INIT,IFIN)                            OUTE  96
      WRITE(IW,9059) (TXCR(I),  I=INIT,IFIN)                            OUTE  97
      WRITE(IW,9060) (ANTI(I),  I=INIT,IFIN)                            OUTE  98
      WRITE(IW,9065) (AFIT(I),  I=INIT,IFIN)                            OUTE  99
      WRITE(IW,9070) (ATPR(I),  I=INIT,IFIN)                            OUTE 100
      WRITE(IW,9075) (CFAT(I),  I=INIT,IFIN)                            OUTE 101
C                                                                       OUTE 102
 9006 FORMAT(2X,40HYEAR ENDING ............................, 10F8.0)    OUTE 103
 9010 FORMAT(2X,40HGROSS OIL PRODUCTION, MBBL ............., 10F8.1)    OUTE 104
 9011 FORMAT(2X,40HWASTE GAS PRODUCTION, MMSCF ............, 10F8.0)    OUTE 105
 9012 FORMAT(2X,40HANNUAL WATER PRODUCTION, MBBL .........., 10F8.0)    OUTE 106
 9014 FORMAT(2X,40HANNUAL AIR INJECTED, MMSCF ............., 10F8.0)    OUTE 107
 9015 FORMAT(2X,40HOIL PRODUCTION RATE, BBL/D ............., 10F8.0)    OUTE 108
 9016 FORMAT(2X,40HGAS PRODUCTION RATE, MSCF/D ............, 10F8.0)    OUTE 109
 9017 FORMAT(2X,40HWATER PRODUCTION RATE, BBL/D ..........., 10F8.0)    OUTE 110
 9018 FORMAT(2X,40HAIR INJECTION RATE, MSCF/D ............., 10F8.0)    OUTE 111
C-----------------------------------------------------------------------OUTE 112
 9121 FORMAT(2X,40HNET OIL SOLD (LESS ROYALTY), MBBL ......, 10F8.1)    OUTE 113
C9122 FORMAT(2X,40HNET GAS SOLD (LESS ROYALTY), MMSCF ....., 10F8.1)    OUTE 114
 9022 FORMAT(2X,40HMEAN PRICE OF OIL, $/BBL ..............., 10F8.2)    OUTE 115
C9023 FORMAT(2X,40HMEAN PRICE OF GAS, $/MSCF .............., 10F8.2)    OUTE 116
 9025 FORMAT(2X,40HANNUAL GROSS OIL SALES, MM$ ............, 10F8.2)    OUTE 117
C9026 FORMAT(2X,40HANNUAL GROSS GAS SALES, MM$ ............, 10F8.2)    OUTE 118
C90265 FORMAT(2X,40HRELEASED OIL REVENUES, MM$ ............, 10F8.2)   OUTE 119
C9027 FORMAT(2X,40HANNUAL TOTAL GROSS SALES, MM$ .........., 10F8.2)    OUTE 120
 9030 FORMAT(2X,40HANNUAL ROYALTY,  MM$ ...................., 10F8.2)    OUTE 121
 9033 FORMAT(2X,40HANNUAL NET SALES, MM$ ..................., 10F8.2)    OUTE 122
C-----------------------------------------------------------------------OUTE 123
 9035 FORMAT(2X,40HANNUAL SEVERANCE TAX,  MM$ .............., 10F8.2)    OUTE 124
 9036 FORMAT(2X,40HANNUAL FIXED OPERATING COST,  MM$ ......, 10F8.2)    OUTE 125
 9037 FORMAT(2X,40HANNUAL VARIABLE OPERATING COST, MM$ ...., 10F8.2)    OUTE 126
 9038 FORMAT(2X,40HANNUAL ELECTRIC DRIVER OP COST, MM$ ...., 10F8.2)    OUTE 127
 9138 FORMAT(2X,40HANNUAL COMPR MAINT AND LABOR COST, MM$ ., 10F8.2)    OUTE 128
 9238 FORMAT(2X,40HANNUAL TECHNICIAN AND INST COST, MM$ ...., 10F8.2)   OUTE 129
 9039 FORMAT(2X,40HANNUAL WELL WORKOVER COST, MM$ .........., 10F8.2)   OUTE 130
 9040 FORMAT(2X,40HANNUAL PROD WATER TREATING COST, MM$ ...., 10F8.2)   OUTE 131
 9041 FORMAT(2X,40HANNUAL PROD WATER DISPOSAL COST, MM$ ...., 10F8.2)   OUTE 132
 9042 FORMAT(2X,40HANNUAL OVERHEAD, MM$ ...................., 10F8.2)    OUTE 133
 9043 FORMAT(2X,40HANNUAL TOTAL OPERATING COST,  MM$ ......, 10F8.2)    OUTE 134
 9045 FORMAT(2X,40HANNUAL NET OPERATING INCOME,  MM$ ......, 10F8.2)    OUTE 135
90455 FORMAT(2X,40HCUM NET OPERATING INCOME,  MM$ .........., 10F8.2)   OUTE 136
 9046 FORMAT(2X,40HANNUAL WORKING CAPITAL, MM$ ............, 10F8.2)    OUTE 137
 9047 FORMAT(2X,40HANNUAL TANGIBLE CAPITAL , MM$ .........., 10F8.2)    LKT5  60
 9048 FORMAT(2X,40HANNUAL INTANGIBLE CAPITAL, MM$ .........., 10F8.2)   OUTE 139
90481 FORMAT(2X,40HANNUAL DEBT INTEREST COST, MM$ .........., 10F8.2)   OUTE 140
90482 FORMAT(2X,40HANNUAL NET BORROWING, MM$ ..............., 10F8.2)   OUTE 141
90483 FORMAT(2X,40HANNUAL PRINCIPAL REPAYMENT, MM$ ........., 10F8.2)   OUTE 142
90484 FORMAT(2X,40HANNUAL UNAMORTIZED LOAN, MM$ ............, 10F8.2)   OUTE 143
 9050 FORMAT(2X,40HCUM CASH FLOW BEFORE TAXES, MM$ ........., 10F8.2)   OUTE 144
C-----------------------------------------------------------------------OUTE 145
 9052 FORMAT(2X,40HBASE PRICE OF OIL FOR WPT, $/BBL ........, 10F8.2)   OUTE 146
 9053 FORMAT(2X,40HANNUAL WINDFALL PRICE DIFF, $/BBL ......, 10F8.2)    OUTE 147
 9054 FORMAT(2X,40HANNUAL NET INCOME LIMIT PRICE, $/BBL ...., 10F8.2)   OUTE 148
 9055 FORMAT(2X,40HANNUAL WINDFALL EXCISE TAX,  MM$ ........, 10F8.2)   OUTE 149
 9056 FORMAT(2X,40HANNUAL STATE INCOME TAX,  MM$ ..........., 10F8.2)   OUTE 150
 9057 FORMAT(2X,40HANNUAL INTANGIBLES AND DEPR,  MM$ ......, 10F8.2)    OUTE 151
 9059 FORMAT(2X,40HANNUAL INVESTMENT TAX CREDIT, MM$ ......, 10F8.2)    OUTE 152
 9060 FORMAT(2X,40HANNUAL NET TAXABLE INCOME,  MM$ ........., 10F8.2)   OUTE 153
 9065 FORMAT(2X,40HANNUAL FEDERAL INCOME TAX,  MM$ ........., 10F8.2)   OUTE 154
 9070 FORMAT(2X,40HANNUAL AFTER TAX CASH FLOW,  MM$ ........, 10F8.2)   OUTE 155
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 9075 FORMAT(2X,40HCUM CASH FLOW AFTER TAXES, MM$ ........., 10F8.2)     OUTE 156
 9100 FORMAT(42X, 10(2X,2A3))                                            OUTE 157
C                                                                        OUTE 158
      IF(IFIN.GE.M) GO TO 200                                            OUTE 159
      INIT = IFIN+1                                                      OUTE 160
      IFIN = MINO(INIT+9,M)                                              OUTE 161
      GO TO 100                                                          OUTE 162
  200 IF(IOUT.LT.0) GO TO 600                                            OUTE 163
C                                                                        OUTE 164
C-----------------------------------------------------------------------OUTE 165
C     ***** PRINT UNDISCOUNTED VALUES - SUMMED OVER ECONOMIC LIFE        OUTE 166
C-----------------------------------------------------------------------OUTE 167
      WRITE(IW,9001)                                                     OUTE 168
      WRITE(IW,9204) PLIFE,URPV,UNOS,                                    OUTE 169
     1 USEV,USFO,USOPC,USED,USML,USTI,USWO,USWT,USWD                     OUTE 170
 9204 FORMAT(/ 4X,25HUNDISCOUNTED MEAN RESULTS / 4X,25(1H-) /            OUTE 171
     1 5X,40HPROJECT ECONOMIC LIFE ...................,F10.1,8H  YEARS / OUTE 172
     1 5X,40HTOTAL GROSS SALES .......................,F10.3,8H  MM$   / OUTE 173
     2 5X,40HTOTAL NET SALES .........................,F10.3,8H  MM$   / OUTE 174
     3 5X,40HTOTAL SEVERANCE TAX .....................,F10.3,8H  MM$   / OUTE 175
     4 5X,40HTOTAL FIXED OPERATING COST ..............,F10.3,8H  MM$   / OUTE 176
     5 5X,40HTOTAL VARIABLE OPERATING COST ...........,F10.3,8H  MM$   / OUTE 177
     6 5X,40HTOTAL ELECTRIC DRIVER OP COST ...........,F10.3,8H  MM$   / OUTE 178
     7 5X,40HTOTAL COMPR MAINT AND LABOR COST ........,F10.3,8H  MM$   / OUTE 179
     7 5X,40HTOTAL TECHNICIAN AND INSTR COST .........,F10.3,8H  MM$   / OUTE 180
     8 5X,40HTOTAL WELL WORKOVER COST ................,F10.3,8H  MM$   / OUTE 181
     9 5X,40HTOTAL PROD WATER TREATING COST ..........,F10.3,8H  MM$   / OUTE 182
     9 5X,40HTOTAL PROD WATER DISPOSAL COST ..........,F10.3,8H  MM$   ) OUTE 183
C                                                                        OUTE 184
      TOPC = USFO+USOPC+USEV+USED+USML+USTI+USWO+USWT+USWD+USOH          OUTE 185
      TINV = UWCAP + USTC + USCI                                         OUTE 186
      TEXP =  TOPC + TINV + UINT                                         OUTE 187
      WRITE(IW,9205) USOH,                                               OUTE 188
     1 TOPC,UWCAP,USTC,USCI,TINV,UINT,TEXP,UCFB,UWPT,USIT,UFIT,UATP,     OUTE 189
     2 ULOAN                                                             OUTE 190
 9205 FORMAT(                                                            OUTE 191
     1 5X,40HTOTAL OVERHEAD ..........................,F10.3,8H  MM$   / OUTE 192
     1 5X,40HTOTAL OPERATING COST ....................,F10.3,8H  MM$   / OUTE 193
     2 5X,40HTOTAL WORKING CAPITAL ...................,F10.3,8H  MM$   / OUTE 194
     5 5X,40HTOTAL TANGIBLE CAPITAL ..................,F10.3,8H  MM$   / OUTE 195
     6 5X,40HTOTAL INTANGIBLE CAPITAL ................,F10.3,8H  MM$   / OUTE 196
     7 5X,40HTOTAL CAPITAL INVESTMENT ................,F10.3,8H  MM$   / OUTE 197
     A 5X,40HTOTAL DEBT INTEREST EXPENSE .............,F10.3,8H  MM$   / OUTE 198
     8 5X,40HTOTAL PROJECT EXPENSE ...................,F10.3,8H  MM$   / OUTE 199
     8 5X,40HTOTAL CASH FLOW BEFORE TAX ..............,F10.3,8H  MM$   / OUTE 200
     7 5X,40HTOTAL WINDFALL EXCISE TAX ...............,F10.3,8H  MM$   / OUTE 201
     8 5X,40HTOTAL STATE INCOME TAX ..................,F10.3,8H  MM$   / OUTE 202
     8 5X,40HTOTAL FEDERAL INCOME TAX ................,F10.3,8H  MM$   / OUTE 203
     9 5X,40HTOTAL AFTER TAX PROFIT ..................,F10.3,8H  MM$   / OUTE 204
     B 5X,40HTOTAL LOAN AMOUNT .......................,F10.3,8H  MM$   ) OUTE 205
C                                                                        OUTE 206
C                                                                        OUTE 207
C-----------------------------------------------------------------------OUTE 208
C     ***** PRINT ANNUAL TABLE - DISCOUNTED VALUES                       OUTE 209
C-----------------------------------------------------------------------OUTE 210
      WRITE(IW,9911)                                                     OUTE 211
 9911 FORMAT(1H0/10X,50HECONOMIC ANALYSIS OF AN INSITU COMBUSTION PROJECLKT5  61
     *T                                                                  LKT5  62
     1 / 10X,47(1H-) )                                                   OUTE 213
C                                                                        OUTE 214
      WRITE(IW,9500)                                                     OUTE 215
 9500 FORMAT(1H0,15X,6HPRESNT,21X,20HMEAN VALUE CASH FLOW   /            OUTE 216
     1 11X, 6X,5HVALUE, 10X,16HBEFORE TAX (MM$), 8X,                     OUTE 217
     1 5X,16HAFTER TAX (MM$) /                                           OUTE 218
     2 7X,4HYEAR,5X,6HFACTOR,4X,6HANNUAL,3X,7HCONST $,3X,7HDISCNTD,      OUTE 219
     2 4X,6HANNUAL,3X,7HCONST $,3X,7HDISCNTD /                           OUTE 220
     3 7X,4H----,5X,6H------,4X,6H------,3X,7H-------,3X,7H-------,      OUTE 221
     3 4X,6H------,3X,7H-------,3X,7H------- )                           OUTE 222
C     ***** PRINT ONLY VALUES THRU ECONOMIC LIFE                         OUTE 223
      DO 500 I=1,MYR                                                     OUTE 224
  500 WRITE(IW,9550) I, DATE(I),PVDF(I),CFBT(I),CDBT(I),                 OUTE 225
     1 DCFBT(I), CFAT(I),CDAT(I),DCFAT(I)                                OUTE 226
 9550 FORMAT(2X,I2, F8.0, F10.4, 7F10.2 )                                OUTE 227
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C                                                                       OUTE 228
C                                                                       OUTE 229
C-----------------------------------------------------------------------OUTE 230
C     ***** SUMMARY OF RESULTS                                          OUTE 231
C-----------------------------------------------------------------------OUTE 232
C                                                                       OUTE 233
  600 CALL TITLE(TITL)                                                  OUTE 234
C                                                                       OUTE 235
      TOPC = SUMFO+SUMOPC+SUMED+SUMML+SUMTI+SUMWO+SUMWT+SUMWD+SUMOH     OUTE 236
     & + SSEV                                                           OUTE 237
      TINV = SUMWC + TOTD + SUMCI                                       OUTE 238
      TEXP =  TOPC + TINV + SINT                                        OUTE 239
      DCPDB = 0.0                                                       OUTE 240
      IF(DNB.GT.0.) DCPDB = TEXP/DNB*UNIT                               OUTE 241
      WRITE(IW,9600) PLIFE,SUMVOM,COSR,SVON,DNB                         OUTE 242
 9600 FORMAT(1H0, 3X,18HPRODUCTION SUMMARY / 4X,18(1H-) /               OUTE 243
     1 5X,40HPROJECT ECONOMIC LIFE ...................,F10.1,8H  YEARS / OUTE 244
     1 5X,40HCUMULATIVE OIL PRODUCED .................,F10.0,8H  MBBL  / OUTE 245
     1 5X,40HCUMULATIVE AIR/OIL RATIO ................,F10.2,8H  MSCF/B/ OUTE 246
     1 5X,40HCUMULATIVE NET OIL SOLD .................,F10.0,8H  MBBL  / OUTE 247
     2 5X,40HPRESENT VALUE OF NET OIL SOLD ...........,F10.0,8H  MBBL  ) OUTE 248
      WRITE(IW,9604) SRPV,SNOS,                                         OUTE 249
     1 SSEV,SUMFO,SUMOPC,SUMED,SUMML,SUMTI,SUMWO,SUMWT,SUMWD            OUTE 250
 9604 FORMAT(1H0, 3X,12HMEAN RESULTS / 4X,12(1H-) /                     OUTE 251
     3 5X,40HPRESENT VALUE OF TOTAL GROSS SALES .....,F10.3,8H  MM$   / OUTE 252
     4 5X,40HPRESENT VALUE OF TOTAL NET SALES .......,F10.3,8H  MM$   / OUTE 253
     4 5X,40HTOTAL SEVERANCE TAX (PV) ...............,F10.3,8H  MM$   / OUTE 254
     5 5X,40HTOTAL FIXED OPERATING COST (PV) ........,F10.3,8H  MM$   / OUTE 255
     5 5X,40HTOTAL VARIABLE OPERATING COST (PV) .....,F10.3,8H  MM$   / OUTE 256
     6 5X,40HTOTAL ELECTRIC DRIVER OP COST (PV) .....,F10.3,8H  MM$   / OUTE 257
     7 5X,40HTOTAL COMPR MAINT AND LABOR COST (PV) ..,F10.3,8H  MM$   / OUTE 258
     7 5X,40HTOTAL TECHNICIAN AND INSTR COST (PV) ...,F10.3,8H  MM$   / OUTE 259
     8 5X,40HTOTAL WELL WORKOVER COST (PV) ..........,F10.3,8H  MM$   / OUTE 260
     9 5X,40HTOTAL PROD WATER TREATING COST (PV) ....,F10.3,8H  MM$   / OUTE 261
     9 5X,40HTOTAL PROD WATER DISPOSAL COST (PV) ....,F10.3,8H  MM$   ) OUTE 262
      WRITE(IW,9605) SUMOH,                                             OUTE 263
     1 TOPC,SUMWC,TOTD,SUMCI,TINV,SINT,TEXP,SPRP,DCPDB,DCFB             OUTE 264
 9605 FORMAT(                                                           OUTE 265
     1 5X,40HTOTAL OVERHEAD (PV) ....................,F10.3,8H  MM$   / OUTE 266
     1 5X,40HTOTAL OPERATING COST (PV) ..............,F10.3,8H  MM$   / OUTE 267
     2 5X,40HTOTAL WORKING CAPITAL (PV) .............,F10.3,8H  MM$   / OUTE 268
     5 5X,40HTOTAL TANGIBLE CAPITAL INVESTED (PV) ...,F10.3,8H  MM$   / OUTE 269
     6 5X,40HTOTAL INTANGIBLE CAPITAL (PV) ..........,F10.3,8H  MM$   / OUTE 270
     7 5X,40HTOTAL CAPITAL INVESTMENT (PV) ..........,F10.3,8H  MM$   / OUTE 271
     A 5X,40HTOTAL INTEREST EXPENSE (PV) ............,F10.3,8H  MM$   / OUTE 272
     8 5X,40HTOTAL PROJECT EXPENSE (PV) .............,F10.3,8H  MM$   / OUTE 273
     B 5X,40HTOTAL LOAN PRINCIPAL REPAYMENT (PV) ....,F10.3,8H  MM$   / OUTE 274
     8 5X,40HDISCOUNTED COST PER DISC NET OIL .......,F10.3,8H  $/BBL / OUTE 275
     9 5X,40HDISCOUNTED CASH FLOW BEFORE TAX ........,F10.3,8H  MM$   ) OUTE 276
C                                                                       OUTE 277
      PXDR = XDR*100.                                                   OUTE 278
      PCC = CC*100.                                                     OUTE 279
      OROR = 100.*((1.+ROR/100.)*(1.+XINF) - 1.0)                       OUTE 280
      DCFL = MUPPV - 1.22*STDDEV                                        OUTE 281
      DCFH = MUPPV + 1.43*STDDEV                                        OUTE 282
      RPE = 0.0                                                         OUTE 283
      RPI = 0.0                                                         OUTE 284
      PROBZ = 0.0                                                       OUTE 285
      IF(TINV.LE.0.) GO TO 630                                          OUTE 286
      RPI = MUPPV/TINV                                                  OUTE 287
  630 IF(TEXP.LE.0.) GO TO 640                                          OUTE 288
      RPE = MUPPV/TEXP                                                  OUTE 289
  640 IF(DNB.LE.0.) GO TO 650                                           OUTE 290
      DCFGS = MUPPV/DNB*UNIT                                            OUTE 291
  650 WRITE(IW,9650) PXDR,DCFL,MUPPV,DCFH,STDDEV,                       OUTE 292
     1 PAYOUT,RPI,RPE,DCFGS,EFFINV,ROR                                  OUTE 293
 9650 FORMAT(1H0, 3X,33HPROJECT PROFITABILITY (AFTER TAX) / 4X,21(1H-) /OUTE 294
     1 5X,40HAVERAGE MONETARY DISCOUNT RATE ..........,F10.2,8H  PCNT  /OUTE 295
     1 5X,40H90 PCNT CONFIDENCE DCF ..................,F10.3,8H  MM$   / OUTE 296
     2 5X,40HMEAN DISCOUNTED CASH FLOW ...............,F10.3,8H  MM$   / OUTE 297
     3 5X,40H10 PCNT CONFIDENCE DCF ..................,F10.3,8H  MM$   / OUTE 298
     4 5X,40HSTANDARD DEVIATION OF THE MEAN DCF .....,F10.3,8H  MM$   / OUTE 299
     5 5X,40HPAYOUT BASED ON AFTER TAX MEAN DCF .....,F10.2,8H  YEARS / OUTE 300
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     5 5X,40HMEAN DCF PROFIT TO INVESTMENT RATIO ....,F10.3,8H  R/I    / OUTE 301
     5 5X,40HMEAN DCF PROFIT TO EXPENSE RATIO .......,F10.3,8H  P/E    / OUTE 302
     5 5X,40HMEAN DCF PROFIT PER DISC NET OIL .......,F10.3,8H  $/BBL  / OUTE 303
     5 5X,40HMEAN INVESTMENT EFFICIENCY .............,F10.3,8H         / OUTE 304
     6 5X,40HMEAN DCF RATE OF RETURN ................,F10.2,8H  PCNT   ) OUTE 305
C                                                                       OUTE 306
      RETURN                                                            OUTE 307
      END                                                               OUTE 308
      BLOCK DATA                                                        BLKDAT 2
      COMMON /FPROP/                                                    FPROP  2
     * API, RS, VIS80, VIS100, VIS210, VIS1, VIS2, SGO, SGW, SGG,        FPROP  3
     1 BB(42)                                                           FPROP  4
C                                                                       FPROP  5
C     READ COEFFICIENTS FOR CURVE-FITTING VISCOSITY CORRELATION         BLKDAT 4
      DATA (BB(K),K=1,20) /                                             BLKDAT 5
     1 -6.76824896E-04,-3.89570682E+00, 2.72180350E+02,-3.47080568E+03, BLKDAT 6
     2 +3.68814527E+04,-1.48843074E+05,-2.51952935E-02,-9.64528667E-01, BLKDAT 7
     3  9.50590107E+01,-3.98368883E+02,-1.90395376E+02, 4.16101142E+03, BLKDAT 8
     4 -1.49577301E-03, 9.44396001E-01, 3.98464375E+00,-1.86338863E+02, BLKDAT 9
     5  3.32520064E+03,-1.81471583E+04,-4.55391223E-05, 1.34211338E-01 /BLKDAT10
      DATA (BB(K),K=21,42) /                                            BLKDAT11
     1  2.81437484E+02,-5.37919095E+04, 4.98525603E+06,-1.73099129E+08, BLKDAT12
     2 -4.75188363E-04, 8.84019819E-01, 7.38565439E+00,-2.37472458E+02, BLKDAT13
     3  3.30129337E+03,-1.56440226E+04,-7.34670759E-05, 5.41912201E-01, BLKDAT14
     4  1.33649237E+02,-2.67713439E+04, 2.79978044E+06,-1.10373996E+08, BLKDAT15
     5  5.47456526E-04,-3.75792641E-01, 1.35019571E+02,-8.57863129E+02, BLKDAT16
     6 -6.88146740E+04,    1.17880005E+06 /                             BLKDAT17
C                                                                       BLKDAT18
      END                                                               BLKDAT19
EOF ENCOUNTERED - 3824 RECORD(S) COPIED
COPY COMPLETE - 1 FILE(S) COPIED
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★ U.S. GPO: 1988 561-025/80021