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CONCEPT-5 User's Manual

C. R. Hudson II

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION FOR THE DEPARTMENT OF ENERGY

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ABSTRACT

The CONCEPT computer code package was developed to provide conceptual capital cost estimates for nuclear-fueled and fossil-fired power plants. Cost estimates can be made as a function of plant type, size, location, and date of initial operation. The output includes a detailed breakdown of the estimate into direct and indirect costs similar to the accounting system described in document NUS-531.

Cost models are currently provided in CONCEPT 5 for single- and multiunit pressurized-water reactors, boiling-water reactors, and coal-fired plants with and without flue gas desulfurization equipment.

Keywords: capital costs, power costs, power plant economics.

1. INTRODUCTION

Three computer programs, which are referred to as the CONCEPT package, have been developed by the Engineering Technology Division of the Oak Ridge National Laboratory (ORNL). This computer package is designed to provide a rapid means of estimating future capital costs of different types of plants under various sets of economic and technical ground rules. The use of the CONCEPT code requires an understanding of trends in contributing costs factors, such as labor rates, labor productivity, and materials and equipment prices, as a function of location and time. For application in project evaluation studies, these cost factors should be based on the specific location and design and construction dates being considered. Cost estimates produced by the CONCEPT code are not intended as substitutes for detailed cost estimates for specific projects; however, the CONCEPT estimates should be useful as a rough check of the detailed estimates or for preliminary studies prior to completion of detailed estimates.

This report describes the fifth generation in the development of the CONCEPT package,* which consists of three separate computer programs as

*Previous work is documented in Refs. 1 to 5.

illustrated in Fig. 1.1. At the preoperational level the CONTAC auxiliary program, described in Appendix A, is used to read cost-model data (i.e., detailed cost breakdowns for reference plants) for the various types of plants from punched cards and to generate the cost-model data file, COMO, on a magnetic storage device. The CONLAM auxiliary program, described in Appendix B, is used to read historical cost data for factory equipment, labor, and site-related materials at various locations from punched cards and to generate the data file, LAMA, on a second magnetic storage device. The two auxiliary programs, CONTAC and CONLAM, are important parts of the

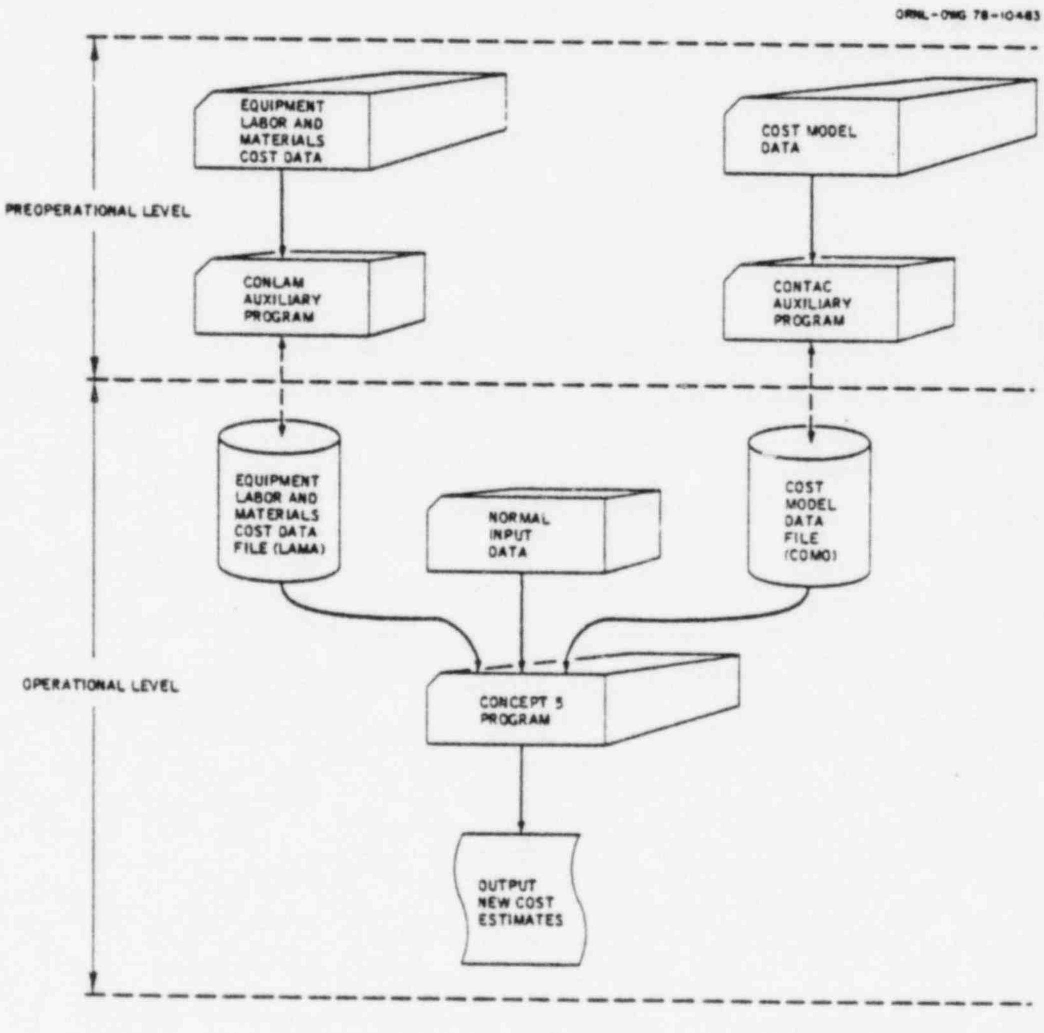

Fig. 1.1. CONCEPT-5 package.

total CONCEPT package and must be used to generate, update, and modify the data files. The main body of this report is devoted to the operational level CONCEPT-5 program, which retrieves cost-model data and historical cost data from the two previously prepared data files and uses them to generate cost estimates based on the ground rules specified by the user at program execution time. The major features in the evolution of the CONCEPT code are summarized in Table 1.1.

Table 1.1. Evolution of the CONCEPT code

Version	Major features
Phase 1	Experimental version, which included only a preliminary cost model for a single-unit pressurized-water reactor (PWR) plant
Phase 2	Added cost models for the first unit of PWR, boiling-water reactor (BWR), coal, and oil plants based on WASH-1230 (vols. I-IV)
	Added historical craft labor and materials cost data for the generation of cost indices and escalation rates
Phase 3	Updated the first-unit cost models for PWR, BWR, coal, and oil plants to account for more stringent environmental and safety regulations between 1971 and 1973
	Added cost models for coal- and oil-fired plants with wet limestone scrubber SO_2 removal systems
	Added cost models for gas-fired plants
	Added cost models for the second unit of two-unit plants
Phase 4	Added cost models for high-temperature gas-cooled reactor (HTGR) plants
	Modified all second-unit cost models
	Modified code to simplify data input for optional calculations, to accept time-dependent escalation rates, and to calculate allowances for interest during construction and escalation during construction based on cash flow curves modified for a specified receipt-of-construction-permit date
Phase 5	Updated cost models for PWR, BWR, and coal plants with and without flue gas desulfurization (FGD) and expanded cost models to include coal-fired plants with cross-compound (as well as tandem-compound) turbine generators
	Added historical factory equipment cost data for the generation of cost indices and escalation rates
	Modified indirect costs to be calculated as a function of unit size in the same manner as direct costs, rather than calculated as a function of direct costs
	Established an indirect cost account for owner's costs
	Improved time-dependent escalation feature

The three programs are written for batch processing in FORTRAN IV for the IBM 360 and 370 class of machines. Instructions for executing the programs on an IBM machine, as well as sample job control language (JCL) statements, are presented in Appendix E. Previous versions of the programs have been implemented on other computers by various users. Less than 270K (bytes) of computer core are required for any one of the three programs. Computer time required for a single cost calculation is dependent on the complexity of the case but averages only a few seconds.

The CONCEPT-5 package, including auxiliary programs and cost-model and historical cost data sets, will be available from the Argonne Code Center, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439.

2. GENERAL DESCRIPTION OF THE CONCEPT-5 CODE

The procedures used in the CONCEPT code are based on the assumption that any central station power plant of the same type involves approximately the same major cost components, regardless of location or date of initial operation. Therefore, if the trends of these major cost components can be established as a function of time, location, and plant size, a cost estimate for a reference case can be adjusted to fit any case of interest.

The application of this approach requires a detailed cost model for each plant type at a reference condition and the determination of the cost trend relationships. The generation and updating of these data sets comprise a large effort in the continuing development of the code.

The cost model for each type of plant is based on a detailed cost estimate for a reference plant at a designated time and location. Each estimate includes a detailed breakdown of each cost account into costs for equipment, labor, and site-related materials. The cost models are stored on a magnetic storage device (the COMO data file) by the auxiliary program, CONTAC, which is described in Appendix A.

Data that reflect historical trends in equipment costs, labor rates, and prices of site-related materials for 23 locations are stored on a second magnetic storage device (the LAMA data file) by the auxiliary program, CONLAM, which is described in Appendix B. CONCEPT uses the historical equipment, labor, and materials cost data to calculate cost indices for translating the cost-model data from the base (or reference) time and location to the specified time and location.

The input to CONCEPT consists of the plant net electrical capacity, plant type, plant location, date of purchase of nuclear steam supply system (NSSS) or fossil-fired steam generator, date of receipt of construction permit, date of initial commercial operation, and interest rate. Specific constants, variables, and cost arrays, which are listed in Chap. 7 of this report, can be altered by input option. In addition, the escalation rates calculated by the code from data stored in the historical cost data file (LAMA file) can be overridden by input option. Contingency cases can be examined with a minimum of effort, and the cost-model data can be altered temporarily at execution time to take into account known costs or factors that affect the design of the plant.

As an example of the procedures described above, suppose a cost estimate for the year 1977 is available for a 1100-MWe PWR plant located on a site near Middletown,* and a cost estimate for 1986 is desired for a corresponding plant located on a similar site but near another city. The new estimate is obtained by adjusting factory and site-related costs for the Middletown plant by the ratios of the projected 1986 cost indices for the new city to the 1977 cost indices for Middletown.

The technique of separating the plant cost into individual components, applying appropriate cost indices, and summing the adjusted components is the basic tool used in CONCEPT. A schematic illustration of this technique is presented in Fig. 2.1. Three sets of cost indices as functions of

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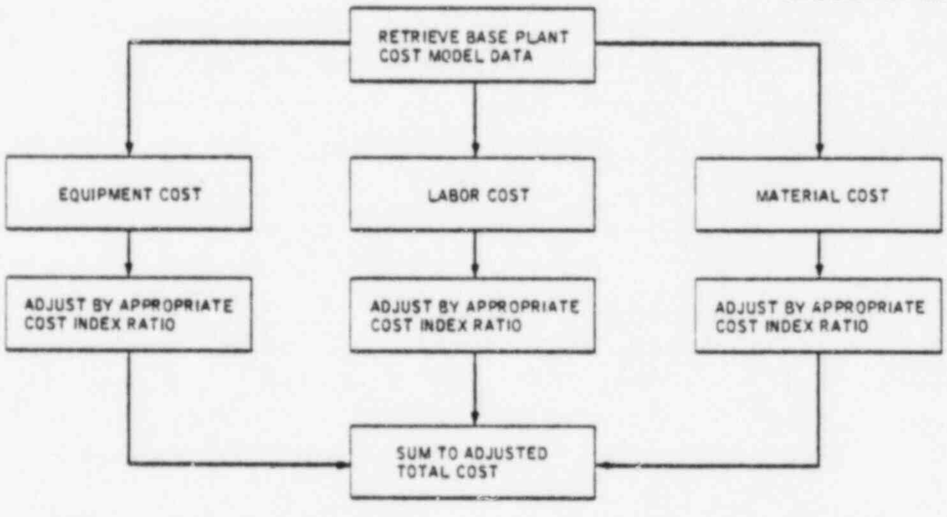

Fig. 2.1. Method used to adjust base costs in CONCEPT.

time and location are required. These indices are used to adjust the costs of equipment, labor, and site-related materials. The equipment cost indices are calculated from Bureau of Labor Statistics data, and the labor cost indices are calculated from basic parameters, which include wage

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*Middletown represents the standard hypothetical site described in the Commercial Electric Power Cost Studies.[6-11]

rates for the various crafts, labor productivity, and overtime considerations. The materials cost indices are calculated from unit costs for site-related materials, which include structural steel, reinforcing steel, concrete, and lumber. A detailed breakdown of the equipment, labor, and materials categories is included in Appendix B.

Figure 2.2 indicates the general flow of calculations in CONCEPT 5. The computer code follows this procedure closely; however, the illustration is not a detailed computer program flowchart. An important feature of this arrangement is that the second block of the diagram utilizes the cost-model data stored in the COMO file for different types of power

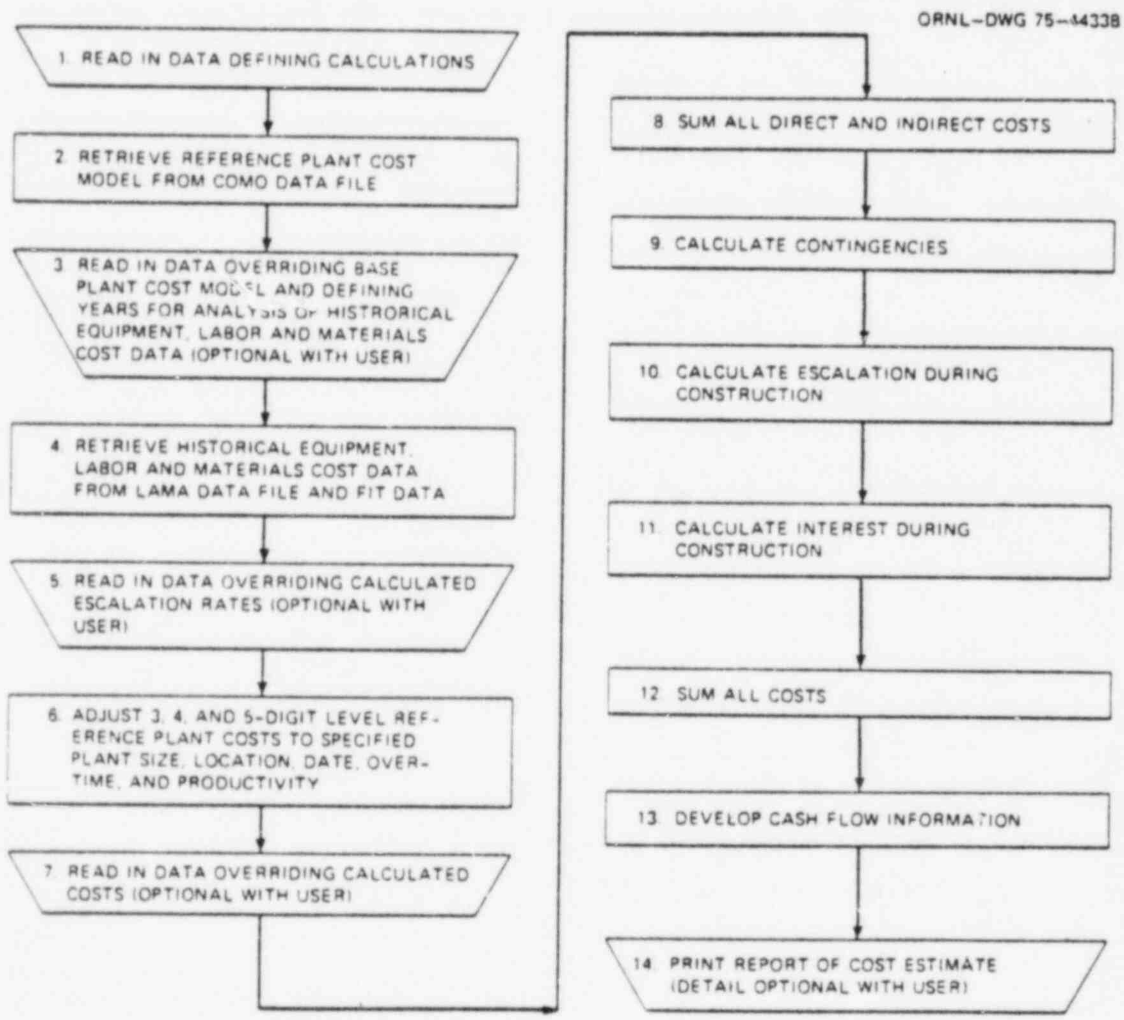

Fig. 2.2. General flow of calculations in CONCEPT 5.

plants, and the fourth block utilizes the historical equipment, labor, and materials cost data stored in the LAMA file for different locations. Therefore, when other types of plants or other cities are studied, only the cost-model data set for the reference plant or the historical cost data set for the new location need be provided.

Block 1 refers to the input data stream. This input is read from punched cards and, for each case, must include the net electrical capacity, plant type, plant location (one of 23 cities), and design and construction period. The code will make the following assumptions if they are not overridden by input data: (1) costs are referenced to the date of purchase of the steam supply system, (2) 40-hr workweek with no overtime, and (3) constant 8% per year simple interest for calculating interest during construction. Cases of interest may differ from these hypothetical cases, and input options have been included to allow modifications to plant cost-model data, to escalation data, and to calculated costs at the time of program execution (blocks 3, 5, and 7).

In block 2, the cost-model data for the type of plant specified by the input data are retrieved from the COMO data file. If a cost-model data set for the type of plant specified is not found, a diagnostic message will be printed, and the code will select the last plant type on the COMO file as a default.

In block 3, the user has the option to read in, at program execution time, values that replace most of the constants or factors in the cost-model data set and in the MAIN program. The unadjusted reference costs stored in the cost model data set may be modified at this point, if desired. This option is also used to specify the time period from which historical equipment, labor, and materials cost data are to be used in calculating escalation rates for cost indices. A list of the variables capable of adjustment is given in Chap. 7.

In block 4, the historical equipment, labor, and materials cost data for the specified city are retrieved from the LAMA data file, and escalation rates are calculated for use in adjusting costs to the specified location and for projecting costs to the specified dates. This calculation of escalation rates utilizes the historical data previously generated by the CONLAM auxiliary program, data from the reference plant cost model, and data stored by the MAIN program. If the specified city is not found, a diagnostic message will be printed, and the code will select the last city on the LAMA file as a default.

In block 5, the user has the option to read in, at program execution time, values that override the equipment, labor, and materials escalation rates previously calculated in block 4. It is also possible to specify time-dependent equipment, labor, and materials escalation rates at this point. Data read in at this point continue in effect only for the current case unless retrieved as described in Chap. 7.

In block 6, the three components of each account in the plant cost model (equipment, labor, and materials at the three-, four-, or five-digit account level) are scaled to the specified plant size, escalated and adjusted to the date of purchase of the NSSS (or fossil-fired steam generator), adjusted to the specified city, and adjusted for craft-labor overtime and productivity. Component costs are scaled by using mathematical models that define each two-digit account cost in the plant cost model as a function of size. Component costs are escalated and adjusted to the specified city by cost indices calculated from the data developed in block 4 and specified in block 5. If overtime is specified, labor costs are adjusted for premium pay and for changes in productivity; the labor costs are also adjusted for changes in straight-time productivity, if specified.

In block 7, the user has the option to read in, at program execution time, values that override the adjusted equipment, labor, and materials costs at the most detailed three-, four-, or five-digit account levels which have been calculated in block 6 for the specified plant. These data changes continue in effect only for the current case.

In block 8, the adjusted three-, four-, and five-digit account costs from blocks 6 and 7 are summed to the two-digit account level.

In block 9, allowances for contingencies are calculated for each two-digit cost account as percentages of corresponding two-digit account costs.

In block 10, an allowance for escalation during construction is calculated. This step utilizes the cost indices generated in blocks 4 and 5 as well as the two-digit-level cash flow curves provided in each plant cost model.

In block 11, an allowance for interest during construction is calculated. This step utilizes a total cumulative cash flow curve and includes the effect of interest on escalation during construction.

In block 12, all costs are summed to give the total capital cost of the specified plant.

In block 13, additional cumulative cash flow information is developed for use in block 14.

In block 14, the final cost report is printed. The amount of detail is optional with the user, allowing either a one-page summary at the two-digit account level, a one page summary and a total cumulative cash flow curve and table, or a multipage detailed listing at the three-, four-, and five-digit subaccount levels and a total cumulative cash flow curve and table.

3. COST MODELS FOR REFERENCE PLANTS

Cost-model data sets are provided in CONCEPT 5 for single- and multiunit PWR and BWR nuclear plants and coal-fired plants with and without FGD equipment. Following the practice that the first unit of a multiunit plant bears the cost of shared facilities, a cost model is provided for a single-unit station, while a separate cost model describes the first of a multiunit plant. A distinction has also been made for coal-fired plants with respect to size. Large coal-fired plants (generally above 1000 MWe) may use cross-compound turbine generators, whereas the smaller plants would operate with tandem-compound turbine generators. Models for either possibility are provided. First- and second-unit models exist for all plant types, and, for the smaller reference-size coal plants, a third-unit model is provided to reflect further facility sharing. As an illustrative example, the complete data set for the first-unit PWR plant cost model is listed in Appendix A. In the previous version of the CONCEPT code, a distinction among cooling systems was made resulting in separate plant models for different cooling systems. It has been shown by United Engineers and Constructors Inc. (UE&C) that the direct and indirect capital costs of plants utilizing either once-through, natural-draft tower, or mechanical-draft tower cooling differ by less than 4%.[11] As this is well within the variance that should be attributed to conceptual estimates, such as made by this code, cost models depicting various cooling systems have not been included. The models herein describe plants with mechanical-draft tower cooling but may be used for any conventional cooling system. The cost-model data sets available in CONCEPT 5 are defined in Table 3.1.

The present cost models were developed using data presented in a series of investment cost studies for hypothetical plants by UE&C.[6-11] The hypothetical plants are assumed to be located at the Middletown site, which is described in considerable detail in the UE&C studies. This site is favorable in all respects, including an adequate supply of cooling water, low population density, satisfactory transportation facilities,

Table 3.1. Cost-model data sets available in CONCEPT-5

Cost-model name	Definition
PWRMET	Pressurized-water reactor; single unit (stand-alone plant)
PWR1MET	Pressurized-water reactor; first unit of multiunit plants
PWR2MET	Pressurized-water reactor; second unit
BWRMET	Boiling-water reactor; single unit (stand-alone plant)
BWR1MET	Boiling-water reactor; first unit of multiunit plant
BWR2MET	Boiling-water reactor; second unit
COALMET	Coal-fired without SO_2 removal system; using tandem-compound turbine; single unit (stand-alone plant)
COAL1MET	Coal-fired without SO_2 removal system; using tandem-compound turbine; first unit of multiunit plant
COAL2MET	Coal-fired without SO_2 removal system; using tandem-compound turbine; second unit
COAL3MET	Coal-fired without SO_2 removal system; using tandem-compound turbine; third unit
COALSMET	Coal-fired with SO_2 removal system; using tandem-compound turbine; single unit (stand-alone plant)
COAL1SMT	Coal-fired with SO_2 removal system; using tandem-compound turbine; first unit of multiunit plant
COAL2SMT	Coal-fired with SO_2 removal system; using tandem-compound turbine; second unit
COAL3SMT	Coal-fired with SO_2 removal system; using tandem-compound turbine; third unit
CBIGMET	Coal-fired without SO_2 removal system; using cross-compound turbine; single unit (stand-alone plant)
CBIG1MET	Coal-fired without SO_2 removal system; using cross-compound turbine; first unit of multiunit plant
CBIG2MET	Coal-fired without SO_2 removal system; using cross-compound turbine; second unit
CBIGSMET	Coal-fired with SO_2 removal system; using cross-compound turbine; single unit (stand-alone plant)
CBIG1SMT	Coal-fired with SO_2 removal system; using cross-compound turbine; first unit of multiunit plant
CBIG2SMT	Coal-fired with SO_2 removal system; using cross-compound turbine; second unit

and sufficient labor supply for a 40-hr workweek. The cost estimates exclude costs for the main transformer, switchyard and transmission facility, waste disposal, and initial fuel supply.

The actual costs stored in the cost-model data sets are subdivided into equipment, labor, and site-related materials at the detailed sub-account level (three-, four-, or five-digit level) and are identified by account numbers to facilitate making modifications through the optional input data stream.

In addition to detailed reference cost data, each cost model contains scaling coefficients for each two-digit account to adjust the costs from the reference size to the size of the specific case. This is done through a classical exponential scaling relation of the form

$$\text{Factor} = a + b \left(\frac{MWe_{new}}{MWe_{base}}\right)^{c} .$$

These scaling coefficients, rounded to one significant digit, are shown in Table 3.2. It is estimated that the scaling equations are representative of capital cost trends for unit sizes in the range from 500 to

Table 3.2. Scaling coefficients for unit-size adjustments

Account	a	b	c (nuclear)	c (coal)
20	1.0	0.0	0.0	0.0
21	0.0	1.0	0.5	0.5
22	0.0	1.0	0.6	0.8
23	0.0	1.0	0.8	0.8
24	0.0	1.0	0.4	0.3
25	0.0	1.0	0.3	0.3
26	0.0	1.0	0.8	0.6
91	0.0	1.0	0.4	0.7
92	0.0	1.0	0.2	0.7
93	0.0	1.0	0.4	0.6
94	0.0	1.0	0.4	0.4

1500 MWe and may be used outside this range at the risk of greater uncertainty. As there are differences of opinion regarding appropriate values for these scaling exponents, the user can readily make changes, either permanently by modifying the cost-model data or temporarily through the optional input data stream.

The calculation of allowances for interest and escalation during construction requires a cash flow curve for each two-digit direct and indirect cost account. A set of cash flow curves is provided with each cost-model data set. Typical cash flow curves for nuclear-fueled and fossil-fired plants are illustrated in Figs. 3.1 and 3.2. These cash flow curves are assumed to be approximately the same for all similar types of power plants. The curves are normalized so that the range for both axes is from zero to one. The time zero corresponds to the date of placing the order for the steam supply system. The times 0.25 and 0.12 correspond to the date of issuance of the construction permit and start of actual construction for nuclear plants and fossil plants, respectively, and the time 1.0 corresponds to the date of initial commercial operation. These three dates — purchase of steam supply system, issuance of construction permit (or start of onsite construction), and commercial operation — are part of the standard input data specified by the program user. The CONCEPT-5 code remaps the cash flow curves over the specified time periods, as discussed in Chap. 5.

The cost model for each type of plant includes relative distributions of equipment, labor, and materials, which are used as weighting factors in calculating weighted-average cost indices for adjusting reference plant costs to other locations and for projecting future costs. Each cost model also includes equipment, labor, and materials rates for the reference-plant cost estimate; arrays defining the number of accounts; and tables of account headings.

Specific data in the cost-model data sets can be altered temporarily at program execution time through the optional input feature. This important feature is discussed in greater detail later in Chap. 7 and is illustrated in Chap. 8. Permanent modification of cost-model data is accomplished through use of the CONTACT auxiliary program described in Appendix A.

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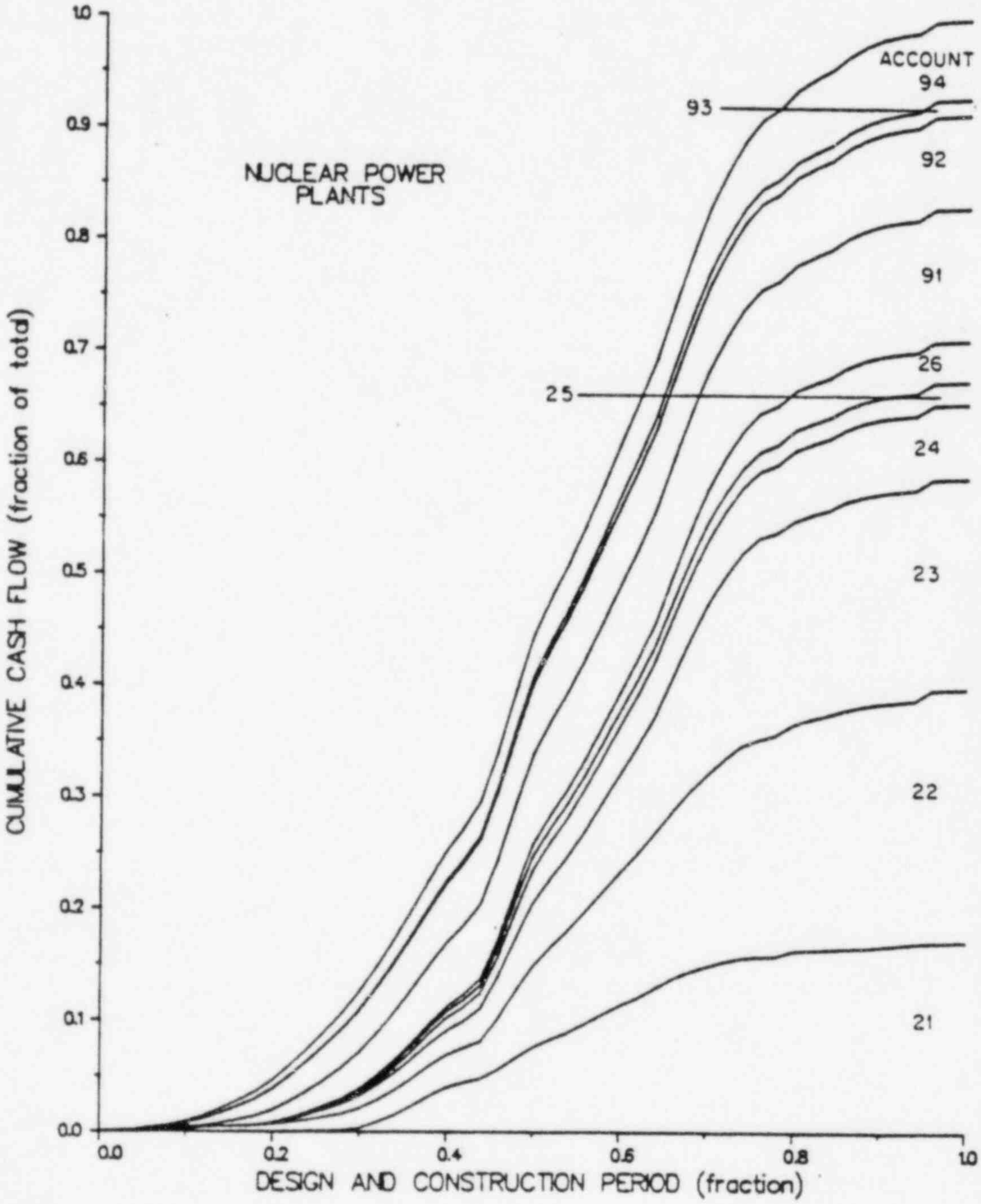

Fig. 3.1. Typical cumulative cash flow curves for major direct cost accounts — nuclear power plants.

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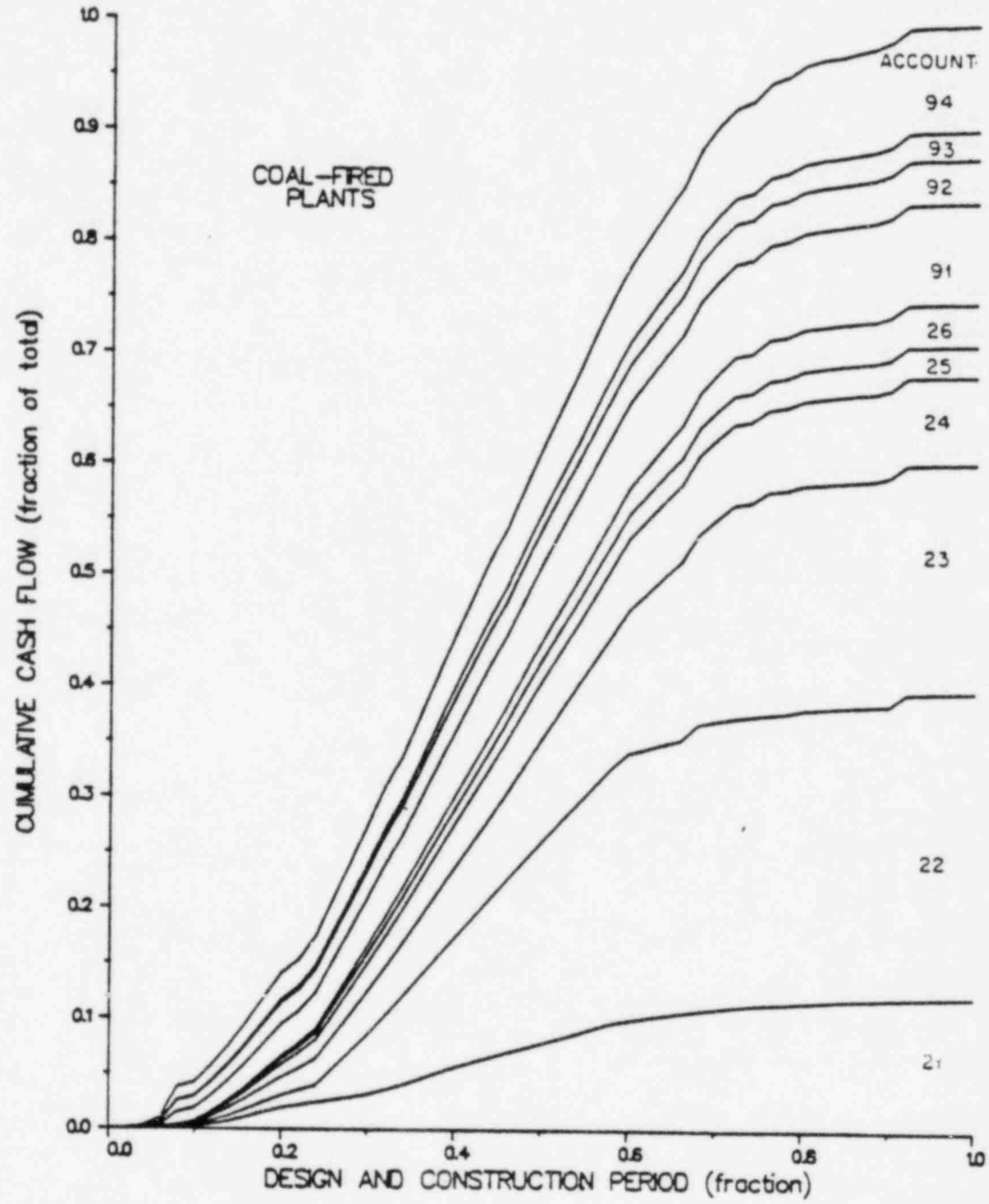

Fig. 3.2. Typical cumulative cash flow curves for major direct cost accounts — coal-fired plants.

4. COST INDEX DATA

Historical cost data for equipment, labor, and site-related materials for 20 U.S. cities, two Canadian cities, and the hypothetical Middletown site are stored in the LAMA data file by the CONLAM auxiliary program described in Appendix B. These locations are identified and illustrated on the map in Fig. 4.1. The file contains cost data for the past 15 years in six-month intervals.

The data used to generate factory equipment cost indices consist of the wholesale price index for steel mill products, SIC Code 10-13; the hourly earnings index in the electrical equipment and supplies industry, SIC Code 36; and the hourly earnings index in the steam engine and

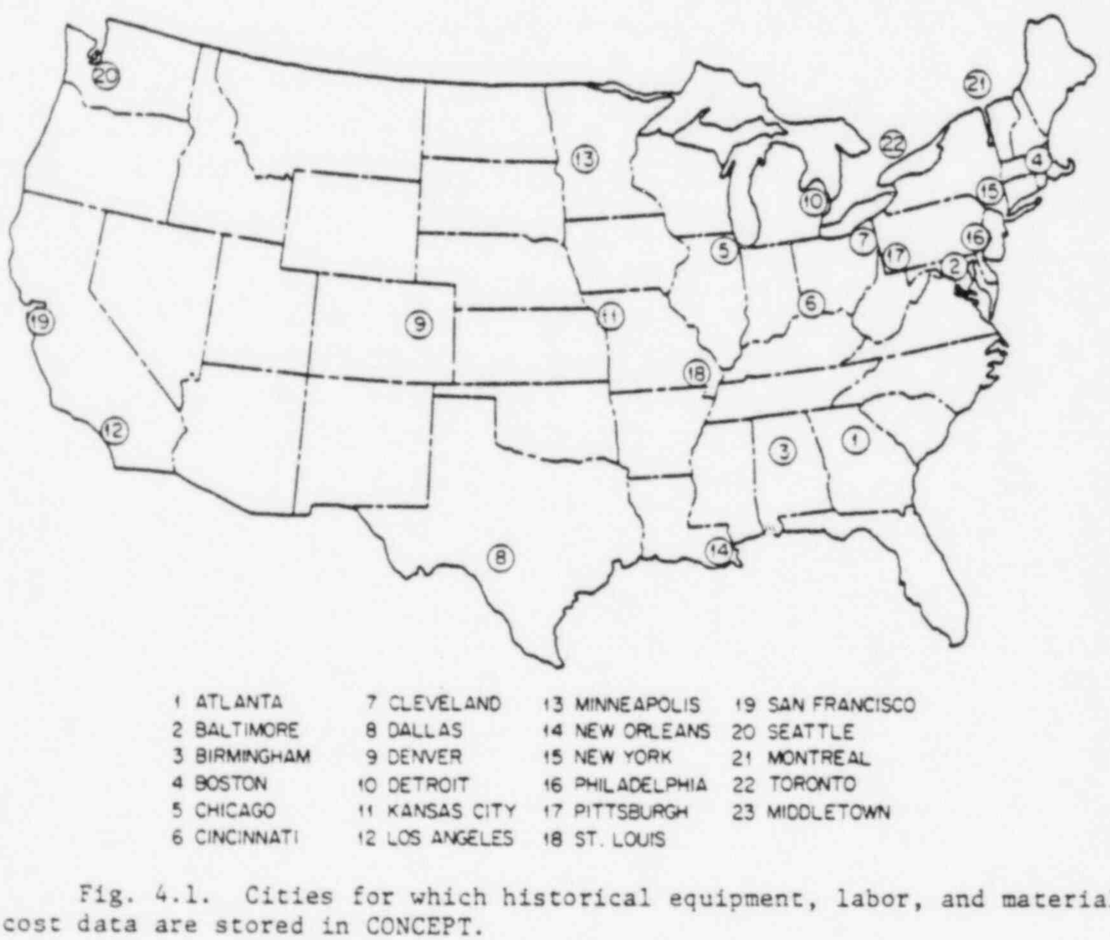

Fig. 4.1. Cities for which historical equipment, labor, and materials cost data are stored in CONCEPT.

turbine industry, SIC Code 3511. This data is obtained from U.S. Department of Labor, Bureau of Labor Statistics publications.[12-14] Unlike the labor and site-related materials data, the equipment data is the same for all cities. This is done in recognition of the limited number of possible equipment suppliers.

A white-collar wage index is also stored in the LAMA data file. It is obtained from white-collar wage escalation data presented in the Bureau of Labor Statistics publication "National Survey of Professional, Administrative, Technical, and Clerical Pay."[15] Like factory equipment data, it is the same for all cities and is used to adjust all noncraft labor costs.

The craft labor cost data consist of hourly rates (including union-negotiated fringe benefits, but not including employers' contributions for social security and workmen's compensation insurance) for 16 classifications of craft labor listed in Appendix B. The materials cost data consist of market quotations for seven classifications of site-materials. The craft labor and materials data for all locations except Middletown are obtained from *Engineering News-Record*.[16] The Middletown location represents a composite of Boston, New York, and Philadelphia data in equal proportions.

The cost data in the LAMA file are retrieved by the CONCEPT program and are used with data on the relative distribution of equipment, labor, and materials included in the cost model for each plant type to calculate indices for adjusting capital costs at the reference (Middletown) site to costs at any of the other 22 cities and to calculate escalation rates.

5. CONCEPT METHODOLOGY

This section is devoted to the description of the analytical methods used in the CONCEPT-5 code. The treatment is presented for the program user who wishes to modify internal and calculated coefficients using the special input options and who therefore must understand the implications of each change.

5.1 Cash Flow Curve Modifications

The shape of the cash flow curves used in the CONCEPT program is dependent upon the construction permit date. This is due to the assumption that only after the construction permit is received does the majority of work and, therefore, expenditures begin. The DELOF subroutine adjusts the reference cash flow curves to reflect the construction schedule of the specific case. To do so, the fraction of the total design and construction period that is prior to the receipt of the construction permit is determined to be

$$P = \frac{YRPER - YRSSS}{YRCOP - YRSSS}, \quad (1)$$

where YRPER is the date of the construction permit, YRSSS is the date of the steam supply order, and YRCOP is the date of commercial operation.

A reference fraction, defined by the variable PO, is either 0.25 or 0.12 for nuclear-fueled or coal-fired plants, respectively. Should P be different from PO, subroutine DELOF compresses or expands the cash flow data such that, at the construction permit date of the specific case, the fraction of total expenditures will be the same as the reference model.

Further, the cash flow curve for each two-digit-level cost account is modeled by 50 data points with equal temporal variation. The program, in adjusting for the specific design and construction schedule, maintains the level of expenditures at the steam supply order date, the construction permit date, and the commercial operation date the same. The other data points are mapped linearly to achieve a modified curve as shown in Fig. 5.1.

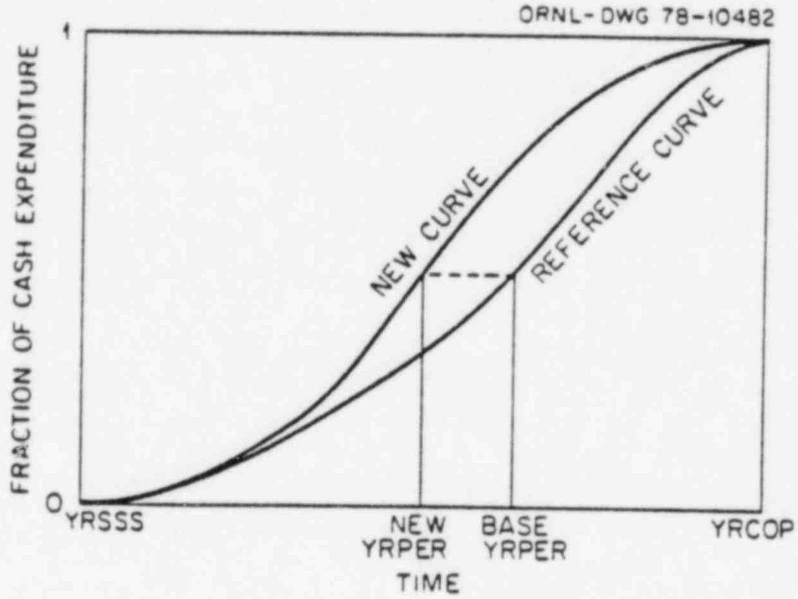

Fig. 5.1. Alteration of project's cash flow.

The procedure for mapping divides the reference array into two sections, one containing data before the construction permit date and the other after that date. Two straight lines with different slopes define the transformation as shown in Fig. 5.2. The units on the ordinate (L) and abscissa (I) are the subscript or index numbers of the reference cash flow array and the cash flow array for the particular case, respectively. There are 50 × P elements of the array prior to and including the construction permit. The reference model assumes 50 × PO elements prior to and including the construction permit. (All of these values are rounded to an integer format.) By taking the ratio of the number of elements in the reference case to the number of elements in the specific case in each of the two sections described above and requiring the P × 50 element in the new array be equated to the PO × 50 element in the reference array, a linear equation of the form

$$L = a + bI \tag{2}$$

is generated. From this, the Ith element of the adjusted array is defined by the Lth element of the reference array.

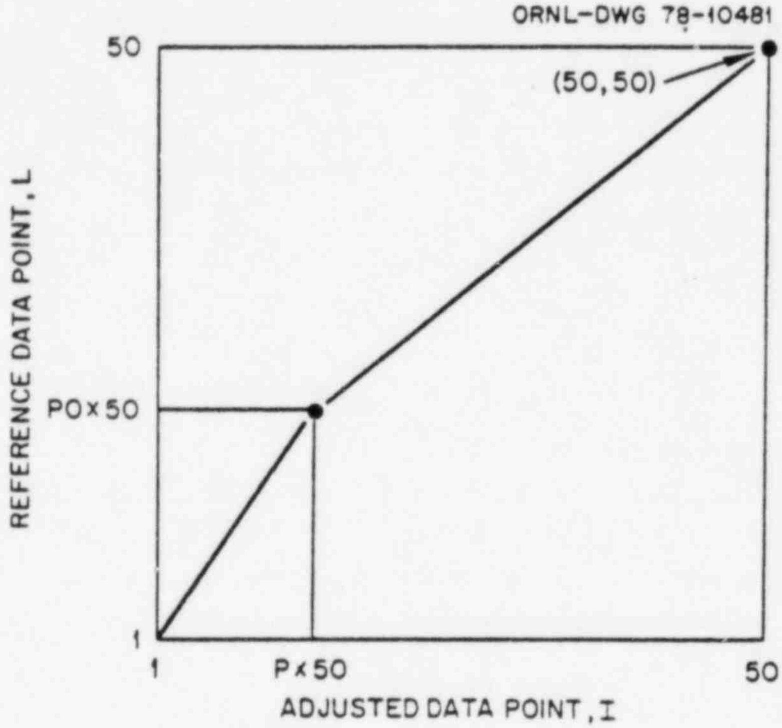

Fig. 5.2. Transformation of cash flow data.

5.2 Cost Index Generation and Alteration

The ability to adjust the reference cost data to various points in time comes from an analysis of historical equipment, labor, and materials unit costs and cost indices. The LAMA file contains 15 years of cost data on which a regression analysis provides escalation rates for each two-digit account. A separate escalation rate is developed for equipment, labor, and materials within each two-digit account.

As there are several equipment items, labor types, and types of materials in the LAMA file, the CONIV subroutine establishes a weighted average unit cost for each point in time in the LAMA file for equipment, labor, and materials. For each of the three categories, a weighted average unit cost can be represented by

$$C_n = \sum_{k=1}^{k_{max}} f_k C_{kn} \Bigg/ \sum_{k=1}^{k_{max}} f_k \ , \qquad (3)$$

where f_k is the weighting factor for item k of the mix and C_{kn} is the historical cost data for item k at time n. The weighting factors are stored in the cost models and represent the relative amount of item k used in construction. The weighted average data can be expressed as a function of time according to

$$C_n = C_o (1 + \varepsilon)^t . \tag{4}$$

Taking the logarithm of both sides, the linear equation

$$\ln C_n = \ln C_o + t \ln (1 + \varepsilon) \tag{5}$$

results which is of the form Y = a + Xb. The values for C_n and the corresponding t are known such that a linear regression can be performed on the data to find $\ln C_o$ and $\ln (1 + \varepsilon)$. The average unit cost at the cost-model reference date and the rate of escalation $(1 + \varepsilon)$ are obtained by taking the exponent of $\ln C_o$ and $\ln (1 + \varepsilon)$, respectively.

An additional feature of CONCEPT allows a combination of cities to be used in establishing a composite site. The above regression procedure is then performed for each city selected. The resulting escalation and the average unit cost at the reference date are combinations of data from each city weighted by proportions (summing to one) specified by the user.

Once the rates of escalation are determined for the categories of equipment, labor, and materials in the various two-digit accounts, the design and construction period is divided into 50 elements, each representing a particular point in time. Using Eq. (4), cost indices for equipment, labor, and materials in each two-digit account are assigned to the 50 elements. The cost indices are used by the code to adjust the reference costs to the steam supply order date and to determine escalation during construction, as described later.

Many times it is useful to modify the cost indices and/or rate of escalation at various points during or before the design and construction period. This is accomplished through the use of time-dependent escalation input data. The INDUSE subroutine reads this data and manipulates the cost indices. As will be further explained in Chap. 7, should the cost index at a particular point in time (A) and the rate of escalation at a particular point in time (B) both be zero for a portion of the time-dependent escalation data input, then no changes will be made to that portion of the cost index array.

Changes in the cost indices representing a given design and construction period can be made using input data corresponding to dates prior to the steam supply order date. This is useful when the design and construction period is well into the future and cost index input data on hand is current. When time-dependent escalation data are input with an effective date prior to the steam supply order date, the INDUSE subroutine adjusts the input data to represent data at the steam supply order date. For example, if A and B are both nonzero, the adjustment is of the form

$$A_{sss} = A_{IN} \times B_{IN}^{YRSSS-YRIN} , \tag{6}$$

where sss and IN represent the steam supply date and the input values, respectively. An initial set of cost indices is present when the program enters INDUSE, and, if A or B should be zero, the initial A and B values will be used. If the input for A is nonzero and the input for B is zero, then the equation is

$$A_{sss} = A_{IN} \times B_{OLD}^{YRSSS-YRIN} , \tag{7}$$

where OLD represents the initial A and B values. If the input for A is zero and B is nonzero, the expression

$$A_{sss} = A_{OLD} \times (B_{IN}/B_{OLD})^{YRSSS-YRIN} \tag{8}$$

discounts back in time at the old rate of escalation and escalates forward in time at the new rate. Once all the input data are for dates during the design and construction period, a substitution process is used to construct a modified array of cost indices.

The escalation rate (B) will be the same for all 50 time periods unless specifically changed with time-dependent escalation input data. Likewise, a change in B holds until additional data, if any, are entered to change it again.

As part of the output produced by the program, the adjusted cost indices and escalation rates are listed. In view of the characteristics of B as explained in the previous paragraph, only the data at the steam supply order date are printed when there are no time-dependent escalation input data or when the effective date of such data is on or before the steam supply order date. If the effective date is after the steam supply order date, then the entire array is printed.

5.3 Adjustments to the Reference Costs

At the heart of the CONCEPT method are the adjustments to the base or reference costs to reflect a specific plant estimate. The goal is to take a reference plant cost estimate at reference conditions, to modify the estimate to reflect the specific characteristics of a particular case, and to express the estimate in dollars current to the steam supply order date. The cost data for the particular plant type selected from the COMO file are adjusted for size, time, location, overtime, productivity, and overhead burden, as shown in Eq. (9). These adjustments will be discussed in the order in which the COST subroutine considers them.

$$\text{Adjusted cost} = \frac{\text{reference cost}}{f_1 f_3} f_2 f_4 f_5 f_6 \ . \qquad (9)$$

The CONCEPT code uses 40 hr as a reference workweek. Should overtime be utilized, two factors influence the costs. First is an overtime efficiency relationship shown in Fig. 5.3. This represents the effects of sustained overtime on the efficiency or productivity of craft labor and can be expressed mathematically as

$$f_1 = 1 - n(\text{HRS} - 40) \ , \qquad (10)$$

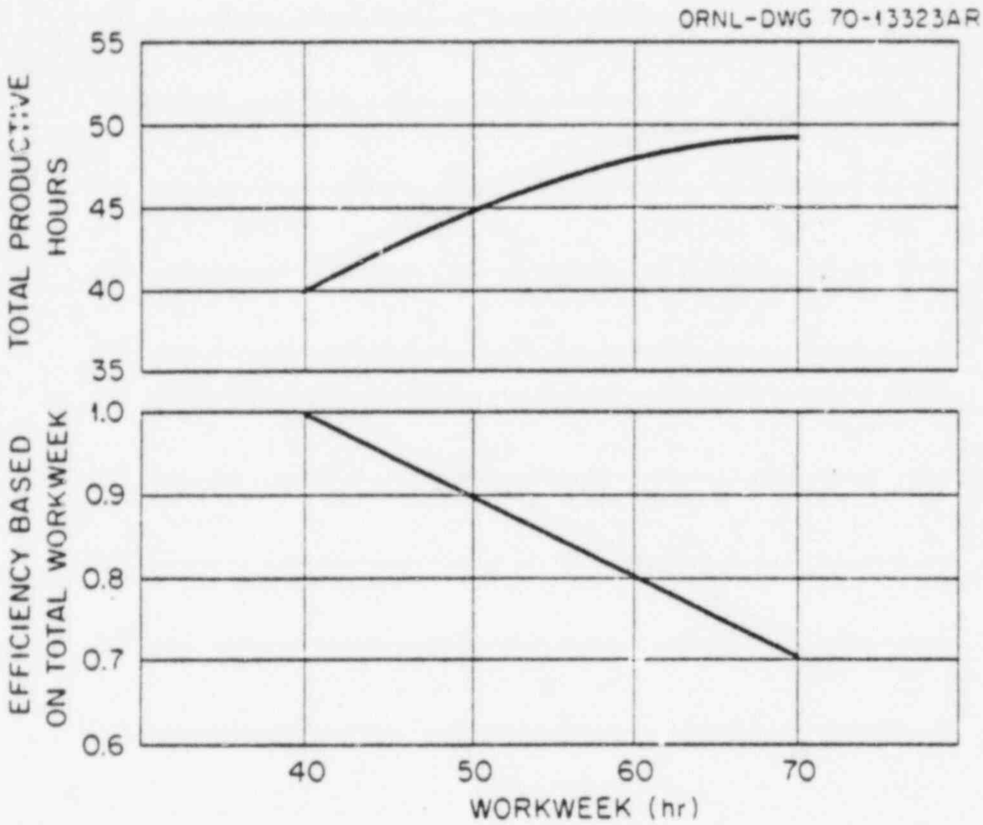

Fig. 5.3. Effects of sustained overtime on productivity of site labor.

where f_1 is an overtime efficiency factor, η is the incremental efficiency loss, and HRS is the number of hours in the workweek. The second cost influence is that of the overtime wage premium, which is assumed to be double time for craft labor and time and one-half for white collar workers. These assumptions can be altered temporarily through the NAMELIST feature or permanently by modification of the MAIN program if desired. The wage premium can be expressed mathematically as a weighted average wage rate factor or

$$f_2 = [40 + OTP(HRS - 40)]/HRS \ , \qquad (11)$$

where OTP is the overtime wage premium.

The productivity of craft labor is difficult to define and, in practice, varies significantly, not only country-wide, but within a single locale, depending on factors such as the general economy, project management, labor relations, job conditions, availability of equipment, and weather conditions. No attempt was made to include productivity factors for the normal 40-hr workweek, either as a function of location or as a function of time. However, an equation of the form

$$f_3 = a + b(YRSSS - YBC) \tag{12}$$

is included in the program, where YRSSS is the steam supply order date and YBC is the year of the reference costs. Coefficients a and b have default values of 1 and 0, respectively, in the program but can be modified by the user through the NAMELIST feature.

In many instances a contractor will apply a percentage to the direct labor costs to cover overhead burden such as insurance, taxes, and other labor-related costs of a general nature. Although the current cost models stored in the COMO file explicitly account for such overhead, provisions are in the CONCEPT program to adjust the reference labor costs by a factor expressed as

$$f_4 = (1 + COS)/(1 + COB) \ , \tag{13}$$

where COS is the decimal amount of overhead burden in the specific case and COB is the decimal amount of overhead burden in the reference model. Because overhead burden is explicitly considered in the CONCEPT-5 cost models, COS and COB have zero as their default values.

Adjusting the reference costs for time and location utilizes the function subprogram CLAB. Essentially, CLAB returns the ratio of the cost index for a specific location and time (as developed by the CONIV subroutine discussed in Sect. 5.2) to the reference cost index stored in the cost model (representing a reference time and location). To adjust for a specific site at the steam supply order date, the reference costs are multiplied by

$$f_5 = \frac{A_{LOC,NSSS}}{A_{BASE,YBC}} \ , \tag{14}$$

where $A_{LOC,NSSS}$ represents the cost index at the specific location and at the steam supply order date and $A_{BASE,YBC}$ represents the cost index at the reference location (Middletown) and at the reference date (1976.5).

The reference model must also be adjusted for size. This is done through a classical exponential scaling relation of the form

$$f_6 = a + b \left(\frac{MWe_{new}}{MWe_{base}}\right)^c . \quad (15)$$

Each two-digit account has its own scaling coefficients (a, b, and c) stored in the cost models.

All of the factors discussed above are developed and applied to the reference costs in the COST subroutine.

5.4 Escalation During Construction

Escalation during construction is calculated in the COST subroutine utilizing the cost indices for the design and construction period generated earlier. Taking the ratio of the cost index at a certain point in time to the index at the steam supply order date produces the change in cost over that interval. By use of the altered cash flow data discussed in Sect. 5.1, an escalation factor can be generated as

$$\text{factor} = \sum_{t=2}^{50} \frac{A_t}{A_{sss}} (CF_t - CF_{t-1}) , \quad (16)$$

where A_t represents the cost index at time t, A_{sss} represents the cost index at the steam supply order date, and CF_t represents the normalized cumulative cash expenditure up to and including time t.

The utility of this procedure can better be seen by observing that this factor is multiplied by total costs that are expressed in dollars current to the steam supply order date, or

$$\text{escalated costs} = D \sum_{t=2}^{50} \frac{A_t}{A_{sss}} (CF_t - CF_{t-1}) , \quad (17)$$

where D is the total unescalated cost in the year of the steam supply order date.

As explained in Chap. 7, the CONCEPT code produces a cost estimate with escalation during construction either broken out as a separate line item or included implicitly in the direct and indirect costs. Either way, the escalation is calculated in the manner described above.

5.5 Interest During Construction

As mentioned earlier, the design and construction period is divided into 50 elements. Associated with each element is a point in time and a cumulative expenditure to date. This cumulative expenditure is developed in the MAIN program using the total costs from the SUM subroutine, the cash flow data from the cost models, and, when escalation is present, the cost indices from the COST subroutine. When escalation is present, the cumulative costs to date during the design and construction period are derived from the equation

$$\text{escalated cumulative costs to date} = D \sum_{t=2}^{T} \frac{A_t}{A_{sss}} (CF_t - CF_{t-1}) , \quad (18)$$

which is very similar to Eq. (17) except that the summation goes to T where T varies from 2 to 50. The cumulative cash flow in the first element (T = 1) is zero corresponding to time zero. When escalation is not considered, cumulative costs are derived from the more simple equation,

$$\text{unescalated cumulative costs to date} = D \sum_{t=2}^{T} (CF_t - CF_{t-1}) , \quad (19)$$

where D is the total unescalated cost.

When escalation is broken out as a separate line item, interest due solely to escalation is calculated separately from interest on direct and indirect costs. To do so requires a cumulative cost of escalation to date which is obtained by subtracting each element of Eq. (19) from the corresponding element of Eq. (18).

Regardless of whether the interest is being calculated on the escalated costs [Eq. (18)], the unescalated costs [Eq. (19)], or the escalation itself [Eq. (18) − Eq. (19)], subroutine DELIN uses whichever cumulative cash flow array is provided to calculate the interest during construction. In addition to the cumulative expenditure to date, the subroutine is given the interest rate, the date associated with each expenditure element, and an indication whether the interest is to be simple or compound.

Subroutine DELIN first ensures that if compound interest has been specified the interest rate is on an annual basis. This must be done because the frequency of compounding for the 50-element cost array is generally more than once per year. Interest during construction is then calculated using either a simple or compound method as follows:

$$\text{interest} = \sum_{i=1}^{50} \left\{ \left[\text{cash expended up to and including period } i + \text{interest charges to date (if compounding)} \right] \times (\text{interest rate}) \times (\text{length of period } i) \right\} . \quad (20)$$

5.6 Multiunit Cost Summation

As multiunit plants may have different design and construction schedules, the dates associated with each 50-element cash flow array will differ, as will the time interval between elements. To obtain the total plant cash flow, a means for summing cash flows having dissimilar schedules must be provided. The ADYR subroutine does this by establishing an all-inclusive time line starting with the earliest steam supply order date and ending with the latest commercial operation date. Such a time line is shown as the lower line in Fig. 5.4. The upper line reflects the schedule of a specific unit. At each element (date) of the overall time line, subroutine ADYR checks the unit line in an effort to have two elements of the unit line straddle a single element of the overall line. As shown in Fig. 5.4, elements 24 and 25 of the unit line straddle element 17 of the overall time line. When this occurs, a linear interpolation of the unit cash expenditures for those two elements provides the

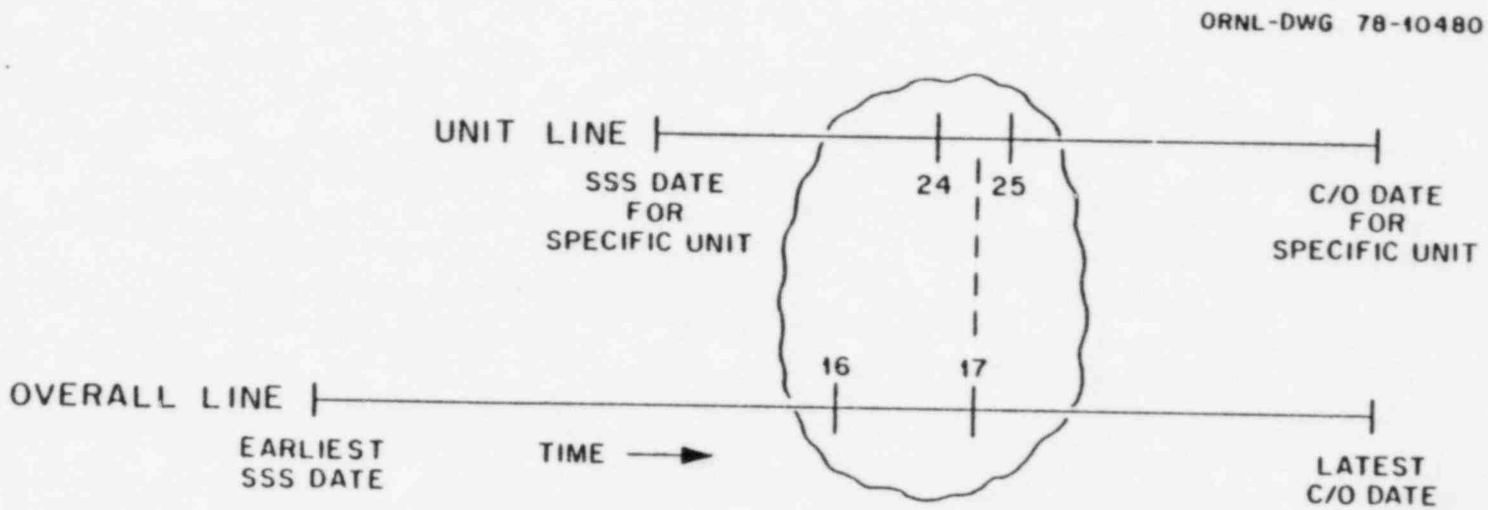

Fig. 5.4. Time lines for cash flow additions.

cash expenditure at the time associated with the element on the overall time line.

Any previous overall time line and cash flow (resulting from previous units already calculated) must also be scanned in the same manner as the unit line to fit it to the new overall line. Summing the costs of the new unit and the previous total at each element (date) of the new total cash flow array provides the total plant cash flow.

6. DESCRIPTION OF CONCEPT-5 MAIN PROGRAM AND SUBPROGRAMS

A brief description of the functions of the CONCEPT-5 MAIN program and subprograms is presented here. The auxiliary programs, CONTAC and CONLAM, are described in Appendices A and B, respectively.

All programs and subprograms that make up the CONCEPT-5 package are written in FORTRAN IV for the IBM 360 and 370 class of computers. The CONCEPT-5 program consists of a MAIN program and 15 subprograms and requires about 240K of computer core for execution. Primary input data are read from punched cards, support data are read from direct access devices (COMO and LAMA), and the output report is listed by the system printer. Listings of the CONCEPT-5 MAIN program and subprograms are included in Appendix C, and several examples of output listings are included in Appendix D. A first-call sequence of the subprograms is illustrated in Fig. 6.1. This figure is intended only to indicate subprogram interactions and should not be considered a program flowchart. For simplicity, some of the calls to minor subprograms are not shown in the following individual flowcharts. The MAIN program and all subprograms are described in the following paragraphs.

6.1 MAIN Program

The MAIN program exercises control over all logical flows and decisions concerning the input data, calculations, and output. The first step in executing a case is concerned with data input; the MAIN program utilizes three on-line direct access devices to manipulate, pass, and save input data used throughout the calculations. The flowchart for MAIN is shown in Fig. 6.2. The upper portion of the diagram is concerned with manipulating standard and nonstandard input data, and the lower portion indicates the logic required for escalation options, multiple-unit plants, and output control.

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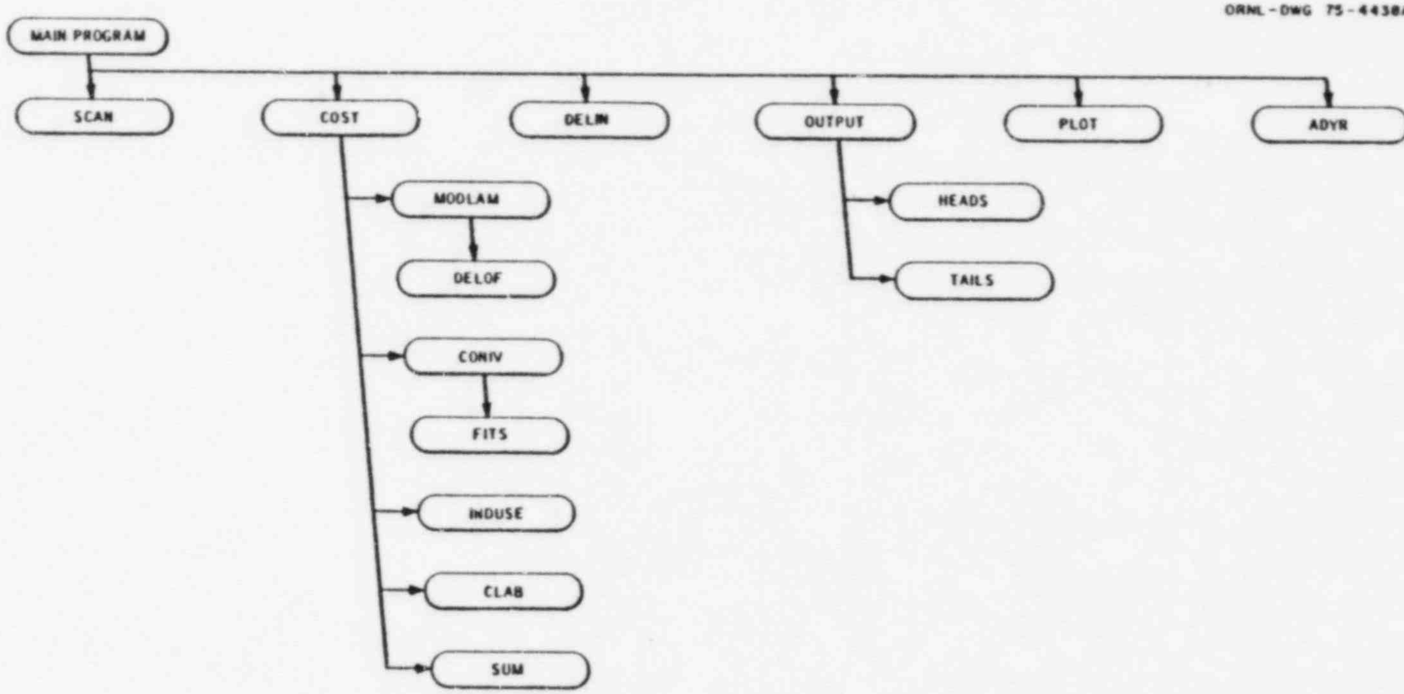


Fig. 6.1. First-call sequence of CONCEPT-5 subprograms.

ORNL-DWG 75-4439R

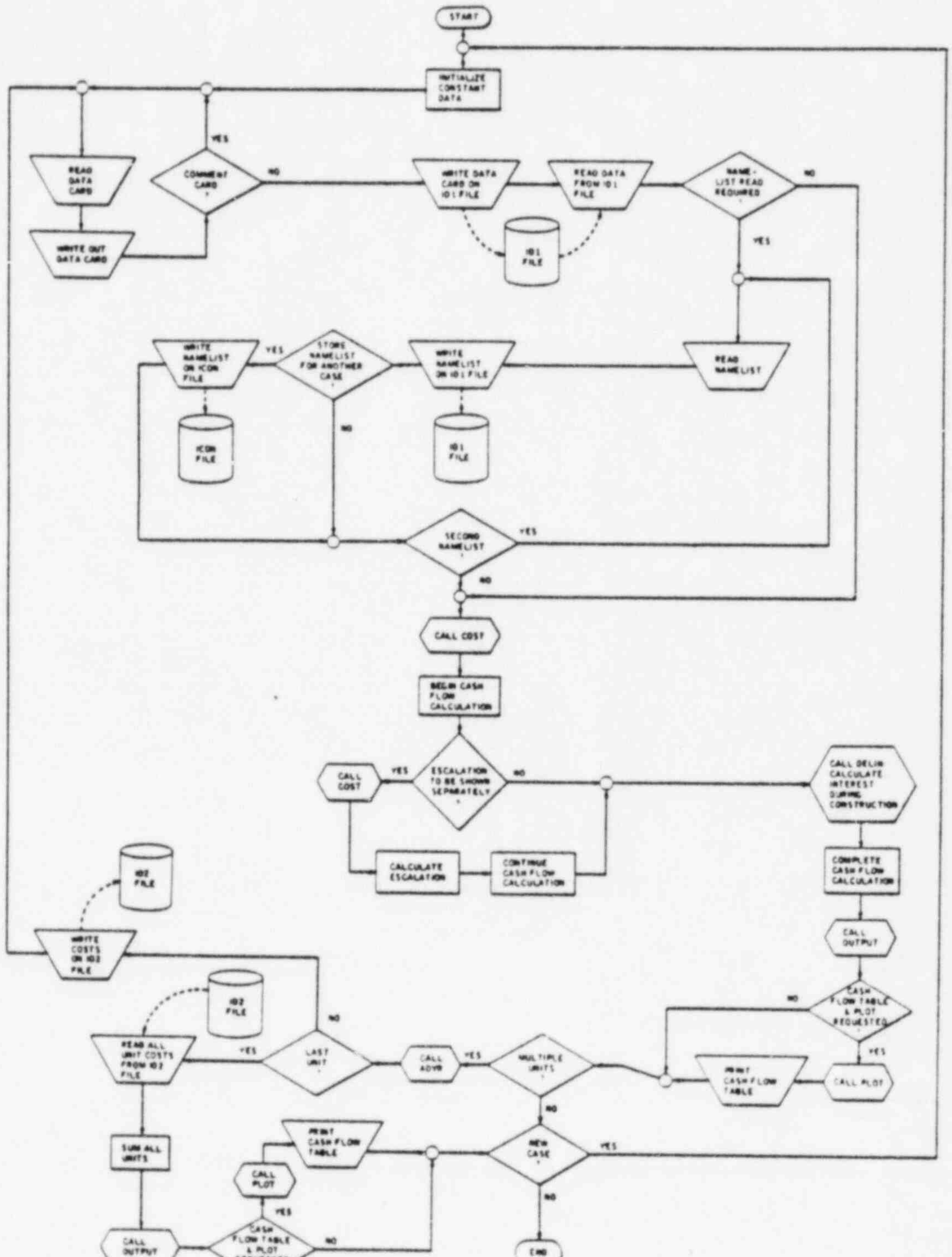


Fig. 6.2. CONCEPT-5 MAIN program.

6.2 Subprograms

The CONCEPT approach is extremely general and easily extends to include other types of power plants or any large construction project. The result of this philosophy is that all subprograms are applicable to the most generalized calculations. Estimates for any type of project can be produced by adding a new cost-model data set to the COMO file, and any city can be studied by adding historical equipment, labor, and materials cost data to the LAMA file.

6.2.1 SCAN

The subprogram SCAN scans the COMO and LAMA data files at the start of a job and provides the user with a listing of the available cost models and site locations. This listing is included in Appendix D. The flow diagram for SCAN is shown in Fig. 6.3.

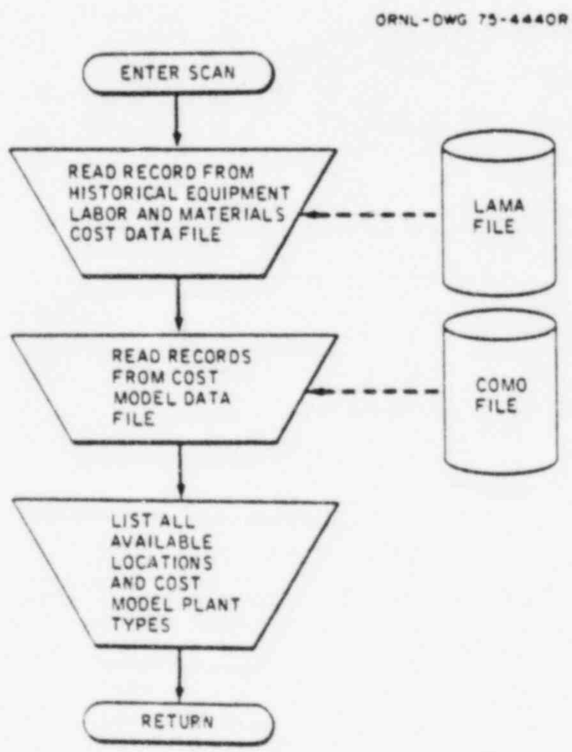


Fig. 6.3. Subprogram SCAN.

6.2.2 COST

The subprogram COST alters the reference plant costs as described in Sects. 5.3 and 5.4, controls logic associated with nonstandard input, and keeps track of the cost accounting structure. This subprogram exercises control over all cost index projections, escalation calculations, and cost summations. The flow diagram for COST is shown in Fig. 6.4.

6.2.3 MODLAM

The subprogram MODLAM is called by subprogram COST and retrieves the cost-model data set for the specified plant type from the COMO file. It initiates adjustments to the reference cash flow data to reflect the specific design and construction schedule. It also checks for the specified location in the LAMA file and determines the date of the latest entry in that file. The flow diagram for MODLAM is shown in Fig. 6.5.

6.2.4 DELOF

The subprogram DELOF is called by subprogram MODLAM and maps the specified plant type reference cash flow curves (shown previously in Fig. 3.1) into those specified by the user's design and construction dates.

6.2.5 CONIV

The subprogram CONIV calculates the escalation coefficients. CONIV is called by subprogram COST when regression analysis of historical equipment, labor, and materials cost data is required. The regression analysis can be specified to calculate weighted-average escalation rates for a multilocational environment. Up to 20 locations can be combined with independent weighting factors for each location. The selection and weighting of locations is accomplished by reading in data through the NAMELIST option. Weighting coefficients for the individual equipment, labor, and materials types are stored as part of each cost model. The raw cost data are selected from the LAMA file for the time period, YFIRST to YLAST, as specified by the user. The CONIV subprogram generates a separate escalation rate for equipment, labor, and material for each two-digit-level cost account. The time-dependent escalation arrays are

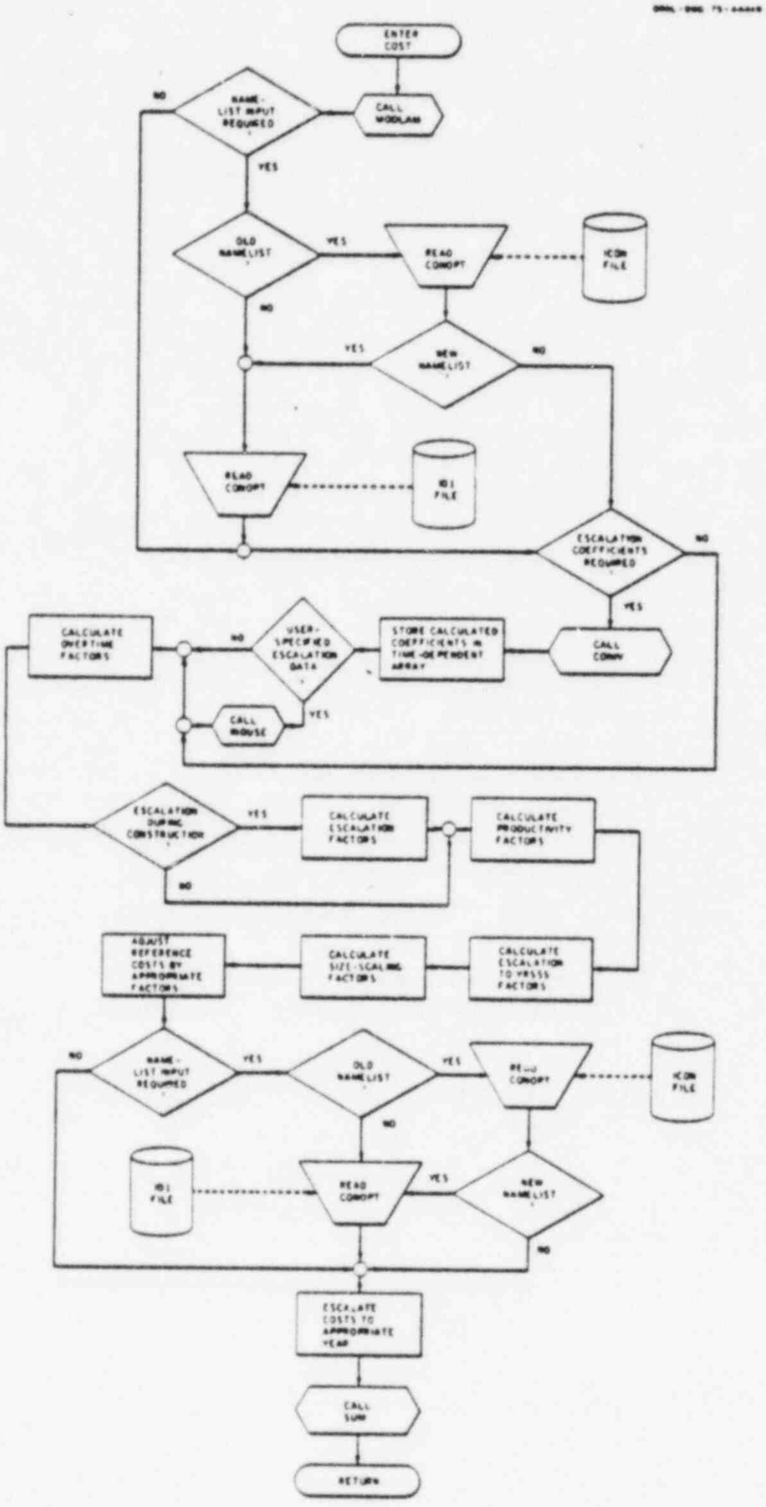


Fig. 6.4. Subprogram COST.

ORNL-DWG 75-4442R

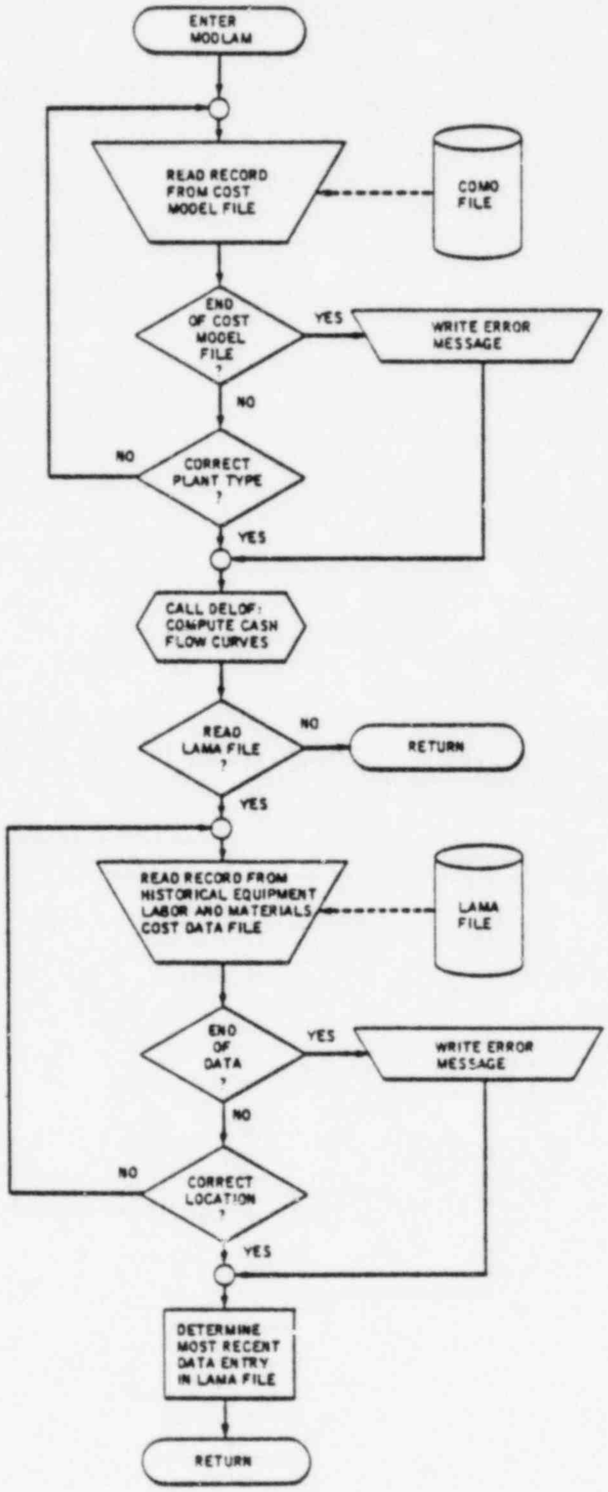


Fig. 6.5. Subprogram MODLAM.

developed after returning to the calling subprogram COST. The flow diagram for CONIV is shown in Fig. 6.6.

6.2.6 FITS

The subprogram FITS is called by subprogram CONIV and performs a linear least-squares fit on the logarithmic data set generated by CONIV. The A and B coefficients are returned for each two-digit account and specified location.

6.2.7 INDUSE

The subprogram INDUSE is called by subprogram COST and is a data input routine designed to read the coefficients and dates specified by the user for changes to the time-dependent escalation arrays. This routine reads data card input and stores it on an on-line direct access device for subsequent cases. The flow diagram for INDUSE is shown in Fig. 6.7.

6.2.8 CLAB

The function subprogram CLAB is called by subprogram COST and is used to calculate cost indices for adjusting base plant costs to the specified site and time and for escalating costs to the year of commercial operation. The coefficients necessary to evaluate the cost indices are either calculated in CONIV or are input via INDUSE.

6.2.9 SUM

The subprogram SUM is called by subprogram COST and sums all the detailed direct and indirect costs, which have been calculated in COST, to the two-digit level. These costs are in terms of the specified plant type, size, location, and date. SUM also calculates direct labor manhours and allowances for contingencies.

6.2.10 DELIN

The subprogram DELIN evaluates the cost of interest during construction.

ORNL-DWG 75-4443R

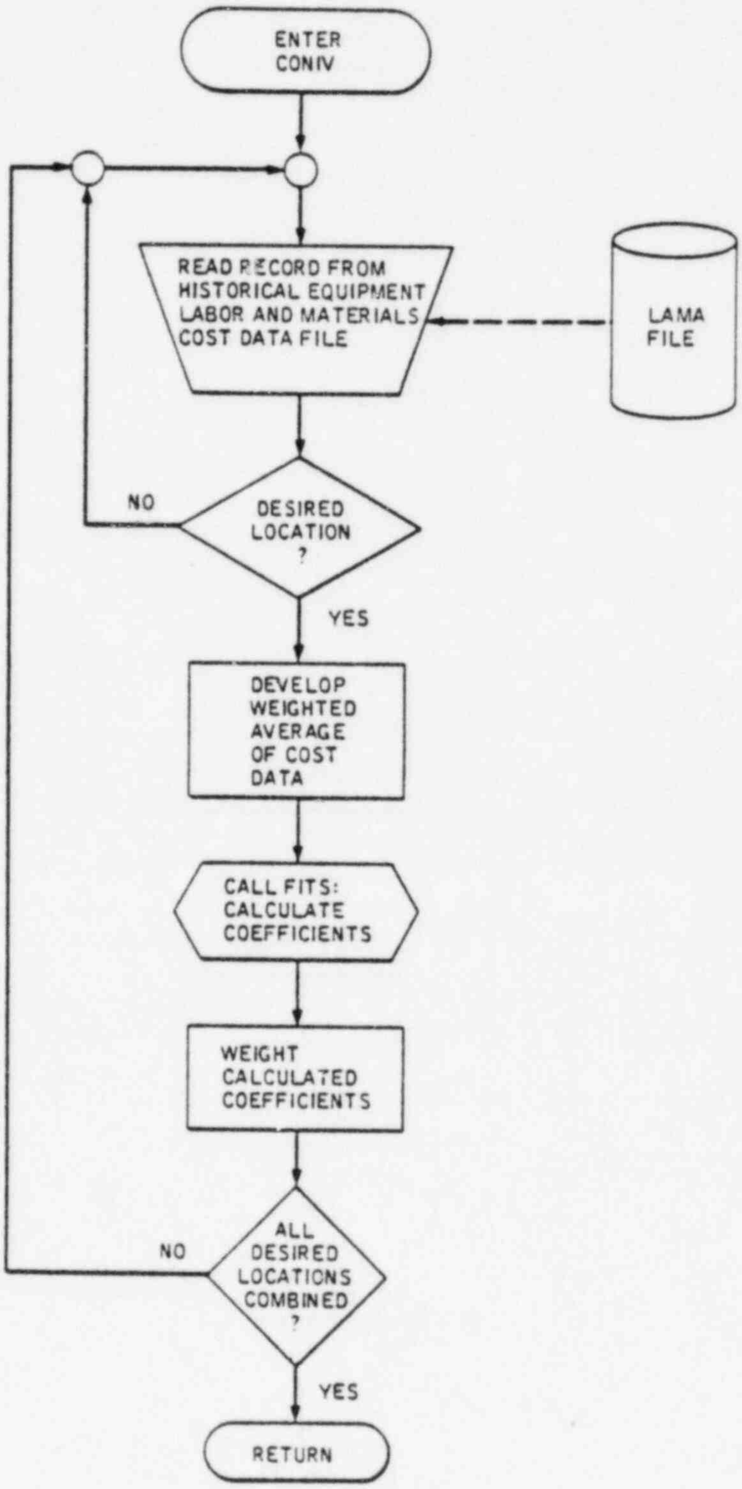


Fig. 6.6. Subprogram CONIV.

ORNL-DWG 78-6453

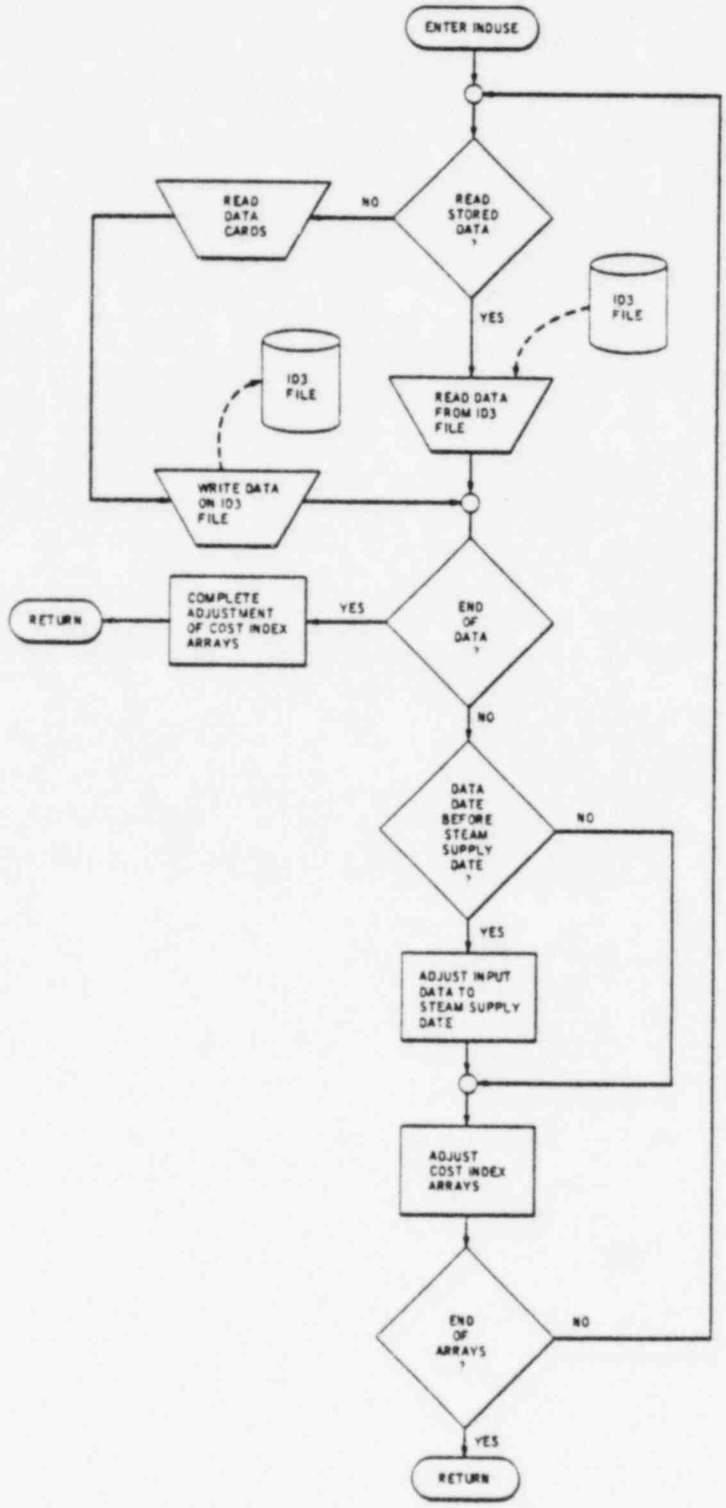


Fig. 6.7. Subprogram INDUSE.

6.2.11 OUTPUT

The subprogram OUTPUT always gives a one-page summary of the cost estimate for the specified plant. Two-digit-account direct and indirect costs are listed, along with contingency, escalation (when applicable), interest, and the total plant capital investment. The two-digit-account direct costs are also broken down into equipment, labor, and materials components.

If a full report is requested, the three-, four-, and five-digit account costs are printed on subsequent pages, following a format similar to that presented in NUS-531.[17] These costs are also broken down into equipment, labor, and materials components. The flow diagram for OUTPUT is shown in Fig. 6.8. Examples of output listings are included in Appendix D.

6.2.12 HEADS

The subprogram HEADS is called by subprogram OUTPUT to generate headings for the summary page of the output listing.

6.2.13 TAILS

The subprogram TAILS is called by subprogram OUTPUT to generate headings for the detailed output listings.

6.2.14 PLOT

The subprogram PLOT uses the system printer to plot the cumulative expenditures from date of purchase of steam supply system to date of commercial operation. The output consists of a one-page graphical representation of cash flow during this period. The original PLOT subprogram was obtained from the IBM Corporation[18] and was modified to meet the needs of CONCEPT.

6.2.15 ADYR

The subprogram ADYR sums the individual-unit cumulative cash flow curves for a multiple-unit plant. The cash flow curves are adjusted to the earliest date of purchase of steam supply system and to the latest date of commercial operation.

ORNL-DWG 75-4444R

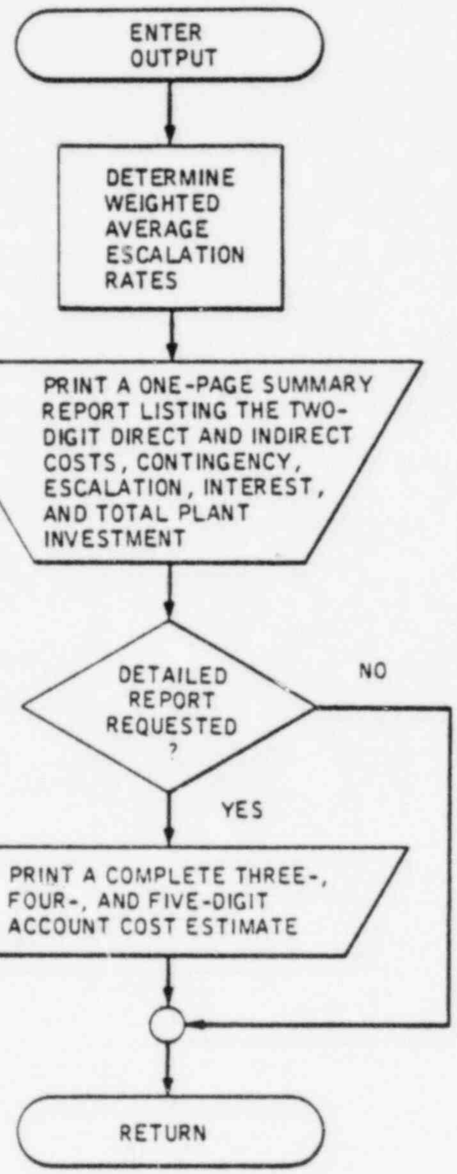


Fig. 6.8. Subprogram OUTPUT.

7. DATA INPUT

Preceding the first data card of any case, any number of comment cards can be included by placing a "C" in column 1 of each card. The program will print these comments at the top of the first output page if space is available or on a separate page if more than a few lines of comments are read in.

Coding forms are illustrated on example problems in Chap. 8.

7.1 Standard Input Data

The first card contains the standard input data for a case and the optional output and nonstandard input flags. Any number of cases can be processed in one run, subject to time and output limitations. The entries on this card are the following:

Column	Variable name	Description
1-4	MWE	The net capacity of the desired unit in MWe, right justified in the field. Format I4
6-13	TYPE	Type of power plant (see Table 3.1), left justified in the field. Format A8
15-30	CITY	The city where the plant is to be located (see Fig. 4.1), left justified in the field. Characters are stored in LOC(1) and LOC(2). Format 2A8
32-39	IDENT	Any alphanumeric data. Characters are stored in LOC(3). Format A8
41-47	YRSSS	Date steam supply system is purchased. Format F7.3
48-54	YRPER	Date construction permit is issued. Format F7.3
55-61	YRCOP	Date of initial commercial operation. Format F7.3
62-66	RIB	Average annual interest rate for interest during construction (in percent). If not input, 8%/year will be used. Format F5.3
68	ILAZ	Flag for saving and retrieving optional NAMELIST input data for use in subsequent cases (IFLAG>0): 0 — NAMELIST input data are neither saved nor retrieved 1 — Save NAMELIST input data for use in subsequent cases

Column	Variable name	Description
		2 — Retrieve NAMELIST input data that have been saved in a previous case
		3 — Retrieve NAMELIST input data that have been saved in a previous case and read additional NAMELIST input data
70	IFLAG	Flag for reading optional NAMELIST input data:
		0 — No NAMELIST input
		1 — Permits changing YFIRST and YLAST prior to the analysis of historical equipment, labor, and materials cost data and permits overriding certain data stored in the cost models and in the MAIN program prior to the detailed cost calculations
		2 — Permits overriding calculated direct and indirect costs after adjustment for size, time, location, and escalation to date of purchase of steam supply system
		3 — Two NAMELIST calls. The first is identical to IFLAG=1, and the second is identical to IFLAG=2
72	IOF	Flag for optional output:
		0 — Two-digit-level summary output only
		1 — Two-digit-level summary output with cumulative cash flow plot and table
		2 — Complete cost breakdown with cumulative cash flow plot and table
74	IESC	Flag for escalation during construction:
		0 — All cost accounts are escalated from date of reference case to date of purchase of steam supply system, and escalation during construction is shown as a separate lump-sum item
		1 — All cost accounts include implicitly both escalation from date of reference case to date of purchase of steam supply system and escalation during construction
		2 — All cost accounts are escalated from date of reference case to date of purchase of steam supply system, with no allowance for escalation during construction
76	IBS	Flag to specify time-dependent escalation data:
		0 — No input data are expected

Column	Variable name	Description
		1 — Input data are expected and will be saved for subsequent cases
		2 — Retrieve data used when IBS was 1
78	IAC	Flag to specify type of interest:
		0 — Simple interest
		1 — Compound interest
80	ISTACK	Flag to specify total number of units for a multiple-unit plant:
		1 — Single-unit plant
		>1 — Total number of units for a multiple-unit plant. The total number of units must be entered on the standard input data card for the first unit only
		blank — Entry for second, third, fourth units, etc., for a multiple-unit plant

Each subsequent unit for a multiple-unit plant must be provided with a standard input data card similar to the card for the first unit, except that column 80 must be blank. The standard input data for a second unit, or subsequent units, can be identical to the data for the first unit, or it can be different in size, construction dates, interest rate, and even location. Multiunit plants should be of the same type (e.g., COAL1SMT, COAL2SMT, COAL3SMT) to prevent incorrect addition of costs for the total plant.

7.2 Nonstandard Input Data

Specific data stored in the cost-model data sets and the MAIN program and certain calculated costs can be changed at program execution time for one case or for a series of cases by setting the flags, IFLAG and ILAZ, on the standard input data card. These changes are effective for the current case only unless indicated by the ILAZ variable. The NAMELIST cards have the following form:

Card	Column	Description
2	2-8	&CONOPT— This identifies the following as a NAMELIST named CONOPT that contains optional data
2	10-80	Data changes start with this card in column 10; data items are separated by commas. The form of the data may be (1) variable name = constant, where the variable name may be a subscripted array name or a single variable name; (2) array name = set of constants (separated by commas). The array name is not subscripted. The number of constants must be less than or equal to the number of elements in the array. Successive occurrences of the same constant can be represented in the form k*constant. The last data entry is followed by a comma
3 or more	2-80	If required, columns 2-80 of additional cards can be used with each data item separated by commas
Last	2-5	&END must be the last card for each set of NAMELIST data

Lists and descriptions of the variables and arrays that can be changed by the NAMELIST input option for the various values of IFLAG follow. Examples of the use of this option and the save-and-retrieve option (ILAZ>0) are presented in Chap. 8 on example problems. The following variables may be changed when IFLAG=1 and in the first NAMELIST call when IFLAG=3:

Variable name	Description
AA(I,J)	Scaling coefficients for adjusting the direct and indirect costs as a function of size according to the relation $a + b\ (MW_1/MW_0)^c$ for each two-digit account. The first dimension, I, varies from 1 to 3 representing a, b, and c, respectively. The second dimension, J, defines the two-digit account such that J=1,11 for accounts 20 through 94
AMAN	The direct labor manhours per kilowatt for the specific case being run
APC(I)	Initial productivity of labor at input location at the reference year of the cost model [coefficient a in Eq. (12)], for each two-digit direct and indirect cost account such that I=1,11 for accounts 20-94

Variable name	Description
BPC(I)	Change in productivity of site labor at input location per unit of time [coefficient b in Eq. (12)], for each two-digit direct and indirect cost account such that I=1,11 for accounts 20–94
CFCA(I,J)	Cash flow data for each two-digit direct and indirect cost account (I=2,12) in each of the 50 time periods between the steam supply date and commercial operation date (J=1,50). The values when I=1 are the fraction of the design and construction period
COB(I) COS(I)	Contractor's overhead burden factor for each two-digit direct and indirect cost account in the base model (COB) and the specific case (COS). I=1,11 for accounts 20–94.
CONTL(I) CONTM(I) CONTE(I)	Contingency percentage for labor, materials, and equipment, respectively, for each two-digit direct and indirect cost account. I=1,11 for accounts 20–94
D(I,J)	Array containing lowest-digit-account direct and indirect costs divided into equipment, labor, and materials components (I=1,3) for a given account (J=1,380) in the base plant cost model
DEOT(I)	Coefficient η in Eq. (10) for calculating the overall efficiency of an overtime workweek for each two-digit direct and indirect cost account. I=1,11 for accounts 20–94
FACS1(I,J) FACS2(I,J) FACS3(I,J)	Weighting factors for labor, materials, and equipment, respectively, for each two-digit direct and indirect cost account. I=1,11 for accounts 20–94. The second dimension, J, correlates a weighting factor to a specific labor, materials, or equipment index in the CONLAM file
FILS(J)	Weighting factors for combining up to 20 specified locations in a composite site (J=1,20) $\sum_{J=1}^{20}$ FILS(J) must equal 1
HWI(J) HW	The number of hours worked per week for each two-digit direct and indirect cost account (J=1,11) for accounts 20–94, or, alternatively, the number of hours worked per week in all the accounts
ISITE(J)	Array for site combinations up to J=20. If nonzero, the ISITE value indicates site (or city) number (see Fig. 4.1) used in conjunction with weighting factor, FILS. For example, sites 12 and 16 might be combined by setting ISITE=12,16 and FILS=0.4,0.6 for 40 and 60% weighting of the respective sites

Variable name	Description
OTP(I)	Overtime premium paid to labor (multiplier of straight-time rate) for time worked in excess of 40-hr workweek for each two-digit direct and indirect cost account (I=1,11) for accounts 20–94
OVERS(I)	Overall efficiency of a nonstandard workweek for each two-digit direct and indirect cost account (I=1,11) for accounts 20–94. Use of this variable overrides the calculations in Eq. (10)
RINT(J)	Interest rate expressed as a decimal number for each of the fifty time periods between the steam supply date and commercial operation date (J=1,50)
YFIRST	The first date to be considered in performing a linear regression on the historical equipment, labor, and materials file
YLAST	The last date to be considered in performing a linear regression on the historical equipment, labor, and materials file

The following variables may be changed when IFLAG=1,2, or 3 (either NAMELIST call)

Variable name	Description
CONTL(I) CONTM(I) CONTE(I)	Contingency percentage for labor, materials, and factory equipment, respectively, for each two-digit direct and indirect cost account (I=1,11) for accounts 20–94
D(I,J)	Lowest-digit account direct and indirect costs divided into equipment, labor, and materials (I=1,3) for a given account (J=1,350). When IFLAG=1 and in the first NAMELIST call when IFLAG=3, the costs in the D array represent the reference cost model. When IFLAG=2 or in the second NAMELIST call when IFLAG=3, the costs in the D array are the costs adjusted for size and location and expressed in dollars current to the steam supply date
RINT(J)	Interest rate expressed as a decimal number for each of the 50 time periods between the steam supply date and commercial operation date (J=1,50)

7.3 Time-dependent Escalation Data

Time-dependent escalation input can be used to alter the escalation rates and cost indices for equipment, labor, and materials. To do so requires a set of six input cards which follows after the standard input and NAMELIST cards (when used). Figure 7.1 shows the form of the six cards. The first two are for factory equipment direct and indirect cost accounts, respectively. Labor and materials are treated in the same fashion. The "A" field in each of the two-digit accounts represents a cost index at a given point in time. The "B" field represents the escalation rate in the $(1 + \varepsilon)$ form at a given point in time. If fields are left blank on the data cards, the current escalation coefficients in these fields will not be altered. The last field on the sixth card is for a date written in decimal notation. This is the "effective" date for the data being input. These data may be during or before the design and construction period.

Additional sets of six cards may be used in a sequential fashion with different dates in chronological order to change escalation parameters with time. However, following the last set a card with -1. in the last field must be input. This is true even if there is only one set of six cards being input.

As described in Sect. 7.1, the time-dependent escalation data input may be saved for subsequent cases.

Examples of this feature are given in Chap. 8.

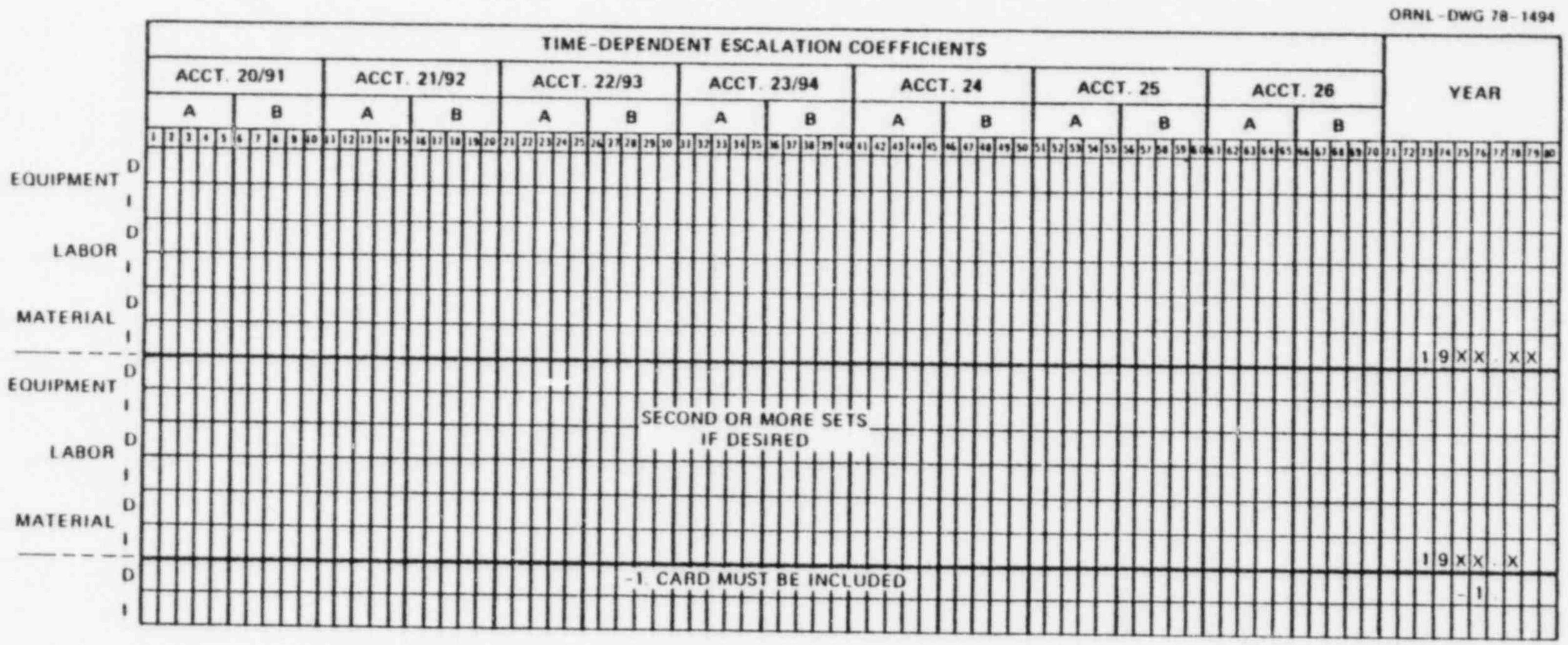


Fig. 7.1. Time-dependent escalation input format.

8. EXAMPLE PROBLEMS

This section illustrates the preparation of input data for the CONCEPT-5 program. Eight examples are presented which are designed to help clarify previous discussion concerning the various options, the use of the NAMELIST input feature, and the input of time-dependent escalation data. Input data for all examples are shown in Fig. 8.1, and complete output listings for problems 3, 6, and 7 are included in Appendix D.

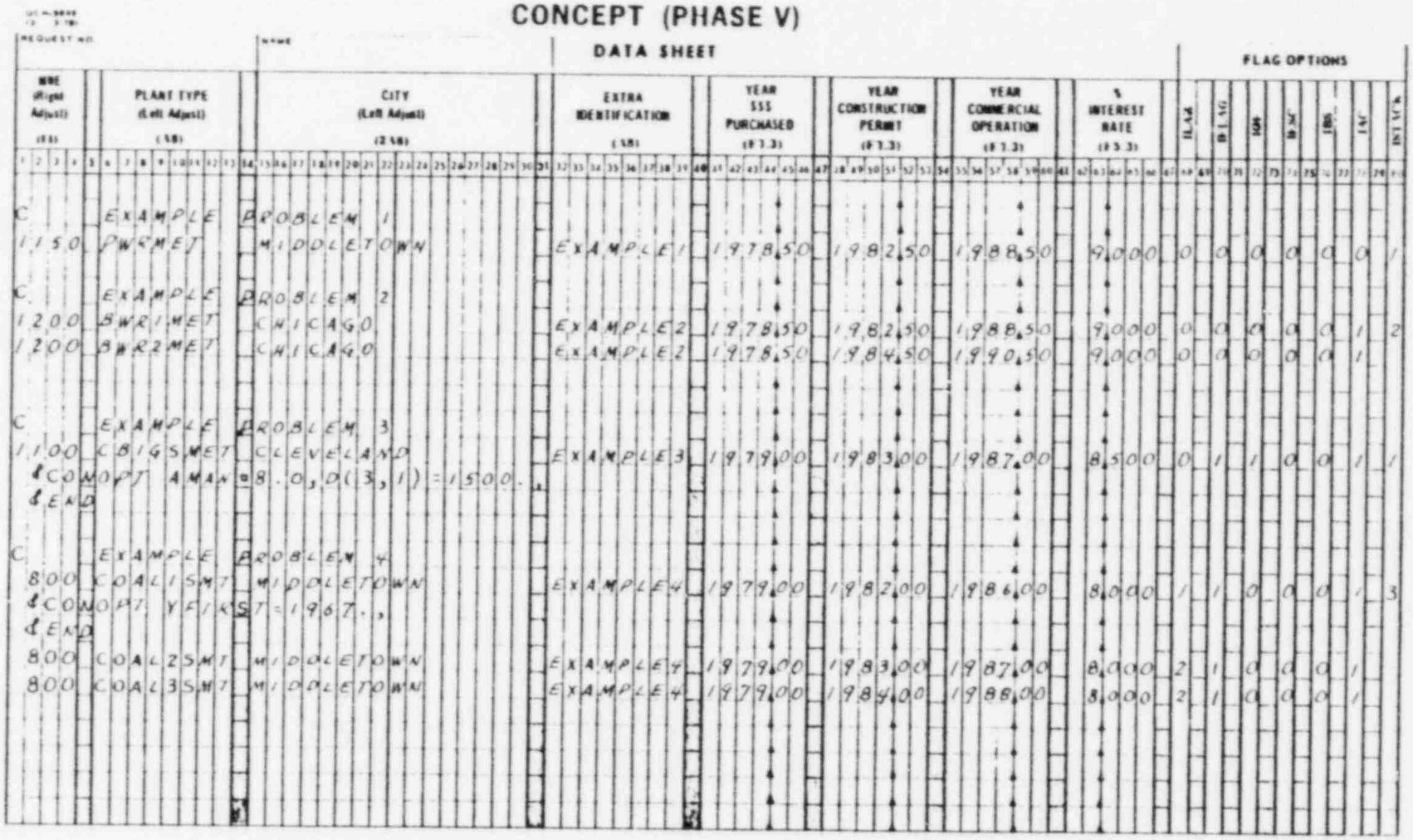
Example problems 1 and 2 are simple cases of single- and multiunit plants. The IOF output variable is set to produce a two-digit-level summary only.

Example problem 3 illustrates the use of the NAMELIST feature for a single-unit plant. As determined by the value of IFLAG, the direct labor manhours per kilowatt and the cost of the site land will be set to the values in the NAMELIST prior to the detailed cost calculations. The output option has been set to produce a two-digit-level summary and a cash flow plot and table.

Example problem 4 is a three-unit coal plant using NAMELIST to modify the starting date for the LAMA file linear regression analysis. For the second and third units, ILAZ=2 to retrieve NAMELIST data used for the first unit, ISTACK is left blank signifying the multiunit case.

Example problem 5 is a single-unit illustration of the time-dependent escalation data input option. Variable IBS is set to 1, which causes the escalation data cards to be read and saved internally, should a subsequent case need the same escalation input. The "effective" date for data input is allowed to be earlier than the steam supply order date. The effect of the time-dependent escalation data is to cause escalation of equipment and materials to occur at a rate of 6% per year and escalation of labor at 8% per year starting in 1977.

Example problem 6 demonstrates the time-dependent escalation data input feature for multiunit plants. By setting IBS=2 for the second unit, the data input for the first unit is retrieved and applied to the second unit. The escalation option variable, IESC, has been set such that the escalation during construction is expressed implicitly within the direct



CONCEPT (PHASE V)

DATA SHEET

REQUEST NO. | NAME

MWE (Right Adjust) (I4)	PLANT TYPE (Left Adjust) (A8)	CITY (Left Adjust) (2A8)	EXTRA IDENTIFICATION (A8)	YEAR NSSS PURCHASED (F7.3)	YEAR CONSTRUCTION PERMIT (F7.3)	YEAR COMMERCIAL OPERATION (F7.3)	% INTEREST RATE (F5.3)	ILAA	IFLAG	IOM	IDC	IBS	IAC	INTVCN
C EXAMPLE PROBLEM 1														
1150	PWRMET	MIDDLETOWN	EXAMPLE1	1978.50	1982.50	1988.50	9.000	0	0	0	0	0	0	1
C EXAMPLE PROBLEM 2														
1200	BWR1MET	CHICAGO	EXAMPLE2	1978.50	1982.50	1988.50	9.000	0	0	0	0	0	1	2
1200	BWR2MET	CHICAGO	EXAMPLE2	1978.50	1984.50	1990.50	9.000	0	0	0	0	0	1	
C EXAMPLE PROBLEM 3														
1100	CBIGSMET	CLEVELAND	EXAMPLE3	1979.00	1983.00	1987.00	8.500	0	1	1	0	0	1	1
$CONOPT AMAN=8.0,D(3,1)=1500.,														
$END														
C EXAMPLE PROBLEM 4														
800	COAL1SMT	MIDDLETOWN	EXAMPLE4	1979.00	1982.00	1986.00	8.000	1	1	0	0	0	1	3
$CONOPT YFIRST=1967.,														
$END														
800	COAL2SMT	MIDDLETOWN	EXAMPLE4	1979.00	1983.00	1987.00	8.000	2	1	0	0	0	1	
800	COAL3SMT	MIDDLETOWN	EXAMPLE4	1979.00	1984.00	1988.00	8.000	2	1	0	0	0	1	

Fig. 8.1. Data input for example problems.

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CONCEPT (PHASE V)

REQUEST NO. | NAME | DATA SHEET

MWE (Right Adjust) (I4)		PLANT TYPE (Left Adjust) (9A)		CITY (Left Adjust) (2A8)		EXTRA IDENTIFICATION (A8)		YEAR SSS PURCHASED (F7.2)		YEAR CONSTRUCTION PERMIT (F7.2)		YEAR COMMERCIAL OPERATION (F7.2)		% INTEREST RATE (F5.3)		ILAB		IFLAG		IOH		IESC		IBS		IAC		ISTACK
C		EXAMPLE		PROBLEM 5																								
1000		PWRMET		SEATTLE		EXAMPLES5		1978.00		1982.00		1988.00		9.500		0		0		2		0		1		0		1

TIME-DEPENDENT ESCALATION COEFFICIENTS

		ACCT. 20/91 A	ACCT. 20/91 B	ACCT. 21/92 A	ACCT. 21/92 B	ACCT. 22/93 A	ACCT. 22/93 B	ACCT. 23/94 A	ACCT. 23/94 B	ACCT. 24 A	ACCT. 24 B	ACCT. 25 A	ACCT. 25 B	ACCT. 26 A	ACCT. 26 B	YEAR
EQUIPMENT	D		1.06		1.06		1.06		1.06		1.06		1.06		1.06	
	I		1.06		1.06		1.06		1.06							
LABOR	D		1.08		1.08		1.08		1.08		1.08		1.08		1.08	
	I		1.08		1.08		1.08		1.08							
MATERIAL	D		1.06		1.06		1.06		1.06		1.06		1.06		1.06	
	I		1.06		1.06		1.06		1.06							1977.0
EQUIPMENT	D															-1.
	I															
LABOR	D															
	I															
MATERIAL	D															
	I															

Fig. 8.1. (continued)

CONCEPT (PHASE V)

ORNL-DWG (?) | REQUEST NO. | NAME

DATA SHEET

MWE (Right Adjust) (I4)	PLANT TYPE (Left Adjust) (A8)	CITY (Left Adjust) (2A8)	EXTRA IDENTIFICATION (A8)	YEAR SSS PURCHASED (F7.2)	YEAR CONSTRUCTION PERMIT (F7.2)	YEAR COMMERCIAL OPERATION (F7.2)	% INTEREST RATE (F5.3)	ILAB	IFLAG	IOH	IESC	IBS	IAC	ISTACK
C	EXAMPLE	PROBLEM 6												
1100	PWR1MET	ATLANTA	EXAMPLE6	1978.50	1982.50	1988.50	9.000	0	0	0	1	1	1	2
1100	PWR2MET	ATLANTA	EXAMPLE6	1978.50	1984.50	1990.50	9.000	0	0	0	1	2	1	

FLAG OPTIONS: ILAB, IFLAG, IOH, IESC, IBS, IAC, ISTACK

TIME-DEPENDENT ESCALATION COEFFICIENTS

		ACCT. 20/91		ACCT. 21/92		ACCT. 22/93		ACCT. 23/94		ACCT. 24		ACCT. 25		ACCT. 26		YEAR
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	
EQUIPMENT	D															
	I															
LABOR	D		1.085		1.085		1.085		1.085		1.085		1.085		1.085	
	I		1.085		1.085		1.085		1.085							
MATERIAL	D															
	I															1978.5
EQUIPMENT	D															-1.
	I															
LABOR	D															
	I															
MATERIAL	D															
	I															

Fig. 8.1. (continued)

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CONCEPT (PHASE V)

DATA SHEET

REQUEST NO. | NAME

MWE (Right Adjust) (I4)	PLANT TYPE (Left Adjust) (A8)	CITY (Left Adjust) (2A8)	EXTRA IDENTIFICATION (A8)	YEAR NSSS PURCHASED (F7.2)	YEAR CONSTRUCTION PERMIT (F7.2)	YEAR COMMERCIAL OPERATION (F7.2)	% INTEREST RATE (F5.3)	ILAA	IFLAG	IOF	ILSC	IBS	IAC	ISTACK
C	EXAMPLE	PROBLEM 7												
1200	CBIGSMET	MIDDLETOWN	EXAMPLE7	1979.00	1983.00	1987.00	8.350	0	2	2	0	1	0	1
$CONOPT CONTE=0.,10*15.,CONTL=0.,10*15.,CONTM=0.,10*15.,														
$END														

TIME-DEPENDENT ESCALATION COEFFICIENTS

		ACCT. 20/91 A	ACCT. 20/91 B	ACCT. 21/92 A	ACCT. 21/92 B	ACCT. 22/93 A	ACCT. 22/93 B	ACCT. 23/94 A	ACCT. 23/94 B	ACCT. 24 A	ACCT. 24 B	ACCT. 25 A	ACCT. 25 B	ACCT. 26 A	ACCT. 26 B	YEAR
EQUIPMENT	D		1.06		1.06		1.06		1.06		1.06		1.06		1.06	
	I		1.06		1.06		1.06		1.06							
LABOR	D		1.08		1.08		1.08		1.08		1.08		1.08		1.08	
	I		1.08		1.08		1.08		1.08							
MATERIAL	D		1.08		1.08		1.08		1.08		1.08		1.08		1.08	
	I		1.08		1.08		1.08		1.08							1978.0
EQUIPMENT	D															-1.
	I															
LABOR	D															
	I															
MATERIAL	D															
	I															

Fig. 8.1. (continued)

CONCEPT (PHASE V)

REQUEST NO. | NAME

DATA SHEET

MWE (Right Adjust) (I4)	PLANT TYPE (Left Adjust) (5A8)	CITY (Left Adjust) (2A8)	EXTRA IDENTIFICATION (A8)	YEAR SSS PURCHASED (F7.3)	YEAR CONSTRUCTION PERMIT (F7.3)	YEAR COMMERCIAL OPERATION (F7.3)	% INTEREST RATE (F5.3)	ILAB	IFLAG	NOI	BSC	IBS	IAC	INTACK
C EXAMPLE PROBLEM 8														
850	COAL1MET	DALLAS	EXAMPLE8	1978.50	1982.50	1986.50	9.000	1	3	1	0	1	0	3
&CONOPT YFIRST=1967.,ISITE=8,9,FILS=2*.5,														
&END														
&CONOPT RINT=20*.09,20*.085,10*.08,														
&END														
850	COAL2MET	DALLAS	EXAMPLE8	1978.50	1983.50	1987.50	9.000	2	3	1	0	2	0	
850	COAL3MET	DALLAS	EXAMPLE8	1978.50	1984.50	1988.50	9.000	2	3	1	0	2	0	

TIME DEPENDENT ESCALATION COEFFICIENTS

		ACCT. 20/91 A	ACCT. 20/91 B	ACCT. 21/92 A	ACCT. 21/92 B	ACCT. 22/93 A	ACCT. 22/93 B	ACCT. 23/94 A	ACCT. 23/94 B	ACCT. 24 A	ACCT. 24 B	ACCT. 25 A	ACCT. 25 B	ACCT. 26 A	ACCT. 26 B	YEAR
EQUIPMENT	D		1.055		1.055		1.055		1.055		1.055		1.055		1.055	
	I		1.055		1.055		1.055		1.055							
LABOR	D		1.07		1.07		1.07		1.07		1.07		1.07		1.07	
	I		1.07		1.07		1.07		1.07							
MATERIAL	D		1.06		1.06		1.06		1.06		1.06		1.06		1.06	
	I		1.06		1.06		1.06		1.06							1978.5
EQUIPMENT	D		1.06		1.06		1.06		1.06		1.06		1.06		1.06	
	I		1.06		1.06		1.06		1.06							
LABOR	D		1.08		1.08		1.08		1.08		1.08		1.08		1.08	
	I		1.08		1.08		1.08		1.08							
MATERIAL	D		1.08		1.08		1.08		1.08		1.08		1.08		1.08	
	I		1.08		1.08		1.08		1.08							1982.5
EQUIPMENT	D															-1.
	I															

Fig. 8.1. (continued)

and indirect costs. Only the labor component is to be adjusted through the escalation data input. However, the number of cards in the input sequence must remain the same. Also, the time-dependent escalation input cards must follow the standard input data card for the first unit (i.e., the standard input data card for the second unit will be the final card in the input stream).

Example problem 7 makes use of both the NAMELIST and time-dependent escalation input features. The NAMELIST option variables have been set to call the NAMELIST input only after the costs have undergone size, time, and location adjustment (IFLAG=2). As contingency factors represent the NAMELIST input, this is perfectly acceptable. Again the effective date for escalation input data is before the steam supply order date.

Example problem 8 combines the NAMELIST and time-dependent escalation data input features in determining the capital cost of a three-unit coal-fired plant. The IFLAG variable is set to 3 so that there will be two NAMELIST calls; one before the detailed cost adjustments and one after. Because the interest is not calculated until the reference costs have been adjusted for size, time, and location, modifying RINT at the second NAMELIST call is acceptable. The time-dependent escalation data consist of two sets, one effective at 1978.5 and the second at 1982.5. This causes the escalation rates to change in 1982.5. The -1. card occurs only after all the sets are input. The NAMELIST and escalation data are used in the second and third units through the retrieval features of the ILAZ and IBS variables.

Appendix A

CONTAC AUXILIARY PROGRAM

CONTAC AUXILIARY PROGRAM

Auxiliary program CONTAC is used to maintain the reference plant cost-model data file, COMO, by converting a card image cost-model data set to a single unformatted binary record. Each record is 50,148 bytes in length and contains all data relating to the cost model for a power plant type at some base location and base time. The CONTAC program can be used to create new records, update existing records, delete unwanted records, and list records that are on the updated file. Written in FORTRAN IV, CONTAC has approximately the same machine requirements as the CONCEPT program. CONTACT consists of only a main program, which exercises control over the option list. The data are entered on punched cards and are listed on the system printer.

Each set of data consists of about 800 cards, depending on the model. These cost-model data sets are defined as logical unit 4 (FT04F001) in the program and are read in sequentially. Each cost model has a control card which specifies the numerical position of the record on the file and a command instruction for the program. This control card is such that a new record may be added by specifying the number of the record preceding the one to be added and the letter A. A record may be changed, deleted, or listed by specifying the desired record number and C, D, or L, respectively, on the control card.

In addition to the control card for each model, there is an overall control card read from logical unit 5 (FT05F001) that instructs the program whether a completely new file is being built or whether an unformatted binary file already exists which is to be modified. A value of zero indicates the absence of an existing binary cost model file. A nonzero value indicates the existence of such a file. A new unformatted cost-model file is created on logical unit 9 (FT09F001) for each computer run regardless of the operations performed during that run.

After all records have been read in and an unformatted binary file created, an output table is listed showing the new cost-model file record sequence with the appropriate plant type.

A description of the input cards is tabulated below, followed by a FORTRAN listing of the program and a listing of the cost model for a PWR plant. The CONTAC program uses a local subroutine to obtain the date of the run in A8 format. CALL IDAY(DATE) is found at CONT1210 and initializes the variable DATE to the current date. A modification to reflect the specific local computer environment may have to be made to assign DATE the date-of-run.

CONTAC program input card description

No. of cards in each type	Column	Variable name	Description
CONTAC control card read from unit FT05F001			
1	1	ITAPE	Input file control. Format I1 0 — No existing binary file 1 — Existing unformatted binary file
Each CONTAC cost model card deck read from unit FT04F001 is assembled as follows:			
1	1-2	IREC	Cost model record number on binary file. Format I2
	3	DOREC	Record control. Format A1 'A' Add (Use IREC number of plant preceding one to be added) 'C' Change, 'D' Delete, 'L' List: Use IREC number of specific model of interest
1	1-16	TYPE1(I)	Plant type and date of origin (I=1,2). Format 2A8
	17-23	BWE	Plant capcity, MWe. Format F7.0
	24-30	YBC	Year of reference case costs. Format F7.2
	31-34	PO	Fraction of time expended up to date of contruction permit. Format F4.2
1	1-80	TITLE	Comment card. Format 20A4
1	1-4	NAA	Number of cards to read for AA array. Format I4
	5-8	NIAR4	Number of cards to read for IAR4 array. Format I4
	9-12	NIAR5	Number of cards to read for IAR5 array. Format I4
	13-16	NCCD	Number of cards to read for D array. Format I4

CONTAC program input card description (continued)

No. of cards in each type	Column	Variable name	Description
	17-20	IAC2	Number of cards to read for AC2 array. Format I4
	21-24	IAC3	Number of cards to read for AC3 array. Format I4
	25-28	IAC4	Number of cards to read for AC4 array. Format I4
	29-32	IAC5	Number of cards to read for AC5 array. Format I4
1	1-3	IAR1	Number of one-digit accounts. Format I3
1	1-3 4-6 7-9 10-12 13-15	IAR2(I2)	Number of two-digit accounts in each one-digit account (I2=1,5). Format 5I3
1	1-3 . . . 43-45	IAR3(I3)	Number of three-digit accounts in each two-digit account (I3=1,15). Format 15I3
NIAR4	1-3 . . . 58-60	IAR4(I4)	Number of four-digit accounts in each three-digit account (I4=1,20*NIAR4). Format 20I3
	73-80	IA4D(I)	Identification field. Format A8. (I=1, NIAR4)
NIAR5	1-3 . . . 58-60	IAR5(I5)	Number of five-digit accounts in each four-digit account (I5=1,20*NIAR5). Format 20I3

CONTAC program input card description (continued)

No. of cards in each type	Column	Variable name	Description
	73-80	IA5D(I)	Identification field. Format A8. (I=1,NIAR5)
1	1-8	Plant Type	Used only for plant identification on this card
	12-16	MHT	Total craft labor in thousands of man-hours for direct cost accounts for reference plant. Format I5
	17-20 . . . 41-44	MHP(I)	Craft labor in thousands of man-hours for each direct cost account (I=1,7). Format 7I4
1	1-7 . . . 71-77	COB(I)	Contractor's overhead burden factor for craft labor in each two-digit account (I=1,11) for accounts 20-94. Format 11F7.3
1	1-7 . . . 71-77	AEB(I)	Coefficient used for reference factory equipment rate in each two-digit account (I=1,11). Format 11F7.3
1	1-7 . . . 71-77	ALB(I)	Coefficient used for base craft wage rate in each two-digit account (I=1,11). Format 11F7.3

CONTAC program input card description (continued)

No. of cards in each type	Column	Variable name	Description
1	1-7 . . . 71-77	AMB(I)	Coefficient used for reference site-related materials rate for each two-digit account (I=1,11). Format 11F7.3
11	1-15 16-30 31-45	AA(J,I)	Size-scaling coefficients for two-digit accounts (J=1,3, and I=1,NAA). Format 3F15.0
	65-66	NAC(I)	Two-digit account number (I=1,11). Format I2
	73-80	AAD(I)	Identification field (I=1,11). Format A8
NCCD	1-15 16-30 31-45	D(J,I)	Array containing costs at lowest-level accounts (J=1,3 and I=1,NCCD). Format 3F15.4
	64-71	IDD(I)	Account number (I=1,NCCD). Format A8
	73-80	IDN(I)	Card identification field (I=1,NCCD). Format A8
50	1-6 7-12 . . 67-72	CFCA(J,I)	Array containing cash flow curves for each two-digit cost account (J=1,12 and I=1,50). Format 12F6.3
16	1-6 . . . 61-66	FACS1(J,I)	Weighting factors for site labor (J=1,11 and I=1,16). Format 11F6.2

CONTAC program input card description (continued)

No. of cards in each type	Column	Variable name	Description
16	1-6 . . . 61-66	FACS2(J,I)	Weighting factors for site material (J=1,11 and I=1,16). Format 11F6.2
8	1-6 . . . 61-66	FACS3(J,I)	Weighting factors for factory equipment (J=1,11 and I=1,8). Format 11F6.2
IAC2	1-64	AC2(J,I)	Alphabetic description of two-digit accounts (J=1,8 and I=1,IAC2). Format 8A8
IAC3	1-64	AC3(J,I)	Alphabetic description of three-digit accounts (J=1,8 and I=1,IAC3). Format 8A8
IAC4	1-64	AC4(J,I)	Alphabetic description of four-digit accounts (J=1,8 and I=1,IAC4). Format 8A8
IAC5	1-64	AC5(J,I)	Alphabetic description of five-digit accounts (J=1,8 and I=1,IAC5). Format 8A8

```
C                     * * * *  C O N T A C  * * * *
C                     * * * * P H A S E   5 * * * *
C   PROGRAM TO PRODUCE A MASTER COST MODEL DATA SET FOR INPUT TO THE
C   CONCEPT PHASE 5 PROGRAM.
C         BY R. J. BARNARD                 MAY 1975
C             MODIFIED BY :  C. R. HUDSON                OCTOBER 1977
C             OAK RIDGE NATIONAL LABORATORY
C             OAK RIDGE, TN.   37830
C  |=================================================================|
C  |                                                                 |
C  |  WRITTEN WITH SYMBOLIC INPUT/OUTPUT ADDRESSING TO FACILITATE USE |
C  |  OF THE PROGRAM ON COMPUTERS IN GENERAL.                         |
C  |                READ (5) CHANGED TO READ(INPT)                   |
C  |                WRITE(6) CHANGED TO WRITE (IOUT)                 |
C  |  NOTE THAT THERE IS STILL ONE STATEMENT TO READ (5) PER SE TO READ |
C  |  A CONTROL CARD WHICH IS NOT INCLUDED AS PART OF THE COST MODEL |
C  |  DATA SETS ON THE CONCEPT SYSTEM MASTER TAPE.  THEREFORE, THE CONT-|
C  |  ROL CARD IS READ FROM WHATEVER SYSIN FILE IS NUMBERED AND THE COST|
C  |  MODELS ARE FROM A DIRECT ACCESS DEVICE SYSDA PRESENTLY ASSIGNED |
C  |  TO FT04F001 FOR UPDATING THE ENTIRE COST MODEL LIBRARY.  "INPT" |
C  |  MAY BE ALTERED FOR READING SINGLE COST MODELS IN CARD FORM FROM |
C  |  SYSIN AS DESIRED.  WHEN USING ALL COST MODELS FROM THE MASTER   |
C  |  CONCEPT SYSTEM TAPE, THE CONTAC OLD MASTER IS NOT NEEDED SO A CARD|
C  |  GO.FT08F001 DD DUMMY IS USED.                                   |
C  |                                                                 |
C  |=================================================================|
      REAL*8  IAD1,   IAD2,   IAD3,   IDD(380),   IDN(380),   DATE,
     1 AC2(8,12),   AC3(8,60),   AC4(8,180),   AC5(8,320),   RECTAB(50),
     1 TYPE1(2),   FACEQP(2,8),   FACLAB(2,16),   FACMAT(2,16),
     1 AAD(12),   IA4D(3),   IA5D(9),   DUM1,   DUM2,   DUM3
      REAL*4   F73(7),  M73(7),  F760(5),  M760(12),  F213(8),
     1 F222(7),                AMB(12),  ALB(12),  AEB(12),  D(3,380),
     1 MULT2(12),   MULT3(12),   FMT1(22),
     1 FMT2(25),  FMT3(27),  FMT4(26),  AA(3,12),  CFCA(12,50), COB(12),
     1 FACS1(12,16),  FACS2(12,16),  FACS3(12,8),  TITLE(20)
      INTEGER  NAC(12)/12*0/,  MHP(12)/12*0/,  IAR1,  IAR2(5), IAR3(15),
     1 IAR4(60),  IAR5(180)
      DATA ADD/'A'/, DELETE/'D'/, CHANGE/'C'/, ALIST/'L'/
      DATA AE,AL,AM,IAD1,IAD2,IAD3/' AEB',' ALB',' AMB',
     1'IAR1   1','IAR2   1','IAR3   1'/
      DATA F760/
     1'(1H ',',T7,',' 6(I','2,7X','))  '/
      DATA M760/ ' 1(I',' 2(I',' 3(I',' 4(I',' 5(I',' 6(I',' 7(I',
     1 ' 8(I',' 9(I','10(I','11(I','12(I'/
      DATA FMT1/
     1'(12H',' CON','ST. ','    ',',4X,',' 7(I','3,5X','),1X',',4HC',
     1'ARD/','13H ','PERI','OD 0','-1.0',',T10','6,6H','NUMB','ER/1',
     1'H+,1','20(1','H_)/',')   '/
      DATA MULT2/', 1(',', 2(',', 3(',', 4(',', 5(',', 6(',', 7(',
     1 ', 8(',', 9(',',10(',',11(',',12(' /
      DATA FMT2 /
     1'(1H0',',5X,','20HM','AN-H','OURS',' SIT','E LA','BOR/','60X,',
     1'7HAC','COUN','T/5X',', 7(','I2,7','X),5','HLAB','OR,1','2X,1',
     1'1HCA','RD N','UMBE','R/1H','+,13','0(1H','_)/)'/
      DATA FMT3 /
     1'(1H0',',5X,','20H ','UNIT','S SI','TE M','ATER','IAL/','60X,',
     1'7HAC','COUN','T/,5','X, 7','(I2,','7X),','28HM','ATER','IAL ',
     1'    ','    ','CARD',' NUM','BER/','1H+,','130(','1H_)','/)  '/
      DATA MULT3 / 'X, 1','X, 2','X, 3','X, 4','X, 5','X, 6','X, 7',
     1 'X, 8','X, 9','X,10','X,11','X,12'/
      DATA FMT4/
     1'(1H0',',5X,','17HF','ACTO','RY E','QUIP','MENT','/60X',',7HA',
     1'CCOU','NT/5','X, 7','(I2,','7X),','11HE','QUIP','. IT','EM,6',
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      1'X,11','HCAR','D NU','MBER','/1H+',',130','(1H_',')/) '/
       DATA F213 /
      1'(1H ',',F10','.5,2','X, 7','F8.3',',T10','5,A8',')    '/
       DATA F222 /
      1'( 3X',', 7(','F6.1',',3X)',',2A8',',7X,','A8) '/
       DATA F73/
      1'(9H ','TOTA','L   ',',6X,','6(I2',',4X)',')    '/
       DATA M73/
      1'1(I2','2(I2','3(I2','4(I2','5(I2','6(I2','7(I2'/
       DATA FACLAB /
      1'BUILDING',' LABOR  ',
      1'HEAVY LA','BOR     ',
      1'BRICKLAY','ERS     ',
      1'CARPENTE','RS      ',
      1'STRUCT. ','IRON    ',
      1'PLASTERE','RS      ',
      1'ELECT. W','ORKERS  ',
      1'STEAM FI','TTERS   ',
      1'OPER. EN','GRS.    ',
      1'SM. TRAC','. OP.   ',
      1'LG. TRAC','. OP.   ',
      1'CRANE OP','ERS.    ',
      1'AIR COMP','. OPERS.',
      1'TRUCK DR','IVERS   ',
      1'BOILER M','AKERS   ',
      1'OTHER CR','AFTS    '/
       DATA FACMAT /
      1'CHANNELS','        ',
      1'I BEAMS ','        ',
      1'W FLANGE','S       ',
      1'RE-BARS ','        ',
      1'REDIMIX ','CONCRETE',
      1'PLYFORM ','        ',
      1'LUMBER  ','        ',
      1'LAND    ','        ',
      1'UNASSIGN','ED      ',
      1'UNASSIGN','ED      ',
      1'UNASSIGN','ED      ',
      1'UNASSIGN','ED      ',
      1'UNASSIGN','ED      ',
      1'UNASSIGN','ED      ',
      1'UNASSIGN','ED      ',
      1'UNASSIGN','ED      '/
       DATA FACEQP /
      1'NOT ASSI','GNABLE  ',
      1'STEEL MI','LL PROD ',
      1'ELEC EQP','T & SUP ',
      1'STM ENG ','& TURB  ',
      1'WHITE-CO','LLAR    ',
      1'UNASSIGN','ED      ',
      1'UNASSIGN','ED      ',
      1'UNASSIGN','ED      '/
C       INPT = 5
C    IF READING COST MODELS FROM CARDS BEHIND DECK OR STEPLIB, USE INPT
C      OTHERWISE READ INPUT FROM INPT = 4 FOR INDIRECT DATA SOURCES.
       INPT = 4
       IOUT = 6
      CALL   IDAY (DATE)
C   USE LOCAL ROUTINE OR READ DATE IN ON NEXT CARD
C     READ(5,500) ITAPE,DATE
C
C      ITAPE=0 - NO EXISTING INPUT FILE
C            1 - EXISTING INPUT FILE
C
      READ(5,500) ITAPE
      IF (ITAPE.NE.0) REWIND 8
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      REWIND 9
      NOREC = 0
      IFLAG = 0
    8 READ(INPT,501,END=104) IREC,DOREC
      IF (ITAPE.EQ.0) GO TO 18
   10 IF (IFLAG.EQ.1) GO TO 12
      READ(8,END=110)
     1   TYPE1,  IDD,  TITLE,  YBC,  BWE,  AA,  IAR1,  IAR2,  IAR3,
     1   IAR4,   IAR5,   CFCA,   FACS1,   FACS2,   FACS3,   AEB,
     1   AMB,   ALB,   D,   AC2,   AC3,   AC4,   AC5,   PO,   COB,
     1   MHT,   MHP,   NAA,   NIAR4,   NIAR5,   NCCD,   NAC,   IAC2,
     1   IAC3,   IAC4,   IAC5
      NOREC = NOREC + 1
      IFLAG = 1
   12 IF (IREC.NE.NOREC) GO TO 14
      IF (DOREC.EQ.ALIST) GO TO 68
      IF (DOREC.EQ.ADD) GO TO 67
      IF (DOREC.NE.CHANGE.AND.DOREC.NE.DELETE) GO TO 14
      NOREC = NOREC - 1
      IFLAG = 0
      IF (DOREC.EQ.CHANGE) GO TO 18
      GO TO 8
   14 RECTAB(NOREC) = TYPE1(1)
      IFLAG = 0
      WRITE(9)
     1   TYPE1,  IDD,  TITLE,  YBC,  BWE,  AA,  IAR1,  IAR2,  IAR3,
     1   IAR4,   IAR5,   CFCA,   FACS1,   FACS2,   FACS3,   AEB,
     1   AMB,   ALB,   D,   AC2,   AC3,   AC4,   AC5,   PO,   COB,
     1   MHT,   MHP,   NAA,   NIAR4,   NIAR5,   NCCD,   NAC,   IAC2,
     1   IAC3,   IAC4,   IAC5
      GO TO 10
   17 IFLAG=0
   18 CONTINUE
      IAR1 = 0
      DO 2 I = 1, 180
      IF (I.LE.5) IAR2(I) = 0
      IF (I.LE.15) IAR3(I) = 0
      IF (I.LE.60) IAR4(I) = 0
    2 IAR5(I) = 0
      DO 4 I = 1,50
      DO 4 J=1,12
    4 CFCA(J,I) = 0.0
      READ(INPT,502) TYPE1,BWE,YBC,PO,TITLE
      WRITE(IOUT,504) TYPE1,DATE,TITLE
      WRITE(IOUT,506) TYPE1,BWE,YBC,IREC,DOREC
C     NAA = NUMBER OF CARDS IN THE AA ARRAY
C     NIAR4  = NUMBER OF CARDS IN THE IAR4 ARRAY
C     NIAR5  = NUMBER OF CARDS IN THE IAR5 ARRAY
C     NCCD   = NUMBER OF CARDS IN THE D ARRAY
C     IAC2 = NUMBER OF CARDS IN AC2 ARRAY
C     IAC3 = NUMBER OF CARDS IN AC3 ARRAY
C     IAC4 = NUMBER OF CARDS IN AC4 ARRAY
C     IAC5 = NUMBER OF CARDS IN AC5 ARRAY
      READ(INPT,512) NAA,NIAR4,NIAR5,NCCD,IAC2,IAC3,IAC4,IAC5
      READ(INPT,518) IAR1
      READ(INPT,518) (IAR2(I), I=1,5)
      NUM = IAR2(1)
      NUM1 = NAA + 1
      READ(INPT,518) (IAR3(I), I=1,15)
      L = 0
      DO 20 I = 1,NIAR4
      K = L + 1
      L = K + 19
      READ(INPT,520) (IAR4(J),J=K,L), IA4D(I)
   20 CONTINUE
      L = 0
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      DO 22 I = 1,NIAR5
      K = L + 1
      L = K + 19
      READ(INPT,520)  (IAR5(J),J=K,L), IA5D(I)
   22 CONTINUE
      READ(INPT,508) MHT, (MHP(I),I=1,NUM)
      READ(INPT,510)  (COB(I),I=1,NAA)
      READ(INPT,510) (AEB(I),I=1,NAA)
      READ(INPT,510) (ALB(I),I=1,NAA)
      READ(INPT,510) (AMB(I),I=1,NAA)
      DO 26 I = 1,NAA
      READ(INPT,524)  (AA(J,I),J=1,3), NAC(I),AAD(I)
   26 CONTINUE
      WRITE(IOUT,526)  NAA,NIAR4,NIAR5,NCCD,IAC2,IAC3,IAC4,IAC5
      WRITE(IOUT,532)  BWE
      DO 30 I = 1,NAA
      WRITE(IOUT,534)  (AA(J,I),J=1,3), NAC(I),AAD(I)
   30 CONTINUE
      F73(5)  = M73(NUM)
       WRITE(IOUT,536)
      WRITE(IOUT,538)
      WRITE(IOUT,F73) (NAC(I),I=1,NUM)
      WRITE(IOUT,540) MHT, (MHP(I),I=1,NUM)
      WRITE(IOUT,542)
      WRITE(IOUT,538)
      F760(3)  = M760(NAA)
      WRITE(IOUT,F760) (NAC(I),I=1,NAA)
      WRITE(IOUT,544) (AEB(I),I=1,NAA),AE
      WRITE(IOUT,544) (ALB(I),I=1,NAA),AL
      WRITE(IOUT,544) (AMB(I),I=1,NAA),AM
      WRITE(IOUT,543)
      WRITE(IOUT,538)
      WRITE(IOUT,F760)  (NAC(I),I=1,NAA)
      WRITE(IOUT,545)  (COB(I),I=1,NAA)
      WRITE(IOUT,504)  TYPE1, DATE, TITLE
      WRITE(IOUT,546)  IAR1, IAD1
      WRITE(IOUT,548)  (IAR2(I), I=1,5), IAD2
      WRITE(IOUT,550)  (IAR3(I), I=1,15), IAD3
      WRITE(IOUT,552)
      L = 0
      DO 32 I = 1, NIAR4
      K = L + 1
      L = K + 19
      WRITE(IOUT,554)  (IAR4(J), J=K,L), IA4D(I)
   32 CONTINUE
      WRITE(IOUT,556)
      L = 0
      DO 34 I = 1, NIAR5
      K = L + 1
      L = K + 19
      WRITE(IOUT,554)  (IAR5(J), J=K,L), IA5D(I)
   34 CONTINUE
      N22 = 0
      N32 = 0
      N42 = 0
      WRITE(IOUT,558)  IAR1
      WRITE(IOUT,568)
      DO 40 I1 = 1,IAR1
      WRITE(IOUT,560)  IAR2(I1)
      WRITE(IOUT,568)
      N2 = IAR2(I1)
      IF (N2.EQ.0) GO TO 40
      N21 = N22 + 1
      N22 = N21 + N2 - 1
      DO 38 I2 = N21,N22
      WRITE(IOUT,562)  IAR3(I2)
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      WRITE(ICUT,568)
      N3 = IAR3(I2)
      IF (N3.EQ.0) GO TO 38
      N31 = N32 + 1
      N32 = N31 + N3 -1
      DO 36 I3 = N31,N32
      WRITE(IOUT,564) IAR4(I3)
      WRITE(IOUT,568)
      N4 = IAR4(I3)
      IF (N4.EQ.0) GO TO 36
      N41 = N42 + 1
      N42 = N41 + N4 - 1
      WRITE(IOUT,566) (IAR5(I4),I4=N41,N42)
      WRITE(IOUT,568)
      WRITE(ICUT,570)
   36 CONTINUE
   38 CONTINUE
   40 CONTINUE
      WRITE(IOUT,572)
      N = 51
      DO 46 I = 1,NCCD
      READ(INPT,574) (D (J,I),J=1,3),IDD(I),IDN(I)
      IF (N.LE.50) GO TO 44
      WRITE(IOUT,504) TYPE1, DATE, TITLE
      WRITE(ICUT,576)
      N = 1
   44 WRITE(IOUT,578) (D (J,I),J=1,3),IDD(I),IDN(I)
      N = N + 1
   46 CONTINUE
      WRITE(IOUT,504) TYPE1, DATE, TITLE
      WRITE(IOUT,580) PO
      FMT1(6) = M760(NAA)
      WRITE(IOUT,FMT1) (NAC(I),I=1,NAA)
      F213(4) = MULT3(NAA)
      DO 48 I = 1,50
      READ(INPT,582) (CFCA(J,I), J=1,NUM1), DUM2
      WRITE(IOUT,F213) (CFCA(J,I), J=1,NUM1), DUM2
   48 CONTINUE
      WRITE(ICUT,504) TYPE1, DATE, TITLE
      FMT2(13) = MULT2(NAA)
      WRITE(IOUT,FMT2) (NAC(I),I=1,NAA)
      F222(2) = MULT2(NAA)
      DO 50 I = 1,16
       READ(INPT,584) (FACS1(J,I),J=1,NAA),DUM3
      WRITE(IOUT,F222) (FACS1(J,I),J=1,NAA),(FACLAB(J,I),J=1,2),DUM3
   50 CONTINUE
      FMT3(13) = MULT3(NAA)
      WRITE(IOUT,FMT3) (NAC(I),I=1,NAA)
      DO 52 I = 1,16
       READ(INPT,584) (FACS2(J,I),J=1,NAA),DUM3
      WRITE(IOUT,F222) (FACS2(J,I),J=1,NAA),(FACMAT(J,I),J=1,2),DUM3
   52 CONTINUE
      FMT4(12) = MULT3(NAA)
      WRITE(ICUT,FMT4) (NAC(I),I=1,NAA)
      DO 53 I=1,8
      READ(INPT,584) (FACS3(J,I),J=1,NAA),DUM3
      WRITE(IOUT,F222) (FACS3(J,I),J=1,NAA),(FACEQP(J,I),J=1,2),DUM3
   53 CONTINUE
      WRITE(ICUT,504) TYPE1, DATE, TITLE
      WRITE(IOUT,586)
      DO 54 I = 1,IAC2
      READ(INPT,588) (AC2(J,I),J=1,8), DUM1, DUM2
      WRITE(IOUT,590) (AC2(J,I),J=1,8), DUM1, DUM2
   54 CONTINUE
      N = 51
      DO 58 I = 1,IAC3
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      IF (N.LE.50) GO TO 56
      WRITE(IOUT,504) TYPE1, DATE, TITLE
      WRITE(IOUT,592)
      N = 1
   56 READ(INPT,588) (AC3(J,I),J=1,8), DUM1, DUM2
      WRITE(IOUT,590) (AC3(J,I),J=1,8), DUM1, DUM2
      N = N + 1
   58 CONTINUE
      N = 51
      DO 62 I = 1,IAC4
      IF (N.LE.50) GO TO 60
      WRITE(IOUT,504) TYPE1, DATE, TITLE
      WRITE(IOUT,594)
      N = 1
   60 READ(INPT,588) (AC4(J,I),J=1,8), DUM1, DUM2
      WRITE(IOUT,590) (AC4(J,I),J=1,8), DUM1, DUM2
      N = N + 1
   62 CONTINUE
      N = 51
      DO 66 I = 1,IAC5
      IF (N.LE.50) GO TO 64
      WRITE(IOUT,504) TYPE1, DATE, TITLE
      WRITE(IOUT,596)
      N = 1
   64 READ(INPT,588) (AC5(J,I),J=1,8), DUM1, DUM2
      WRITE(IOUT,590) (AC5(J,I),J=1,8), DUM1, DUM2
      N = N + 1
   66 CONTINUE
   67 CONTINUE
      IF (IFLAG.EQ.1) RECTAB(NOREC) = TYPE1(1)
      WRITE(9)
     1   TYPE1,  IDD,  TITLE,  IBC,  BWE,  AA,  IAR1,  IAR2,  IAR3,
     1   IAR4,   IAR5,   CPCA,   FACS1,   FACS2,   FACS3,   AEB,
     1   AMB,   ALB,   D,   AC2,   AC3,   AC4,   AC5,   PO,   COB,
     1   MHT,   MHP,   NAA,   NIAR4,   NIAR5,   NCCD,   NAC,   IAC2,
     1   IAC3,   IAC4,   IAC5
      IF (DOREC.EQ.ADD.AND.IFLAG.EQ.1) GO TO 17
      NOREC = NOREC + 1
      IF (IFLAG.EQ.0) RECTAB(NOREC) = TYPE1(1)
      GO TO 8
   68 CONTINUE
      WRITE(IOUT,504) TYPE1,DATE,TITLE
      WRITE(IOUT,506) TYPE1,BWE,IBC,IREC,DOREC
      WRITE(IOUT,526) NAA,NIAR4,NIAR5,NCCD,IAC2,IAC3,IAC4,IAC5
      NUM = IAR2(1)
      NUM1 = NAA + 1
      WRITE(IOUT,532) BWE
      DO 72 I= 1,NAA
      WRITE(IOUT,535) (AA(J,I),J= 1,3), NAC(I),I
   72 CONTINUE
      F73(5) = M73(NUM)
       WRITE(IOUT,536)
      WRITE(IOUT,538)
      WRITE(IOUT,F73) (NAC(I),I= 1,NUM)
      WRITE(IOUT,540) MHT,(MHP(I),I=1,NUM)
      WRITE(IOUT,542)
      WRITE(IOUT,538)
      F760(3) = M760(NAA)
      WRITE(IOUT,F760) (NAC(I),I=1,NAA)
      WRITE(IOUT,544) (AEB(I),I=1,NAA),AE
      WRITE(IOUT,544) (ALB(I),I=1,NAA),AL
      WRITE(IOUT,544) (AMB(I),I=1,NAA),AM
      WRITE(IOUT,543)
      WRITE(IOUT,538)
      WRITE(IOUT,F760)  (NAC(I),I=1,NAA)
      WRITE(IOUT,545)  (COB(I),I=1,NAA)
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      WRITE(IOUT,504)  TYPE1,DATE,TITLE
      WRITE(IOUT,546)  IAR1,IAD1
      WRITE(IOUT,548)  (IAR2(I), I=1,5),IAD2
      WRITE(IOUT,550)  (IAR3(I), I=1,15),IAD3
      WRITE(IOUT,552)
      L = 0
      DO 74 I = 1,NIAR4
      K = L + 1
      L = K + 19
      WRITE(IOUT,555)  (IAR4(J),J=K,L), I
   74 CONTINUE
      WRITE(IOUT,556)
      L = 0
      DO 76 I = 1,NIAR5
      K = L + 1
      L = K + 19
      WRITE(IOUT,555)  (IAR5(J),J=K,L),I
   76 CONTINUE
      N22 = 0
      N32 = 0
      N42 = 0
      WRITE(IOUT,558)  IAR1
      WRITE(IOUT,568)
      DO 82 I1 = 1,IAR1
      WRITE(IOUT,560)  IAR2(I1)
      WRITE(IOUT,568)
      N2 = IAR2(I1)
      IF (N2.EQ.0) GO TO 82
      N21 = N22 + 1
      N22 = N21 + N2 - 1
      DO 80 I2 = N21,N22
      WRITE(IOUT,562)  IAR3(I2)
      WRITE(IOUT,568)
      N3 = IAR3(I2)
      IF (N3.EQ.0) GO TO 80
      N31 = N32 + 1
      N32 = N31 + N3 - 1
      DO 78 I3 = N31, N32
      WRITE(IOUT,564)  IAR4(I3)
      WRITE(IOUT,568)
      N4 = IAR4(I3)
      IF (N4.EQ.0) GO TO 78
      N41 = N42 + 1
      N42 = N41 + N4 - 1
      WRITE(IOUT,566)  (IAR5(I4), I4=N41,N42)
      WRITE(IOUT,568)
      WRITE(IOUT,570)
   78 CONTINUE
   80 CONTINUE
   82 CONTINUE
      WRITE(IOUT,572)
      N=51
      DO 84 I = 1,NCCD
      IF (N.LE.50) GO TO 83
      WRITE(IOUT,504)  TYPE1,DATE,TITLE
      WRITE(IOUT,576)
      N=1
   83 WRITE(IOUT,598)  (D(J,I),J=1,3),IDD(I),I
      N= N + 1
   84 CONTINUE
      WRITE(IOUT,504)  TYPE1, DATE, TITLE
      WRITE(IOUT,580)  PO
      FMT1(6) = M760(NAA)
      WRITE(IOUT,FMT1) (NAC(I),I=1,NAA)
      FMT3(4) = MULT3(NAA)
      DO 86 I = 1,50
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      WRITE(IOUT,F213)  (CFCA(J,I),J=1,NUM1)
   86 CONTINUE
      WRITE(IOUT,504) TYPE1, DATE, TITLE
      FMT2(13) = MULT2(NAA)
      WRITE(IOUT,FMT2) (NAC(I),I=1,NAA)
      F222(2) = MULT2(NAA)
      DO 88 I = 1,16
      WRITE(IOUT,F222)  (FACS1(J,I),J=1,NAA),(FACLAB(J,I),J=1,2)
   88 CONTINUE
      FMT3(13) = MULT3(NAA)
      WRITE(IOUT,FMT3) (NAC(I),I=1,NAA)
      DO 90 I = 1,16
      WRITE(IOUT,F222)  (FACS2(J,I),J=1,NAA),(FACMAT(J,I),J=1,2)
   90 CONTINUE
      FMT4(12) = MULT3(NAA)
      WRITE(IOUT,FMT4)  (NAC(I),I=1,NAA)
      DO 91 I=1,8
      WRITE(IOUT,F222)  (FACS3(J,I),J=1,NAA),(FACEQP(J,I),J=1,2)
   91 CONTINUE
      WRITE(IOUT,504) TYPE1, DATE, TITLE
      WRITE(IOUT,586)
      DO 92 I = 1,IAC2
      WRITE(IOUT,600)  (AC2(J,I),J=1,8), I
   92 CONTINUE
      N = 51
      DO 96 I = 1,IAC3
      IF (N.LE.50) GO TO 94
      WRITE(IOUT,504) TYPE1, DATE, TITLE
      WRITE(IOUT,592)
      N = 1
   94 WRITE(IOUT,602)  (AC3(J,I), J=1,8), I
      N = N + 1
   96 CONTINUE
      N = 51
      DO 100 I = 1,IAC4
      IF (N.LE.50) GO TO 98
      WRITE(IOUT,504) TYPE1, DATE, TITLE
      WRITE(IOUT,594)
      N = 1
   98 WRITE(IOUT,604)  (AC4(J,I),J=1,8), I
      N = N + 1
  100 CONTINUE
      N=51
      DO 102 I=1,IAC5
      IF (N.LE.50) GO TO 101
      WRITE(IOUT,504) TYPE1, DATE, TITLE
      WRITE(IOUT,596)
      N=1
  101 WRITE(IOUT,606)  (AC5(J,I), J=1,8), I
      N = N + 1
  102 CONTINUE
      RECTAB(NOREC) = TYPE1(1)
      IFLAG=0
      WRITE(9)
     1   TYPE1,  IDD,  TITLE,  YBC,  BWE,  AA,  IAR1,  IAR2,  IAR3,
     1   IAR4,   IAR5,   CFCA,   FACS1,   FACS2,   FACS3,   AEB,
     1   AMB,   ALB,   D,   AC2,   AC3,   AC4,   AC5,   PO,   COB,
     1   MHT,   MHP,   NAA,   NIAR4,   NIAR5,   NCCD,   NAC,   IAC2,
     1   IAC3,   IAC4,   IAC5
      GO TO 8
  104 IF (ITAPE.EQ.0) GO TO 110
      IF (IFLAG.EQ.1) GO TO 108
  106 READ(8,END=110)
     1   TYPE1,  IDD,  TITLE,  YBC,  BWE,  AA,  IAR1,  IAR2,  IAR3,
     1   IAR4,   IAR5,   CFCA,   FACS1,   FACS2,   FACS3,   AEB,
     1   AMB,   ALB,   D,   AC2,   AC3,   AC4,   AC5,   PO,   COB,
```

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     1   MHT,    MHP,    NAA,    NIAR4,    NIAR5,    NCCD,    NAC,    IAC2,
     1   IAC3,    IAC4,    IAC5
      NOREC = NOREC + 1
  108 RECTAB(NOREC) = TYPE1(1)
      WRITE(9)
     1   TYPE1,  IDD,  TITLE,  YBC,  BWE,  AA,  IAR1,  IAR2,  IAR3,
     1   IAR4,   IAR5,   CFCA,   FACS1,   FACS2,   FACS3,   AEB,
     1   AMB,   ALB,   D,   AC2,   AC3,   AC4,   AC5,   PO,   COB,
     1   MHT,   MHP,   NAA,   NIAR4,   NIAR5,   NCCD,   NAC,   IAC2,
     1   IAC3,   IAC4,   IAC5
      GO TO 106
  110 END FILE 9
      REWIND 9
      I = 1
      WRITE(IOUT,608)
  112 READ(9,END=114)
     1   TYPE1,  IDD,  TITLE,  YBC,  EWE,  AA,  IAR1,  IAR2,  IAR3,
     1   IAR4,   IAR5,   CFCA,   FACS1,   FACS2,   FACS3,   AEB,
     1   AMB,   ALB,   D,   AC2,   AC3,   AC4,   AC5,   PO,   COB,
     1   MHT,   MHP,   NAA,   NIAR4,   NIAR5,   NCCD,   NAC,   IAC2,
     1   IAC3,   IAC4,   IAC5
      WRITE(IOUT,610) I,TYPE1(1),TYPE1(2),(TITLE(J),J=1,20)
      I = I + 1
      GO TO 112
  114  STOP
C  USE THE NEXT FORMAT IF DATE IS READ IN FROM UNIT 5
C500   FORMAT(I1,3X,A8)
  500 FORMAT(I1)
  501 FORMAT(I2,A1)
  502 FORMAT(2A8,F7.0,F7.2,F4.2/20A4)
  504 FORMAT('1',30X,A8,2X,A8,10X,'DATE ',A8/'0',20A4)
  506 FORMAT('0 C O S T   M O D E L   D E S C R I P T I O N ' /
     1'0POWER PLANT TYPE =  ',A8,5X,' DATE MODIFIED =  ',A8,5X,
     1' BASE MODEL MWE = ',F6.0,5X,' YEAR BASE MODEL COSTS = ',F9.2/
     1'0RECORD NO. = ',I2,'  FUNCTION = ',A1)
 508   FORMAT(11X,I5,7I4)
  510 FORMAT(11F7.3)
  512 FORMAT(8I4)
  518 FORMAT(15I3)
  520 FORMAT(20I3,12X,A8)
  524 FORMAT(3F15.0,T65,I2,T73,A8)
  526 FORMAT('0INDICES FOR ARRAYS:        AA      IAR4     IAR5    NCCD     I
     1AC2     IAC3    IAC4    IAC5'/' ',T21,8(I8)/)
  532 FORMAT('0TABLE AA CONTAINS CONSTANTS FOR THE EQUATION'/
     1 '0',10X,'Y = A + B * (X / BASE) **C'/
     1 '0WHICH DESCRIBES THE COST (IN THOUSANDS OF DOLLARS)'/
     1 ' LESS CONTINGENCY OF EACH 2-DIGIT ACCOUNT AS A FUNCTION'/
     1 ' OF POWER LEVEL BASE SIZE = ',F7.2/
     1 '0',11X,'A',14X,'B',14X,'C',15X,'ACCOUNT',8X,'CARD NUMBER'/
     1 '+',84('_'))
  534 FORMAT(' ',3F15.4,15X,I2,5X,A8)
  535 FORMAT(' ',3F15.4,15X,I2,15X,I2)
  536 FORMAT('0 THOUSANDS OF MAN/HOURS IN EACH 2-DIGIT DIRECT COST '
     1'ACCOUNT'/)
  538 FORMAT(' ',T40,'ACCOUNT'/'+',100('_'))
  540 FORMAT('0',I5,T12,7I6,T73,'MANHOURS'//)
  542 FORMAT('0  COEFFICIENTS USED FOR CALCULATING BASE RATE AND ESCALAT
     1ION')
  543 FORMAT(/'0CONTRACTOR''S OVERHEAD BURDEN (FRACTION IMPLICIT IN '
     1'D-ARRAY LABOR ACCOUNTS)')
  544 FORMAT('0',11F9.3,T103,A4)
  545 FORMAT('0',11F9.3)
  546 FORMAT('0IAR1 DESCRIBES THE NUMBER OF 1 DIGIT ACCOUNTS', 15X,
     1 'CARD NUMBER'/ '+',73('_')/'0',I3,59X,A8/)
  548 FORMAT('0IAR2 DESCRIBES THE NUMBER OF 2 DIGIT ACCOUNTS', 15X,
     1 'CARD NUMBER'/ '+',73('_')/'0',5I3,47X,A8/)
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550 FORMAT('0IAR3 DESCRIBES THE NUMBER OF 3 DIGIT ACCOUNTS', 15X,       CONT5920
   1 'CARD NUMBER'/'+',73('_')/'0', 15I3, 17X, A8/)                     CONT5930
552 FORMAT('0IAR4 DESCRIBES THE NUMBER OF 4 DIGIT ACCOUNTS', 15X,       CONT5940
   1 'CARD NUMBER'/ '+',73('_'))                                        CONT5950
554 FORMAT(' ',20I3,2X,A8)                                              CONT5960
555 FORMAT(' ',20I3,7X,I2)                                              CONT5970
556 FORMAT('0IAR5 DESCRIBES THE NUMBER OF 5 DIGIT ACCOUNTS', 15X,       CONT5980
   1 'CARD NUMBER'/ '+',73('_'))                                        CONT5990
558 FORMAT('0',30X,'ACCOUNT INDICES'/'+',120('_')/' |IAR1 |  IAR2  |    CONT6000
   1IAR3  |  IAR4  |  IAR5',79X,'|'/'+',120('_')/' ',I3/'+',7('_'))     CONT6010
560 FORMAT(10X,I3/'+',6X,10('_'))                                       CONT6020
562 FORMAT(19X,I3/'+',15X,10('_'))                                      CONT6030
564 FORMAT(28X,I3/'+',24X,10('_'))                                      CONT6040
566 FORMAT(37X,40I2)                                                    CONT6050
568 FORMAT('+|',5X,'|',8X,'|',8X,'|',8X,'|',85X,'|')                    CONT6060
570 FORMAT('+',33X,87('_'))                                             CONT6070
572 FORMAT('+',120('_'))                                                CONT6080
574 FORMAT(3F15.4,T64,A8,1X,A8)                                         CONT6090
576 FORMAT('0D-ARRAY SPLITS BASE COST INTO LOWEST LEVEL COST COMPONENTCONT6100
   1S (THOUSANDS OF DOLLARS)'/'0', T9,'$ FACTORY',T24,'$ SITE',T40,     CONT6110
   1'$ SITE',T75,'CARD'/1X,T11,'COST',T25,'LABOR',T39,'MATERIAL',       CONT6120
   1T63,'ACCOUNT',T74,'NUMBER'/'+',86('_')//)                           CONT6130
578 FORMAT(' ',3F15.4,T64,2A8)                                          CONT6140
580 FORMAT('0',T30,'CUMULATIVE CONSTANT DOLLAR CASH FLOW'/' ',T20,      CONT6150
   1'FRACTION OF TOTAL CONSTRUCTION PERIOD EXPENDED UP TO RECIPIT OF CCONT6160
   1ONSTRUCTION PERMIT = ',F5.2/'0FRACTION OF ',T60,'ACCOUNT')          CONT6170
582 FORMAT(12F6.3,A8)                                                   CONT6180
584 FORMAT(11(F6.2),6X,A8)                                              CONT6190
586 FORMAT('0AC2 DESCRIBES THE 2-DIGIT ACCOUNT NUMBERS AND ALPHABETIC   CONT6200
   1ACCOUNT INFORMATION'/'0ACC NO  ALPHABETIC INFORMATION',39X,         CONT6210
   1'CARD NUMBER'/'+',80('_')/)                                         CONT6220
588 FORMAT(10A8)                                                        CONT6230
590 FORMAT(' ',10A8)                                                    CONT6240
592 FORMAT('0AC3 DESCRIBES THE 3-DIGIT ACCOUNT NUMBERS AND ALPHABETIC   CONT6250
   1ACCOUNT INFORMATION'/'0ACC NO  ALPHABETIC INFORMATION',39X,         CONT6260
   1'CARD NUMBER'/'+',80('_')/)                                         CONT6270
594 FORMAT('0AC4 DESCRIBES THE 4-DIGIT ACCOUNT NUMBERS AND ALPHABETIC   CONT6280
   1ACCOUNT INFORMATION'/'0ACC NO  ALPHABETIC INFORMATION',39X,         CONT6290
   1'CARD NUMBER'/'+',80('_')/)                                         CONT6300
596 FORMAT('0AC5 DESCRIBES THE 5-DIGIT ACCOUNT NUMBERS AND ALPHABETIC   CONT6310
   1ACCOUNT INFORMATION'/'0ACC NO  ALPHABETIC INFORMATION',39X,         CONT6320
   1'CARD NUMBER'/'+',80('_')/)                                         CONT6330
598 FORMAT(' ',3F15.4,15X,A8,5X,'D ',1X,I3)                             CONT6340
600 FORMAT(' ',8A8,6X,'AC2',2X,I3)                                      CONT6350
602 FORMAT(' ',8A8,6X,'AC3',2X,I3)                                      CONT6360
604 FORMAT(' ',8A8,6X,'AC4',2X,I3)                                      CONT6370
606 FORMAT(' ',8A8,6X,'AC5',2X,I3)                                      CONT6380
608 FORMAT('1NEW MASTER LIST')                                          CONT6390
610 FORMAT('0RECORD NO ',I2,' IS PLANT TYPE ',2A8,2X,20A4)              CONT6400
    END                                                                 CONT6410
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0 1A
PWRMET   05-02-78   1139.1976.500.250.0
     PWRMET MODEL FOR CONTACT 5 / CONCEPT 5
  11    3    8 369   11   52 161 306
   2                                                                                IAR1    1
   7  4                                                                             IAR2    1
   2  7  9  6  6  4  2  4  3  4  5                                                  IAR3    1
   0  0  3  2  2  2  2  2 14  2  2  1  4  3  3  7  5  3  5  5                       IAR4    1
   4  6  3  2  2  3  2  5  3  5  1  4  2  6  4  1  2  3  4  1                       IAR4    2
   5  4  4  4  6  4  4                                                              IAR4    3
   7  5  1  2  3  2  5  2  4  2  4  2  3  2  2  2  2  2  1  2                       IAR5    1
   2  2  2  1  1  2  1  1  0  4  1  5  6  6  7  5  8  1  2  3                       IAR5    2
   1  4  1  6  2  1  2  3  4  6  0  7  3  0  3  0  3  2  1  6                       IAR5    3
   2  5  1  7  1  1  0  0  5  4  6  2  1  7  0  0  5  1  0  0                       IAR5    4
   3  2  3  2  3  3  3  2  2  2  0  0  0  0  2  0  0  1  2  0                       IAR5    5
   0  0  4  2  3  8  2  2  2  1  2  1  1  5  1  2  2  2  1  4                       IAR5    6
   3  5  3  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0                       IAR5    7
   0  0  0  0  0  0  0  0  0  0  0  0  2                                            IAR5    8
PWRMET       10819   0 47162146 18271450 308 372
     0        0       0       0        0          0         0       0         0        0         0    COB
179.6   179.6   179.6   179.6   179.6   179.6   179.6   179.6   174.8   174.8   174.8   AEB
11.809  11.809  12.940  12.773  12.272  12.863  12.314  12.68   13.24   13.24   13.24   ALB
1000.   20.58   20.58   20.58   20.58   20.58   20.58   20.58   20.58   20.58   20.58   AMB
          1.00000          0.0                0.0                            20        AA     1
          0.0              1.00000            0.50000                        21        AA     2
          0.0              1.00000            0.60000                        22        AA     3
          0.0              1.00000            0.80000                        23        AA     4
          0.0              1.00000            0.40000                        24        AA     5
          0.0              1.00000            0.30000                        25        AA     6
          0.0              1.00000            0.80000                        26        AA     7
    0.0           1.0            0.428                                       91        AA     8
    0.0           1.0            0.208                                       92        AA     9
    0.0           1.0            0.406                                       93        AA    10
    0.0           1.0            0.4                                         94        AA    11
           0.              0.             2000.                              201.      D      1
           0.              0.                0.                              202.      D      2
           0.            155.              211.                              211.11    D      3
           0.            170.              509.                              211.12    D      4
           0.             54.               59.                              211.14    D      5
         169.             94.               67.                              211.15    D      6
           0.            178.              487.                              211.16    D      7
           0.            258.              210.                              211.17    D      8
           0.             63.              104.                              211.19    D      9
           0.             10.               13.                              211.41    D     10
           0.              5.               12.                              211.42    D     11
           0.            775.              817.                              211.43    D     12
           0.             14.               22.                              211.45    D     13
           0.              4.                3.                              211.46    D     14
           0.           2730.             2084.                              211.71    D     15
           0.           1250.             1029.                              212.13    D     16
        1300.          17305.            12308.                              212.14    D     17
        1452.            648.              151.                              212.22    D     18
           0.             72.               74.                              212.24    D     19
          50.             29.                7.                              212.25    D     20
           0.           1169.              721.                              213.13    D     21
           0.           2824.             5582.                              213.14    D     22
         122.            216.               51.                              213.21    D     23
         253.            183.               27.                              213.22    D     24
          74.            146.               20.                              213.23    D     25
           0.            258.              126.                              213.24    D     26
          50.             23.                2.                              213.25    D     27
           0.            338.              197.                              215.13    D     28
           0.           3808.             2301.                              215.14    D     29
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24.	61.	11.	215.21	D	30
554.	688.	205.	215.22	D	31
3.	19.	5.	215.23	D	32
0.	156.	81.	215.24	D	33
0.	206.	179.	216.13	D	34
0.	4391.	2367.	216.14	D	35
23.	45.	8.	216.21	D	36
94.	253.	98.	216.22	D	37
0.	184.	100.	216.24	D	38
50.	23.	2.	216.25	D	39
0.	957.	666.	217.13	D	40
0.	1455.	832.	217.14	D	41
22.	43.	8.	217.21	D	42
306.	96.	30.	217.22	D	43
0.	52.	25.	217.24	D	44
0.	4454.	2567.	218A.1	D	45
755.	1112.	311.	218A.2	D	46
0.	1170.	1494.	218B.1	D	47
517.	1152.	341.	218B.2	D	48
0.	101.	72.	218D.1	D	49
17.	24.	6.	218D.2	D	50
0.	1435.	532.	218E.1	D	51
22.	44.	14.	218E.2	D	52
0.	339.	142.	218F.1	D	53
2.	17.	9.	218F.2	D	54
3.	5.	3.	218G.2	D	55
0.	145.	112.	218H.1	D	56
10.	23.	10.	218H.2	D	57
0.	1472.	1010.	218J.1	D	58
7.	29.	13.	218J.2	D	59
0.	177.	76.	218K.1	D	60
0.	20.	11.	218K.2	D	61
0.	57.	44.	218M.1	D	62
0.	3.	3.	218M.2	D	63
0.	102.	32.	218P.1	D	64
0.	78.	33.	218S.1	D	65
0.	2213.	1091.	218T.1	D	66
25.	8.	1.	218T.2	D	67
0.	102.	43.	218V.1	D	68
65000.	0.	0.	220A.1	D	69
0.	0.	0.	220B.	D	70
475.	33.	3.	221.11	D	71
0.	763.	86.	221.12	D	72
0.	183.	19.	221.13	D	73
0.	0.	1800.	221.14	D	74
0.	168.	38.	221.21	D	75
775.	379.	34.	222.11	D	76
735.	3634.	397.	222.12	D	77
1850.	777.	82.	222.13	D	78
100.	81.	8.	222.14	D	79
490.	44.	4.	222.15	D	80
0.	26.	2.	223.11	D	81
0.	13.	1.	223.12	D	82
625.	1707.	189.	223.15	D	83
8.	0.	0.	223.16	D	84
20.	0.	0.	223.17	D	85
26.	2.	0.	223.18	D	86
15.	30.	3.	223.31	D	87
0.	161.	231.	223.33	D	88
569.	1803.	248.	223.35	D	89
178.	0.	0.	223.36	D	90
22.	0.	0.	223.37	D	91
54.	5.	0.	223.38	D	92
150.	33.	3.	223.41	D	93
151.	13.	1.	223.42	D	94
86.	3.	0.	223.43	D	95

799.	2092.	216.	223.45	D	96
563.	3.	0.	223.46	D	97
27.	0.	0.	223.47	D	98
36.	4.	0.	223.48	D	99
20.	39.	4.	223.55	D	100
7.	0.	0.	223.56	D	101
2.	0.	0.	223.57	D	102
10.	1.	0.	223.58	D	103
750.	52.	5.	223.59	D	104
704.	543.	118.	224.11	D	105
705.	40.	4.	224.12	D	106
342.	20.	2.	224.13	D	107
6.	1.	0.	224.14	D	108
204.	312.	93.	224.15	D	109
1076.	310.	110.	224.16	D	110
45.	12.	1.	224.17	D	111
64.	6.	1.	224.18	D	112
805.	509.	129.	224.21	D	113
793.	1114.	285.	224.31	D	114
900.	327.	33.	224.32	D	115
482.	63.	6.	225.11	D	116
900.	5.	0.	225.12	D	117
120.	100.	10.	225.13	D	118
65.	13.	1.	225.32	D	119
183.	67.	7.	225.41	D	120
183.	67.	7.	225.42	D	121
495.	413.	68.	225.43	D	122
15.	2.	0.	225.48	D	123
57.	79.	8.	226.11	D	124
6.	3.	0.	226.31	D	125
0.	71.	158.	226.33	D	126
76.	200.	26.	226.35	D	127
40.	0.	0.	226.36	D	128
4.	0.	0.	226.37	D	129
5.	1.	0.	226.38	D	130
1053.	1428.	267.	226.41	D	131
1358.	2405.	920.	226.42	D	132
95.	2.	0.	226.68	D	133
1365.	1995.	949.	226.71	D	134
2653.	2810.	281.	226.72	D	135
0.	0.	200.	226.86	D	136
0.	0.	60.	226.87	D	137
0.	0.	5.	226.88	D	138
0.	47.	15.	226.95	D	139
17.	0.	0.	226.96	D	140
1.	0.	0.	226.97	D	141
200.	18.	1.	226.98	D	142
615.	52.	3.	227.11	D	143
100.	10.	1.	227.14	D	144
50.	5.	0.	227.15	D	145
209.	21.	1.	227.16	D	146
200.	20.	1.	227.17	D	147
264.	36.	2.	227.18	D	148
1722.	508.	51.	227.2	D	149
550.	56.	3.	227.31	D	150
662.	34.	2.	227.32	D	151
80.	0.	0.	227.33	D	152
263.	27.	1.	227.34	D	153
120.	12.	1.	227.35	D	154
60.	6.	1.	227.36	D	155
54.	6.	1.	227.37	D	156
500.	25.	3.	227.41	D	157
600.	31.	3.	227.42	D	158
350.	20.	2.	227.43	D	159
117.	38.	4.	227.5	D	160
0.	864.	55.	228.11	D	161

0.	239.	105.	228.12	D	162
0.	98.	45.	228.13	D	163
1500.	0.	0.	228.2	D	164
0.	358.	743.	228.31	D	165
0.	66.	230.	228.32	D	166
0.	209.	746.	228.33	D	167
53217.	0.	0.	231.11	D	168
0.	2566.	245.	231.12	D	169
0.	1337.	834.	231.21	D	170
0.	4.	23.	231.43	D	171
3.	21.	4.	231.45	D	172
24.	0.	0.	231.46	D	173
1.	0.	0.	231.47	D	174
10.	1.	0.	231.48	D	175
109.	54.	60.	231.49	D	176
97.	81.	8.	231.51	D	177
63.	55.	5.	231.52	D	178
91.	16.	2.	231.63	D	179
507.	1058.	106.	231.65	D	180
624.	0.	0.	231.66	D	181
102.	0.	0.	231.67	D	182
27.	2.	0.	231.68	D	183
5939.	1325.	133.	233.12	D	184
829.	88.	9.	233.21	D	185
234.	120.	12.	233.23	D	186
725.	1505.	151.	233.25	D	187
506.	0.	0.	233.26	D	188
145.	0.	0.	233.27	D	189
49.	5.	0.	233.28	D	190
0.	287.	234.	233.29	D	191
324.	114.	12.	233.31	D	192
150.	0.	0.	233.41	D	193
1504.	544.	54.	233.5	D	194
2023.	628.	63.	234.1	D	195
1739.	221.	22.	234.21	D	196
1601.	3541.	355.	234.25	D	197
1548.	0.	0.	234.26	D	198
310.	0.	0.	234.27	D	199
59.	6.	0.	234.28	D	200
294.	611.	61.	234.35	D	201
398.	0.	0.	234.36	D	202
59.	0.	0.	234.37	D	203
34.	3.	0.	234.38	D	204
199.	24.	2.	234.41	D	205
0.	16.	79.	234.43	D	206
239.	495.	50.	234.45	D	207
211.	0.	0.	234.46	D	208
48.	0.	0.	234.47	D	209
47.	4.	0.	234.48	D	210
4283.	6244.	624.	235.11	D	211
1000.	81.	8.	235.14	D	212
4.	20.	4.	235.21	D	213
32.	16.	2.	235.31	D	214
296.	10.	1.	235.32	D	215
1.	1.	0.	235.33	D	216
210.	442.	45.	235.35	D	217
376.	0.	0.	235.36	D	218
42.	0.	0.	235.37	D	219
18.	2.	0.	235.38	D	220
1053.	157.	22.	235.4	D	221
35.	8.	2.	235.5	D	222
15.	5.	1.	235.61	D	223
40.	3.	0.	235.63	D	224
2.	4.	0.	235.65	D	225
0.	0.	0.	235.66	D	226
0.	0.	0.	235.67	D	227

996.	136.	12.	236.11	D	228
0.	0.	0.	236.2	D	229
139.	35.	3.	236.3	D	230
0.	99.	88.	237.11	D	231
0.	399.	180.	237.12	D	232
0.	98.	30.	237.13	D	233
0.	634.	1329.	237.31	D	234
0.	209.	440.	237.32	D	235
735.	56.	6.	241.11	D	236
0.	42.	4.	241.12	D	237
0.	7.	1.	241.13	D	238
2870.	437.	44.	241.21	D	239
856.	256.	26.	241.22	D	240
504.	70.	7.	242.11	D	241
968.	83.	8.	242.12	D	242
0.	154.	84.	242.13	D	243
1284.	271.	27.	242.21	D	244
442.	197.	20.	242.22	D	245
15.	11.	1.	242.23	D	246
196.	58.	6.	242.31	D	247
3693.	441.	70.	242.32	D	248
130.	22.	2.	242.34	D	249
200.	46.	5.	243.11	D	250
150.	35.	3.	243.14	D	251
22.	7.	1.	243.21	D	252
88.	40.	52.	243.22	D	253
0.	288.	126.	244.11	D	254
0.	273.	65.	244.12	D	255
0.	102.	52.	244.2	D	256
0.	25.	80.	244.3	D	257
0.	129.	150.	244.4	D	258
0.	221.	100.	244.5	D	259
0.	416.	195.	245.11	D	260
0.	185.	87.	245.12	D	261
0.	2766.	1112.	245.2	D	262
0.	3443.	788.	245.3	D	263
435.	189.	19.	246.11	D	264
0.	211.	759.	246.21	D	265
0.	763.	334.	246.22	D	266
0.	3305.	2799.	246.3	D	267
0.	2944.	1520.	246.4	D	268
506.	300.	30.	246.5	D	269
713.	100.	10.	251.11	D	270
1183.	220.	22.	251.12	D	271
0.	39.	84.	251.16	D	272
43.	8.	1.	251.17	D	273
146.	253.	47.	252.11	D	274
577.	54.	7.	252.12	D	275
834.	896.	90.	252.21	D	276
1046.	1688.	171.	252.22	D	277
69.	76.	10.	252.24	D	278
541.	95.	10.	252.31	D	279
29.	13.	1.	252.32	D	280
6.	9.	2.	252.33	D	281
28.	15.	1.	252.34	D	282
11.	7.	2.	252.35	D	283
14.	19.	2.	252.36	D	284
9.	3.	0.	252.38	D	285
85.	8.	0.	252.39	D	286
40.	47.	5.	252.43	D	287
0.	33.	11.	252.49	D	288
0.	37.	35.	253.11	D	289
0.	154.	108.	253.15	D	290
242.	24.	2.	253.21	D	291
726.	73.	7.	253.22	D	292
0.	2.	9.	254.11	D	293

50.	2.	0.	254.22	D	294
100.	9.	1.	254.23	D	295
111.	0.	0.	254.31	D	296
18.	1.	0.	254.41	D	297
178.	9.	1.	254.51	D	298
97.	10.	1.	254.52	D	299
50.	5.	1.	254.53	D	300
30.	3.	0.	254.54	D	301
40.	4.	0.	254.55	D	302
184.	45.	5.	254.61	D	303
5.	251.	167.	261.11	D	304
0.	8.	8.	261.12	D	305
0.	591.	276.	261.21	D	306
56.	53.	16.	261.22	D	307
0.	238.	296.	261.31	D	308
36.	64.	17.	261.32	D	309
0.	5.	4.	261.41	D	310
165.	68.	8.	262.11	D	311
4228.	1115.	229.	262.12	D	312
9729.	1623.	162.	262.13	D	313
1484.	570.	118.	262.15	D	314
0.	1121.	1250.	911.11	D	315
0.	1309.	150.	911.12	D	316
0.	2065.	150.	911.13	D	317
0.	1538.	750.	911.21	D	318
0.	3075.	3300.	911.22	D	319
0.	2590.	1500.	911.23	D	320
0.	660.	600.	911.24	D	321
0.	4021.	200.	911.26	D	322
0.	0.	10000.	912.11	D	323
0.	3075.	1700.	912.13	D	324
0.	0.	400.	912.14	D	325
0.	0.	2750.	912.3	D	326
0.	0.	2750.	912.4	D	327
0.	8588.	0.	913.1	D	328
0.	5465.	0.	913.2	D	329
0.	6246.	0.	913.3	D	330
0.	781.	0.	913.4	D	331
0.	0.	4000.	914.1	D	332
20050.	0.	0.	921.1	D	333
3000.	0.	0.	921.2	D	334
5010.	0.	0.	921.3	D	335
13840.	0.	0.	921.4	D	336
3890.	0.	0.	921.6	D	337
945.	0.	0.	922.1	D	338
235.	0.	0.	922.2	D	339
650.	0.	0.	922.3	D	340
350.	0.	0.	922.4	D	341
600.	0.	0.	923.1	D	342
150.	0.	0.	923.2	D	343
410.	0.	0.	923.3	D	344
90.	0.	0.	923.4	D	345
0.	0.	200.	931.1	D	346
0.	0.	650.	931.2	D	347
0.	0.	2000.	931.3	D	348
0.	0.	150.	931.4	D	349
5501.	0.	0.	932.1	D	350
5501.	0.	0.	932.2	D	351
2750.	0.	0.	932.3	D	352
2063.	0.	0.	932.4	D	353
800.	0.	0.	932.5	D	354
120.	0.	0.	932.61	D	355
1661.	0.	0.	932.62	D	356
3020.	0.	0.	933.1	D	357
755.	0.	0.	933.2	D	358
565.	0.	0.	933.3	D	359

		150.		0.			0.			933.4		D	360
		1312.		0.			0.			934.1		D	361
		328.		0.			0.			934.2		D	362
		900.		0.			0.			934.3		D	363
		195.		0.			0.			934.4		D	364
	6000.		0.		0.					941.		D	365
	14000.		0.		0.					942.		D	366
	6000.		0.		0.					943.		D	367
	4000.		0.		0.					944.		D	368
	12000.		0.		0.					945.		D	369
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	CFCA	1
0.020	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.003	0.004	0.0	0.004	CFCA	2
0.040	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.005	0.008	0.001	0.008	CFCA	3
0.060	1.000	0.0	0.007	0.0	0.0	0.0	0.0	0.007	0.011	0.002	0.014	CFCA	4
0.080	1.000	0.0	0.011	0.0	0.0	0.0	0.0	0.010	0.014	0.004	0.021	CFCA	5
0.100	1.000	0.0	0.015	0.0	0.0	0.0	0.0	0.012	0.038	0.005	0.030	CFCA	6
0.120	1.000	0.0	0.019	0.0	0.0	0.0	0.0	0.014	0.068	0.007	0.041	CFCA	7
0.140	1.000	0.0	0.022	0.0	0.0	0.0	0.0	0.029	0.103	0.008	0.054	CFCA	8
0.160	1.000	0.0	0.025	0.0	0.0	0.0	0.0	0.047	0.141	0.009	0.070	CFCA	9
0.180	1.000	0.0	0.027	0.0	0.0	0.0	0.0	0.070	0.183	0.011	0.087	CFCA	10
0.200	1.000	0.001	0.032	0.005	0.001	0.007	0.005	0.096	0.226	0.013	0.106	CFCA	11
0.220	1.000	0.002	0.038	0.014	0.004	0.025	0.014	0.126	0.271	0.017	0.127	CFCA	12
0.240	1.000	0.004	0.047	0.023	0.007	0.049	0.023	0.159	0.316	0.021	0.149	CFCA	13
0.260	1.000	0.006	0.057	0.034	0.011	0.077	0.034	0.195	0.361	0.027	0.173	CFCA	14
0.280	1.000	0.009	0.067	0.046	0.016	0.111	0.046	0.233	0.405	0.033	0.198	CFCA	15
0.300	1.000	0.022	0.078	0.058	0.027	0.144	0.058	0.274	0.449	0.044	0.225	CFCA	16
0.320	1.000	0.052	0.088	0.069	0.048	0.173	0.069	0.315	0.490	0.063	0.252	CFCA	17
0.340	1.000	0.090	0.098	0.080	0.072	0.202	0.080	0.358	0.530	0.086	0.281	CFCA	18
0.360	1.000	0.136	0.108	0.092	0.102	0.233	0.092	0.401	0.568	0.113	0.310	CFCA	19
0.380	1.000	0.190	0.118	0.103	0.136	0.264	0.103	0.443	0.603	0.145	0.339	CFCA	20
0.400	1.000	0.234	0.128	0.115	0.167	0.294	0.115	0.486	0.637	0.175	0.369	CFCA	21
0.420	1.000	0.260	0.137	0.125	0.189	0.322	0.125	0.527	0.667	0.203	0.399	CFCA	22
0.440	1.000	0.280	0.147	0.155	0.210	0.350	0.155	0.567	0.695	0.231	0.429	CFCA	23
0.460	1.000	0.326	0.203	0.196	0.273	0.423	0.196	0.606	0.721	0.283	0.459	CFCA	24
0.480	1.000	0.386	0.265	0.250	0.358	0.521	0.250	0.643	0.744	0.350	0.489	CFCA	25
0.500	1.000	0.443	0.323	0.301	0.439	0.603	0.301	0.677	0.765	0.411	0.519	CFCA	26
0.520	1.000	0.485	0.365	0.327	0.487	0.620	0.327	0.709	0.784	0.450	0.549	CFCA	27
0.540	1.000	0.520	0.404	0.352	0.520	0.627	0.352	0.739	0.801	0.479	0.578	CFCA	28
0.560	1.000	0.566	0.443	0.383	0.561	0.633	0.383	0.767	0.817	0.520	0.607	CFCA	29
0.580	1.000	0.614	0.484	0.424	0.601	0.645	0.424	0.792	0.831	0.565	0.635	CFCA	30
0.600	1.000	0.660	0.526	0.466	0.650	0.665	0.466	0.814	0.843	0.732	0.663	CFCA	31
0.620	1.000	0.700	0.571	0.511	0.690	0.695	0.511	0.835	0.855	0.786	0.69[illegible]	CFCA	32
0.640	1.000	0.750	0.615	0.555	0.750	0.720	0.555	0.853	0.866	0.817	0.71[illegible]	CFCA	33
0.660	1.000	0.800	0.662	0.639	0.798	0.757	0.639	0.869	0.876	0.843	0.744	CFCA	34
0.680	1.000	0.837	0.711	0.726	0.830	0.803	0.726	0.884	0.885	0.861	0.770	CFCA	35
0.700	1.000	0.865	0.758	0.811	0.852	0.844	0.811	0.897	0.895	0.876	0.796	CFCA	36
0.720	1.000	0.891	0.800	0.868	0.870	0.862	0.868	0.908	0.904	0.890	0.821	CFCA	37
0.740	1.000	0.910	0.840	0.915	0.880	0.870	0.915	0.919	0.913	0.901	0.845	CFCA	38
0.760	1.000	0.919	0.859	0.956	0.895	0.885	0.956	0.929	0.921	0.908	0.869	CFCA	39
0.780	1.000	0.920	0.877	0.960	0.910	0.900	0.960	0.939	0.930	0.912	0.892	CFCA	40
0.800	1.000	0.950	0.897	0.965	0.945	0.919	0.965	0.948	0.939	0.947	0.913	CFCA	41
0.820	1.000	0.954	0.916	0.969	0.950	0.936	0.969	0.956	0.948	0.954	0.934	CFCA	42
0.840	1.000	0.957	0.931	0.972	0.958	0.950	0.972	0.965	0.956	0.959	0.952	CFCA	43
0.860	1.000	0.964	0.944	0.991	0.966	0.966	0.991	0.973	0.964	0.966	0.969	CFCA	44
0.880	1.000	0.965	0.958	0.995	0.988	0.982	0.995	0.980	0.972	0.970	0.984	CFCA	45
0.900	1.000	0.974	0.961	0.998	1.000	0.994	0.998	0.987	0.980	0.977	0.996	CFCA	46
0.920	1.000	0.982	0.962	1.000	1.000	1.000	1.000	0.994	0.986	0.984	0.997	CFCA	47
0.940	1.000	0.990	0.962	1.000	1.000	1.000	1.000	0.998	0.992	0.991	0.998	CFCA	48
0.960	1.000	0.995	1.000	1.000	1.000	1.000	1.000	0.999	0.996	0.996	0.999	CFCA	49
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	CFCA	50
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		FACS1	1
96180	96180	5026	7749	7032	9467	49592	96180	0	0	0		FACS1	2
10052	10052	270	747	135	1080	8350	10052	0	0	0		FACS1	3
116800	116800	0.0	5960	2634	5702	33951	116800	0	0	0		FACS1	4
106162	106162	2684	7142	4612	2952	25925	106162	0	0	0		FACS1	5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.	0.0		FACS1	6

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15128 15128 17158 10064124616 41327 31950 15128    0       0        0          FACS1  7
17509 17509143121101698   1079206254155027 17509    0        0       00          FACS1  8
41407 41407 16313 12726  4648 22297 37793 41407    0        0        0          FACS1  9
                                                                                 FACS1 10
                                                                                 FACS1 11
                                                                                 FACS1 12
                                                                                 FACS1 13
 1551  1551  7664  5214    67 10820  9187  1551    0        0       0           FACS1 14
40187 40184 12549  9364   123  5206  8512 40184    0        0        0          FACS1 15
26654 26654  9804 22038    48  2722 12060 26654  1.0      1.0      1.0          FACS1 16
 0.0  72813 72813 72813 72813 72813 72813 72813 72813 72813 72813               FACS2  1
 0.0  72813 72813 72813 72813 72813 72813 72813 72813 72813 72813               FACS2  2
 0.0  72813 72813 72813 72813 72813 72813 72813 72813 72813 72813               FACS2  3
 0.0 41944041944041944041944041944041944041944041944041944041944 0              FACS2  4
 0.0 1659141659141659141659141659141659141659141659141659141659 14              FACS2  5
 0.0   1660  1660  1660  1660  1660  1660  1660  1660  1660  1660               FACS2  6
 0.0   2888  2888  2888  2888  2888  2888  2888  2888  2888  2888               FACS2  7
 1.0                                                                             FACS2  8
                                                                                 FACS2  9
                                                                                 FACS2 10
                                                                                 FACS2 11
                                                                                 FACS2 12
                                                                                 FACS2 13
                                                                                 FACS2 14
                                                                                 FACS2 15
                                                                                 FACS2 16
                                                                                 FACS3  1
  500   500   500   500   500   500   500   500  0.0      0.0      0.0          FACS3  2
  250   250   250   250   250   250   250   250   0.       0.     0.            FACS3  3
  250   250   250   250   250   250   250   250   0.       0.     0.            FACS3  4
                                                 1.0      1.0      1.0          FACS3  5
                                                                                 FACS3  6
                                                                                 FACS3  7
                                                                                 FACS3  8
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252.34	AUX DEAR + MAKEUP SYSTEM	AC5 261
252.35	AUX CHEM FEED SYSTEM	AC5 262
252.36	AUX.STEAM+CONDENSATE RETRN	AC5 263
252.38	AUX BOILER BLOWDOWN	AC5 264
252.39	AUX STEAM SYS COMPLETE I+C	AC5 265
252.43	TANKS AND PRESSURE VESSELS	AC5 266
252.49	FOUNDATIONS/SKIDS	AC5 267
253.11	GEN.PURPOSE TELEPHONE SYS	AC5 268
253.15	PA + INTERCOM SYS.	AC5 269
253.21	FIRE DETECTION SYSTEM	AC5 270

253.22	SECURITY SYSTEM	AC5	271
254.11	PORTABLE FIRE EXTINGUISHRS	AC5	272
254.22	INSTRUMENT SHOP APPARATUS	AC5	273
254.23	SPEC LAB FURNITURE+FIXTURE	AC5	274
254.31	OFFICE FURNITURE	AC5	275
254.41	LOCKERS+BENCHES	AC5	276
254.51	OFF SITE RADIOLOGICAL MONT	AC5	277
254.52	METEOROLOGICAL MONIT.EQUIP	AC5	278
254.53	WATER QUALITY MONITORING	AC5	279
254.54	THERMAL EFFLUENT MONITOR	AC5	280
254.55	SEISMIC MONITORING	AC5	281
254.61	CAFETERIA EQUIPMENT	AC5	282
261.11	INTAKE STRUCTURE	AC5	283
261.12	DISCHARGE STRUCTURE	AC5	284
261.21	BUILDING STRUCTURE	AC5	285
261.22	BUILDING SERVICE	AC5	286
261.31	BUILDING STRUCTURE	AC5	287
261.32	BUILDING SERVICES	AC5	288
261.41	BUILDING STRUCTURE	AC5	289
262.11	WATER INTAKE EQUIPMENT	AC5	290
262.12	CIRCULATING WATER SYSTEM	AC5	291
262.13	COOLING TOWERS	AC5	292
262.15	MAIN CT.MAKEUP+BLOWDN SYS.	AC5	293
911.11	FIELD OFFICE,SHOPS,WHSE.	AC5	294
911.12	JANITOR SERVICES	AC5	295
911.13	GUARDS - SECURITY	AC5	296
911.21	ROADS,PARKING,LAYDOWN AREA	AC5	297
911.22	TEMPORARY ELECTRICAL SUCE	AC5	298
911.23	TEMPORARY MECH. & PIPING	AC5	299
911.24	TEMPORARY HEAT	AC5	300
911.26	GENERAL CLEANUP	AC5	301
912.11	PURCHASE MAJOR EQUIPMENT	AC5	302
912.13	EQUIPMENT MAINTENANCE	AC5	303
912.14	FUEL + LUBRICANTS	AC5	304
932.61	HOME OFFICE	AC5	305
932.62	FIELD	AC5	306

Appendix B

CONLAM AUXILIARY PROGRAM

CONLAM AUXILIARY PROGRAM

Auxiliary program CONLAM is used to generate the data file, LAMA, containing information on historical factory equipment, craft and white collar labor, and site-related materials costs for the 23 cities shown previously in Fig. 4.1. Data for other locations can also be entered through this program as they become available. However, normal application of CONLAM will be limited to updating cost data for the existing 23 cities at regular time intervals. Six-month intervals have been used; however, other time intervals are acceptable. The LAMA file currently contains 15 years of historical data.

Factory equipment data are obtained from the U.S. Department of Labor, Bureau of Labor Statistics, and are the same for all locations, reflecting the limited market. The items used are given on the following page. Craft labor and site materials data for the 22 actual cities are obtained from *Engineering News-Record*. The hypothetical Middletown site is a composite of Boston, New York, and Philadelphia weighted equally. The craft labor and materials items are listed on the following page.

Data can be read for a maximum of 30 time periods, as specified by the user, for each of the 22 actual locations. The hypothetical Middletown site is generated internally by the CONLAM program. At the user's option, data can be read either from cards alone when initially generating a file (variable IRMOLD=1) or from an existing file in card images with update cards when updating or modifying an existing file (IRMOLD=0). In either case, one new file is produced in card images and another file is written in unformatted binary records. It is the unformatted binary record file (LAMA) that is used by the CONCEPT program. Options also exist for punching card decks of the data stored on the file and for producing the following listings: (1) card image output and (2) tabular output for equipment, labor, and materials for each site in the file. The program is designed to eliminate automatically the oldest time period as each new period is introduced, or it will add a new period if there are less than 30 total periods.

The program uses two wage duplications, as follows, by option of the user: (1) boilermaker wages are duplicated from steamfitter wages, and

(2) other crafts' wages are duplicated from bricklayer wages. This is done since *Engineering News-Record*[16] does not include boilermaker wages or a combination of other crafts' wages. An option flag for both labor categories permits using data punched into standard input cards.

The remainder of this Appendix consists of a description of the input data requirements and a FORTRAN listing of the CONLAM program. (When updating an existing file, Card 2 is not used; hence, the update card deck order must correspond to the city order of the old card image file.)

CONLAM input card description

Card	Column	Variable name	Description
1	1-5	NOPER	Number of actual data points stored on file, less than or equal to MAXREC. Format I5
	6-10	MAXREC	Maximum number of time periods on file for each location, not to exceed 30. Format I5
	11-15	NCITY	Number of locations on file, presently 23. Format I5.
	16-20	IRMOLD	Flag for type of input. Format I5 0 — Update existing master files 1 — Establish new master files from card input
	21-25	IPUNCH	Flag for card output. Format I5 0 — Omits card output 1 — Produces card deck
	26-30	NOLIST	Flag for listing card images. Format I5 0 — Produces list 1 — Omits list
	31-35	NOREF	Flag for table output. Format I5 0 — Produces table 1 — Omits table
	36-40	IBLMKR	Flag for boilermakers' wages. Format I5 0 — Uses steamfitters' wages 1 — Boilermakers' wages must be supplied in B(15)
	41-45	IOCRFT	Flag for other crafts' wages. Format I5 0 — Uses bricklayers' wages 1 — Other crafts' wages must be supplied, in B(16)
2	3-4	IC	City number (see Fig. 4.1). Format I2
	7-8	IS	Site number (not used by CONCEPT). Format I2
	11-12	IR	Region number (not used by CONCEPT). Format I2

CONLAM input card description (continued)

Card	Column	Variable name	Description
	17-48	LOC	Location (alphabetic) (see Fig. 4.1). Format 8A4
3	1-10	A(1)	Date (e.g., 1978.5). Format F10.2
	11-20	A(2)	Wholesale price index for steel mill products, Code 10-13 Steel Mill Products, "Monthly Labor Review," Bureau of Labor Statistics. Format F10.2
	21-30	A(3)	Hourly earnings index in the electrical equipment and supplies industry. Data from "Employment and Earnings," Bureau of Labor Statistics, SIC Code 36 Electrical Equipment and Supplies. This number has been normalized so that the index for 1967 is 100. This was done by multiplying the BLS data by 100/2.70. Format F10.2
	31-40	A(4)	Hourly earnings index in the steam engine and turbine industry. Data from "Employment and Earnings," BLS, SIC Code 3511 Steam Engines and Turbines. This has also been normalized by multiplying the BLS number by 100/3.50 so that the index for 1967 is 100. Format F10.2
	41-50	A(5)	White collar wage index. Data from "National Survey of Professional, Administrative, Technical, and Clerical Pay," BLS. This data has been converted from a percent annual increase to an index based on 1967=100. Format F10.2

The following cards use a format of 8F10.2

Card	Column	Variable name	Description
4	1-10	B(1)	Hourly rate for building labor
	11-20	B(2)	Hourly rate for heavy construction labor

CONLAM input card description (continued)

Card	Column	Variable name	Description
	21-30	B(3)	Hourly rate for bricklayers
	31-40	B(4)	Hourly rate for carpenters
	41-50	B(5)	Hourly rate for structural ironworkers
	51-60	B(6)	Hourly rate for plasterers
	61-70	B(7)	Hourly rate for electrical workers
	71-80	B(8)	Hourly rate for steamfitters
5	1-10	B(9)	Hourly rate for operating engineers
	11-20	B(10)	Hourly rate for small tractor operators
	21-30	B(11)	Hourly rate for scraper operators
	31-40	B(12)	Hourly rate for crane operators
	41-50	B(13)	Hourly rate for air compressor operators
	51-60	B(14)	Hourly rate for truck drivers (<4 yd^3)
	61-70	B(15)	Hourly rate for boilermakers. Steamfitters' wages used
	71-80	B(16)	Hourly rate for all other crafts. Bricklayers' wages used
6	1-10	C(1)	Material costs for channels, \$/100 lb
	11-20	C(2)	Material costs for I-beams, \$/100 lb
	21-30	C(3)	Material costs for W-flanges, \$/100 lb
	31-40	C(4)	Material costs for re-bars, \$/100 lb
	41-50	C(5)	Material costs for 3000-psi Redimix concrete, $\$/yd^3$

CONLAM input card description (continued)

Card	Column	Variable name	Description
	51-60	C(6)	Material costs for 3/4-in. B-B plyform, $/1000 ft^2
	61-70	C(7)	Material costs for 2 x 4 fir or pine lumber, $/1000 bd ft
	71-80	C(8)	Land coefficient, Input 1000.00
7	1-80	C(9-16)	Unassigned

```
C
C =====================================================================
C |                                                                   |
C |                 C O N L A M   P R O G R A M                       |
C |                            PHASE 5                                |
C |                                                                   |
C |      (CONSTRUCTION MODEL EQUIPMENT,LABOR,AND MATERIAL COSTS)      |
C |  AUTHOR: R. J. BARNARD                                            |
C |  JULY 1972   - REVISED SEPT. 1975                                 |
C |  MODIFIED BY : C. R. HUDSON                    OCTOBER  1977      |
C |                OAK RIDGE NATIONAL LABORATORY                      |
C |                                                                   |
C =====================================================================
C |                                                                   |
C |  COST DATA ARE TAKEN FROM THE MAGAZINE "ENGINEERING NEWS RECORD"  |
C |  (ENR)   EVERY JULY AND JANUARY FOR SELECTED LABOR AND MATERIALS. |
C |  EQUIPMENT DATA ARE OBTAINED FROM U.S. DEPT. OF LABOR, BUREAU OF  |
C |  LABOR STATISTICS.  A HYPOTHETICAL CITY CALLED "MIDDLETOWN" HAS   |
C |  BEEN GENERATED FROM AN EQUAL WEIGHTED MIX OF BOSTON, NEW YORK, AND|
C |  PHILADELPHIA DATA TO APPROXIMATE A TYPICAL NORTHEASTERN CITY.    |
C |                                                                   |
C =====================================================================
C
C =====================================================================
C |                                                                   |
C |  * * * N.B.   SINCE THE COST DATA IS POSITIONALLY DEPENDENT FOR   |
C |  CORRECT PROCESSING AND SINCE THERE IS NO IDENTIFICATION PUNCHED IN|
C |  THE DATA CARDS, AN OLD CARD IMAGE FILE (MOLD) AND A NEW CARD IMAGE|
C |  FILE (NEW) ARE MAINTAINED IN THE CORRECT CARD SEQUENCE WHICH WILL |
C |  PERMIT REPUNCHING A MASTER CARD FILE IN THE EVENT THE ORIGINAL   |
C |  CARD FILE IS COMPROMISED.  * * *                                 |
C |                                                                   |
C =====================================================================
C
      DIMENSION LOC(8), D(30,8), E(30,16), F(30,16)
      DIMENSION DX(30,8),EX(30,16),FX(30,16),MIDDLE(8)
      DATA I,J,K/0,0,0/
      DATA MIDDLE/'USA ','    ','    ','    ','MIDD','LETO','WN  ',
     1 '    '/
C
C =====================================================================
C |                                                                   |
C |                      F I L E   N A M E S                          |
C |                                                                   |
C |           MASCON = CONLAM UNFORMATTED MASTER COST FILE            |
C |           INP = SYSTEM INPUT FILE                                 |
C |           IOPT = SYSTEM OUTPUT FILE                               |
C |           IPUN = SYSTEM PUNCH FILE                                |
C |           NEW = UPDATED FORMATTED EQUIP LABOR & MATLS MASTER      |
C |           MOLD = OLD FORMATTED EQUIP LABOR & MATLS MASTER         |
C |                                                                   |
C =====================================================================
C
      MASCON = 9
      INP = 5
      IOPT = 6
      IPUN = 7
      NEW = 8
      MOLD = 4
C
C =====================================================================
C |                                                                   |
C |  P R O G R A M   O P T I O N S  &  I N P U T   V A R I A B L E S |
```

```
C |             NOPER FORMAT I5 IN COL. 1-5                              |
C |                                                                      |
C |  NOPER = NUMBER OF TIME-PERIODS FOR WHICH DATA IS AT HAND            |
C |  INCLUDING THE UPDATE TIME-PERIOD.                                   |
C |                                                                      |
C ======================================================================
C |                                                                      |
      REWIND NEW
C
C ======================================================================
C |                                                                      |
C |             MAXREC FORMAT I5 IN COL. 6-10                            |
C |  MAXREC = ARBITRARY NUMBER OF TIME-PERIODS IN THE COST DATA ARRAY.   |
C |                                                                      |
C ======================================================================
C
      REWIND MOLD
C
C ======================================================================
C |                                                                      |
C |             NCITY FORMAT I5 IN COL. 11-15                            |
C |                                                                      |
C | NCITY = NUMBER OF CITIES IN THE CITY SET WHICH IS CURRENTLY LIMITED|
C |  TO THOSE CITIES NAMED IN THE ENR DATA PLUS THE COMPUTED VALUES FOR|
C |  MIDDLETCWN, USA, MAKING A TOTAL OF 23 SETS.                         |
C |                                                                      |
C ======================================================================
C
      REWIND MASCON
C
C |---------------------------------------------------------------------|
C |                                                                      |
C |             IRMOLD FORMAT I5 IN COL 16-20                            |
C |                                                                      |
C |  IRMOLD DETERMINES WHETHER AN OLD FORMATTED MASTER FILE IS USED      |
C |  FOR INPUT OR A MASTER CARD FILE DECK IS USED. ALL MASTER FILES OR  |
C |  THE FILE NEEDED TO WRITE MASCON FILE MUST BE CREATED FROM A MAST-  |
C |  ER CARD DECK FILE.                                                  |
C |  IRMOLD = 0      UPDATE EXISTING MASTER FILES                        |
C |  IRMOLD = 1      ESTABLISH NEW MASTER FILES                          |
C |                                                                      |
C ======================================================================
C
      READ(INP,500)NOPER,MAXREC,NCITY,IRMOLD,IPUNCH,NOLIST,NOREF,
     1 IBLNKR,IOCRPT
C
C ======================================================================
C |                                                                      |
C |             IPUNCH FORMAT I5 IN COL. 21-25                           |
C |                                                                      |
C |  OPTION TO PUNCH AN ALTERED CARD DECK OF COST VALUES WHEN AN OLD    |
C |  DATA SET IS USED FOR INPUT AND A NEW DATA SET IS TO BE GENERATED   |
C |  WITH CORRECTIONS FOR A NEW VERSION OR REVISION OF THE MODEL.        |
C |                                                                      |
C |  IPUNCH = 0 SKIPS THE PUNCHING OF NEW CARDS .                        |
C |  IPUNCH = 1 PRODUCES A NEW DECK OF CITY COST DATA CARDS AS ALTERED  |
C |  BY THE PROGRAM LOGIC.                                               |
C |                                                                      |
C ======================================================================
C
C
C ======================================================================
C |                                                                      |
C |             NOLIST FORMAT I5 IN COL. 26-30                           |
C |  NOLIST = 0 PRODUCES NORMAL CARD LIST FOR EACH CITY                  |
C |  NOLIST = 1 NO CITY CARD LIST IS PRODUCED.                           |
```

```
C |                                                                      |CLAM1300
C |- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - |CLAM1310
C |               NOREF FORMAT I5 IN COL. 31-35                          |CLAM1320
C |  NOREF = 0 PRODUCES NORMAL COST REFERENCE TABLES FOR EACH CITY       |CLAM1330
C |  NOREF = 1 REFERENCE TABLES ARE OMITTED.                             |CLAM1340
C |                                                                      |CLAM1350
C ======================================================================CLAM1360
C                                                                        CLAM1370
      WRITE(IOPT,502)NOPER,MAXREC,NCITY,IRMOLD,IPUNCH,NOLIST,NOREF,      CLAM1380
     1 IBLNKB, IOCRPT                                                    CLAM1390
      DO 3 I=1,MAXREC                                                    CLAM1400
      DO 3 J=1,16                                                        CLAM1410
      IF (J.LT.9) DX(I,J) = 0.0                                          CLAM1420
      EX(I,J) = 0.0                                                      CLAM1430
      FX(I,J) = 0.0                                                      CLAM1440
    3 CONTINUE                                                           CLAM1450
      IF (IRECLD.GT.0) GO TO 20                                          CLAM1460
      WRITE(IOPT,504)                                                    CLAM1470
C                                                                        CLAM1480
C ======================================================================CLAM1490
C |                                                                      |CLAM1500
C | THE FOLLOWING ROUTINES UPDATE AN OLD MASTER TAPE WITH AN INPUT FILE|CLAM1510
C | CARD DECK OF RECENT COST DATA FOR EQUIP.,LABOR, & MATERIAL.          |CLAM1520
C |                                                                      |CLAM1530
C ======================================================================CLAM1540
C                                                                        CLAM1550
      DO 18 K = 1,NCITY                                                  CLAM1560
C ======================================================================CLAM1570
C |                                                                      |CLAM1580
C |  FOR UPDATING AFTER NOPER REACHES MAXREC, THE D, E, AND F ARRAYS    |CLAM1590
C |  ARE KEPT THE SAME SIZE BY DROPPING THE EARLIEST COST PERIOD FOR A  |CLAM1600
C |  MAXIMUM OF THIRTY (30) PERIODS.  THIS IS DONE IN THE "DO LOOP"      CLAM1610
C |  STARTING WITH CARD #CLAM1870 THRU CARD #CLAM1960,  A ROUTINE        CLAM1620
C |  WHICH POSITIONS THE SECOND AND FOLLOWING PERIODS OF OLD DATA IN    |CLAM1630
C |  THE FIRST AND FOLLOWING ARRAY LOCATIONS AND ZEROES THE MAXREC      |CLAM1640
C |  LOCATION FOR STORAGE OF THE NEW PERIOD DATA TO BE ADDED.           |CLAM1650
C |                                                                      |CLAM1660
C ======================================================================CLAM1670
C                                                                        CLAM1680
C                                                                        CLAM1690
C ======================================================================CLAM1700
C |                                                                      |CLAM1710
C |  READ IN ONE CITY DATA SET FROM OLD MASTER FILE                     |CLAM1720
C |                                                                      |CLAM1730
C ======================================================================CLAM1740
C                                                                        CLAM1750
      READ(MOLD,510) IC, IS, IR, LOC                                     CLAM1760
      WRITE(NEW,510) IC, IS, IR, LOC                                     CLAM1770
      WRITE(IOPT,512) IC, IS, IR, LOC                                    CLAM1780
      DO 2 I = 1,MAXREC                                                  CLAM1790
      READ(MOLD,508) (D(I,J),J=1,8)                                      CLAM1800
      READ(MOLD,508) (E(I,J),J=1,16)                                     CLAM1810
      READ(MOLD,508) (F(I,J),J=1,16)                                     CLAM1820
      F(I,8)=1000.                                                       CLAM1830
      IF (I.GT.NOPER) F(I,8) = 0.0                                       CLAM1840
    2 CONTINUE                                                           CLAM1850
        IF (NOPER.LT.30) GO TO 8                                         CLAM1860
      DO 6 I = 2,MAXREC                                                  CLAM1870
      DO 4 J = 1,16                                                      CLAM1880
      IF (J.LT.9) D(I-1,J) = D(I,J)                                      CLAM1890
      E(I-1,J) = E(I,J)                                                  CLAM1900
      F(I-1,J) = F(I,J)                                                  CLAM1910
      IF (I.EQ.MAXREC.AND.J.LT.9) D(I,J) = 0.0                           CLAM1920
      IF (I.EQ.MAXREC) E(I,J) = 0.0                                      CLAM1930
      IF (I.EQ.MAXREC) F(I,J) = 0.0                                      CLAM1940
    4 CONTINUE                                                           CLAM1950
```

```
    6 CONTINUE
C
C ===========================================================================
C |                                                                         |
C |  N O T I C E   N O T I C E   N O T I C E   N O T I C E   N O T I C E
C |                                                                         |
C |  BEGIN THE UPDATE FOR A CITY IF IT IS NOT MIDDLETOWN                   |
C |                                                                         |
C ===========================================================================
C
    8 IF (K.EQ.23) GO TO 10
C
C ===========================================================================
C |                                                                         |
C |  SAMPLE UPDATE DECK INPUT FORMAT                                        |
C |  (FIRST CITY IN UPDATE DECK)                                            |
C
C  1975.5      195.50    170.74     162.57     168.70      0.0       0.0        0.0
C     5.95       5.95      9.46       9.12       9.19      9.02     11.27       9.94
C     8.97       8.52      8.87       8.87       6.95      5.85      9.94       9.46
C    19.25      18.55     19.25      17.00      23.25    349.      144.      1000.00
C     0.         0.        0.         0.         0.        0.        0.         0.0
C ===========================================================================
C |                                                                         |
C |  (A BLANK CARD IS USED WHERE ONLY ZEROES ARE TO BE PUNCHED SINCE        |
C |  MATERIAL COSTS ARE NOT YET BEING STORED IN F(I,J),J=9,16))            |
C |                                                                         |
C ===========================================================================
C ===========================================================================
C
C |  (SECOND CITY IN UPDATE DECK)                                           |
C |                                                                         |
C  1975.5      195.50    170.74     162.57     168.70      0.0       0.0        0.0
C     7.14       7.14     10.57      10.24      11.16      9.20     10.50      11.13
C     9.63       9.63      9.63      10.18       8.22      7.99     11.13      10.57
C    19.85      19.75     19.15      17.50      30.10    325.      165.       1000.00
C     0.         0.        0.         0.         0.        0.        0.         0.0
C |                                                                         |
C ===========================================================================
C
      READ(INP,508) (D(NOPER,J),J=1,8)
      WRITE(IOPT,522) (D(NOPER,J),J=1,8)
      READ(INP,508) (E(NOPER,J),J=1,16)
      IF (IOCRPT.LT.1) E(NOPER,16) = E(NOPER,3)
      IF (IBLMKR.LT.1) E(NOPER,15) = E(NOPER,8)
      WRITE(IOPT,522) (E(NOPER,J),J=1,8)
      WRITE(IOPT,522) (E(NOPER,J),J=9,16)
      READ(INP,508) (F(NOPER,J),J=1,16)
      F( NOPER,8) = 1000.
      WRITE(IOPT,522) (F(NOPER,J),J=1,8)
      WRITE(IOPT,522) (F(NOPER,J),J=9,16)
      IF (K.NE.4.AND.K.NE.15.AND.K.NE.16) GO TO 14
      DO 9 J=1,16
      IF (J.LT.9) DX(NOPER,J) = DX(NOPER,J) + D(NOPER,J)/3.
      EX(NOPER,J) = EX(NOPER,J) + E(NOPER,J)/3.
      FX(NOPER,J) = FX(NOPER,J) + F(NOPER,J)/3.
    9 CONTINUE
      GO TO 14
C
C
C ===========================================================================
C |                                                                         |
C |  BEGIN UPDATE FOR MIDDLETOWN USING PREVIOUS PERIOD DATA AND COST       |
C |  PROJECTION FACTORS.                                                    |
C |                                                                         |
C ===========================================================================
```

```
C
   10 CONTINUE
      DO 12 J=1,16
      IF (J.LT.9) D(NOPER,J) = DX(NOPER,J)
      E(NOPER,J) = EX(NOPER,J)
      F(NOPER,J) = FX(NOPER,J)
   12 CONTINUE
      WRITE(IOPT,522)  (D(NOPER,J),J=1,8)
      WRITE(IOPT,522)  (E(NOPER,J),J=1,8)
      WRITE(IOPT,522)  (E(NOPER,J),J=9,16)
      WRITE(IOPT,522)  (F(NOPER,J),J=1,8)
      WRITE(IOPT,522)  (F(NOPER,J),J=9,16)
C
C ====================================================================
C |                                                                  |
C |  COMPLETED CITY UPDATE NOW STORED ON NEW FORMATTED MASTER FILE.  |
C |                                                                  |
C ====================================================================
C
   14 DO 16 I = 1,MAXREC
      WRITE(NEW,508) (D(I,J),J=1, 8)
      WRITE(NEW,508) (E(I,J),J=1,16)
      WRITE(NEW,508) (F(I,J),J=1,16)
   16 CONTINUE
   18 CONTINUE
      GO TO 32
C=====================================================================
C |                                                                  |
C |      START HERE FOR READING ENTIRE CARD FILE                     |
C |                                                                  |
C=====================================================================
   20 NC = NCITY - 1
      DO 30 K=1,NC
      READ(INP,510) IC, IS, IR, LOC
C
C |                                                                  |
C ====================================================================
C |                                                                  |
C |  READ IN ONE CITY DATA SET FROM A MASTER CARD DECK INPUT FILE    |
C |                                                                  |
C ====================================================================
C
      WRITE(NEW,510) IC, IS, IR, LOC
      WRITE(IOPT,512) IC, IS, IR, LOC
      DO 22 I = 1,NOPER
      READ(INP,508) (D(I,J),J=1,8)
      READ(INP,508) (E(I,J),J=1,16)
      IF (IBLMKR.LT.1) E(I,15) = E(I,8)
      IF (IOCRPT.LT.1) E(I,16) = E(I,3)
      READ(INP,508) (F(I,J),J=1,16)
      F(I,8)=1000.
   22 CONTINUE
      IF (MAXREC.EQ.NOPER) GO TO 26
      NZ = NOPER + 1
      DO 24 I = NZ,MAXREC
      DO 24 J = 1,16
      IF (J.LE.8) D(I,J) = 0.0
      E(I,J) = 0.0
      F(I,J) = 0.0
   24 CONTINUE
   26 DO 28 I = 1,MAXREC
      WRITE(NEW,508) (D(I,J),J=1, 8)
      WRITE(NEW,508) (E(I,J),J=1,16)
      WRITE(NEW,508) (F(I,J),J=1,16)
   28 CONTINUE
C |  DATA GENERATION FOR MIDDLETOWN                                  |
```

```
      IF (K.NE.4.AND.K.NE.15.AND.K.NE.16) GO TO 30
      DO 29 I=1,MAXREC
      DO 29 J=1,16
      IF (J.LT.9) DX(I,J) = DX(I,J) + D(I,J)/3.
      EX(I,J) = EX(I,J) + E(I,J)/3.
      FX(I,J) = FX(I,J) + F(I,J)/3.
   29 CONTINUE
   30 CONTINUE
C |  MIDDLETOWN GENERATION
      IC = 23
      IS = 1
      IR = 1
      WRITE(NEW,510) IC, IS, IR, MIDDLE
      WRITE(ICPT,512) IC, IS, IR, MIDDLE
      DO 31 I=1,MAXREC
      WRITE(NEW,508) (DX(I,J),J=1,8)
      WRITE(NEW,508) (EX(I,J),J=1,16)
      WRITE(NEW,508) (FX(I,J),J=1,16)
   31 CONTINUE
C
C =====================================================================
C |                                                                   |
C |  WRITE NEW FORMATTED MASTER FILE HERE TO ORIGINATE A TAPE MASTER  |
C |                                                                   |
C =====================================================================
C
C =====================================================================
C |                                                                   |
C |  BOTH UPDATE METHODS, FROM TAPE OR FROM CARD, CONVERGE AT THIS    |
C |  POINT AND FOLLOW THE SAME PATH OF WRITING AN UNFORMATTED MASTER  |
C |  USED IN THE MODELING PROGRAM WITHOUT CONTINUALLY ENDANGERING THE |
C |  TAPES USED FOR UPDATING THE COST DATA, SINCE THE COST DATA CARDS |
C |  NOR THE TAPE RECORDS ARE IDENTIFIED UNIQUELY, BUT ARE IN UNIQUE  |
C |  POSITIONS IN THE DATA SET AND IN EACH CITY RECORD IN EACH PERIOD.|
C |                                                                   |
C =====================================================================
C
   32 END FILE NEW
      REWIND NEW
      WRITE(IOPT,516)
C
C =====================================================================
C |                                                                   |
C |  READ NEW FORMATTED MASTER FILE AND WRITE NEW UNFORMATTED MASTER  |
C |  FILE                                                             |
C |                                                                   |
C =====================================================================
C
      DO 38 K = 1, NCITY
      READ(NEW,510,END=40) IC, IS, IR, LOC
      IF (IPUNCH.GT.0) WRITE(IPUN,510) IC, IS, IR, LOC
      WRITE(ICPT,518)
      WRITE(IOPT,520) IC, IS, IR, LOC
      DO 36 I = 1,MAXREC
      READ(NEW,508) (D(I,J),J=1,8)
      READ(NEW,508) (E(I,J),J=1,8)
      READ(NEW,508) (E(I,J),J=9,16)
      READ(NEW,508) (F(I,J),J=1,8)
      READ(NEW,508) (F(I,J),J=9,16)
C
C =====================================================================
C |                                                                   |
C |  DO YOU WANT A NEW DECK PUNCHED WITH A CHANGED DATA SET???? IF SO |
C |  MAKE CHANGES BEFORE BUT PUNCH THE CARDS HERE.                    |
C |                                                                   |
```

```
C =========================================================================
C
      IF (I.GT.NOPER) GO TO 34
      IF (IPUNCH.GT.0)  WRITE(IPUN,508) (D(I,J),J=1,8)
      IF (IPUNCH.GT.0)  WRITE(IPUN,508) (E(I,J),J=1,8)
      IF (IPUNCH.GT.0)  WRITE(IPUN,508) (E(I,J),J=9,16)
      IF (IPUNCH.GT.0)  WRITE(IPUN,508) (F(I,J),J=1,8)
      IF (IPUNCH.GT.0)  WRITE(IPUN,508) (F(I,J),J=9,16)
   34 IF (NOLIST.GT.0)  GO TO 36
      WRITE(IOPT,522)   (D(I,J),J=1,8)
      WRITE(IOPT,522)   (E(I,J),J=1,8)
      WRITE(IOPT,522)   (E(I,J),J=9,16)
      WRITE(IOPT,522)   (F(I,J),J=1,8)
      WRITE(IOPT,522)   (F(I,J),J=9,16)
   36 CONTINUE
      WRITE(MASCON) IC, IS, IR, LOC, D, E, F
   38 CONTINUE
   40 REWIND NEW
      END FILE MASCON
       REWIND MASCON
C
C =========================================================================
C |                                                                       |
C |  READ NEW UNFORMATTED MASTER FILE TO PRODUCE COST REFERENCE TABLES   |
C |  FOR EACH CITY AND ALSO PROVE THAT DATA IS ON THE DATA SET.           |
C |                                                                       |
C =========================================================================
C
      IF (NOREF.GT.0) GO TO 52
      DO 50 K=1,NCITY
      READ(MASCON) IC, IS, IR, LOC, D, E, F
      WRITE(IOPT,514) IC. IS, IR, LOC
      DO 54 I=1,NOPER
   54 WRITE(IOPT,532) (D(I,J),J=1,5)
      WRITE(IOPT,524) IC, IS, IR, LOC
      DO 44 I=1,NOPER
      YR = D(I,1) - 1900.
   44 WRITE(IOPT,526) (E(I,J),J=1,16),YR
      WRITE(IOPT,528) IC, IS, IR, LOC
      DO 48 I=1,NOPER
   48 WRITE(IOPT,530) (F(I,J),J=1,8),D(I,1)
   50 CONTINUE
   52 STOP
  500 FORMAT(9I5)
  502 FORMAT('1',T20,'O P T I O N S   S E L E C T E D ',/
     1'0',T20,'DATA NOW AVAILABLE FOR (NOPER) PERIODS = ',I5,/
     1'0',T20,'MAXIMUM PERIODS POSSIBLE (MAXREC) = ',I5,/
     1'0',T20,'MAXIMUM CITY GROUPS (NCITY) = ',I5,/
     1'0',T20,'IRMOLD = 0 USES TAPE OLD MASTER;= 1 CARD DECK MASTER =',
     1I5,/
     1'0',T20,'IPUNCH = 0 NO CARDS PUNCHED; =1 CARD DECK PUNCHED =',I5,/
     1'0',T20,'NOLIST = 0 STANDARD LIST OF DATA BY CITY =',I5,/
     1'0',T20,'NOREF = 0 STANDARD COST TABLES BY CITY = ',I5,/
     1'0',T20,'IBLMKR=0  BOILERMAKER = STEAMFITTER WAGES=',I5,/
     1'0',T20,'IOCRFT = 0 OTHERCRAFTS = BRICKLAYER WAGES = ',I5,/T1,'1')
  504 FORMAT('1',T20,'LISTED CITY NAMES FROM "MOLD" TAPE AND CARDS FROM
     1THE UPDATE DECK',/)
  508  FORMAT(8F10.2)
  510 FORMAT(3(2X,I2),4X,8A4)
  512 FORMAT(' ',3I5,7X,8A4)
  514 FORMAT('1    CITY-',I2,T15,'STATE-',I2,T24,'REGION-',I4,
     1T60,8A4/' ',T50,'F A C T O R Y   E Q U I P M E N T   D A T A',10X,
     1'1967=100'/'+',T50,43('_')/' ',T16,'WHOLESALE PRICE INDEX-',T47,
     1 'HOURLY EARNINGS INDEX-',T77,'HOURLY EARNINGS INDEX-',T107,
     1 'SALARY INDEX-'/' ',T5,' DATE ',T16,'STEEL MILL PRODUCTS',T47,
     1 'ELEC.EQUIP & SUPPLIES',T77,'STM.ENG. & TURBINES',T107,'PROFESSIO
```

```
     1NAL & CLERICAL'/'+',T5,6('_'),T15,21('_'),T46,24('_'),T76,21('_'),
     1 T106,25('_'))
  516 FORMAT('1MASTER RECORDS')
  518 FORMAT(T1,'1','SINCE CARDS ARE NOT IDENTIFIED AND MAY GET OUT OF O
     1RDER ***** S A V E   T H I S   L I S T *****',/T1,' ',131('_'),/)
  520 FORMAT('0',2I2,I4,8A4)
  522 FORMAT(' ',8F10.2)
  524 FORMAT(T1,'1    CITY-',I2,T15,'STATE-',I2,T24,'REGION-',I4,
     1  T60,8A4,/T1,' ',T50,'C R A F T   L A B O R   R A T E S',/T1,'+',
     1T50,32('_'),/T1,' BLDG    HEAVY   BRICK   CARPEN- STRUCT. PLAST-
     1ELECT.  STEAM  OPERATING TRACTOR OPRTERS  CRANE   AIR CMP TRUCK  B
     1OILER  OTHER  YEAR',/T1,' LABOR   LABOR   LAYER    TER   IRON WKR
     1ERER    WORKER  FITTER ENGINEER  SMALL   LARGE   OPERATOR OPRATOR
     1DRIVER MAKER   CRAFTS ',/T1,'+',T2,131('_'))
  526 FORMAT(T1,' ',T2,16(F5.2,3X),F4.1)
  528 FORMAT(T1,'1    CITY-',I2,T15,'STATE-',I2,T24,'REGION-',I4,
     1  T60,8A4,/T1,' ',T50,'M A T E R I A L   C O S T S',/T1,'+',
     1T50,27('_'
     1),/T1,'    CHANNEL BEAMS     I-BEAMS     WIDE-FLANGE BEAMS  REINFO
     1RCING BARS  READY-MIX CONCRETE  PLYFORM     LUMBER   LAND   YEAR',
     1/T1,'+',T2,131('_'))
  530 FORMAT(T1,' ',T7,F6.2,T23,F6.2,T40,F6.2,T58,F6.2,T78,F6.2,T92,F6.2
     1,T104,F6.2,T112,F6.1,T120,F6.1)
  532 FORMAT(1H ,T4,F7.2,T24,F6.2,T54,F6.2,T84,F6.2,T114,F6.2)
      END
```

Appendix C

CONCEPT-5 PROGRAM LISTING

```
C |====================================================================|
C |                                                                    |
C |                    - C O N C E P T -                               |
C |          COMPUTERIZED CONCEPTUAL COST ESTIMATE                     |
C |         FOR STEAM/ELECTRIC POWER PLANTS                            |
C |                                                                    |
C |                        PHASE 5                                     |
C |                                                                    |
C |====================================================================|
C |                                                                    |
C |            BY:  R. C. DELOZIER     |   COMPUTING APPLICATIONS      |
C |                 R. J. BARNARD      |   DEPARTMENT                  |
C |                                    |   COMPUTER SCIENCES DIVISION  |
C |                                    |   K-25 SITE                   |
C |                                    |   UNION CARBIDE CORP.         |
C |                                    |   OAK RIDGE, TENN. 37830      |
C |                                                                    |
C | MODIFIED BY : C. R. HUDSON  |  ENGINEERING ANALYSIS SECTION        |
C |        DATE : OCTOBER 1977  |  ENGINEERING TECHNOLOGY DIVISION     |
C |                             |  OAK RIDGE NATIONAL LABORATORY       |
C |                             |  OAK RIDGE, TN.    37830             |
C |                                                                    |
C |     THE CONCEPT COMPUTER CODE PACKAGE PROVIDES CONCEPTUAL          |
C |   CAPITAL COST ESTIMATE FOR NUCLEAR AND FOSSIL-FUELED POWER        |
C |   PLANTS.  COST ESTIMATES ARE MADE AS A FUNCTION OF PLANT TYPE,    |
C |   SIZE, LOCATION, AND DATE OF CONSTRUCTION AND OPERATION.          |
C |      OUTPUT INCLUDES A DETAILED BREAKDOWN OF THE ESTIMATE INTO     |
C |   DIRECT AND INDIRECT COSTS ACCORDING TO THE U.S.A.E.C.            |
C |   ACCOUNTING SYSTEM DESCRIBED IN DOCUMENT NUS-531.                 |
C |       COST MODELS CURRENTLY AVAILABLE ARE:                         |
C |   INITIAL- AND ADDITIONAL-UNIT MODELS FOR MIXED MULTI-UNIT POWER   |
C |   PLANTS.  NUCLEAR PLANTS INCLUDE PRESSURIZED AND BOILING WATER    |
C |   REACTORS.   FOSSIL PLANTS INCLUDE COAL-FIRED UNITS               |
C |   WITH AND WITHOUT SULFUR REMOVAL SYSTEMS.                         |
C |                                                                    |
C |  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    |
C |      THIS WORK WAS PERFORMED BY MEMBERS OF THE ENGINEERING         |
C |    ANALYSIS SECTION OF THE OAK RIDGE NATIONAL LABORATORY           |
C |    ENGINEERING TECHNOLOGY DIVISION  AND THE                        |
C |   COMPUTING APPLICATIONS DEPARTMENT,  K-25 SITE, OF THE            |
C |   COMPUTER SCIENCES DIVISION                                       |
C |                                                                    |
C |                                                                    |
C |      PROGRAM DOCUMENTATION:                                        |
C |             CONCEPT-5 USER'S MANUAL (ORNL-5470)                    |
C |                                                                    |
C |====================================================================|
      REAL*8 AC2, AC3, AC4, AC5, CITY, DATE, LOC
      REAL * 8 TYPE(2),TYPE1(2),LOCIN(4),SPACE
      DIMENSION ICARD(80), CM(50),  CM1(50) , CX(50)
      DIMENSION C5X(4,400),C4X(4,180),C3X(4,60),C2X(4,12),C2CX(4,12)
      DIMENSION C2TX(4,12),MHSX(7)
      DIMENSION CMU(50),CMES(50),YCOMB(50)
      DATA ICOM /'C'/, IAMEND /'SEND'/,SPACE/'        '/
      COMMON/HDMAIN/ ISTSIG
      COMMON /MOUT/DIDCI,ESCI
      COMMON / FORM /
     1 TYPE,  TYPE1,  LOCIN,  AC2(8,12),  AC3(8,60),  AC4(8,180),
     1 AC5(8,320),  DATE,                   D(3,380),  TITLE(20),
     1 IAR1,  IAR2(5),  IAR3(15),  IAR4(60),  IAR5(180),  IST,  IGO,
     1 NIN,  NOUT,  ID1,  ID2,  ID3,  ICON,  COMO,  LAMA,  ISDJ(3)
      COMMON / PROG /
     1 LOC(3),  CITY(25),  CFCA(12,50),  YRSSS,  YRPER,  YRCOP,  IMM,
```

```
     1 MWE,  IBS
      COMMON / OUT /
     1 BWE,  C2(4,12),  C3(4,60),  C4(4,180),  C5(4,400),  C2C(4,12),
     1 C2T(4,12),  ESCL,  SFMC,  SSMC,  SSLC,  SCONT,  STDC,  TIC,
     1 TDA,  MHS(7),  MMHS,  IAC,  IPG,  N2
      COMMON / NAML /
     1 AEB(12),  ALB(12),  AMB(12),  APC(12,50),  ALS(12,50),
     1 AMS(12,50),  BPC(12,50),  BLS(12,50),  BMS(12,50),  APC(12),
     1 BPC(12),  YES(50),  AA(3,12),  CCB(12),  COS(12),  CONTL(12),
     1 CONTM(12),  CONTE(12),  DEOT(12),  FACS1(12,16),  FACS2(12,16),
     1 FACS3(12,8),  RIB,  RIBA,  RINT(50),  PO,  YBC,  YFIRST,  YLAST,
     1 FILS(20),  FACE(3,12),  AMAN,  AMANB,  HW,  ISITE(20),  NUMSL,
     1 OTP(12),  OTPP(12),  OVERS(12),  MHT,  MHP(12),  HWI(12)
      NAMELIST /CONOPT/
     1 AA,  APC,  BPC,  COB,  COS,  CONTL,  CONTM,  CONTE,  DEOT,  OTP,
     1 FACS1,  FACS2,  FACS3,  FILS,  ISITE,  OVERS,  RINT,  YFIRST,
     1 YLAST,  HW,  AMAN,  CFCA,  D,  HWI
      INTEGER COMO
      INTEGER WANT(9)/2,1,7*0/
      CALL      IDAY (DATE)
      ISDJ(1) = 1
      ISDJ(2) = 1
      ISDJ(3) = 2
      ICON = 2
      ID1 = 3
      ID3 = 4
      NIN = 5
      NOUT = 6
      LAMA = 8
      COMO = 9
      ID2 = 11
      IMM = 50
C |=================================================================|
C |
C |  READ AND LIST ALL INPUT DATA PRIOR TO PROCESSING               |
C |                                                                 |
C |=================================================================|
    2 READ(NIN,506,END=4)ICARD
      WRITE(NOUT,508)ICARD
      GO TO 2
    4 REWIND NIN
C |=================================================================|
C |                                                                 |
C |  SEARCH AND LIST ALL COST MODELS AND ALL CITY LABOR, EQUIPMENT, |
C |  AND MATERIALS COST HISTORIES.                                  |
C |                                                                 |
C |=================================================================|
      CALL      SCAN
      WRITE(NOUT,504)
C |=================================================================|
C |                                                                 |
C |  BEGIN THE INITIAL LOOP THROUGH THE PROGRAM                     |
C |                                                                 |
C |=================================================================|
   10 CONTINUE
      DO 12 I   =   1,IMM
      CM1(I)    =   0.0
      IF(I .LE. 20) FILS(I) = 0.
      IF(I .LE. 20) ISITE(I) = 0
   12 CONTINUE
      FILS(1) = 1.0
      IBIN = 0
      ISTSIC = 0
      IPG = 0
      IAC       =   1
      IGO       =   1
```

```
      IS         =   1
      IST = 0
      YRS        =   9999.0
      YRE        =   0000.0
      REWIND ID2
C |==================================================================|
C |                                                                  |
C |  CONTINUATION LOOP THROUGH MAIN PROGRAM FOR MULTI-UNIT PLANTS    |
C |                                                                  |
C |==================================================================|
   16 CONTINUE
      DO 14 I = 1,12
      APC(I) = 1.0
      BPC(I) = 0.0
      IF (I.LE.8) OTP(I) = 2.0
      IF (I.GT.8) OTP(I) = 1.5
      OVERS(I) = 0.0
      DEOT(I) = 0.01
      COS(I) = 0.0
      HWI(I) = 40.0
      CONTE(I) = 10.0
      CONTL(I) = 10.0
      CONTM(I) = 10.0
   14 CONTINUE
      CONTE(1) = 0.0
      CONTL(1) = 0.0
      CONTM(1) = 0.0
      YFIRST = 1963.5
      YLAST = 2000.0
      AMAN = 0.0
      HW = 40.0
      DO 15 I=1,IMM
      BINT(I) = .08
   15 CONTINUE
      WRITE(NOUT,504)
   18 READ(NIN,506,END=82) ICARD
      IF (ICARD(1).NE.ICOM) GO TO 20
      WRITE(NOUT,508) ICARD
C |==================================================================|
C |                                                                  |
C |   COMMENTS PRINTED BUT NOT STORED ON ANY DEVICE                  |
C |                                                                  |
C |==================================================================|
      GO TO 18
   20 REWIND ID1
C |==================================================================|
C |                                                                  |
C |   SELECTION CARDS STORED ON ID1                                  |
C |                                                                  |
C |==================================================================|
      WRITE(ID1,506) ICARD
         REWIND ID1
C |==================================================================|
C |                                                                  |
C |                                                                  |
C |   DESCRIPTION OF STANDARD INPUT CARD.                            |
C |                                                                  |
C |   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    |
C |                                                                  |
C |  COLUMN    VARIABLE        FUNCTION AND FORMAT                   |
C |                                                                  |
C |  ______    ________        ___________________                   |
C |   1-4       MWE         NOMINAL MEGAWATTS OUTPUT OF THE PLANT UNIT |
C |   6-13      TYPE           POWER PLANT SYSTEM TYPE, A8 FORMAT    |
C |   15-30     LOC(I),I=1,2  CITY, BEGIN IN COLUMN 15.              |
C |   32-39     LOC(I),I=3    EXTRA IDENTIFICATION BEGIN IN COLUMN 32. |
C |   41-47     YRSSS         DATE S. S. S. PURCHASED : F7.3         |
```

```
C |   48-54     YRPER           DATE CONSTRUCTION PERMIT ISSUED: F7.3
C |   55-61     YRCOP           DATE OF COMMERCIAL OPERATION : F7.3
C |   62-66     RIB             INTEREST DURING CONSTRUCTION IN %,(F5.3)
C |    68  ILAZ       IF = 0    NAMELIST DATA NEITHER SAVED NOR RETRIEVED
C |                   IF = 1    FLAG FOR STORING CONOPT DATA FOR REPET-
C |                             ITIVE USE OF DATA FROM THE ICON FILE
C |                             FOR SIMILIAR PROBLEMS.
C |                   IF = 2    PERMITS READING ONLY PREVIOUSLY STORED
C |                             CONOPT REPETITIVE DATA.
C | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
C | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
C |
C |  * * * NO OTHER CONOPT DATA WILL BE ACCEPTED WHEN ILAZ = 2 * * *
C | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
C | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
C |
C |                   IF = 3    REPETITIVE CONOPT DATA IS READ IN FROM
C |                             ICON FILE AND THEN PROGRAM EXPECTS OVER-
C |                             RIDING OR SUPPLEMENTAL CONOPT DATA INPUT
C |
C |
C |           N.B.  ICON FILE (CONTROLLED BY ILAZ), IF PERMITTED BY
C |                 IFLAG CONTROLS IS ALWAYS READ FIRST SO VARIABLES
C |                 STORED ON ID1 (CONTROLLED BY IFLAG) MAY BE READ
C |                 LAST AND OVER-RIDE TEMPORARILY DATA FROM ICON.
C |                 THIS LEAVES ICON INTACT FOR FURTHER USE BUT
C |                 PERMITS FLEXIBILITY IN ALTERING VARIABLES
C |                 INTERMITTENTLY DURING A DATA RUN.
C |                 ICON FILE IS WRITTEN ONLY WHEN ILAZ = 1 BUT IS NOT
C |                 READ AT ALL WHEN CONTROL IS SET FOR WRITING.
C |
C |   70       IFLAG   FLAG FOR OPTIONAL NAMELIST INPUT;  CALLS MADE
C |
C |     0 - NO NAMELIST CALLS MADE
C |     1 - PERMITS CHANGING YFIRST AND YLAST PRIOR TO THE          1
C |         ANALYSIS OF HISTORICAL EQUIP. LABOR AND MATLS.
C |         COST DATA AND PERMITS OVERRIDING ALL NAMELIST
C |         VARIABLES PRIOR TO THE DETAILED COST
C |         CALCULATIONS.
C |
C |     2 - PERMITS OVERRIDING CALCULATED COSTS, ONLY,              1
C |         AFTER ESCALATION TO YEAR OF PURCHASE OF SSS IF
C |          IESC=0 OR 2; AND PERMITS OVERRIDING CALCULATED
C |         COSTS, ONLY, AFTER ESCALATION TO COMMERCIAL
C |         OPERATION IF IESC = 1.
C |     3 - THE FIRST NAMELIST CALL IS IDENTICAL TO FLAG=1          2
C |         AND THE SECOND IS IDENTICAL TO IFLAG=2.
C |
C |   72         IOF            OUTPUT FLAG; 0 = 2-DIGIT SUMMARY PAGE
C |                             1 = 2-DIGIT SUMMARY & CASH FLOW INFO.
C |                             2 = DETAILED ACCOUNT BREAKDOWN
C |   74         IESC           FLAG FOR ESCALATION DURING CONSTRUCTION;
C |                             0 = ESCALATION STATED SEPARATELY
C |                             1 = ESCALATION INCLUDED IMPLICITLY
C |                             2 = NO ESCALATION
C |   76         IBS            FLAG USED TO CHANGE ESCALATION AS A
C |                             FUNCTION OF TIME BY CALL TO THE
C |                             INDUSE SUBROUTINE.
C |                             0 - INOPERATIVE
C |                             1 - ESCALATION DATA EXPECTED IN INPUT.
C |                             2 - RETRIEVE DATA USED WHEN IBS WAS 1
C |
C |   78         IAC            FLAG USED TO COMPUTE TYPE OF INTEREST
C |                               0 - STRAIGHT INTEREST
C |                               1 - COMPOUND INTEREST
C |
```

```
C |   80        ISTACK          NUMBER OF UNITS TO  BE CONSIDERED ONE     |
C |                             PLANT SITE.                               |
C |                                                                       |
C |                                                                       |
C |=======================================================================|
C |=======================================================================|
C |                                                                       |
C |  SELECTION DATA CARD READ BACK INTO CORE                              |
C |                                                                       |
C |=======================================================================|
      READ(ID1,510) MWE,TYPE(1),(LOC(I), I=1,3),YRSSS,YRPER,YRCOP,RIB,
     1ILAZ,IFLAG,IOP, IESC,IBS,IAC,ISTACK
      IWANT = WANT(IESC + 1)
      RIBA = RIB
      WRITE(NOUT,512)
      WRITE(NOUT,514)MWE,TYPE(1),(LOC(I),I=1,3),YRSSS,YRPER,YRCOP,RIBA,
     1ILAZ,IFLAG,IOP, IESC,IBS,IAC,ISTACK
      TYPE(2) = SPACE
      IF (YRS.GT.YRSSS) YRS = YRSSS
      IF (YRE.LT.YRCOP) YRE = YRCOP
      REWIND ICON
      REWIND ID1
      RIB         =   RIB / 100.0
      IF (RIB.LE.0.) GO TO 22
      DO 21 I=1,IMM
   21 RINT(I) = RIB
C |=======================================================================|
C |                                                                       |
C |   READY TO PICK UP CONOPT DATA DEPENDING ON IFLAG VALUE 0 THRU 3      |
C |                                                                       |
C |=======================================================================|
   22 IF (IFLAG.EQ.0) GO TO 40
      IF (ILAZ.EQ.2) GO TO 28
      IRE = ISDJ(IFLAG)
      DO 26 IJK = 1,IRE
C |=======================================================================|
C |                                                                       |
C |  READ ADDITIONAL CARDS DEPENDING ON IFLAG > 0                         |
C |                                                                       |
C |=======================================================================|
   24 READ(NIN,516) (ICARD(KK),KK=1,20)
      WRITE(NOUT,518) (ICARD(KK),KK=1,20)
      WRITE(ID1,516) (ICARD(KK),KK=1,20)
      IF (ILAZ.EQ.1) WRITE(ICON,516) (ICARD(KK),KK=1,20)
      IF (ICARD(1).NE.IAMEND) GO TO 24
C |=======================================================================|
C |                                                                       |
C |  FIRST GROUP OF CONOPT STORED ON ID1 AND ICON FOR REPETITIVE READ    |
C |                                                                       |
C |=======================================================================|
   26 CONTINUE
   28 CONTINUE
      REWIND ID1
      REWIND ICON
      IF (ILAZ.EQ.0) GO TO 40
       WRITE(NOUT,500)
C |=======================================================================|
C |                                                                       |
C |   READ ICON TO LIST REPETITIVE CONOPT DATA WITH EACH PROBLEM          |
C |                                                                       |
C |=======================================================================|
   30 READ(ICON,516,END=32) (ICARD(KK),KK=1,20)
      WRITE(NOUT,518) (ICARD(KK),KK=1,20)
      GO TO 30
   32 REWIND ICON
      IF (ILAZ.EQ.3) GO TO 34
```

```
      GO TO 40
   34 WRITE(NCUT,502)
C |==================================================================|
C |                                                                  |
C |   READ ID1 TO LIST THE OVER-RIDING CONOPT DATA WITH EACH PROBLEM |
C |                                                                  |
C |==================================================================|
   36 READ(ID1,516,END=38) (ICARD(KK),KK=1,20)
      WRITE(NOUT,518) (ICARD(KK),KK=1,20)
      GO TO 36
   38 REWIND ID1
   40 CONTINUE
         IST        =   IST+1
      CALL HEADS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
     1 NOUT,IPG)
         IST        =   IST-1
      ESCL = 0.
      IWANTS      =    IWANT
      IF (IWANT.EQ.2) IWANTS = -1
      KONTRL = 1
      CALL CCST(IWANTS,IFLAG,KONTRL,ILAZ)
      IST         =    IST + 1
      DO 35 I=1,IMM
      CMU(I) = 0.
   35 CM(I) = 0.
      CMT = 0.
      IF (IWANT.EQ.0) GO TO 42
      DO 39 I=2,IMM
      Y1D = YES(I)
      CME=0.
      DO 37 J=1,N2
      CFFAT = CFCA(J+1,I) - CFCA(J+1,I-1)
      DO 37 K=1,3
      CFFAC = CFFAT/CLAB(J,K,YRSSS)
      CME = CME + CFFAC*CLAB(J,K,Y1D)*C2T(K,J)/FACE(K,J)
   37 CONTINUE
      CM(I) = CME + CMT
      CMT = CM(I)
   39 CONTINUE
      GO TO 43
   42 DO 41 I=2,IMM
      CME=0.
      DO 49 J=1,N2
      CFFAC = CFCA(J+1,I) - CFCA(J+1,I-1)
      DO 49 K=1,3
      CME = CME + CFFAC*C2T(K,J)
   49 CONTINUE
      CM(I) = CME + CMT
      CMT = CM(I)
   41 CONTINUE
   43 RIBA = 0.
      RUCM = 0.
      DO 48 J=1,IMM
      RIBA = RIBA + RINT(J)*CM(J)
      RUCM = RUCM + CM(J)
   48 CONTINUE
      RIBA = RIBA/RUCM*100.
      IF (IWANT.LT.2) CALL DELIN(RINT,CM,CFCA,YRSSS,YRCOP,DIDCI,IMM,IAC)
      IF (IWANT.LT.2) GO TO 44
C |==================================================================|
C |                                                                  |
C |    BREAK OUT ESCALATION                                          |
C |                                                                  |
C |==================================================================|
      IWANTS      =    0
      SVIC = TDA
```

```
         KONTRL     =    2
      CALL CCST(IWANTS,IFLAG,KONTRL,ILAZ)
      ESCLD = SVIC - TDA
      CMT=0.
      DO 47 I=2,IMM
      CME = 0.
      DO 45 J=1,N2
      CFFAC = CFCA(J+1,I) - CFCA(J+1,I-1)
      DO 45 K=1,3
      CME = CME + CFFAC*C2T(K,J)
   45 CONTINUE
      CMU(I) = CME + CMT
      CMT = CMU(I)
   47 CONTINUE
      DO 46 I=1,IMM
      CMES(I) = CM(I) - CMU(I)
   46 CONTINUE
      CALL DELIN(RINT,CMES,CFCA,YRSSS,YRCOP,ESCI,IMM,IAC)
      CALL DELIN(RINT,CMU,CFCA,YRSSS,YRCOP,DIDCI,IMM,IAC)
      DO 50 I=1,IMM
   50 CM(I) = CMES(I) + CMU(I)
   44 CONTINUE
C |===================================================================|
C |                                                                   |
C |   WRITE OUTPUT FOR A SINGLE UNIT                                  |
C |                                                                   |
C |===================================================================|
      CALL OUTPUT(IOF,IWANT,E
C |===================================================================|
C |                                                                   |
C |   GENERATE PROJECT CASH FLOW                                      |
C |                                                                   |
C |===================================================================|
      IF (IOF.EQ.0) GO TO 54
      CALL TAILS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
     1 NOUT,IPG)
      CALL       PLOT(YRSSS,YRCOP,CM,IMM)
      CALL TAILS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
     1 NOUT,IPG)
      DO 55 I=1,IMM
   55 CX(I) = CM(I)/1000.
      WRITE(NOUT,520)
      WRITE(NOUT,522) (YES(I),CX(I),I=1,IMM)
      WRITE(NOUT,504)
   54 CONTINUE
      IF (ISTACK.EQ.1) GO TO 10
      CALL ADYR(YES,YCOMB,CM,CM1,YRS,YRE,CFCA,IMM,IBIN)
      IBIN = 1
      IF (ISTACK.GT.1) IS = ISTACK - 1
      IGO = IGO - 1 + ISTACK
      IF (IGO.GT.1) WRITE(ID2) C5,C4,C3,C2,C2C,C2T,MHS,MMHS,SFMC,SSLC,
     1 SSMC,MWE,ESCLD,SCONT,TIC,DIDCI,ESCI
      IF (IGO.GT.1) GO TO 16
      REWIND ID2
      DO 56 II = 1,IS
      READ(ID2) C5X,C4X,C3X,C2X,C2CX,C2TX,MHSX,MMHSX,SFMCX,SSLCX,
     1 SSMCX,MWEX,ESCLDX,SCONTX,TICX,DIDCIX,ESCIX
      DO 57 J = 1,N2
      DO 58 I = 1,4
      C2(I,J) = C2(I,J) + C2X(I,J)
      C2C(I,J) = C2C(I,J) + C2CX(I,J)
      C2T(I,J) = C2T(I,J) + C2TX(I,J)
   58 CONTINUE
      IF (J.LT.8) MHS(J) = MHS(J) + MHSX(J)
   57 CONTINUE
      MMHS = MMHS + MMHSX
```

```
      SFMC = SFMC + SFMCX
      SSLC = SSLC + SSLCX
      SSMC = SSMC + SSMCX
      MWE = MWE + MWEX
      ESCLD = ESCLD + ESCLDX
      SCONT = SCONT + SCONTX
      TIC = TIC + TICX
      DIDCI = DIDCI + DIDCIX
      ESCI = ESCI + ESCIX
      IF (IOP.LT.2) GO TO 56
      DO 59 I=1,4
      DO 60 J = 1,400
   60 C5(I,J) = C5(I,J) + C5X(I,J)
      DO 61 J=1,180
   61 C4(I,J) = C4(I,J) + C4X(I,J)
      DO 62 J=1,60
   62 C3(I,J) = C3(I,J) + C3X(I,J)
   59 CONTINUE
   56 CONTINUE
      YRSSS = YRS
      YRCOP = YRE
      ISTSIG = 1
C   |=====================================================================|
C   |                                                                     |
C   |    WRITE OUTPUT FOR COMBINED UNITS                                  |
C   |                                                                     |
C   |=====================================================================|
      CALL OUTPUT(IOP,IWANT,ESCLD)
      IF (IOP.EQ.0) GO TO 76
      CALL TAILS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
     1 NOUT,IPG)
      CALL PLOT(YRSSS,YRCOP,CM1,IMM)
      CALL TAILS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
     1 NOUT,IPG)
      DO 70 I=1,IMM
   70 CX(I) = CM1(I)/1000.
      WRITE(NOUT,520)
      WRITE(NOUT,522) (YCOMB(I),CX(I),I=1,IMM)
      WRITE(NOUT,504)
   76 CONTINUE
C   |=====================================================================|
C   |                                                                     |
C   |  RETURN TO INITIAL PLANT PROGRAM LOOP START                         |
C   |                                                                     |
C   |=====================================================================|
      GO TO 10
   82 STOP
  500 FORMAT('0  LIST OF REPEATED CONOPT DATA FROM ICON FILE'/)
  502 FORMAT('0  LIST OF OVER-RIDING CONOPT DATA FROM ID1 FILE '/)
  504 FORMAT('1')
  506 FORMAT(80A1)
  508 FORMAT(' ',80A1/)
  510 FORMAT(I4,1X,A8,1X,2A8,1X,A8,1X,3F7.3,F5.3,7I2)
  512 FORMAT('0',T20,'D A T A   C A R D   C O L U M N S   U S E D'
     1            /'+',T20,42('_')/'0 1--4  6-----13 15------------30 32--
     1--39 41----47 48----54 55----61 62--66    68     70     72    74    76
     1  78     80'
     1                          /'  MWE   MODEL',T22,'CITY',T35,'EXTRA ID YR
     1 SSS    YR PER    YR COP   % INT  ILAZ  IFLAG  IOP  IESC  IBS  IAC
     1 ISTACK'/)
  514 FORMAT('0',T3,I4,T9,A8,T18,2A8,T35,A8,T44,F8.3,T53,F8.3,T62,F8.3,
     1T71,F6.3,T80,I1,T86,I1,T92,I1,T97,I1,T103,I1,T108,I1,T115,I1)
  516 FORMAT(1X,19A4,A3)
  518 FORMAT(' ',T4,20A4)
  520 FORMAT('0',T46,'C U M U L A T I V E   C A S H   F L O W'/
     1 '0',T32,'BOTH THE CASH FLOW CURVE SHOWN ABOVE AND THE FOLLOWING '
```

```
     1 ,'CASH FLOW TABLE'/' ',T32,'HAVE COSTS EXPRESSED AS TOTAL COST '
     1 ,'INCURRED TO DATE (INCLUDING INTEREST CHARGES TO DATE).'/
     1 '0',T46,'DATE',T66,'COST TO DATE (MILLIONS OF DOLLARS)'/)
  522 FORMAT(1H ,T44,F8.3,T75,F8.3)
      END
      SUBROUTINE SCAN
C |===================================================================|
C |                                                                   |
C |     SCAN SUBPROGRAM ITEMIZES THE CONTENTS OF THE COMO FILE FOR ALL|
C |     COST MODELS AND THE LAMA FILE FOR ALL CITY NAMES              |
C |                                                                   |
C |   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   |
C |                                                                   |
C |               BY: R. J. BARNARD, MAY 1975                         |
C |                                                                   |
C |===================================================================|
      REAL*8 AC2, AC3, AC4, AC5, CITY, DATE, LOC
      REAL * 8 TYPE(2),TYPE1(2),LOCIN(4),IDD(380)
      DIMENSION AT(30,8),BL(30,16),CMT(30,16),NAC(12)
      COMMON / FORM /
     1 TYPE,  TYPE1,  LOCIN,  AC2(8,12),  AC3(8,60),  AC4(8,180),
     1 AC5(8,320),  DATE,                        D(3,380),  TITLE(20),
     1 IAR1,  IAR2(5),  IAR3(15),  IAR4(60),  IAR5(180),  IST,  IGO,
     1 NIN,  NOUT,  ID1,  ID2,  ID3,  ICON,  COMO,  LAMA,  ISDJ(3)
      COMMON / PROG /
     1 LOC(3),  CITY(25),  CFCA(12,50),  YRSSS,  YRPER,  YRCOP,  IMM,
     1 MWE,  IBS
      COMMON / OUT /
     1 BWE,  C2(4,12),  C3(4,60),  C4(4,180),  C5(4,400),  C2C(4,12),
     1 C2T(4,12),  ESCL,  SFMC,  SSMC,  SSLC,  SCONT,  STDC,  TIC,
     1 TDA,  MHS(7),  MMHS,  IAC,  IPG,  N2
      COMMON / NAML /
     1 AEB(12),  ALB(12),  AMB(12),  APC(12,50),  ALS(12,50),
     1 AMS(12,50),  BPC(12,50),  BLS(12,50),  BMS(12,50),  APC(12),
     1 BPC(12),  YES(50),  AA(3,12),  COB(12),  COS(12),  CONTL(12),
     1 CONTM(12),  CONTE(12),  DEOT(12),  FACS1(12,16),  FACS2(12,16),
     1 FACS3(12,8),  RIB,  RIBA,  RINT(50),  PO,  YBC,  YFIRST,  YLAST,
     1 FILS(20),  FACE(3,12),  AMAN,  AMANB,  HW,  ISITE(20),  NUMSL,
     1 OTP(12),  OTPP(12),  OVERS(12),  MHT,  MHP(12),  HWI(12)
      INTEGER COMO
      REWIND COMO
      REWIND LAMA
      IND8 = 0
      LIN = 0
      IND9 = 0
      NUMSL = 0
      WRITE(NOUT,500)
C |===================================================================|
C |                                                                   |
C |  READ THE CONLAM PRODUCED LABOR EQUIP & MATL FILE "LAMA" AND      |
C |  STORE AND DISPLAY THE CITY NAMES AVAILABLE.                      |
C |                                                                   |
C |===================================================================|
      DO 16 I = 1,100
      IF (IND8) 6,2,6
    2 READ(LAMA,END=4) IR,IS,IT,LOCIN,AT,BL,CMT
      CITY(I) = LOCIN(3)
      NUMSL = NUMSL + 1
      GO TO 6
    4 IND8 = 1
    6 IF (IND9) 12,8,12
C |===================================================================|
C |                                                                   |
C |  READ THE CONTAC PRODUCED FILE "COMO" CONTAINING THE COST MODELS  |
C |  AND DISPLAY THE COST MODEL TYPES AVAILABLE.                      |
C |                                                                   |
```

```
C  |===================================================================|
    8 READ(COMO,END=10)
     1   TYPE1,  IDD,  TITLE,  YBC,  BWE,  AA,  IAR1,  IAR2,  IAR3,
     1   IAR4,   IAR5,   CPCA,   FACS1,   FACS2,   FACS3,   AEB,
     1   AMB,   ALB,   D,   AC2,   AC3,   AC4,   AC5,   PO,   COB,
     1   MHT,   MHP,   NAA,   NIAR4,   NIAR5,   NCCD,   NAC,   IAC2,
     1   IAC3,   IAC4,   IAC5
      GO TO 12
   10 IND9 = 1
   12 IF (IND8.GT.0.AND.IND9.GT.0) GO TO 18
      LIN = LIN + 1
      IF (LIN.LE.50) GO TO 14
      WRITE(NOUT,500)
      LIN = 1
   14 IF (IND8.EQ.0.AND.IND9.EQ.0) WRITE(NOUT,502)                  I,TYP
     1E1(1),TYPE1(2),I,CITY(I),LOCIN(4),LOCIN(1),LOCIN(2)
      IF (IND8.EQ.0.AND.IND9.GT.0) WRITE(NOUT,504) I,CITY(I), LOCIN(4),LO
     1CIN(1),LOCIN(2)
      IF (IND8.GT.0.AND.IND9.EQ.0) WRITE(NOUT,506) I,TYPE1(1),TYPE1(2)
   16 CONTINUE
   18 REWIND COMO
      REWIND LAMA
      WRITE(NOUT,508)
      RETURN
  500 FORMAT('1',T41,'C O N C E P T   P H A S E   5   D A T A   S E T S
     1 '/'+',T41,52('_')/'0',T21,'P O W E R   P L A N T   T Y P E   C O
     1D E S',T84,'C I T Y   N A M E   C O D E S'/'+',T21,43('_'),T84,29(
     1'_')//)
  502 FORMAT(' ',T32,I2,2(2X,A8),T81,I2,2(2X,2A8))
  504 FORMAT(' ',T81,I2,2(2X,2A8))
  506  FORMAT(' ',T32,I2,2(2X,A8))
  508 FORMAT('0',T41,'      IF THE PLANT TYPE OR CITY SELECTED WAS NOT US
     1ED'/' ',T41,'IN COMPUTATIONS, CHECK SPELLING AND FIELD JUSTIFICATI
     1ON'/' ',T41,'WITH THE AVAILABLE PLANT TYPE AND CITY NAME CODES')
      END
      SUBROUTINE COST(IWANT,IFLAG,KONTRL,ILAZ)
C  |===================================================================|
C  |                                                                   |
C  |  THE COST SUBPROGRAM PROCESSES ONLY THE LOWEST LEVEL ACCOUNT      |
C  |  IN A SYSTEM BY THE CONCEPT ALGORITHM.                            |
C  |                                                                   |
C  |  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    |
C  |                                                                   |
C  |          R. C. DE LOZIER AND R. J. BARNARD IN APRIL 1975          |
C  |                                                                   |
C  |          MODIFIED BY C. R. HUDSON IN OCTOBER 1977                 |
C  |                                                                   |
C  |===================================================================|
C  |===================================================================|
C  |                                                                   |
C  |                     LIST OF NOMENCLATURE                          |
C  |  VARIABLE                                                         |
C  |   NAME         DESCRIPTION                                        |
C  |  ________      _____________________________________________      |
C  |   C2             2-DIGIT COST ACCOUNTS                            |
C  |   C3             3-DIGIT COST ACCOUNTS                            |
C  |   C4             4-DIGIT COST ACCOUNTS                            |
C  |   C5             5-DIGIT COST ACCOUNTS                            |
C  |   C2C            CONTINGENCY FOR 2-DIGIT ACCOUNTS                 |
C  |   C2T            TOTAL COSTS FOR 2-DIGIT ACCOUNTS                 |
C  |   SUBSCRIPTS FOR C ARRAYS                                         |
C  |                  1 - FACTORY                                      |
C  |                  2 - LABOR                                        |
C  |                  3 - MATERIAL                                     |
C  |                  4 - TOTAL OF FACTORY, LABOR AND MATERIAL         |
C  |   CONTE(I)     EQUIP CONTINGENCY AS PERCENTAGE OF 2-DIGIT SUBTOTAL |
```

```
C |   CONTL(I)      LABOR CONTINGENCY AS PERCENTAGE OF 2-DIGIT SUBTOTAL |
C |   CONTM(I)      MTL CONTINGENCY AS PERCENTAGE OF 2-DIGIT SUBTOTALS  |
C |                                                                     |
C |=====================================================================|
      REAL * 8 TYPE(2),TYPE1(2),LOCIN(4)
      REAL*8 AC2, AC3, AC4, AC5, CITY, DATE, LOC
      DIMENSION BLSS(12),BMSS(12),BFCC(12),ALSS(12),AMSS(12),APCC(12)
      DIMENSION FAD(3,12), OVER(12)
      COMMON / FORM /
     1 TYPE,  TYPE1,  LOCIN,  AC2(8,12),  AC3(8,60),  AC4(8,180),
     1 AC5(8,320),  DATE,                       D(3,380),  TITLE(20),
     1 IAR1,  IAR2(5),  IAR3(15),  IAR4(60),  IAR5(180),  IST,  IGO,
     1 NIN,  NOUT,  ID1,  ID2,  ID3,  ICON,  COMO,  LAMA,  ISDJ(3)
      COMMON / PROG /
     1 LOC(3),  CITY(25),  CPCA(12,50),  YRSSS,  YRPER,  YRCOP,  IMM,
     1 MWE,  IBS
      COMMON / OUT /
     1 BWE,  C2(4,12),  C3(4,60),  C4(4,180),  C5(4,400),  C2C(4,12),
     1 C2T(4,12),  ESCL,  SFMC,  SSMC,  SSLC,  SCONT,  STDC,  TIC,
     1 TDA,  MHS(7),  MMHS,  IAC,  IPG,  N2
      COMMON / NAML /
     1 AEB(12),  ALB(12),  AMB(12),  AFC(12,50),  ALS(12,50),
     1 AMS(12,50),  BPC(12,50),  BLS(12,50),  BMS(12,50),  APC(12),
     1 BPC(12),  YES(50),  AA(3,12),  COB(12),  COS(12),  CONTL(12),
     1 CONTM(12),  CONTE(12),  DEOT(12),  FACS1(12,16),  FACS2(12,16),
     1 FACS3(12,8),  RIB,  RIBA,  RINT(50),  PO,  YBC,  YFIRST,  YLAST,
     1 FILS(20),  FACE(3,12),  AMAN,  AMANB,  HW,  ISITE(20),  NUMSL,
     1 OTP(12),  OTPP(12),  OVERS(12),  MHT,  MHP(12),  HWI(12)
      NAMELIST /CONOPT/
     1 AA,  APC,  BPC,  COB,  COS,  CONTL,  CONTM,  CONTE,  DEOT,  OTP,
     1 FACS1,  FACS2,  FACS3,  FILS,  ISITE,  OVERS,  RINT,  YFIRST,
     1 YLAST,  HW,  AMAN,  CPCA,  D,  HWI
      INTEGER COMO
      N2 = 0
      DO 4 I = 1,IAR1
    4 N2 = N2 + IAR2(I)
      CALL     MODLAM(KONTRL)
      IF (IFLAG.EQ.0) GO TO 8
      IF (IFLAG.EQ.2) GO TO 8
C |=====================================================================|
C |                                                                     |
C |                                                                     |
C |   IF IFLAG = 1 READ CONOPT ONE TIME ONLY HERE                       |
C |   IF IFLAG = 3 READ CONOPT FOR THE FIRST TIME HERE                  |
C |                                                                     |
C |=====================================================================|
      IF (ILAZ.GT.1) READ(ICON,CONOPT,END=6)
    6 CONTINUE
      IF (ILAZ.EQ.2) GO TO 8
      IF (IFLAG.NE.2) READ(ID1,CONOPT,END=8)
    8 CONTINUE
      IF (KONTRL.EQ.2) GO TO 14
      CALL CONIV(APCC,BPCC,ALSS,BLSS,AMSS,BMSS,ISITE,FACS1,FACS2,
     1 FACS3,FILS,YFIRST,YLAST,YBC,N2,LAMA)
      DO 12 JJ = 1,IMM
      YES(JJ) = YRSSS + (CPCA(1,JJ) * (YRCOP-YRSSS))
      YTIME = YES(JJ) - YBC
      DO 10 JI = 1,N2
      IF (BLSS(JI).LE.0.0) BLSS(JI) = 1.0
      IF (BMSS(JI).LE.0.0) BMSS(JI) = 1.0
      IF (BFCC(JI).LE.0.0) BFCC(JI) = 1.0
      ALS(JI,JJ) = ALSS(JI)   * BLSS(JI) ** YTIME
      BLS(JI,JJ) = BLSS(JI)
      AMS(JI,JJ) = AMSS(JI)   * BMSS(JI) ** YTIME
      BMS(JI,JJ) = BMSS(JI)
      APC(JI,JJ) = APCC(JI)   * BFCC(JI) ** YTIME
      BFC(JI,JJ) = BFCC(JI)
```

```
   10 CONTINUE
   12 CONTINUE
      IF (IBS.GT.0) CALL     INDUSE (N2)
   14 CONTINUE
      IWANT = IABS(IWANT)
      DO 18 I = 1,4
      DO 16 J = 1,400
      IF (J.LT.13) C2(I,J) = 0.0
      IF (J.LT.61) C3(I,J) = 0.0
      IF (J.LT.181) C4(I,J) = 0.0
      C5(I,J) = 0.0
   16 CONTINUE
   18 CONTINUE
      IF (HW.EQ.40.) GO TO 22
      DO 21 J=1,N2
      HWI(J)  = HW
   21 CONTINUE
   22 DO 19 J=1,N2
      OVER(J) = 1.0 - DEOT(J) * (HWI(J) - 40.0)
      IF (OVERS(J).GT.0.001) OVER(J) = OVERS(J)
      OTPP(J) = (40. + OTP(J) * (HWI(J) - 40.))/HWI(J)
   19 CONTINUE
      DO 20 I = 1,3
      DO 20 J = 1,12
      FACE(I,J) = 1.0
         IF (IWANT.EQ.1) FACE(I,J)=0.
   20 CONTINUE
      IF (IWANT.EQ.0) GO TO 30
      DO 28 K = 1,3
      DO 26 J = 1,N2
      DO 24 I = 2, IMM
      Y1D = YRSSS + ((YRCOP - YRSSS) * CPCA(1,I))
      CFFAC = CPCA(J+1,I) - CPCA(J+1,I-1)
         CFFAC     =    CFFAC/CLAB(J,K,YRSSS)
      FACE(K,J) = FACE(K,J) + CLAB(J,K,Y1D) * CFFAC
   24 CONTINUE
      IF (FACE(K,J).LE.0.) FACE(K,J) = 1.0
   26 CONTINUE
   28 CONTINUE
   30 DO 52 I = 1,3
      IC = 1
      N32 = 0
      N42 = 0
      N52 = 0
      DO 50 I2 = 1,N2
      PRATIO = 1.0
      ORATIO = 1.0
      IF (I.NE.2) GO TO 32
      PRATIO = APC(I2) + BPC(I2) * (YRSSS - YBC)
      ORATIO = OTPP(I2) / OVER(I2) * (1. + COS(I2)) / (1. + COB(I2))
   32 CONTINUE
      FAD(I,I2) = CLAB(I2,I,YRSSS)
C  |=================================================================|
C  |                                                                 |
C  |  COST LEVELING FROM BASE POWER OUTPUT TO PROBLEM MEGAWATT LEVEL  |
C  |                                                                 |
C  |=================================================================|
      FACM = 1.0
      FAC1 = AA(1,I2) + AA(2,I2) * (MWE/BWE) ** AA(3,I2)
      IF (AMAN.GT.0.) FACM = AMAN/AMANB / FAC1     *MWP
         COMBF     =    FAC1*FAD(I,I2)/PRATIO*ORATIO
      IF (IAB3(I2).EQ.0) GO TO 46
      N31  = N32 + 1
      N32 = N31 + IAB3(I2) - 1
      DO 44 I3 =   N31,N32
      IF (IAB4(I3).EQ.0) GO TO 42
```

```
      N41          =    N42 + 1                                         COST1640
      N42          =    N41 + IAR4(I3) - 1                              COST1650
      DO 40 I4     =    N41,N42                                         COST1660
      IF (IAR5(I4).EQ.0) GO TO 38                                       COST1670
      N51          =    N52 + 1                                         COST1680
      N52          =    N51 + IAR5(I4) - 1                              COST1690
      DO 36 I5     =    N51,N52                                         COST1700
      D(I,IC) = D(I,IC) * COMBF                                         COST1710
      IF (I.EQ.2.AND.AMAN.GT.0.) D(I,IC) = D(I,IC) * FACM               COST1720
      IC = IC + 1                                                       COST1730
   36 CONTINUE                                                          COST1740
      GO TO 40                                                          COST1750
   38 CONTINUE                                                          COST1760
      D(I,IC) = D(I,IC) * COMBF                                         COST1770
      IF (I.EQ.2.AND.AMAN.GT.0.) D(I,IC) = D(I,IC) * FACM               COST1780
      IC = IC + 1                                                       COST1790
   40 CONTINUE                                                          COST1800
      GO TO 44                                                          COST1810
   42 CONTINUE                                                          COST1820
      D(I,IC) = D(I,IC) * COMBF                                         COST1830
      IF (I.EQ.2.AND.AMAN.GT.0.) D(I,IC) = D(I,IC) * FACM               COST1840
      IC = IC + 1                                                       COST1850
   44 CONTINUE                                                          COST1860
      GO TO 48                                                          COST1870
   46 CONTINUE                                                          COST1880
      D(I,IC) = D(I,IC) * COMBF                                         COST1890
      IF (I.EQ.2.AND.AMAN.GT.0.) D(I,IC) = D(I,IC) * FACM               COST1900
      IC = IC + 1                                                       COST1910
   48 CONTINUE                                                          COST1920
   50 CONTINUE                                                          COST1930
   52 CONTINUE                                                          COST1940
      IF (IFLAG.LT.2) GO TO 62                                          COST1950
C    |=================================================================|COST1960
C    |                                                                 |COST1970
C    |    IF IFLAG=2 READ CONOPT ONE TIME ONLY HERE                    |COST1980
C    |    IF IFLAG = 3 READ CONOPT FOR THE SECOND TIME HERE            |COST1990
C    |                                                                 |COST2000
C    |=================================================================|COST2010
      IF (ILAZ.GT.1) READ(ICON,CONOPT,END=60)                           COST2020
   60 CONTINUE                                                          COST2030
      IF (ILAZ.EQ.2) GO TO 62                                           COST2040
      READ(ID1,CONOPT,END=62)                                           COST2050
   62 CONTINUE                                                          COST2060
      REWIND ID1                                                        COST2070
      REWIND ICON                                                       COST2080
      DO 82 I = 1,3                                                     COST2090
      IC = 1                                                            COST2100
      N32 = 0                                                           COST2110
      N42 = 0                                                           COST2120
      N52 = 0                                                           COST2130
      DO 80 I2 = 1,N2                                                   COST2140
      IF (IAR3(I2).EQ.0) GO TO 74                                       COST2150
      N31  = N32 + 1                                                    COST2160
      N32 = N31 + IAR3(I2) - 1                                          COST2170
      DO 72 I3 =    N31,N32                                             COST2180
      IF (IAR4(I3).EQ.0) GO TO 70                                       COST2190
      N41          =    N42 + 1                                         COST2200
      N42          =    N41 + IAR4(I3) - 1                              COST2210
      DO 68 I4     =    N41,N42                                         COST2220
      IF (IAR5(I4).EQ.0) GO TO 66                                       COST2230
      N51          =    N52 + 1                                         COST2240
      N52          =    N51 + IAR5(I4) - 1                              COST2250
      DO 64 I5     =    N51,N52                                         COST2260
      C5(I,I5) = D(I,IC)  * FACE(I,I2)                                  COST2270
      IC = IC + 1                                                       COST2280
   64 CONTINUE                                                          COST2290
```

```
      GO TO 68
   66 CONTINUE
      C4(I,I4) = D(I,IC)    * FACE(I,I2)
      IC = IC + 1
   68 CONTINUE
      GO TO 72
   70 CONTINUE
      C3(I,I3) = D(I,IC)    * FACE(I,I2)
      IC = IC + 1
   72 CONTINUE
      GO TO 76
   74 CONTINUE
      C2(I,I2) = D(I,IC)     * FACE(I,I2)
      IC = IC + 1
   76  CONTINUE
   80 CONTINUE
   82 CONTINUE
      CALL SUM(FAD)
      RETURN
      END
      SUBROUTINE MODLAM (KONTRL)
C
C |==============================================================|
C |                                                              |
C |                BY R. J. BARNARD     NOV 1974                 |
C |                -------------       ---------                 |
C |                                                              |
C |- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - |
C |   MODLAM SUBPROGRAM CONTROLS THE ENTRY OF COST MODEL DATA FROM |
C |   THE COMO FILE AND THE LABOR EQUIP & MATL DATA FROM LAMA FILE.|
C |   EACH FILE MUST BE SEARCHED FOR SPECIFIC DATA RECORDS THEN   |
C |   PROCESSING CONTINUES WITH PROPER DATA IF FOUND OR THE LAST  |
C |   RECORD ON EITHER FILE IS USED IF IMPROPER SELECTIONS HAVE BEEN|
C |   REQUESTED IN THE INPUT DATA CARDS.                          |
C |                                                              |
C |==============================================================|
      REAL*8 AC2, AC3, AC4, AC5, CITY, DATE, LOC
      REAL * 8 TYPE(2),TYPE1(2),LOCIN(4),IDD(380)
      DIMENSION AT(30,8),BL(30,16),CMT(30,16),NAC(12)
      DIMENSION F(50)
      COMMON / FORM /
     1 TYPE,  TYPE1,  LOCIN,  AC2(8,12),  AC3(8,60),  AC4(8,180),
     1 AC5(8,320),  DATE,                     D(3,380),  TITLE(20),
     1 IAR1,  IAR2(5),  IAR3(15),  IAR4(60),  IAR5(180),  IST,  IGO,
     1 NIN,  NOUT,  ID1,  ID2,  ID3,  ICON,  COMO,  LAMA,  ISDJ(3)
      COMMON / PROG /
     1 LOC(3),  CITY(25),  CFCA(12,50),  YRSSS,  YRPER,  YRCOP,  IMM,
     1 MWE,  IBS
      COMMON / OUT /
     1 BWE,  C2(4,12),  C3(4,60),  C4(4,180),  C5(4,400),  C2C(4,12),
     1 C2T(4,12),  ESCL,  SFMC,  SSMC,  SSLC,  SCONT,  STDC,  TIC,
     1 TDA,  MHS(7),  MMHS,  IAC,  IPG,  N2
      COMMON / NAML /
     1 AEB(12),  ALB(12),  AMB(12),  AFC(12,50),  ALS(12,50),
     1 AMS(12,50),  BFC(12,50),  BLS(12,50),  BMS(12,50),  APC(12),
     1 BPC(12),  YES(50),  AA(3,12),  COB(12),  COS(12),  CONTL(12),
     1 CONTM(12),  CONTE(12),  DEOT(12),  FACS1(12,16),  FACS2(12,16),
     1 FACS3(12,8),  RIB,  RIBA,  RINT(50),  PO,  YBC,  YFIRST,  YLAST,
     1 FILS(20),  FACE(3,12),  AMAN,  AMANB,  HW,  ISITE(20),  NUMSL,
     1 OTP(12),  OTPP(12),  OVERS(12),  MHT,  MHP(12),  HWI(12)
      INTEGER COMO
      REWIND COMO
      REWIND LAMA
C |==============================================================|
C |                                                              |
C |      IF KONTRL = 1 BOTH THE COST MODEL FILE (COMO) AND THE  |
```

```
C |       EQUIP LABOR & MATL COST FILE (LAMA) WILL BE READ IN.      .     |
C |_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _|
C |       IF KCNTRL = 2 THE COST MODEL FILE (COMO) IS READ IN AND THE     |
C |       EQUIP LABOR & MATL COST FILE (LAMA) WILL BE SKIPPED.            |
C |                                                                       |
C |=======================================================================|
    2 READ(COMO,END=4)
     1   TYPE1,  IDD,  TITLE,  YBC,  BWE,  AA,  IAR1,  IAR2,  IAR3,
     1   IAR4,   IAR5,   CPCA,   FACS1,   FACS2,   FACS3,   AEB,
     1   AMB,   ALB,   D,   AC2,   AC3,   AC4,   AC5,   PO,   COB,
     1   MHT,   MHP,   NAA,   NIAR4,   NIAR5,   NCCD,   NAC,   IAC2,
     1   IAC3,   IAC4,   IAC5
      IF (TYPE1(1).EQ.TYPE(1)) GO TO 8
      GO TO 2
    4 WRITE(NOUT,500) TYPE (1)
      DO 6 L = 1,20
    6 WRITE(NOUT,502)
    8 CONTINUE
      AMANB = MHT
      REWIND COMO
       TYPE(1) = TYPE1(1)
       TYPE(2) = TYPE1(2)
      P = (YRPER - YRSSS) / (YRCOP - YRSSS)
      NX = N2 + 1
      DO 14 I=2,NX
      DO 10 K = 1,IMM
   10 F(K) = CPCA(I,K)
      CALL       DELOF(F,P,PO,IMM)
      DO 12 K = 1,IMM
      CPCA(I,K) = F(K)
   12 CONTINUE
   14 CONTINUE
      IF (KONTRL.EQ.2) RETURN
C |=======================================================================|
C |                                                                       |
C |     CHECK FOR LOCATION IN GEOGRAPHIC TABLE                            |
C |    ** NO DEFAULT OPERATIONS - ERRORS UTILIZE THE LAST LOCATION FOR    |
C |     CONTINUING EXECUTION WITH ERROR NOTICE GIVEN.                     |
C |                                                                       |
C |=======================================================================|
      DO 16 J    =    1,NUMSL
      READ(LAMA,END=18)IR,IS,IT,LOCIN,AT,BL,CMT
      IF (LOC(1).NE.LOCIN(3)) GO TO 16
      GO TO 22
   16 CONTINUE
   18 REWIND LAMA
      WRITE(NOUT,504)  (LOC(I), I=1,3)
      DO 20 L = 1,20
   20 WRITE(NOUT,502)
      J = NUMSL
C
C |=======================================================================|
C |                                                                       |
C |   DETERMINE LATEST YEAR OF LABOR AND MATERIAL COSTS FOR THIS          |
C |   LOCATION.                                                           |
C |                                                                       |
C |=======================================================================|
C
   22 ISITE(1)    =    J
      HAT = 0.0
      DO 24 I = 1,30
   24 IF (AT(I,1).GT.HAT) HAT = AT(I,1)
      YLAST = HAT
      RETURN
  500 FORMAT('1',T12,A8,' TYPE OF PLANT NOT FOUND ON COST MODEL TAPE, CH
     1ECK REQUESTED TYPE FOR SPELLING AND CARD POSITION'//)
```

```
  502 FORMAT(' ',T20,50('<>'))
  504 FORMAT('1',3A8,' WAS NOT FOUND IN TABLE OF CITIES- CHECK CITY NAME
     1 FOR SPELLING AND CARD POSITION'//)
      END
         SUBROUTINE DELOF(F,P,PO,IM)
C |=================================================================|
C |                                                                 |
C |          THIS SUBPROGRAM MAPS THE FUNCTION F(Y,PO)              |
C |          INTO A NEW FUNCTION F(Y,P), WHERE BOTH FUNCTIONS       |
C |          HAVE THE SAME END POINTS (YS AND YE) BUT SOME          |
C |          ARBITARY POINT YM IS CHANGED -                         |
C |  WHERE  P =(YM-YS)/(YE-YS) USED FOR ADJUSTING CASH FLOW CURVES. |
C |                                                                 |
C |- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -|
C |                                                                 |
C |          BY:  R. C. DELOZIER             DATE:  AUGUST 5, 1974   |
C |  MODIFIED BY:  C. R. HUDSON              DATE:  OCTOBER 17, 1977 |
C |                                                                 |
C |=================================================================|
         DIMENSION  F(IM),G(50)
      LM1 = PO*IM + .5
      LM2 = P *IM + .5
      IF (LM2.LT.2) LM2 = 2
         IF (LM1.EQ.LM2) RETURN
      DO 3 I=1,IM
    3 G(I) = F(I)
         B1         =     LM1-1
         B1         =     B1     /(LM2-1)
      A1 = LM1 - B1*LM2
      B2 = IM - LM1
      B2 = B2 / (IM-LM2)
      A2 = LM1 - B2*LM2
      DO 2 I=1,LM2
      L = A1 + B1*I + .5
         IF (L.LT.1) L=1
         IF (L.GT.LM1) L=LM1
         F(I)       =    G(L)
    2    CONTINUE
      LX = LM2 + 1
      DO 4 I=LX,IM
      L = A2 + B2*I + .5
         IF (L.LT.LM1) L=LM1
         IF (L.GT.IM) L=IM
         F(I)       =    G(L)
    4    CONTINUE
         RETURN
      END
      SUBROUTINE CONIV(AE,BE,AL,BL,AM,BM,IL,FL,FM,FE,FIL,YFIRST,YLAST,
     1 YBC,N2,LAMA)
C |=================================================================|
C |                                                                 |
C |  CONIV  IS CALLED FROM COST SUBROUTINE FOR EVALUATION OF        |
C |  ESCALATION COMPONENTS.                                         |
C |                                                                 |
C |- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -|
C |                                                                 |
C |  BY R. C. DELOZIER AND B. E. SMITH 01/01/72                     |
C |                                                                 |
C |  MODIFIED BY C. R. HUDSON  10-17-77                             |
C |                                                                 |
C |=================================================================|
C |=================================================================|
C |                                                                 |
C |    AE       EQUIPMENT COST IN YBC                               |
C |    BE       ESCALATION RATE FOR EQUIPMENT                       |
C |    AL       LABOR RATE IN YBC                                   |
```

```
C |    BL       ESCALATION RATE FOR LABOR                                  |
C |    AM       MATERIAL COST IN YBC                                       |
C |    BM       ESCALATION RATE FOR MATERIAL                               |
C |    IL       LOCATIONS TO BE STUDIED                                    |
C |    FE       FACTOR FOR EQUIPMENT TYPE                                  |
C |    FL       FACTOR FOR LABOR TYPE                                      |
C |    FM       FACTOR FOR MATERIAL TYPE                                   |
C |    FIL      FACTOR FOR LOCATION                                        |
C |    YFIRST   FIRST YEAR PERTAINING TO LAMA FILE DATA                    |
C |    YLAST    LAST YEAR PERTAINING TO LAMA FILE DATA                     |
C |    N2       NUMBER OF 2-DIGIT ACCOUNTS  (DIRECTS & INDIRECTS)          |
C |    YBC      YEAR OF BASE MODEL COSTS                                   |
C |                                                                        |
C |========================================================================|
C
      DIMENSION AE(12),BE(12),AL(12),BL(12),AM(12),BM(12),FL(12,16),
     1FM(12,16),FE(12,8),FIL(20),A(30,8),B(30,16),C(30,16),YR(30),
     2RE(30),RM(30),RL(30)
      DIMENSION IL(20),SAE(12),SAM(12),SAL(12),SBE(12),SBM(12),SBL(12)
      DIMENSION LOCIN(8)
      REWIND LAMA
       DO 2  I    =    1,20
       IF (IL(I).EQ.0) GO TO 4
    2 CONTINUE
      I           =    21
    4 CONTINUE
      IMX         =    IL(I-1)
      DO 6 I      =    1,N2
      SAE(I) = 0.0
      SBE(I) = 0.0
      SAM(I)      =     0.0
      SBM(I)      =     0.0
      SAL(I)      =     0.0
      SBL(I)      =     0.0
    6 CONTINUE
C
C |========================================================================|
C |                                                                        |
C |  SEARCH FOR MAXIMUM OF 20 LOCATIONS WHICH CAN BE COMBINED FOR          |
C |  REGIONAL PROJECTIONS.                                                 |
C |                                                                        |
C |========================================================================|
C
      IC          =    1
      DO 18 I     =    1,IMX
      READ(LAMA,END=22) IR, IS, IT, LOCIN, A, B, C
      IF (IL(IC).NE.I) GO TO 18
      WRITE(6,500) LOCIN
      IC          =    IC + 1
C
C |========================================================================|
C |                                                                        |
C |  PROCESS THE 2-DIGIT ACCOUNTS                                          |
C |                                                                        |
C |========================================================================|
C
      DO 16 J     =    1,N2
      DO 8 K      =    1,30
      RE(K) = 0.0
      RL(K)       =    0.0
      RM(K)       =    0.0
    8 CONTINUE
      KK          =    0
      DO 12 K     =    1,30
      IF (A(K,1).EQ.0.0) GO TO 14
      IF (A(K,1).GT.YLAST) GO TO 18
```

```
      IF (YFIRST.GT.A(K,1)) GO TO 12
      SUMEQT = 0.
         SUMLAB    =   0.
         SUMMAT    =   0.
      KK           =   KK + 1
      DO 10 L      =   1,16
         SUMMAT    =   SUMMAT+FM(J,L)
         SUMLAB    =   SUMLAB+FL(J,L)
      IF (L.LT.9) SUMEQT = SUMEQT + FE(J,L)
      IF (L.LT.9) RE(KK) = RE(KK) + A(K,L) * FE(J,L)
      RL(KK)       =   RL(KK) + B(K,L) * FL(J,L)
      RM(KK)       =   RM(KK) + C(K,L) * FM(J,L)
   10 CONTINUE
      IF (SUMEQT.NE.0.) RE(KK) = RE(KK)/SUMEQT
      IF (SUMLAB.NE.0.) RL(KK)     =   RL(KK)/SUMLAB
      IF (SUMMAT.NE.0.) RM(KK)     =   RM(KK)/SUMMAT
      IF(RE(KK).GT.0.) RE(KK) = ALOG(RE(KK))
      IF (RL(KK).GT.0.) RL(KK)        =   ALOG(RL(KK))
      IF (RM(KK).GT.0.) RM(KK)        =   ALOG(RM(KK))
      YR(KK)       =   A(K,1) - YBC
   12 CONTINUE
   14 CONTINUE
      CALL        FITS (YR, RE, KK, AE1, BE1)
      CALL        FITS (YR, RL, KK, AL1, BL1)
      CALL        FITS (YR, RM, KK, AM1, BM1)
      SAE(J) = SAE(J) + FIL(IC-1) * AE1
      SAL(J)      = SAL(J) + FIL(IC-1) * AL1
      SAM(J)      =   SAM(J) + FIL(IC-1) * AM1
      SBE(J) = SBE(J) + FIL(IC-1) * BE1
      SBL(J)      =   SBL(J) + FIL(IC-1) * BL1
      SBM(J)      =   SBM(J) + FIL(IC-1) * BM1
   16 CONTINUE
   18 CONTINUE
      DO 20 J     =   1,N2
      AE(J) = SAE(J)
      BE(J) = SBE(J)
      AL(J)       =   SAL(J)
      BL(J)       =   SBL(J)
      AM(J)       =   SAM(J)
      BM(J)       =   SBM(J)
   20 CONTINUE
   22 RETURN
  500 FORMAT('0CONIV CALLED - DATA FIT DONE ON ',8A4)
      END
       SUBROUTINE FITS(X,Y,N,A,B)
C
C  |=================================================================|
C  |                                                                 |
C  |   EVALUATE COEFFICIENTS A AND B OF LN(Y) = LN(A) + B LN(X)      |
C  |  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   |
C  |      LINEAR FIT ....   R.C. DELOZIER  .....  5/17/72            |
C  |                                                                 |
C  |=================================================================|
C
      REAL X(N),Y(N)
      R            =   N
      SX           =   0.
      SX2          =   0.
      SY           =   0.
      SXY          =   0.
      DO 2 I       =   1,N
      SX           =   SX + X(I)
      SX2          =   SX2+ X(I)      **2
      SY           =   SY +Y(I)
      SXY          =   SXY+Y(I)            *X(I)
    2 CONTINUE
```

```
      B               =     (SY*SX-SXY*R)/(SX*SX-SX2*R)
      A               =     (SY-B*SX)/R
     A                =     EXP(A)
     B                =     EXP(B)
      RETURN
     END
        SUBROUTINE  INDUSE(N2)
C |========================================================================|
C |                                                                        |
C |      THIS SUBPROGRAM USES NORMAL INPUT CARDS                           |
C |      TO ALTER THE ESCLATION RATES TO FORM A                            |
C |      TIME DEPENDENT NONLINEAR FUNCTIONAL SYSTEM.                       |
C |                                                                        |
C |  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   |
C |                                                                        |
C |      BY:  R. C. DELOZIER              DATE:  SEPT. 12, 1974            |
C |           -------------                      --------------            |
C |      MODIFIED BY :  C. R. HUDSON             OCT. 6, 1977              |
C |                                                                        |
C |========================================================================|
C
      DIMENSION ICARD(20),A(12,3),B(12,3),AX(12,3),BX(12,3)
      DIMENSION FMT(7), FCH(4)
      REAL * 8 TYPE(2), TYPE1(2),LOCIN(4)
      REAL*8 AC2, AC3, AC4, AC5, CITY, DATE, LOC
      COMMON / FORM /
     1 TYPE,  TYPE1,  LOCIN,  AC2(8,12),  AC3(8,60),  AC4(8,180),
     1 AC5(8,320),  DATE,                      D(3,380),  TITLE(20),
     1 IAR1,  IAR2(5),  IAR3(15),  IAR4(60),  IAR5(180),  IST,  IGO,
     1 NIN,  NOUT,  ID1,  ID2,  ID3,  ICON,  COMO,  LAMA,  ISDJ(3)
      COMMON / PROG /
     1 LOC(3),  CITY(25),  CPCA(12,50),  YRSSS,  YRPER,  YRCOP,  IMM,
     1 MWE,  IBS
      COMMON / NAML /
     1 AEB(12),  ALB(12),  AMB(12),  AFC(12,50),  ALS(12,50),
     1 AMS(12,50),  BFC(12,50),  BLS(12,50),  BMS(12,50),  APC(12),
     1 BPC(12),  YES(50),  AA(3,12),  COB(12),  COS(12),  CONTL(12),
     1 CONTM(12),  CONTE(12),  DEOT(12),  FACS1(12,16),  FACS2(12,16),
     1 FACS3(12,8),  RIB,  RIBA,  RINT(50),  PO,  YBC,  YFIRST,  YLAST,
     1 FILS(20),  FACE(3,12),  AMAN,  AMANB,  HW,  ISITE(20),  NUMSL,
     1 OTP(12),  OTPP(12),  OVERS(12),  MHT,  MHP(12),  HWI(12)
      COMMON /TELPRT/  ISET
      DATA FMT/'(4F5','.3,T','71,F','10.2',',T1,','20A4',')    '/
      DATA FCH/'(2F5','(4F5','(6F5','(8F5'/
      ISET = 0
        IN          =    1
        I           =    1
      REWIND ID3
      N = N2 - 7
      FMT(1) = FCH(N)
      NOW = NIN
      IF (IBS.NE.1) NOW = ID3
      WRITE(NOUT,500)
    2 CONTINUE
      IC = 0
      DO 4 J=1,3
      READ(NOW,504) (A(K,J),B(K,J),K=1,7),T,ICARD
      WRITE(NOUT,502) ICARD
      IF (IBS.EQ.1) WRITE(ID3,508) ICARD
      IF (T.LE.-1.) GO TO 6
      READ(NOW,FMT) (A(K,J),B(K,J),K=8,N2),T,ICARD
      WRITE(NOUT,502) ICARD
      IF (IBS.EQ.1) WRITE(ID3,508) ICARD
    4 CONTINUE
      IF (T.GE.YES(1)) GO TO 6
      DO 20 K=1,N2
```

```
      AX(K,1) = APC(K,1)
      AX(K,2) = ALS(K,1)
      AX(K,3) = AMS(K,1)
      BX(K,1) = BPC(K,1)
      BX(K,2) = BLS(K,1)
      BX(K,3) = BMS(K,1)
   20 CONTINUE
      IF = 1
      I = 1
      TM = YES(1) - T
      T = YES(1)
      IC = 1
      DO 30 J=1,3
      DO 30 K=1,N2
      IF (A(K,J).LE.0.AND.B(K,J).LE.0.) GO TO 30
      IF (B(K,J).LE.0.) B(K,J) = BX(K,J)
      IF (A(K,J).GT.0.) GO TO 15
      A(K,J) = AX(K,J) * (B(K,J)/BX(K,J))**TM
      GO TO 30
   15 A(K,J) = A(K,J) * B(K,J)**TM
   30 CONTINUE
    6    CONTINUE
         IF (I.NE.1) IN=I-1
         IN1       =    1
      IF (I.GT.IMM) RETURN
         DO 10 II  =    I,IMM
         IF (II.NE.1) IN1=II-1
         DY        =    YES(II)-YES(IN)
         DO 8 KK   =    1,N2
         APC(KK,II)=    APC(KK,IN)*BPC(KK,IN)**DY
         ALS(KK,II)=    ALS(KK,IN)*BLS(KK,IN)**DY
         AMS(KK,II)=    AMS(KK,IN)*BMS(KK,IN)**DY
         BPC(KK,II)=    BPC(KK,IN)
         BLS(KK,II)=    BLS(KK,IN)
         BMS(KK,II)=    BMS(KK,IN)
    8    CONTINUE
      IF (T.GE.YES(IN1).AND.T.LE.(YES(II)+.001)) GO TO 14
   10    CONTINUE
      RETURN
   14    CONTINUE
         I         =    II
         DO 16 K   =    1,N2
         IF (A(K,1).GT.0.) APC(K,II)=A(K,1)
         IF (A(K,2).GT.0.) ALS(K,II)=A(K,2)
         IF (A(K,3).GT.0.) AMS(K,II)=A(K,3)
         IF (B(K,1).GT.0.) BPC(K,II)=B(K,1)
         IF (B(K,2).GT.0.) BLS(K,II)=B(K,2)
         IF (B(K,3).GT.0.) BMS(K,II)=B(K,3)
   16    CONTINUE
      IF (T.NE.YES(1)) ISET=1
         YES(II)   =    T
      IF (IC.EQ.1) GO TO 2
      I= I + 1
      GO TO 2
  500 FORMAT('0INPUT CARDS TO PRODUCE TIME DEPENDENT ESCALATION RATES'
     1 /,'+',60('_'))
  502 FORMAT(1X,T10,20A4)
  504    FORMAT         ( 14F5.3,F10.2,T1,20A4)
  508 FORMAT(20A4)
      END
      FUNCTION CLAB(K,ITYP,Y)
C
C |===============================================================|
C !                                                               |
```

```
C |    EVALUATE PROJECTED INDEXES FOR LABOR OR MATERIAL                     |
C |                                                                         |
C |       K     =    ACCOUNT INDEX                                          |
C |       ITYP   =    ACCOUNT COST TYPE WHERE:     1 = FACTORY COSTS        |
C |                                                2 = SITE LABOR COSTS     |
C |                                             3 = SITE MATERIAL COSTS     |
C |       Y     =    YEAR OF COST INDEX PROJECTION                          |
C |                                                                         |
C |  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    |
C |                                                                         |
C |        BY R. C. DE LOZIER AND B. E. SMITE NOV. 1972                     |
C |                                                                         |
C |=========================================================================|
C
      REAL*8 LOC,CITY
      COMMON / NAML /
     1 AEB(12),  ALB(12),  AMB(12),  AFC(12,50),  ALS(12,50),
     1 AMS(12,50),  BFC(12,50),  BLS(12,50),  BMS(12,50),  APC(12),
     1 BPC(12),  YES(50),  AA(3,12),  COB(12),  COS(12),  CONTL(12),
     1 CONTM(12),  CONTE(12),  DEOT(12),  FACS1(12,16),  FACS2(12,16),
     1 FACS3(12,8),  RIB,  RIBA,  RINT(50),  PO,  YBC,  YFIRST,  YLAST,
     1 FILS(20),  FACE(3,12),  AMAN,  AMANB,  HW,  ISITE(20),  NUMSL,
     1 OTP(12),  OTPP(12),  OVERS(12),  MHT,  MHP(12),  HWI(12)
      COMMON / PROG /
     1 LOC(3),  CITY(25),  CFCA(12,50),  YRSSS,  YRPER,  YRCOP,  IMM,
     1 MWE,  IBS
      IM1 = IMM - 1
      DO 2 J = 1,IM1
      IF (Y.GE.YES(J).AND.Y.LE.YES(J+1)) GO TO 4
    2 CONTINUE
      J = IMM
    4 CONTINUE
       IF (Y.LE.YES(1)) J= 1
      IID = Y - YES(J)
      GO TO (6,8,12),ITYP
    6 CONTINUE
      CLAB=AFC(K,J) * BFC(K,J) ** IID / AEB(K)
      RETURN
    8 CONTINUE
   10 CLAB = ALS(K,J) * BLS(K,J) ** IID / ALB(K)
      RETURN
   12 CONTINUE
   14 CLAB = AMS(K,J) * BMS(K,J) ** IID / AMB(K)
      RETURN
      END
      SUBROUTINE ADYR(YES,YCOMB,CM,CM1,YRS,YRE,CFCA,IMM,IBIN)
C |=========================================================================|
C |                                                                         |
C |  ADYR SUBPROGRAM ADDS THE MULTIPLE UNIT'S CASHFLOW CURVES TOGETHER      |
C |                                                                         |
C |           BY C. R. HUDSON        OCTOBER 1977                           |
C |                                                                         |
C |=========================================================================|
      DIMENSION YES(50),YCOMB(50),CM(50),CM1(50),CM2(50),CM3(50)
      DIMENSION YX(50),CFCA(12,50)
      TIM = YRE - YRS
      DO 14 I=1,IMM
      CM2(I) = 0.
   14 CM3(I) = 0.
      J = 2
      K = 2
      DO 15 I=1,IMM
      YX(I) = YRS + CFCA(1,I)*TIM
      IF (IBIN.EQ.0) GO TO 30
   45 IF (J.GT.IMM) CM2(I) = CM1(IMM)
      IF (J.GT.IMM) GO TO 30
```

```
      IF (YCOMB(J-1).GT.YX(I)) GO TO 30
      IF (YCOMB(J).LT.YX(I)) GO TO 25
      CM2(I) = CM1(J-1) + (YX(I) - YCOMB(J-1))/(YCOMB(J)-YCOMB(J-1))
     1 *(CM1(J)-CM1(J-1))
      GO TO 30
   25 J = J + 1
      GO TO 45
   30 IF (K.GT.IMM) CM3(I) = CM(IMM)
      IF (K.GT.IMM) GO TO 15
      IF (YES(K-1).GT.YX(I)) GO TO 15
      IF (YES(K).LT.YX(I)) GO TO 35
      CM3(I) = CM(K-1) + (YX(I)-YES(K-1))/(YES(K) - YES(K-1))
     1 *(CM(K) - CM(K-1))
      GO TO 15
   35 K= K + 1
      GO TO 30
   15 CONTINUE
      DO 50 I=1,IMM
      CM1(I) = CM2(I) + CM3(I)
   50 YCOMB(I) = YX(I)
      RETURN
      END
      SUBROUTINE SUM(FAD)
C
C |=================================================================|
C |                                                                 |
C |  SUM SUBPROGRAM SUMS ALL THE LOWEST LEVEL COSTS TO THEIR HIGHEST |
C |  LEVEL.                                                         |
C |                                                                 |
C |        BY R. C. DE LOZIER AND R. J. BARNARD   APRIL 1975        |
C |                                                                 |
C |        MODIFIED BY : C. R. HUDSON          OCTOBER 1977         |
C |                                                                 |
C |=================================================================|
      REAL * 8 TYPE(2),TYPE1(2),LOCIN(4)
      REAL*8 AC2,AC3,AC4,AC5,DATE
      DIMENSION FAD(3,12)
      COMMON / FORM /
     1 TYPE,  TYPE1,  LOCIN,  AC2(8,12),  AC3(8,60),  AC4(8,180),
     1 AC5(8,320),  DATE,                      D(3,380),  TITLE(20),
     1 IAR1,  IAR2(5),  IAR3(15),  IAR4(60),  IAR5(180),  IST,  IGO,
     1 NIN,  NOUT,  ID1,  ID2,  ID3,  ICON,  COMO,  LAMA,  ISDJ(3)
      COMMON / OUT /
     1 BWE,  C2(4,12),  C3(4,60),  C4(4,180),  C5(4,400),  C2C(4,12),
     1 C2T(4,12),  ESCL,  SPMC,  SSMC,  SSLC,  SCONT,  STDC,  TIC,
     1 TDA,  MHS(7),  MMHS,  IAC,  IPG,  N2
      COMMON / NAML /
     1 AEB(12),  ALB(12),  AMB(12),  AFC(12,50),  ALS(12,50),
     1 AMS(12,50),  BFC(12,50),  BLS(12,50),  BMS(12,50),  APC(12),
     1 BPC(12),  YES(50),  AA(3,12),  COB(12),  COS(12),  CONTL(12),
     1 CONTM(12),  CONTE(12),  DEOT(12),  FACS1(12,16),  FACS2(12,16),
     1 FACS3(12,8),  RIB,  RIBA,  RINT(50),  PO,  YRC,  YFIRST,  YLAST,
     1 FILS(20),  FACE(3,12),  AMAN,  AMANB,  HW,  ISITE(20),  NUMSL,
     1 OTP(12),  OTPP(12),  OVERS(12),  MHT,  MHP(12),  HWI(12)
      INTEGER COMO
C |=================================================================|
C |                                                                 |
C |  CLEAR ALL COST COLLECTING ARRAYS                               |
C |                                                                 |
C |=================================================================|
      DO 18 I = 1,3
      N32 = 0
      N42 = 0
      N52 =  0
      DO 16 I2 = 1,N2
      IF (IAR3(I2).EQ.0) GO TO 12
```

```
      N31 = N32 + 1
      N32 = N31 + IAR3(I2) - 1
      DO 10 I3 = N31,N32
      IF (IAR4(I3).EQ.0) GO TO 8
      N41 = N42 + 1
      N42 = N41 + IAR4(I3) - 1
      DO 6 I4 = N41,N42
      IF (IAR5(I4).EQ.0) GO TO 4
      N51 = N52+ 1
      N52 = N51 + IAR5(I4) - 1
      DO 2 I5= N51,N52
      C5(4,I5) = 0.
      C4(I,I4) = 0.
      C4(4,I4) = 0.
      C3(I,I3) = 0.
      C3(4,I3) = 0.
      C2(I,I2) = 0.
      C2(4,I2) = 0.
    2 CONTINUE
      GO TO 14
    4 CONTINUE
      C4(4,I4) = 0.
      C3(I,I3) = 0.
      C3(4,I3) = 0.
      C2(I,I2) = 0.
      C2(4,I2) = 0.
    6 CONTINUE
      GO TO 14
    8 CONTINUE
      C3(4,I3) = 0.
      C2(I,I2) = 0.
      C2(4,I2) = 0.
   10 CONTINUE
      GO TO 14
   12 CONTINUE
      C2(4,I2) = 0.
   14 CONTINUE
      C2C(4,I2) =0.
      C2T(4,I2)    = 0.
      IF (I2.LE.IAR2(1)) MHS(I2) = 0
   16 CONTINUE
   18 CONTINUE
      SFMC          = 0.
      SSLC          = 0.
      SSMC          = 0.
      TIC = 0.
      TICT=0.
      SCONT         = 0.
      STDC          = 0.
      MMHS = 0
C  |=====================================================================|
C  |                                                                     |
C  |  SUM ALL ACCOUNTS TO THE NEXT ACCUMULATIVE LEVEL                    |
C  |                                                                     |
C  |=====================================================================|
      DO 38 I = 1,3
      N32 = 0
      N42 = 0
      N52 = 0
      DO 36 I2 = 1,N2
      IF (IAR3(I2).EQ.0) GO TO 30
      N31  = N32 + 1
      N32 = N31 + IAR3(I2) - 1
      DO 28 I3 =   N31,N32
      IF (IAR4(I3).EQ.0) GO TO 26
      N41           =   N42 + 1
```

```
      N42          =   N41 + IAR4(I3) - 1
      DO 24 I4     =   N41,N42
      IF (IAR5(I4).EQ.0) GO TO 22
      N51          =   N52 + 1
      N52          =   N51 + IAR5(I4) - 1
      DO 20 I5     =   N51,N52
      C5(4,I5) = C5(4,I5) + C5(I,I5)
      C4(I,I4) = C4(I,I4) + C5(I,I5)
      C4(4,I4) = C4(4,I4) + C5(I,I5)
      C3(I,I3) = C3(I,I3) + C5(I,I5)
      C3(4,I3) = C3(4,I3) + C5(I,I5)
      C2(I,I2) = C2(I,I2) + C5(I,I5)
      C2(4,I2) = C2(4,I2) + C5(I,I5)
   20 CONTINUE
      GO TO 24
   22 CONTINUE
      C4(4,I4) = C4(4,I4) + C4(I,I4)
      C3(I,I3) = C3(I,I3) + C4(I,I4)
      C3(4,I3) = C3(4,I3) + C4(I,I4)
      C2(I,I2) = C2(I,I2) + C4(I,I4)
      C2(4,I2) = C2(4,I2) + C4(I,I4)
   24 CONTINUE
      GO TO 28
   26 CONTINUE
      C3(4,I3) = C3(4,I3) + C3(I,I3)
      C2(I,I2) = C2(I,I2) + C3(I,I3)
      C2(4,I2) = C2(4,I2) + C3(I,I3)
   28 CONTINUE
      GO TO 32
   30 CONTINUE
      C2(4,I2) = C2(4,I2) + C2(I,I2)
   32  CONTINUE
      IF (I.EQ.2.AND.I2.LE.IAR2(1)) MHS(I2) = C2(2,I2) / ALB(I2)
     1 / FACE(2,I2) / FAD(2,I2) / OTPP(I2) / (1. + COS(I2))
      IF (I.EQ.2.AND.I2.LE.IAR2(1)) MMHS = MMHS + MHS(I2)
      IF (I.EQ.1) C2C(I,I2) = CONTE(I2) * C2(I,I2) / 100.
      IF (I.EQ.2) C2C(I,I2) = CONTL(I2) * C2(I,I2)  / 100.
      IF (I.EQ.3) C2C(I,I2)    =    CONTM(I2) * C2(I,I2) / 100.
      C2C(4,I2)    =    C2C(4,I2) + C2C(I,I2)
      C2T(I,I2)    =    C2(I,I2) + C2C(I,I2)
      C2T(4,I2)    =    C2T(4,I2) + C2T(I,I2)
      IF (I.EQ.1.AND.I2.LE.IAR2(1)) SFMC = SFMC + C2(1,I2)
      IF (I.EQ.2.AND.I2.LE.IAR2(1)) SSLC = SSLC + C2(2,I2)
      IF (I.EQ.3.AND.I2.LE.IAR2(1)) SSMC = SSMC + C2(3,I2)
   36 CONTINUE
   38 CONTINUE
      IX = IAR2(1)
      DO 34 I2 = 1,IX
      SCONT        =    SCONT + C2C(4,I2)
      STDC         =    STDC + C2T(4,I2)
   34 CONTINUE
      I = IAR2(1) + 1
      DO 35 I2 = I,N2
      TIC = TIC + C2(4,I2)
      TICT = TICT + C2T(4,I2)
      SCONT = SCONT + C2C(4,I2)
   35 CONTINUE
      TDA = STDC + TICT
      RETURN
      END
      SUBROUTINE DELIN(R,C,G,YS,YE,CI,M,IAC)
C
C |==================================================================|
C |
C |                 THIS SUBPROGRAM EVALUATES THE INTEREST AND       |
C |                 ESCALATION INTEREST DURING CONSTRUCTION          |
```

```
C |
C |   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   |
C |                                                                       |
C |              BY R. C. DELOZIER              DATE: JULY 21,1975        |
C |                 --------------                    ------------        |
C |                                                                       |
C |              MODIFIED BY : C. R. HUDSON          OCTOBER 1977         |
C |                                                                       |
C |=======================================================================|
      DIMENSION R(50),C(50),G(12,50)
      DY       =   YE-YS
   CA= (M-1)/(YE-YS)
   CX = 1./CA
      CI       =    0.
      DC       =    0.
      DO 4 I   =    2,M
C  R1 ADJUSTS INTEREST RATE TO REFLECT FREQ. OF COMPOUNDING
   R1 = R(I)
   IF(IAC.EQ.1) R1 = CA* ((1.+R(I))**CX - 1.)
      FAC         =       R1*(G(1,I)-G(1,I-1))*DY
      CI          =    CI+(C(I)+DC)*FAC
      IF (IAC.EQ.1) DC    =    CI
   C(I) = C(I) + CI
 4    CONTINUE
      RETURN
   END
   SUBROUTINE OUTPUT(IOP,IWANT,ESCLD)
C |=======================================================================|
C |                                                                       |
C |    ROUTINE TO GENERATE OUTPUT REPORTS                                 |
C |                                                                       |
C |   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   |
C |                                                                       |
C |                                                                       |
C |    BY :                                                               |
C |         R.C.DELOZIER                                                  |
C |         R. J. BARNARD                                                 |
C |                                                                       |
C |        MODIFIED BY :  C. R. HUDSON       SEPTEMBER 1977               |
C |                       ENGINEERING TECHNOLOGY DIVISION                 |
C |                       OAK RIDGE NATIONAL LABORATORY                   |
C |                                                                       |
C |=======================================================================|
C
   REAL * 8 TYPE(2),TYPE1(2),LOCIN(4)
   REAL * 8 SIMP/'SIMPLE'/,COMP/'COMPOUND'/,TINT
   REAL*8 AC2, AC3, AC4, AC5, CITY, DATE, LOC
   REAL*4 AL(12)/12*'A   '/,BL(12)/12*' B  '/
   DIMENSION IC2R(12),FMHS(7),XC2(4,12),NX(12)
   COMMON /MOUT/DIDCI,ESCI
   COMMON /HDMAIN/ ISTSIG
   COMMON / FORM /
  1 TYPE,  TYPE1,  LOCIN,  AC2(8,12),  AC3(8,60),  AC4(8,180),
  1 AC5(8,320),  DATE,                        D(3,380),  TITLE(20),
  1 IAR1,  IAR2(5),  IAR3(15),  IAR4(60),  IAR5(180),  IST,  IGO,
  1 NIN,  NOUT,  ID1,  ID2,  ID3,  ICON,  COMO,  LAMA,  ISDJ(3)
   COMMON / PROG /
  1 LOC(3),  CITY(25),  CFCA(12,50),  YRSSS,  YRPER,  YRCOP,  IMM,
  1 MWE,  IBS
   COMMON / OUT /
  1 BWE,  C2(4,12),  C3(4,60),  C4(4,180),  C5(4,400),  C2C(4,12),
  1 C2T(4,12),  ESCL,  SFMC,  SSMC,  SSLC,  SCONT,  STDC,  TIC,
  1 TDA,  MHS(7),  MMHS,  IAC,  IPG,  N2
   COMMON / NAML /
  1 AEB(12),  ALB(12),  AMB(12),  AFC(12,50) ,  ALS(12,50),
  1 AMS(12,50),  BFC(12,50),  BLS(12,50),  BMS(12,50),  APC(12),
```

```
 1 BPC(12),  YES(50),  AA(3,12),  COB(12),  COS(12),  CONTL(12),
 1 CONTM(12),  CONTE(12),  DEOT(12),  FACS1(12,16),  FACS2(12,16),
 1 FACS3(12,8),  RIB,  RIBA,  RINT(50),  PO,  YBC,  YFIRST,  YLAST,
 1 FILS(20),  FACE(3,12),  AMAN,  AMANB,  HW,  ISITE(20),  NUMSL,
 1 OTP(12),  OTPP(12),  OVERS(12),  MHT,  MHP(12),  HWI(12)
  COMMON /TBLPRT/ ISET
  INTEGER COMO
  IRND(X) = X*1.E-3 + .5
  IF (IAC.EQ.0) TINT = SIMP
  IF (IAC.EQ.1) TINT = COMP
  IR = IAR2(1)
  DO 4 I=1,IR
4 NX(I) = 19 + I
  IR = IAR2(2)
  DO 5 I=1,IR
  IX = IAR2(1) + I
5 NX(IX) = 90 + I
  DO 10 I = 1,12
  DO 8 J = 1,4
  XC2(J,I) = C2(J,I) / 1000.
8 CONTINUE
  IC2R(I) = XC2(4,I) + .5
10 CONTINUE
  IF (ISTSIG.GT.0) GO TO 16
  IF (ISITE(2).GT.0) WRITE(NOUT,500)ISITE,FILS
  WRITE(NOUT,502)YFIRST,YLAST
  WRITE(NOUT,504) (NX(I),I=1,N2)
  WRITE(NOUT,506) (AL(I),BL(I),I=1,N2)
  DO 14 K=1,IMM
  WRITE(NOUT,508) YES(K)
  WRITE(NOUT,510)(AFC(J,K),BFC(J,K),J=1,N2)
  WRITE(NOUT,512)(ALS(J,K),BLS(J,K),J=1,N2)
  WRITE(NOUT,514)(AMS(J,K),BMS(J,K),J=1,N2)
  IF (IBS.EQ.0) GO TO 16
  IF (ISET.EQ.0) GO TO 16
14 CONTINUE
16 CONTINUE
  CALL HEADS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
 1 NOUT,IFG)
  WRITE(NOUT,516)
  WRITE(NOUT,518)
  N21          =   IAR2(1)
  N22          =   IAR2(2)
  ISTDCS = 0
  DO 18 I2   =    1,N21
  FMHS(I2) = MHS(I2)
   IF (FMHS(I2).GT.0.) FMHS(I2) = FMHS(I2) / 1000.
  ISTDCS = ISTDCS + IC2R(I2)
  WRITE(NOUT,522)(AC2(J,I2),J=1,8),IC2R  (I2),XC2(1,I2),FMHS(I2),
 1XC2(2,I2),XC2(3,I2)
18 CONTINUE
  WRITE(NOUT,524)
  FMMHS = MMHS
  FMMHS      = FMMHS      / 1000.
  TFMC = SFMC / 1000.
  TSLC = SSLC / 1000.
  TSMC = SSMC / 1000.
  WRITE(NOUT,526)ISTDCS, TFMC,FMMHS, TSLC, TSMC
  ISCONT = IRND(SCONT)
  FMWE = MWE
  FMHKW =FMMHS /FMWE * 1000
  WRITE(NOUT,528) FMHKW
  I2          =    N21
  DO 20 I    =    1,N22
  I2              =    I2 + 1
  WRITE(NOUT,534)  (AC2(J,I2), J=1,8),IC2R(I2)
```

```
20 CONTINUE
   WRITE(NCUT,524)
   ITIC = IRND(TIC)
   WRITE(NOUT,530)ITIC
   ITPCSC = ISTDCS + ITIC
   ICKW = 1000. * FLOAT(ITPCSC)/MWE + 0.5
   WRITE(NCUT,531) ICKW,ITPCSC
   WRITE(NOUT,532) ISCONT
   WRITE(NOUT,536)
   ITPCSC = ITPCSC + ISCONT
   ICSW = 1000. * FLOAT(ITPCSC) / MWE + .5
   WRITE(NCUT,538)ICSW,ITPCSC
   ITPCOP = ITPCSC
   IF (IWANT.NE.2) GO TO 24
   WRITE(NOUT,539)
   XNUMER = 0.
   XDENOM = 0.
   XN1 = 0.
   XN2 = 0.
   XN3 = 0.
   XD1 = 0.
   XD2 = 0.
   XD3 = 0.
   DO 21 I2 = 2,N2
   XNUMER = XNUMER + XC2(1,I2)*BPC(I2,1) + XC2(2,I2)*BLS(I2,1) +
  1 XC2(3,I2)*BMS(I2,1)
   XDENOM = XDENOM + XC2(4,I2)
   XN1 = XN1 + XC2(1,I2)*BPC(I2,1)
   XN2 = XN2 + XC2(2,I2)*BLS(I2,1)
   XN3 = XN3 + XC2(3,I2)*BMS(I2,1)
   XD1 = XD1 + XC2(1,I2)
   XD2 = XD2 + XC2(2,I2)
   XD3 = XD3 + XC2(3,I2)
21 CONTINUE
   PES = (XNUMER/XDENOM -1.) * 100.
   P1 = (XN1/XD1 - 1.)*100.
   P2 = (XN2/XD2 - 1.)*100.
   P3 = (XN3/XD3 - 1.)*100.
   IESCL = IRND(ESCLD)
   ITPCOP = ITPCSC + IESCL
   WRITE(NOUT,540) PES,IESCL,P1,P2,P3
   ICKW = 1000. * FLOAT(ITPCOP) / MWE + .5
   WRITE(NOUT,524)
   WRITE(NOUT,542) ICKW,ITPCOP
   WRITE(NCUT,536)
24 CONTINUE
   IDIDCI = IRND(DIDCI)
   WPITE(NOUT,544)TINT,RIBA
   IF (IWANT.NE.2) GO TO 26
   IESCI = IRND(ESCI)
   WRITE(NCUT,546)IDIDCI
   WRITE(NOUT,548)IESCI
    WRITE(NOUT,524)
26 CONTINUE
   IF(IWANT .NE. 2) IESCI = 0
   ITIDC = IDIDCI + IESCI
   INKW = 1000. * FLOAT(ITIDC) / MWE + .5
   WRITE(NOUT,550)INKW,ITIDC
   WRITE(NOUT,536)
   ITPCIT = ITPCOP + ITIDC
   ICKWT = 1000. * FLOAT(ITPCIT) / MWE + .5
   WRITE(NCUT,552) ICKWT,ITPCIT
   IF (IOF.LT.2) GO TO 62
   I2           =    0
   I3           =    0
   I4           =    0
```

```
      I5            =   0
      DO 58 J       =   1,N2
      I2            =   I2 + 1
      N3            =   IAR3(I2)
      CALL TAILS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
     1 NOUT,IPG)
      WRITE(NOUT,554)
      LIN = 0
      WRITE(NOUT,558) (AC2(LL,I2), LL=1,8)
      IF (N3.EQ.0) GO TO 50
      DO 50 K       =   1,N3
      I3            =   I3 + 1
      N4            =   IAR4(I3)
      IF (N4.EQ.0) GO TO 40
      WRITE(NOUT,560) (AC3(LL,I3), LL=1,8)
      LIN           =   LIN + 1
      DO 38 L = 1,N4
      I4            =   I4 + 1
      N5            =   IAR5(I4)
      IF (N5.EQ.0) GO TO 36
      WRITE(NOUT,562) (AC4(LL,I4), LL=1,8)
      LIN           =   LIN + 1
      DO 34 M = 1,N5
      I5            =   I5 + 1
      WRITE(NOUT,562) (AC5(LL,I5),LL=1,8), C5(1,I5), C5(2,I5),
     1C5(3,I5), C5(4,I5)
      LIN           =   LIN + 1
      IF (M.EQ.1) WRITE(NOUT,564)
   34 CONTINUE
      WRITE(NOUT,566) C4(1,I4), C4(2,I4), C4(3,I4), C4(4,I4)
      LIN           =   LIN + 1
      GO TO 37
   36 CONTINUE
      WRITE(NOUT,562) (AC4(LL,I4),LL=1,8), C4(1,I4), C4(2,I4),
     1C4(3,I4), C4(4,I4)
      LIN           =   LIN + 1
   37 IF (LIN.LT.45) GO TO 38
      CALL TAILS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
     1 NOUT,IPG)
      WRITE(NOUT,554)
      LIN=0
   38 CONTINUE
      WRITE(NOUT,566) C3(1,I3), C3(2,I3), C3(3,I3), C3(4,I3)
      LIN           =   LIN + 1
      GO TO 44
   40 CONTINUE
      WRITE(NOUT,560) (AC3(LL,I3), LL=1,8), C3(1,I3), C3(2,I3),
     1C3(3,I3), C3(4,I3)
      LIN           =   LIN + 1
      WRITE(NOUT,564)
   44 IF (LIN.LT.45) GO TO 50
      CALL TAILS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
     1 NOUT,IPG)
      WRITE(NOUT,554)
      LIN = 0
   50 CONTINUE
      WRITE(NOUT,570) C2(1,I2), C2(2,I2), C2(3,I2), C2(4,I2)
      WRITE(NOUT,572) CONTE(I2),CONTL(I2),CONTM(I2),C2C(1,I2),C2C(2,I2),
     1C2C(3,I2), C2C(4,I2)
      WRITE(NOUT,576)
      WRITE(NOUT,582) AC2(1,I2), C2T(1,I2), C2T(2,I2), C2T(3,I2),
     1C2T(4,I2)
   58 CONTINUE
   62  RETURN
  500 FORMAT('0    OPTIONAL COMBINED COSTS BY CITY AND WEIGHTING FACTORS'
     1/'0    CITY ',20(2X,I4)/'+',T10,20(2X,4('_'))/'0 FACTOR ',20F6.2/
```

```
     1'+',T10,20(2X,4('_'))/)
  502 FORMAT('OSITE RATE AND ESCALATION USED IN COST PROJECTIONS',10X
     1 'YFIRST = ', F7.2, '    YLAST = ',F7.2/)
  504 FORMAT('0',[illegible]'  ACCT ',2X,I2,1X))
  506 FORMAT(' ',11(3X,A4,1X,A4))
  508 FORMAT(' ',10('* '),5X,F8.3,5X,10('* '))
  510 FORMAT(' E',10(F5.1,1X,F5.3,1X),F5.1,1X,F5.3)
  512 FORMAT(' L',10(F5.2,1X,F5.3,1X),F5.2,1X,F5.3)
  514 FORMAT(' M',F5.0,1X,F5.3,1X,9(F5.2,1X,F5.3,1X),F5.2,1X,F5.3)
  516 FORMAT('0ACCOUNT',T67,'TOTAL',T90,'EQUIPMENT       LABOR        MATE
     1RIAL')
  518 FORMAT(' NUMBER',T19,'A C C O U N T   T I T L E',T67,'COSTS',T92,'
     1COSTS  MANHOURS  COSTS    COSTS'/'+',62('_'),2X,08('_'),T90,36('_'
     1))
  522 FORMAT('0',8A8,I8,T89,F9.3,1X,'(',F7.3,')',F8.3,F8.3)
  524 FORMAT('+',T66,8('_'))
  526 FORMAT('+',T90,36('_'),/'0',T56,'SUBTOTAL ',
     1T66      ,I8,T89,F9.3,1X,'(',F7.3,')',F8.3,F8.3)
  528 FORMAT('0',T97,F10.3,'  MANHOURS/KW')
  530 FORMAT('0',T56,'SUBTOTAL',T65      ,'  ',I7)
  531 FORMAT('0',T10,'DIRECT & INDIRECT COSTS',T52,'($',I6,'/KW)',T66,
     1 I8)
  532 FORMAT('0',T10,'CONTINGENCY ALLOWANCE',T66,I8)
  534 FORMAT('0',8A8,1X,I7)
  536 FORMAT(T66,8('='))
  538 FORMAT('0',8X,'TOTAL DIRECT & INDIRECT COSTS',T52,'($',I6,'/KW)',
     1T66,I8)
  539 FORMAT('+',T90,'WEIGHTED AVERAGE ESCALATION (%/YR)',/
     1 ' ',T90,'EQUIPMENT       LABOR        MATERIAL')
  540 FORMAT(' ',8X,'ESCALATION DURING CONSTRUCTION ',T52,'(',F6.3,
     1 '%/YR)', T65,' ',I8,T90,F6.3,8X,F6.3,7X,F6.3)
  542 FORMAT('0',T10,'TOTAL ESCALATED DIRECT & INDIRECT COSTS',T52,
     1'($',I6,'/KW)',T66,I8)
  544 FORMAT('0',8X,'INTEREST DURING CONSTRUCTION',T39,A8,T52,
     1'(',F6.3,'%/YR)')
  546 FORMAT('0',10X,'ON DIRECT & INDIRECT COSTS',T66,I8)
  548 FORMAT('0',10X,'ON ESCALATION DURING CONSTRUCTION',T66,I8)
  550 FORMAT('0',8X,'TOTAL INTEREST DURING CONSTRUCTION',T52,
     1'($',I6,'/KW)',T66,I8)
  552 FORMAT('0',8X,'TOTAL PLANT CAPITAL INVESTMENT',T52,
     1'($',I6,'/KW)',T66,I8)
  554 FORMAT(
     1 '0ACCOUNT',T70,'FACTORY',T87,'SITE',T101,'SITE'/' NUMBER',T13,
     1 'ACCOUNT TITLE',T70,'EQUIPMENT',T87,'LABOR',T101,'MATERIALS',
     1 T120,'TOTAL'/'+',8('_'),2X,55('_'),3X,9('_'),8X,5('_'),9X,
     1 9('_'),10X,5('_'))
  558 FORMAT(' ',A8,2X,7A8,/)
  560 FORMAT(' ',A8,2X,7A8,2X,4(F8.0,8X))
  562 FORMAT(' ',A8,2X,7A8,2X,4(F8.0,8X))
  564 FORMAT('+',T69,3('$',15X))
  566 FORMAT('+',T70,4(9('_'),7X)/T20,'SUBTOTAL',20('. '),1X,4('$',F8.0,
     1 7X))
  570 FORMAT(' ',124('_'),/T20,'SUBTOTAL FOR ACCOUNT',14('. '),  1X,
     1      4('$',F8.0,7X))
  572 FORMAT(T20,'CONTINGENCY (',F4.1,'%EQP-',F4.1,'%LABOR-',F4.1,'%MTL)
     1',3('. '),2X,3(F8.0,8X),F8.0)
  576 FORMAT('+',T70,4(8('_'),8X))
  582 FORMAT('+',T70,4( 8('_'),8X),/T20,'TOTAL FOR ACCOUNT ',A8,11('. ')
     1,1X,4('$',F8.0,7X),/'+',T70,4(9('_'),7X),/T70,4(9('-'),7X))
      END
      SUBROUTINE HEADS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
     1 NOUT,IPG)
C
C |==================================================================|
C |                                                                  |
C |                BY R. J. BARNARD     OCT 1974                     |
```

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C |                ------------       ---------                        |
C |                                                                    |
C |   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    |
C |                                                                    |
C |        SUBPROGRAM HEADS PREPARES THE HEADING LINES FOR ALL OF THE  |
C |        SUMMARY PAGE OUTPUT OF CONCEPT.                             |
C |                                                                    |
C |====================================================================|
C
      REAL*8 TYPE(2),LOC(3),DATE
      REAL*8 NUT(9)/'UNIT 1  ','UNIT 2  ','UNIT 3  ','UNIT 4  ','UNIT 5
     1 ','UNIT 6  ','UNIT 7  ','UNIT 8  ','UNIT 9  '/,ALL/'TOTAL   '/,
     1ISTOUT
      REAL * 4 SCE(9),EDC(9)
      DATA SCE/
     1'YEAR',' OF ','STEA','M SU','PPLY',' SYS','TEM ','PURC','HASE'/
      DATA EDC/
     1'YEAR',' OF ','COMM','ERCI','AL O','PERA','TION','    ','    '/
      COMMON/HDMAIN/ ISTSIG
      ISTOUT = NUT(IST)
      IF (IST.LT.1) ISTOUT = NUT (1)
       IF (ISTSIG.GT.0) ISTOUT = ALL
      IPG = IPG + 1
      WRITE(NOUT,500) DATE,IPG
      WRITE(NOUT,502) ISTOUT
      WRITE(NOUT,504) MWE,TYPE(1),TYPE(2),(LOC(II),II=1,3)
      IF (IWANT.EQ.1) GO TO 2
      WRITE(NOUT,506) SCE
      GO TO 4
    2 WRITE(NOUT,506) EDC
    4 CONTINUE
      WRITE(NOUT,512) YRSSS
      WRITE(NOUT,514) YRPER
      WRITE(NOUT,516) YRCOP
      RETURN
  500 FORMAT('1    DATE ',A8,'    C O N C E P T    C O S T    E S T I M A T
     1 E S   (PHASE 5)',T125,'PAGE ',I3)
  502 FORMAT('      ',A8,     '  CAPITAL INVESTMENT SUMMARY (MILLIONS OF
     1DOLLARS) ')
  504 FORMAT(5X,I5,' MWE  ',A8,1X,'(',A8,')',1X,'POWER PLANT AT ',3A8)
  506 FORMAT(5X,'COST BASIS:',7X,9A4)
  512 FORMAT(5X,'DESIGN & CONSTRUCTION PERIOD:',T40,'STEAM SUPPLY SYSTEM
     1 PURCHASE: ',T71,F8.3)
  514 FORMAT(' ',T40, 'CONSTRUCTION PERMIT:',T71,F8.3)
  516 FORMAT(' ',T40, 'COMMERCIAL OPERATION:',T71,F8.3)
      END
      SUBROUTINE TAILS(DATE,IST,MWE,TYPE,LOC,YRSSS,YRPER,YRCOP,IWANT,
     1 NOUT,IPG)
C
C |====================================================================|
C |                                                                    |
C |                  BY R. J. BARNARD     SEPT 1974                    |
C |                ------------       ---------                        |
C |                                                                    |
C |   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    |
C |                                                                    |
C |        SUBPROGRAM TAILS PREPARES THE HEADINGS FOR THE DETAILED     |
C |        ACCOUNT OUTPUT OF CONCEPT PROGRAM.                          |
C |                                                                    |
C |====================================================================|
C
      REAL*8 TYPE(2),LOC(3),DATE
      REAL*8 NUT(9)/'UNIT 1  ','UNIT 2  ','UNIT 3  ','UNIT 4  ','UNIT 5
     1 ','UNIT 6  ','UNIT 7  ','UNIT 8  ','UNIT 9  '/,ALL/'TOTAL   '/,
     1ISTOUT
      REAL * 4 SCE(9),EDC(9)
```

```
      DATA SCE/
     1'YEAR',' OF ','STEA','M SU','PPLY',' SYS','TEM ','PURC','HASE'/
      DATA EDC/
     1'YEAR',' OF ','COMM','ERCI','AL O','PERA','TION','    ','    '/
      COMMON/HDMAIN/ ISTSIG
      ISTOUT = NOT(IST)
      IF (IST.LT.1) ISTOUT = NOT (1)
       IF (ISTSIG.GT.0) ISTOUT = ALL
      IPG = IPG + 1
      WRITE(NOUT,500)DATE,IPG
      WRITE(NOUT,502)ISTOUT,YRSSS
      WRITE(NOUT,504)MWE,TYPE(1),TYPE(2),(LOC(I),I=1,3),YRPER
      IF (IWANT.EQ.1) GO TO 2
      WRITE(NOUT,506)SCE,YRCOP
      GO TO 4
    2 WRITE(NOUT,506) EDC,YRCOP
    4 RETURN
  500 FORMAT('1DATE ',A8,'  C O N C E P T   C O S T   E S T I M A T E S
     1 (PHASE 5)  ',T122,'PAGE ',       I4)
  502 FORMAT(' ',A8,       '  CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS O
     1F DOLLARS)',T82,'STEAM SUPPLY SYSTEM PURCHASE:',T113,F8.3)
  504 FORMAT(' ',I5,' MWE ',A8,'(',A8,')  POWER PLANT AT: ',3A8,
     1T82,'CONSTRUCTION PERMIT:',T113,F8.3)
  506 FORMAT(' COST BASIS: ',9A4,T82,'COMMERCIAL OPERATION:',T113,F8.3)
      END
      SUBROUTINE PLOT (XFYR, XLYR, SOST, IMM)
C
C  |============================================================|
C  |                                                            |
C  |   GENERATE PRINTER PLOT OF PROJECT CASH FLOW               |
C  |   *******      DAVID BERNSTEIN *********** 05/20/72 ********** |
C  |                                                            |
C  |============================================================|
C
      LOGICAL*1 IVERT(52)/' ',' ','C','A','P','I','T','A','L',' ','C',
     1 'O','S','T',' ','(','M','I','L','L','I','O','N','S',' ','O','F',
     1 ' ','D','O','L','L','A','R','S',')',16*' '/
      DIMENSION COST(100), IOUT(101), YR(5), SOST(IMM)
      NOUT        =   6
      DATA ISTAR/'*'/
C
C  |============================================================|
C  |                                                            |
C  |   FIND X (YEAR) AXIS DIVISIONS.                            |
C  |                                                            |
C  |============================================================|
C
      TST              =    2.0
      DIF              =    XLYR - XFYR
      FF1              =    100.0
      FF2              =    IMM
      DFF              =    FF2 / FF1
      DII              =    1.0
      II               =    1
      III              =    2
      DO 2 I           =    1,100
      COST(I)          =    (SOST(II) + (DII - II) * (SOST(III) - SOST(II)))
     1 /1000.0
      DII              =    DII + DFF
      II               =    DII
      IF (II.GT.IMM) II = IMM
      IF (III+1.LE.IMM) III = II + 1
    2 CONTINUE
    4 IF (TST.GT.DIF) GO TO 6
      TST              =    2.0 + TST
      GO TO 4
```

```
C
C |==================================================================|
C |                                                                  |
C |   FIND Y (COST) AXIS DIVISIONS.                                  |
C |                                                                  |
C |==================================================================|
C
    6 ICST= (COST(100)+100.0)/100
      XCST = ICST
                      N50 = ((XCST + 50.) / 50.)
      I50 = (N50 + 1) * 50
      IF (ICST.LT.1) ICST = 1
      IMULT = 1
      ISPACE = (IMULT * I50) / (ICST * 2)
      IF (ISPACE .LT. 1) ISPACE = 1
      IDIVS = (IMULT * I50) / ISPACE
      IXTRA = 50-ISPACE*IDIVS
      CST=ICST*100.0
      RANGE = I50 * IMULT
      DIV = RANGE / ISPACE
    8 IYEAR       =    IFYR
      YRDIF = IFYR - IYEAR
      YR(1) = IYEAR
      DO 10 I=2,5
   10 YR(I)       =    YR(I-1) + TST / 4.0
C
C |==================================================================|
C |                                                                  |
C |   WRITE TOP LEGEND.                                              |
C |                                                                  |
C |==================================================================|
C
      WRITE(NOUT,500) (YR(N), N=1,5)
      WRITE(NOUT,502)
C
C |==================================================================|
C |                                                                  |
C |  CALCULATIONS TO FIND START OF SHADED AREA.                      |
C |                                                                  |
C |==================================================================|
C
      LSTCOL      =    (DIF / TST) * 100.0 + (YRDIF/TST) * 100.0
      IF (LSTCOL.GT.101) LSTCOL = 101
C
C |==================================================================|
C |                                                                  |
C |  BLANK OUTPUT ARRAY.                                             |
C |                                                                  |
C |==================================================================|
C
      DO 12 I     =    1,101
   12 IOUT(I)     =    0
      NUM         =    CST
      IF (IXTRA.EQ.0) GO TO 16
      DO 14 M=1,IXTRA
   14 WRITE(NOUT,504)
   16 WRITE(NOUT,506) NUM, NUM
```

```
C
C |================================================================|
C |                                                                |
C |  PRINT GRAPH WITH VERTICAL MARGINS.                            |
C |                                                                |
C |================================================================|
C
      DO 32 I      =   1,IDIVS
      DO 30 J      =   1,ISPACE
      KK           =    ((I-1) * ISPACE) + J
      ID = J - 1
      PRCOST = NUM - ID * DIV
      DPRC = PRCOST - DIV
      IF (COST(100).LT.DPRC) GO TO 28
      DO 18 K      =    1,100
      IM           =   K
      IF (COST(IM).LE.PRCOST.AND.COST(IM).GE.DPRC) GO TO 20
   18 CONTINUE
      GO TO 26
   20 X            =    IM
      IFRCOL = ((((X /100.0) * DIF) + YRDIF) / TST) * 100.0
      IF (IFRCOL.GT.101) IFRCOL = 101
   22 DO 24 LL = IFRCOL, LSTCOL
   24 IOUT(LL)      =    ISTAR
   26 CONTINUE
      IF (J.EQ.ISPACE) GO TO 30
      WRITE(NOUT,508) IVERT(KK), (IOUT(JP), JP=1,101), IVERT(KK)
      GO TO 30
   28 WRITE(NOUT,504) IVERT(KK), IVERT(KK)
   30 CONTINUE
      NUM = CST - I * (I50 * IMULT)
       IF (NUM.LT.0) GO TO 32
      WRITE(NOUT,510) IVERT(I*ISPACE), NUM, (IOUT(JP),JP=1,101), NUM,
     1IVERT(I*ISPACE)
       IF (NUM.LE.0) GO TO 34
   32 CONTINUE
   34  CONTINUE
C
C |================================================================|
C |                                                                |
C |  PRINT BOTTOM SCALES.                                          |
C |                                                                |
C |================================================================|
C
      WRITE(NOUT,502)
      WRITE(NOUT,500) (YR(N), N=1,5)
      RETURN
  500 FORMAT('0',11X,4(F6.1,19X),F6.1)
  502 FORMAT (' ',16X,4('+........................'),'+')
  504 FORMAT (' ',2X,A1,11X,'- ',101X,'-',10X,A1)
  506 FORMAT (' ',6X,I6,3X,'+',102X,'+',I6)
  508 FORMAT (' ',2X,A1,11X,'- ',101A1,'-',10X,A1)
  510 FORMAT (' ',2X,A1,3X,I6,3X,'+',101A1,' +',I6,3X,A1)
      END
```

Appendix D

EXAMPLE PROBLEMS LISTING

```
1100 CBIGSMET CLEVELAND         EXAMPLE5 197900 198300 198700  8500 0 1 1 0 0 1 1
 &COMOPT SMAX=8.0, D(3,1)=1500.,
 &END
1100 PWR1MET  ATLANTA           EXAMPLE6 197850 198250 198850  9000 0 0 0 1 1 1 2


     1.085     1.085     1.085     1.085     1.085     1.085     1.085
     1.085     1.085     1.085     1.085


                                                                        1978.5
                                                                           -1.
1100 PWR2MET  ATLANTA           EXAMPLE6 197850 198450 199050  9000 0 0 0 1 2 1
1200 CBIGSMET MIDDLETOWN        EXAMPLE7 197900 198300 198700  8350 0 2 2 0 1 0 1
 &COMOPT CONTE=0.,10*15.,CONTE=0.,10*15.,CONTM=0.,10*15.,
 &END
     1.06      1.06      1.06      1.06      1.06      1.06      1.06
     1.06      1.06      1.06      1.06
     1.08      1.08      1.08      1.08      1.08      1.08      1.08
     1.08      1.08      1.08      1.08
     1.08      1.08      1.08      1.08      1.08      1.08      1.08
     1.08      1.08      1.08      1.08                                 1978.0
                                                                           -1.
```

CONCEPT PHASE 5 DATA SETS

POWER PLANT TYPE CODES

1	PWRMET	05-02-78
2	PWR1MET	03-21-78
3	PWR2MET	03-31-78
4	BWRMET	05-16-78
5	BWR1MET	04-05-78
6	BWR2MET	04-05-78
7	CBIGSMET	05-16-78
8	CBIG1SMT	04-10-78
9	CBIG2SMT	04-10-78
10	COALMET	05-19-78
11	COAL1MET	04-11-78
12	COAL2MET	04-11-78
13	COAL3MET	04-12-79
14	COALSMET	04-25-78
15	COAL1SMT	04-14-78
16	COAL2SMT	04-14-78
17	COAL3SMT	04-14-78
18	CBIGMET	04-24-78
19	CBIG1MET	04-13-78
20	CBIG2MET	04-13-78

CITY NAME CODES

1	ATLANTA	GEORGIA
2	BALTIMORE	MARYLAND
3	BIRMINGHAM	ALABAMA
4	BOSTON	MASSACHUSETTS
5	CHICAGO	ILLINOIS
6	CINCINNATI	OHIO
7	CLEVELAND	OHIO
8	DALLAS	TEXAS
9	DENVER	COLORADO
10	DETROIT	MICHIGAN
11	KANSAS CITY	KANSAS
12	LOS ANGELES	CALIFORNIA
13	MINNEAPOLIS	MINNESOTA
14	NEW ORLEANS	LOUISIANA
15	NEW YORK	NEW YORK
16	PHILADELPHIA	PENNSYLVANIA
17	PITTSBURGH	PENNSYLVANIA
18	ST. LOUIS	MISSOURI
19	SAN FRANCISCO	CALIFORNIA
20	SEATTLE	WASHINGTON
21	MONTREAL	CANADA
22	TORONTO	CANADA
23	MIDDLETOWN	USA

IF THE PLANT TYPE OR CITY SELECTED WAS NOT USED IN COMPUTATIONS, CHECK SPELLING AND FIELD JUSTIFICATION WITH THE AVAILABLE PLANT TYPE AND CITY NAME CODES

D A T A   C A R D   C O L U M N S   U S E D

```
1--4  6-----13 15------------30 32----39 41----47 48----54 55----61 62--66   68    70    72   74   76   78    80
MWE   MODEL         CITY         EXTRA ID YR SSS   YR PER   YR COP   % INT  ILAZ IFLAG  IOF IESC  IBS  IAC  ISTACK

1100  CBIGSMET CLEVELAND         EXAMPLE3 1979.000 1983.000 1987.000 8.500    0     1     1    0    0    1     1
 &CONOPT AMAN=8.0, D(3,1)=1500.,
 &END
```

```
DATE 11-10-78   C O N C E P T   C O S T   E S T I M A T E S  (PHASE 5)
UNIT 1    CAPITAL INVESTMENT SUMMARY (MILLIONS OF DOLLARS)
 1100 MWE  CBIGSMET (         ) POWER PLANT AT CLEVELAND          EXAMPLE3
COST BASIS:        YEAR OF STEAM SUPPLY SYSTEM PURCHASE
DESIGN & CONSTRUCTION PERIOD:       STEAM SUPPLY SYSTEM PURCHASE:  1979.000
                                    CONSTRUCTION PERMIT:           1983.000
                                    COMMERCIAL OPERATION:          1987.000
```

CONIV CALLED - DATA FIT DONE ON OHIO   CLEVELAND

SITE RATE AND ESCALATION USED IN COST PROJECTIONS   YFIRST = 1964.00   YLAST = 1978.50

	ACCT 20 A	B	ACCT 21 A	B	ACCT 22 A	B	ACCT 23 A	B	ACCT 24 A	B	ACCT 25 A	B	ACCT 26 A	B	ACCT 91 A	B	ACCT 92 A	B	ACCT 93 A	B	ACCT 94 A	B
	* * * * * * * * * * *				1979.000		* * * * * * * * * * *															
E	218.6	1.067	218.6	1.067	218.6	1.067	218.6	1.067	218.6	1.067	218.6	1.067	218.6	1.067	218.6	1.067	206.4	1.061	206.4	1.061	206.4	1.061
L	15.40	1.086	15.40	1.086	16.29	1.088	16.17	1.089	16.02	1.087	16.14	1.089	15.67	1.088	15.25	1.086	16.58	1.087	16.58	1.087	16.58	1.087
M	1000.	1.000	23.76	1.080	23.76	1.080	23.76	1.080	23.76	1.080	23.76	1.080	23.76	1.080	23.76	1.080	23.76	1.080	23.76	1.080	23.76	1.080

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT SUMMARY (MILLIONS OF DOLLARS)
1100 MWE CBIGSMRT (05-16-78) POWER PLANT AT CLEVELAND EXAMPLE)
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE
DESIGN & CONSTRUCTION PERIOD: STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

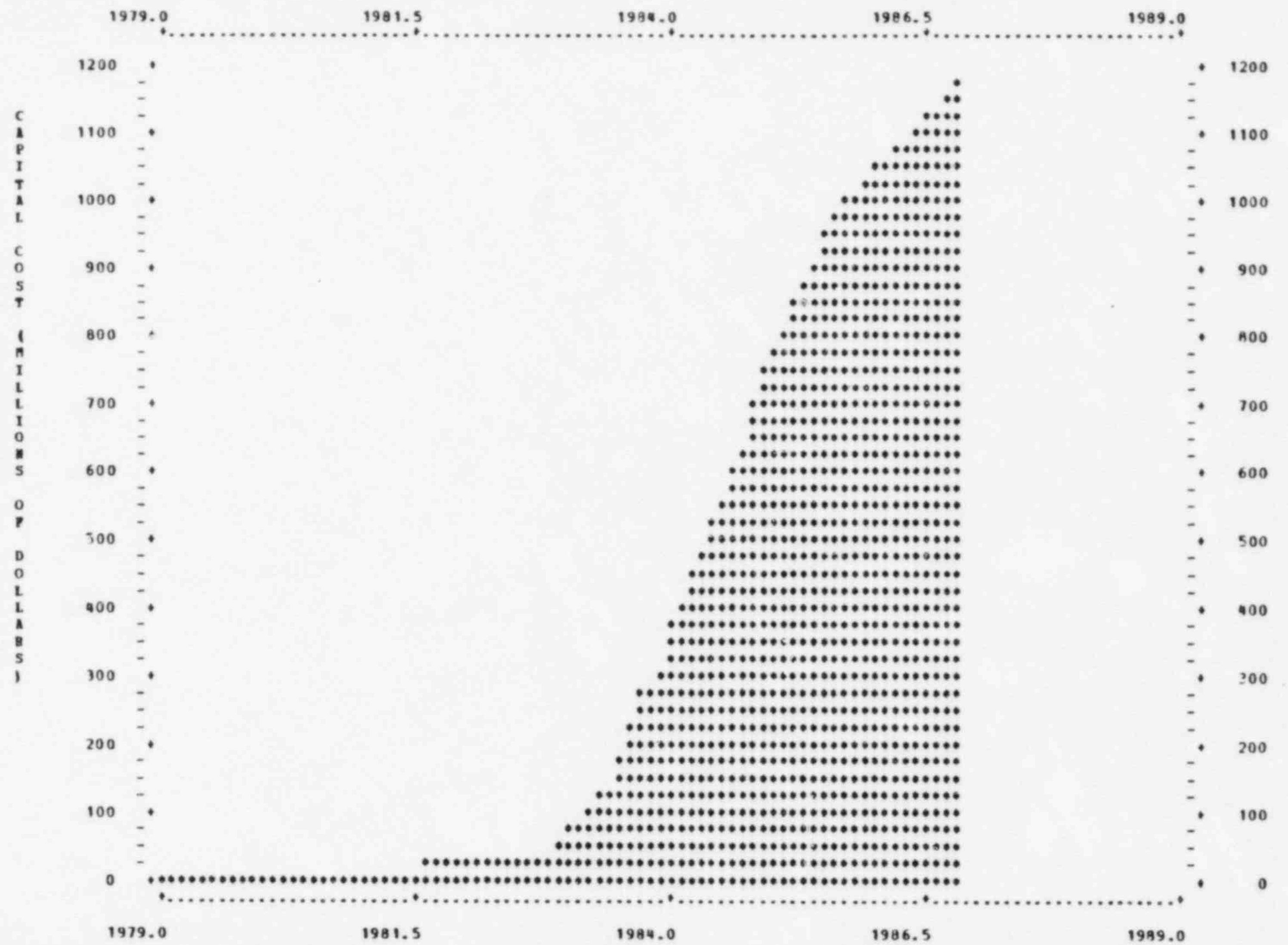
ACCOUNT NUMBER	ACCOUNT TITLE		TOTAL COSTS	EQUIPMENT COSTS	LABOR MANHOURS	LABOR COSTS	MATERIAL COSTS
20 .	LAND AND LAND RIGHTS		2	0.0	(0.0)	0.0	1.500
21 .	STRUCTURES + IMPROVEMENTS		57	2.943	(1.474)	22.706	31.106
22 .	BOILER PLANT EQUIPMENT		196	117.644	(3.656)	59.560	18.388
23 .	TURBINE PLANT EQUIPMENT		126	90.290	(1.880)	30.404	5.776
24 .	ELECTRIC PLANT EQUIPMENT		41	10.557	(1.261)	20.201	10.648
25 .	MISCELLANEOUS PLANT EQUIPT		12	6.736	(0.262)	4.242	0.937
26 .	MAIN COND HEAT REJECT SYS		18	13.092	(0.265)	4.156	1.192
		SUBTOTAL	452	241.260	(8.798)	141.268	69.548
					7.998 MANHOURS/KW		
91 .	CONSTRUCTION SERVICES		57				
92 .	HOME OFFICE ENGRG.&SERVICE		21				
93 .	FIELD OFFICE ENGRG&SERVICE		15				
94 .	OWNER'S COSTS		40				
		SUBTOTAL	134				
	DIRECT & INDIRECT COSTS	($ 533/KW)	586				
	CONTINGENCY ALLOWANCE		58				
	TOTAL DIRECT & INDIRECT COSTS	($ 585/KW)	644				
	ESCALATION DURING CONSTRUCTION	(7.435%/YR)	297				
	TOTAL ESCALATED DIRECT & INDIRECT COSTS	($ 855/KW)	941				
	INTEREST DURING CONSTRUCTION COMPOUND	(9.500%/YR)					
	ON DIRECT & INDIRECT COSTS		166				
	ON ESCALATION DURING CONSTRUCTION		69				
	TOTAL INTEREST DURING CONSTRUCTION	($ 214/KW)	235				
	TOTAL PLANT CAPITAL INVESTMENT	($ 1069/KW)	1176				

WEIGHTED AVERAGE ESCALATION (%/YR)

EQUIPMENT	LABOR	MATERIAL
6.542	8.735	8.014

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1100 MWE CBIGSMET(05-16-78)   POWER PLANT AT: CLEVELAND   EXAMPLE3
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000



DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1100 MWE CBIGSMET(05-16-78) POWER PLANT AT: CLEVELAND   EXAMPLE3
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

C U M U L A T I V E   C A S H   F L O W

BOTH THE CASH FLOW CURVE SHOWN ABOVE AND THE FOLLOWING CASH FLOW TABLE
HAVE COSTS EXPRESSED AS TOTAL COST INCURRED TO DATE (INCLUDING INTEREST CHARGES TO DATE).

DATE	COST TO DATE (MILLIONS OF DOLLARS)
1979.000	0.0
1979.160	0.0
1979.320	0.0
1979.480	2.138
1979.640	2.166
1979.800	2.195
1979.960	2.224
1980.120	2.253
1980.280	3.810
1980.440	3.860
1980.600	3.911
1980.760	3.963
1980.920	8.299
1981.080	8.408
1981.240	8.518
1981.400	8.630
1981.560	8.744
1981.720	29.192
1981.880	29.576
1982.040	29.964
1982.200	30.358
1982.360	30.757
1982.520	34.319
1982.680	34.770
1982.840	35.227
1983.000	63.247
1983.160	98.793
1983.320	118.239
1983.480	148.884
1983.640	212.245
1983.800	279.331
1983.960	309.833
1984.120	383.051
1984.280	456.222
1984.440	524.005
1984.600	567.189
1984.760	644.832
1984.920	722.327
1985.080	796.019
1985.240	829.688
1985.400	886.861
1985.560	954.656
1985.720	989.698
1985.880	1019.125
1986.040	1048.694
1986.200	1069.345
1986.360	1091.279
1986.520	1112.349
1986.680	1144.118
1987.000	1176.293

D A T A   C A R D   C O L U M N S   U S E D

1--4 MWE	6-----13 MODEL	15------------30 CITY	32----39 EXTRA ID	41----47 YR SSS	48----54 YR PER	55----61 YR COP	62--66 % INT	68 ILAI	70 IFLAG	72 IOF	74 IESC	76 IBS	78 IAC	80 ISTACK
1100	PWR1MET	ATLANTA	EXAMPLE6	1978.500	1982.500	1988.500	9.000	0	0	0	1	1	1	2

DATE 11-10-78   C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT SUMMARY (MILLIONS OF DOLLARS)
1100 MWE PWR1MET (   ) POWER PLANT AT ATLANTA   EXAMPLE6
COST BASIS: YEAR OF COMMERCIAL OPERATION
DESIGN & CONSTRUCTION PERIOD: STEAM SUPPLY SYSTEM PURCHASE: 1978.500
CONSTRUCTION PERMIT: 1982.500
COMMERCIAL OPERATION: 1988.500

CONIV CALLED - DATA FIT DONE ON GEORGIA   ATLANTA

INPUT CARDS TO PRODUCE TIME DEPENDENT ESCALATION RATES

1.085	1.085	1.085	1.085	1.085	1.085	1.085
1.085	1.085	1.085	1.085			

1978.5
-1.

SITE RATE AND ESCALATION USED IN COST PROJECTIONS   YFIRST = 1964.00   YLAST = 1978.50

	ACCT 20 A	B	ACCT 21 A	B	ACCT 22 A	B	ACCT 23 A	B	ACCT 24 A	B	ACCT 25 A	B	ACCT 26 A	B	ACCT 91 A	B	ACCT 92 A	B	ACCT 93 A	B	ACCT 94 A	B
* * * * * * * * * * 1978.500 * * * * * * * * * *																						
E	211.6	1.067	211.6	1.067	211.6	1.067	211.6	1.067	211.6	1.067	211.6	1.067	211.6	1.067	211.6	1.067	200.4	1.061	200.4	1.061	200.4	1.061
L	10.65	1.085	10.65	1.085	12.21	1.085	11.96	1.085	13.19	1.095	12.27	1.085	11.43	1.085	10.65	1.085	11.46	1.085	11.46	1.085	11.46	1.085
M	1000.	1.000	22.21	1.072	22.21	1.072	22.21	1.C72	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT SUMMARY (MILLIONS OF DOLLARS)
1100 MWE PWR1MET (03-21-78) POWER PLANT AT ATLANTA EXAMPLE6
COST BASIS: YEAR OF COMMERCIAL OPERATION
DESIGN & CONSTRUCTION PERIOD: STEAM SUPPLY SYSTEM PURCHASE: 1978.500
CONSTRUCTION PERMIT: 1982.500
COMMERCIAL OPERATION: 1988.500

ACCOUNT NUMBER	ACCOUNT TITLE		TOTAL COSTS	EQUIPMENT COSTS	LABOR MANHOURS	LABOR COSTS	MATERIAL COSTS
20 .	LAND + LAND RIGHTS(COMMON)		2	0.0	(0.0)	0.0	2.000
21 .	STRUCTURES + IMPROVEMENTS		159	10.267	(4.717)	83.174	65.798
22 .	REACTOR PLANT EQUIPMENT		232	171.915	(2.141)	44.501	15.678
23 .	TURBINE PLANT EQUIPMENT		189	144.156	(1.776)	36.161	8.762
24 .	ELECTRIC PLANT EQUIPMENT		68	22.828	(1.429)	31.396	14.007
25 .	MISCELLANEOUS PLANT EQUIPT		19	12.329	(0.304)	6.085	1.046
26 .	MAIN COND HEAT REJECT SYS		37	27.626	(0.373)	7.263	2.260
		SUBTOTAL	706	389.121	(10.740)	208.579	109.550
					9.764 MANHOURS/KW		
91 .	CONSTRUCTION SERVICES		97				
92 .	HOME OFFICE ENGRG.&SERVICE		74				
93 .	FIELD OFFICE ENGRG&SERVICE		47				
94 .	OWNER'S COSTS		67				
		SUBTOTAL	285				
	DIRECT & INDIRECT COSTS	($ 901/KW)	991				
	CONTINGENCY ALLOWANCE		99				
	TOTAL DIRECT & INDIRECT COSTS	($ 991/KW)	1090				
	INTEREST DURING CONSTRUCTION COMPOUND	(9.000%/YR)					
	TOTAL INTEREST DURING CONSTRUCTION	($ 402/KW)	442				
	TOTAL PLANT CAPITAL INVESTMENT	($ 1393/KW)	1532				

D A T A   C A R D   C O L U M N S   U S E D

1--4	6-----13	15------------30	32----39	41----47	48----54	55----61	62--66	68	70	72	74	76	78	80
MWE	MODEL	CITY	EXTRA ID	YR SSS	YR PER	YR COP	% INT	ILAZ	IFLAG	IOF	IESC	IPS	IAC	ISTACK
1100	PWR2MET	ATLANTA	EXAMPLE6	1978.500	1984.500	1990.500	9.000	0	0	0	1	2	1	0

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DATE 11-10-78   C O N C E P T   C O S T   E S T I M A T E S  (PHASE 5)
UNIT 2    CAPITAL INVESTMENT SUMMARY (MILLIONS OF DOLLARS)
 1100 MWE  PWR2MET  (        ) POWER PLANT AT ATLANTA         EXAMPLE6
COST BASIS:       YEAR OF COMMERCIAL OPERATION
DESIGN & CONSTRUCTION PERIOD:      STEAM SUPPLY SYSTEM PURCHASE:  1978.500
                                   CONSTRUCTION PERMIT:           1984.500
                                   COMMERCIAL OPERATION:          1990.500
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CONIV CALLED - DATA FIT DONE ON GEORGIA   ATLANTA

INPUT CARDS TO PRODUCE TIME DEPENDENT ESCALATION RATES

```
* 1.085    1.085    1.085    1.085    1.085    1.085    1.085
  1.085    1.085    1.085    1.085

                                                          1978.5
                                                            -1.
```

SITE RATE AND ESCALATION USED IN COST PROJECTIONS   YFIRST = 1964.00   YLAST = 1978.50

	ACCT A	20 B	ACCT A	21 B	ACCT A	22 B	ACCT A	23 B	ACCT A	24 B	ACCT A	25 B	ACCT A	26 B	ACCT A	91 B	ACCT A	92 B	ACCT A	93 B	ACCT A	94 B
* * * * * * * * * * *				1978.500		* * * * * * * * * * *																
E	211.6	1.067	211.6	1.067	211.6	1.067	211.6	1.067	211.6	1.067	211.6	1.067	211.6	1.067	211.6	1.067	200.4	1.061	200.4	1.061	200.4	1.061
L	10.65	1.085	10.65	1.085	12.21	1.085	11.96	1.085	13.19	1.085	12.27	1.085	11.43	1.085	10.65	1.085	11.46	1.085	11.46	1.085	11.46	1.085
M	1000.	1.000	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072	22.21	1.072

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 2 CAPITAL INVESTMENT SUMMARY (MILLIONS OF DOLLARS)
1100 MWE PWR2MET (03-31-78) POWER PLANT AT ATLANTA EXAMPLE6
COST BASIS: YEAR OF COMMERCIAL OPERATION
DESIGN & CONSTRUCTION PERIOD: STEAM SUPPLY SYSTEM PURCHASE: 1978.500
CONSTRUCTION PERMIT: 1984.500
COMMERCIAL OPERATION: 1990.500

ACCOUNT NUMBER	ACCOUNT TITLE		TOTAL COSTS	EQUIPMENT COSTS	LABOR MANHOURS	LABOR COSTS	MATERIAL COSTS
20.	LAND + LAND RIGHTS (COMMON)		0	0.0	(0.0)	0.0	0.0
21.	STRUCTURES + IMPROVEMENTS		149	9.506	(3.782)	78.146	61.145
22.	REACTOR PLANT EQUIPMENT		235	176.461	(1.800)	43.732	14.489
23.	TURBINE PLANT EQUIPMENT		213	161.418	(1.765)	42.072	9.980
24.	ELECTRIC PLANT EQUIPMENT		74	24.505	(1.320)	33.973	15.017
25.	MISCELLANEOUS PLANT EQUIPT		16	10.391	(0.207)	4.858	0.941
26.	MAIN COND HEAT REJECT SYS		40	30.219	(0.335)	7.638	2.126
	SUBTOTAL		727	412.500	(9.209)	210.420	103.697
					8.372 MANHOURS/KW		
91.	CONSTRUCTION SERVICES		69				
92.	HOME OFFICE ENGRG.&SERVICE		28				
93.	FIELD OFFICE ENGRG&SERVICE		36				
94.	OWNER'S COSTS		48				
	SUBTOTAL		161				
	DIRECT & INDIRECT COSTS	($ 825/KW)	908				
	CONTINGENCY ALLOWANCE		91				
	TOTAL DIRECT & INDIRECT COSTS	($ 908/KW)	999				
	INTEREST DURING CONSTRUCTION COMPOUND	(9.000%/YR)					
	TOTAL INTEREST DURING CONSTRUCTION	($ 362/KW)	398				
	TOTAL PLANT CAPITAL INVESTMENT	($ 1270/KW)	1397				

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
TOTAL CAPITAL INVESTMENT SUMMARY (MILLIONS OF DOLLARS)
2200 MWE PWR2MET (03-31-78) POWER PLANT AT ATLANTA EXAMPLE6
COST BASIS: YEAR OF COMMERCIAL OPERATION
DESIGN & CONSTRUCTION PERIOD: STEAM SUPPLY SYSTEM PURCHASE: 1978.500
CONSTRUCTION PERMIT: 1984.500
COMMERCIAL OPERATION: 1990.500

ACCOUNT NUMBER	ACCOUNT TITLE		TOTAL COSTS	EQUIPMENT COSTS	LABOR MANHOURS	LABOR COSTS	MATERIAL COSTS
20 .	LAND + LAND RIGHTS(COMMON)		2	0.0	(0.0)	0.0	2.000
21 .	STRUCTURES + IMPROVEMENTS		308	19.774	(8.499)	161.320	126.944
22 .	REACTOR PLANT EQUIPMENT		467	348.376	(3.941)	88.233	30.167
23 .	TURBINE PLANT EQUIPMENT		403	305.573	(3.541)	78.233	18.742
24 .	ELECTRIC PLANT EQUIPMENT		142	47.734	(2.749)	65.370	29.024
25 .	MISCELLANEOUS PLANT EQUIPT		36	22.719	(0.511)	10.943	1.987
26 .	MAIN COND HEAT REJECT SYS		77	57.846	(0.708)	14.901	4.386
		SUBTOTAL	1435	802.021	(19.949)	418.999	213.247
					9.068	MANHOURS/KW	
91 .	CONSTRUCTION SERVICES		166				
92 .	HOME OFFICE ENGRG.&SERVICE		102				
93 .	FIELD OFFICE ENGRG&SERVICE		83				
94 .	OWNER'S COSTS		114				
		SUBTOTAL	466				
	DIRECT & INDIRECT COSTS	($ 864/KW)	1901				
	CONTINGENCY ALLOWANCE		190				
	TOTAL DIRECT & INDIRECT COSTS	($ 950/KW)	2091				
	INTEREST DURING CONSTRUCTION COMPOUND	(9.000%/YR)					
	TOTAL INTEREST DURING CONSTRUCTION	($ 382/KW)	840				
	TOTAL PLANT CAPITAL INVESTMENT	($ 1332/KW)	2931				

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              D A T A   C A R D   C O L U M N S   U S E D

1--4  6-----13 15------------30 32----39 41----47 48----54 55----61 62--66   68    70    72   74   76   78    80
MWE   MODEL         CITY         EXTRA ID YR SSS   YR PER   YR CCP   % INT  ILAZ  IFLAG  IOP  IESC  IBS  IAC   ISTACK


1200  CBIGSMET MIDDLETOWN        EXAMPLE7 1979.000 1983.000 1987.000  8.350   0     2     2    0    1    0     1
 ECONOPT CONTE=0.,10*15.,CONTL=0.,10*15.,CONTM=0.,10*15.,
 &END



    DATE 11-10-78   C O N C E P T   C O S T   E S T I M A T E S  (PHASE 5)
    UNIT 1    CAPITAL INVESTMENT SUMMARY (MILLIONS OF DOLLARS)
     1200 MWE  CBIGSMET (        ) POWER PLANT AT MIDDLETOWN       EXAMPLE7
    COST BASIS:        YEAR OF STEAM SUPPLY SYSTEM PURCHASE
    DESIGN & CONSTRUCTION PERIOD:      STEAM SUPPLY SYSTEM PURCHASE:  1979.000
                                       CONSTRUCTION PERMIT:            1983.000
                                       COMMERCIAL OPERATION:           1987.000

CONIV CALLED - DATA FIT DONE ON USA             MIDDLETOWN

INPUT CARDS TO PRODUCE TIME DEPENDENT ESCALATION RATES
               1.06      1.06      1.06      1.06      1.06      1.06      1.06
               1.06      1.06      1.06      1.06
               1.08      1.08      1.08      1.08      1.08      1.08      1.08
               1.08      1.08      1.08      1.08
               1.08      1.08      1.08      1.08      1.08      1.08      1.08
               1.08      1.08      1.08      1.08                                1978.0
                                                                                     -1.

SITE RATE AND ESCALATION USED IN COST PROJECTIONS         YFIRST = 1964.00   YLAST = 1978.50

  ACCT   20   ACCT   21   ACCT   22   ACCT   23   ACCT   24   ACCT   25   ACCT   26   ACCT   91   ACCT   92   ACCT   93   ACCT   91
   A     B     A     B     A     B     A     B     A     B     A     B     A     B     A     B     A     B     A     P     A     B
* * * * * * * * * * *         1979.000     * * * * * * * * * * *
E217.2 1.060 217.2 1.060 217.2 1.060 217.2 1.060 217.2 1.060 217.2 1.060 217.2 1.060 217.2 1.060 206.2 1.060 206.2 1.060 206.2 1.060
L15.42 1.080 15.42 1.080 15.91 1.080 16.01 1.080 16.16 1.080 16.06 1.080 15.60 1.080 15.33 1.080 15.79 1.080 15.79 1.080 15.79 1.080
M1080. 1.080 24.96 1.080 24.96 1.080 24.96 1.080 24.96 1.080 24.96 1.080 24.96 1.080 24.96 1.080 24.96 1.080 24.96 1.080 24.96 1.080
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DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT SUMMARY (MILLIONS OF DOLLARS)
1200 MWE CBIGSMET (05-16-78) POWER PLANT AT MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE
DESIGN & CONSTRUCTION PERIOD: STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE		TOTAL COSTS	EQUIPMENT COSTS	LABOR MANHOURS	LABOR COSTS	MATERIAL COSTS
20 .	LAND AND LAND RIGHTS		2	0.0	(0.0)	0.0	2.160
21 .	STRUCTURES + IMPROVEMENTS		59	3.052	(1.434)	22.115	34.115
22 .	BOILER PLANT EQUIPMENT		202	124.861	(3.533)	56.208	20.633
23 .	TURBINE PLANT EQUIPMENT		132	96.189	(1.815)	29.057	6.506
24 .	ELECTRIC PLANT EQUIPMENT		42	10.802	(1.232)	19.914	11.519
25 .	MISCELLANEOUS PLANT EQUIPT		12	6.867	(0.257)	4.129	1.010
26 .	MAIN COND HEAT REJECT SYS		19	13.738	(0.257)	4.012	1.323
	SUBTOTAL		468	255.5[illegible]	(8.528)	135.435	77.266
					7.107 MANHOURS/KW		
91 .	CONSTRUCTION SERVICES		58				
92 .	HOME OFFICE ENGRG.&SERVICE		23				
93 .	FIELD OFFICE ENGRG&SERVICE		16				
94 .	OWNER'S COSTS		42				
	SUBTOTAL		139				
	DIRECT & INDIRECT COSTS	($ 506/KW)	607				
	CONTINGENCY ALLOWANCE		91				
	TOTAL DIRECT & INDIRECT COSTS	($ 582/KW)	698				
	ESCALATION DURING CONSTRUCTION	(6.894%/YR)	294				
	TOTAL ESCALATED DIRECT & INDIRECT COSTS	($ 827/KW)	992				
	INTEREST DURING CONSTRUCTION SIMPLE	(8.350%/YR)					
	ON DIRECT & INDIRECT COSTS		161				
	ON ESCALATION DURING CONSTRUCTION		62				
	TOTAL INTEREST DURING CONSTRUCTION	($ 186/KW)	223				
	TOTAL PLANT CAPITAL INVESTMENT	($ 1013/KW)	1215				

WEIGHTED AVERAGE ESCALATION (%/YR)

EQUIPMENT	LABOR	MATERIAL
6.000	8.000	8.000

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSNET(05-16-78) POWER PLANT AT: MIDDLETOWN   EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
20 .	LAND AND LAND RIGHTS				
201.	LAND AND PRIVILEGE ACQUISITION	$ 0.	$ 0.	$ 2160.	2160.
202.	RELOCATION OF BUILDINGS, UTILITIES, ETC.	$ 0.	$ 0.	$ 0.	0.
	SUBTOTAL FOR ACCOUNT.	$ 0.	$ 0.	$ 2160.	$ 2160.
	CONTINGENCY (0.0%EQP- 0.0%LABOR- 0.0%MTL). . .	0.	0.	0.	0.
	TOTAL FOR ACCOUNT 20	$ 0.	$ 0.	$ 2160.	$ 2160.

•DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78)   POWER PLANT AT: MIDDLETOWN   EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
21 .	STRUCTURES + IMPROVEMENTS				
211.	YARDWORK				
211.1	GENERAL YARDWORK				
211.11	GENERAL CUT + FILL	$ 0.	$ 291.	$ 332.	623.
211.12	ROADS, WALKS+PARKING AREA	0.	268.	752.	1020.
211.14	FENCING + GATES	0.	106.	152.	258.
211.15	SANITARY SEWER FACILITY	138.	65.	40.	243.
211.16	YARD DRAINAGE STORM SEWERS	0.	129.	97.	226.
211.17	ROADWAY + YARD LIGHTING	0.	178.	140.	318.
	SUBTOTAL.	$ 138.	$ 1037.	$ 1513.	$ 2688.
211.4	RAILROADS				
211.41	CUT + FILL	$ 0.	$ 19.	$ 25.	44.
211.42	GRADING	0.	10.	22.	33.
211.43	TRACK(BALLAST,TIES,RAIL)	0.	1593.	1611.	3204.
211.45	SWITCHES + BUMPERS	0.	30.	43.	73.
	SUBTOTAL.	$ 0.	$ 1652.	$ 1702.	$ 3354.
211.7	STRUCTURE ASSOCIATED YDWK.				
211.71	CUT + FILL	$ 0.	$ 268.	$ 144.	411.
	SUBTOTAL.	$ 0.	$ 268.	$ 144.	$ 411.
	SUBTOTAL.	$ 138.	$ 2957.	$ 3358.	$ 6453.
212.	STEAM GENERATOR BUILDING				
212.1	BUILDING STRUCTURE				
212.13	SUBSTRUCTURE CONCRETE	$ 0.	$ 926.	$ 1003.	1928.
212.14	SUPERSTRUCTURE	0.	6992.	17369.	24361.
	SUBTOTAL.	$ 0.	$ 7918.	$ 18371.	$ 26289.
212.2	BUILDING SERVICES				
212.21	PLUMBING + DRAINS	$ 98.	$ 149.	$ 15.	261.
212.22	HEATING,VENT + AIR COND	442.	344.	50.	835.
212.24	LIGHTING + SERVICE POWER	0.	296.	139.	435.
212.25	ELEVATOR	84.	41.	4.	129.
212.26	FIRE PROTECTION SYSTEM	10.	4.	0.	13.
	SUBTOTAL.	$ 633.	$ 834.	$ 207.	$ 1673.
	SUBTOTAL.	$ 633.	$ 8752.	$ 18578.	$ 27963.
213.	TURBINE,HEATER,CONTROL BLD				
213.1	BUILDING STRUCTURE				
213.13	SUBSTRUCTURE CONCRETE	$ 0.	$ 755.	$ 901.	1656.
213.14	SUPERSTRUCTURE	0.	2748.	5806.	8554.
	SUBTOTAL.	$ 0.	$ 3503.	$ 6707.	$ 10210.
213.2	BUILDING SERVICES				
213.21	PLUMBING + DRAINS	$ 109.	$ 167.	$ 16.	292.
213.22	HEATING,VENT + AIR COND	300.	235.	33.	568.
213.24	LIGHTING + SERVICE POWER	0.	405.	198.	603.
	SUBTOTAL.	$ 408.	$ 807.	$ 248.	$ 1463.
	SUBTOTAL.	$ 408.	$ 4310.	$ 6955.	$ 11673.
218.	OTHER STRUCTURES				
218B.	ADMINISTRATION+SERVICE BLD				
218B.1	BUILDING STRUCTURE	$ 0.	$ 515.	$ 895.	1409.
218B.2	BUILDING SERVICES	257.	412.	128.	797.
	SUBTOTAL.	$ 257.	$ 927.	$ 1022.	$ 2206.

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
218D.	FIRE PUMPHOUSE	0.	0.	0.	0.
218I.	ELECTRICAL SWITCHGR BLDGS				
218I.1	BUILDING STRUCTURE	$ 16.	$ 53.	$ 29.	97.
218I.2	BUILDING SERVICES	12.	56.	29.	96.
	SUBTOTAL.	$ 27.	$ 109.	$ 57.	$ 193.
218M.	COAL CAR THAW SHED				
218M.1	BUILDING STRUCTURE	$ 0.	$ 30.	$ 15.	45.
	SUBTOTAL.	$ 0.	$ 30.	$ 15.	$ 45.
218N.	ROTARY CAR DUMP BLDG+TUNNL				
218N.1	BUILDING STRUCTURE	$ 0.	$ 526.	$ 446.	972.
218N.2	BUILDING SERVICES	4.	32.	17.	53.
	SUBTOTAL.	$ 4.	$ 558.	$ 463.	$ 1026.
218O.	COAL BREAKER HOUSE				
218O.1	BUILDING STRUCTURE	$ 0.	$ 256.	$ 413.	669.
218O.2	BUILDING SERVICES	64.	71.	13.	149.
	SUBTOTAL.	$ 64.	$ 327.	$ 426.	$ 818.
218P.	COAL CRUSHER HOUSE				
218P.1	BUILDING STRUCTURE	$ 0.	$ 156.	$ 233.	389.
218P.2	BUILDING SERVICES	95.	95.	14.	204.
	SUBTOTAL.	$ 95.	$ 251.	$ 247.	$ 593.
218Q.	BOILER HOUSE TRANSFR TOWER				
218Q.1	BUILDING STRUCTURE	$ 0.	$ 92.	$ 162.	254.
218Q.2	BUILDING SERVICES	4.	5.	1.	10.
	SUBTOTAL.	$ 4.	$ 97.	$ 164.	$ 264.
218R.	ROTARY PLOW MAINTNCE SHED				
218R.1	BUILDING STRUCTURE	$ 0.	$ 1330.	$ 982.	2312.
218R.2	BUILDING SERVICES	7.	6.	1.	15.
	SUBTOTAL.	$ 7.	$ 1337.	$ 983.	$ 2327.
218T.	LOCOMOTIVE REPAIR GARAGE				
218T.1	BUILDING STRUCTURE	$ 0.	$ 54.	$ 74.	129.
218T.2	BUILDING SERVICES	14.	21.	6.	41.
	SUBTOTAL.	$ 14.	$ 75.	$ 81.	$ 170.
218U.	MATERIAL HANDL+SERVICE BLD				
218U.1	BUILDING STRUCTURE	$ 0.	$ 137.	$ 161.	298.
218U.2	BUILDING SERVICES	21.	30.	7.	59.
	SUBTOTAL.	$ 21.	$ 167.	$ 169.	$ 357.
218V.	WASTE WATER TREATMENT BLDG				
218V.1	WASTE WATER EQUIPMENT BLDG	$ 6.	$ 49.	$ 46.	101.
218V.2	WASTE WATER SETTLING BASIN	0.	112.	62.	174.
218V.3	API OIL SEPARATOR	0.	8.	9.	16.
	SUBTOTAL.	$ 6.	$ 169.	$ 116.	$ 292.
218W.	MISC COAL HANDLING STRUCT				
218W.1	CONVEYOR GALLERIES	$ 0.	$ 522.	$ 1115.	1638.
218W.2	ROTARY PLOW ACCESS TUNNEL	0.	101.	41.	142.
218W.3	COAL PILE MEMBRANE BARRIER	179.	309.	47.	535.
218W.4	LOWERING WELLS	0.	114.	43.	157.
218W.5	BUILDING SERVICES	0.	3.	1.	4.
	SUBTOTAL.	$ 179.	$ 1048.	$ 1248.	$ 2475.

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN   EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
	SUBTOTAL.	$ 679.	$ 5095.	$ 4991.	$ 10764.
219.	STACK STRUCTURE				
219.1	STRUCTURE				
219.11	EXCAVATION WORK	$ 0.	$ 21.	$ 6.	27.
219.13	SUBSTRUCTURE CONCRETE	0.	141.	227.	368.
219.14	SUPERSTRUCTURE	1194.	840.	0.	2034.
	SUBTOTAL.	$ 1194.	$ 1002.	$ 233.	$ 2429.
219.2	CHIMNEY SERVICES	0.	0.	0.	0.
	SUBTOTAL.	$ 1194.	$ 1002.	$ 233.	$ 2429.
	SUBTOTAL FOR ACCOUNT.	$ 3052.	$ 22115.	$ 34115.	$ 59282.
	CONTINGENCY (15.0%EQP-15.0%LABOR-15.0%MTL). . .	458.	3317.	5117.	8892.
	TOTAL FOR ACCOUNT 21	$ 3510.	$ 25432.	$ 39232.	$ 68175.

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CRIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN   EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
22 .	BOILER PLANT EQUIPMENT				
220.	FOSSIL STEAM SUPPLY SYSTEM				
220A.	FOSSIL STEAM SUPPLY SYSTEM				
220A.1	QUOTED FSSS PRICE	$ 66003.	$ 17296.	$ 1721.	85020.
	SUBTOTAL.	$ 66003.	$ 17296.	$ 1721.	$ 85020.
	SUBTOTAL.	$ 66003.	$ 17296.	$ 1721.	$ 85020.
221.	STEAM GENERATING SYSTEM				
221.1	STEAM GENERATING EQUIPMENT	0.	0.	0.	0.
221.2	STEAM GENERATING ACCESSORY				
221.21	BOILER BYPASS SYSTEM	$ 302.	$ 249.	$ 25.	576.
221.22	BOILER VENTS AND DRAINS	174.	215.	30.	419.
	SUBTOTAL.	$ 477.	$ 464.	$ 54.	$ 995.
221.3	SOOTBLOWING SYSTEM				
221.31	ROTATING MACHINERY	$ 910.	$ 59.	$ 6.	976.
221.33	TANKS AND PRESSURE VESSELS	9.	4.	0.	13.
221.35	PIPING	47.	78.	11.	136.
221.36	VALVES	33.	0.	0.	33.
221.37	PIPING-MISC ITEMS	9.	0.	0.	9.
	SUBTOTAL.	$ 1010.	$ 141.	$ 17.	$ 1168.
	SUBTOTAL.	$ 1487.	$ 605.	$ 71.	$ 2163.
222.	DRAFT SYSTEM				
222.1	ROTATING MACHINERY				
222.14	AIR HEATER DRAIN PUMP+MTR	$ 7.	$ 4.	$ 0.	11.
	SUBTOTAL.	$ 7.	$ 4.	$ 0.	$ 11.
222.2	HEAT TRANSFER EQUIPMENT				
222.22	INLET COMBUST AIR STM COIL	$ 281.	$ 17.	$ 1.	300.
222.23	COMBST AIR PREHT STM COILS	142.	15.	1.	158.
	SUBTOTAL.	$ 423.	$ 32.	$ 2.	$ 458.
222.3	TANKS AND PRESSURE VESSELS				
222.31	AIR HEATER DRAIN TANK	$ 4.	$ 1.	$ 0.	5.
	SUBTOTAL.	$ 4.	$ 1.	$ 0.	$ 5.
222.4	PURIFICATION+FILTRATION EQ				
222.41	ELECTROSTATIC PRECIPITATOR	$ 11857.	$ 3642.	$ 362.	15861.
	SUBTOTAL.	$ 11857.	$ 3642.	$ 362.	$ 15861.
222.5	PIPING + DUCTWORK				
222.51	AIR PREHEAT STEAM PIPING	$ 156.	$ 213.	$ 21.	390.
222.52	DUCTWORK	2266.	2270.	763.	5298.
	SUBTOTAL.	$ 2422.	$ 2483.	$ 784.	$ 5689.
222.6	VALVES	95.	0.	0.	95.
222.7	PIPING-MISC ITEMS				
222.73	SPECIALTIES	$ 145.	$ 25.	$ 2.	172.
	SUBTOTAL.	$ 145.	$ 25.	$ 2.	$ 172.
222.8	INSTRUMENTATION + CONTROLS	70.	10.	0.	80.
222.9	FOUNDATIONS/SKIDS				
222.91	PRECIPITATOR+DUCT FOUND	$ 0.	$ 303.	$ 640.	943.
222.92	PRIMARY AIR+FD FAN FOUND	0.	33.	33.	67.
222.93	AIR HEATER FOUNDATIONS	0.	126.	272.	398.
	SUBTOTAL.	$ 0.	$ 463.	$ 945.	$ 1408.

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
	SUBTOTAL.	$ 15023.	$ 6659.	$ 2096.	$ 23778.
223.	ASH + DUST HANDLING SYSTEM				
223.1	ASH + DUST HANDLING EQUIP	5335.	1828.	241.	7404.
223.2	MISC ASH+DUST HANDLING EQ				
223.21	ROTATING MACHINERY	$ 43.	$ 5.	$ 0.	48.
223.25	PIPING	85.	141.	20.	246.
223.26	VALVES	13.	0.	0.	13.
	SUBTOTAL.	$ 141.	$ 146.	$ 20.	$ 307.
	SUBTOTAL.	$ 5476.	$ 1974.	$ 261.	$ 7711.
224.	FUEL HANDLING SYSTEMS	$ 8136.	$ 2340.	$ 763.	11239.
225.	FLUE GAS DESULFUR STRUCT				
225.1	LIME SLAKING BUILDING				
225.11	BUILDING STRUCTURE	$ 0.	$ 288.	$ 490.	778.
225.12	BUILDING SERVICES	23.	83.	31.	136.
	SUBTOTAL.	$ 23.	$ 371.	$ 521.	$ 914.
225.2	LIME SLAKING SERVICE BLDG				
225.21	BUILDING STRUCTURE	$ 0.	$ 36.	$ 50.	86.
	SUBTOTAL.	$ 0.	$ 36.	$ 50.	$ 86.
225.3	DESULFUR CTRL+SWTCHGR BLDG				
225.31	BUILDING STRUCTURE	$ 0.	$ 84.	$ 144.	228.
225.32	BUILDING SERVICES	15.	28.	6.	50.
	SUBTOTAL.	$ 15.	$ 113.	$ 150.	$ 278.
225.5	PROCESS+SEAL WATER PUMPHSE				
225.51	BUILDING STRUCTURE	$ 0.	$ 14.	$ 9.	22.
225.52	BUILDING SERVICES	6.	10.	1.	17.
	SUBTOTAL.	$ 6.	$ 24.	$ 10.	$ 39.
225.6	THICKENER EQUIPMENT BLDG				
225.61	BUILDING STRUCTURE	$ 0.	$ 33.	$ 25.	58.
225.62	BUILDING SERVICES	7.	16.	5.	28.
	SUBTOTAL.	$ 7.	$ 50.	$ 30.	$ 86.
225.7	SLUDGE STABILIZATION BLDG				
225.71	HANGERS AND SUPPORTS	$ 0.	$ 156.	$ 214.	370.
225.72	BUILDING SERVICES	44.	78.	18.	140.
	SUBTOTAL.	$ 44.	$ 234.	$ 233.	$ 510.
225.8	SLUDGE PUMP HOUSE				
225.81	BUILDING STRUCTURE	$ 0.	$ 19.	$ 23.	42.
225.82	BUILDING SERVICES	8.	14.	2.	24.
	SUBTOTAL.	$ 8.	$ 32.	$ 26.	$ 66.
225.9	LIME UNLOADING BLDG+TUNNEL				
225.91	BUILDING STRUCTURE	$ 0.	$ 165.	$ 153.	317.
225.92	BUILDING SERVICES	2.	12.	4.	18.
	SUBTOTAL.	$ 2.	$ 177.	$ 156.	$ 336.
	SUBTOTAL.	$ 106.	$ 1036.	$ 1175.	$ 2317.
226.	DESULFURIZATION EQUIPMENT				
226.1	LIME HANDLING SYSTEM	1067.	1547.	438.	3052.

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSNET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
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ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
226.2	FEED PREPARATION SYSTEM				
226.21	ROTATING MACHINERY	$ 328.	$ 64.	$ 6.	399.
226.22	TANKS AND PRESSURE VESSELS	0.	168.	239.	407.
226.25	PIPING	188.	255.	26.	469.
226.26	VALVES	28.	0.	0.	28.
226.27	PIPING-MISC ITEMS	38.	0.	0.	38.
226.29	FOUNDATIONS/SKIDS	0.	22.	15.	37.
	SUBTOTAL.	$ 583.	$ 510.	$ 286.	$ 1379.
226.3	SOL DIOXIDE SCRUBBING SYS	11424.	6564.	4103.	22091.
226.4	GAS HANDLING SYSTEM				
226.41	ROTATING MACHINERY	$ 2127.	$ 334.	$ 33.	2494.
226.45	PIPING,DUCTS,EXPANSION JTS	3056.	3335.	1319.	7711.
226.46	VALVES + DAMPERS	474.	58.	6.	539.
226.49	FOUNDATIONS/SKIDS	0.	406.	910.	1315.
	SUBTOTAL.	$ 5657.	$ 4133.	$ 2268.	$ 12059.
226.5	SLUDGE HANDLING SYSTEM				
226.51	ROTATING MACHINERY	$ 1515.	$ 230.	$ 23.	1769.
226.53	TANKS AND PRESSURE VESSELS	0.	1068.	1641.	2709.
226.55	PIPING	5006.	6774.	673.	12454.
226.56	VALVES	166.	0.	0.	166.
226.57	PIPING-MISC ITEMS	0.	93.	124.	217.
226.59	FOUNDATIONS/SKIDS	0.	1743.	2916.	4658.
	SUBTOTAL.	$ 6687.	$ 9908.	$ 5377.	$ 21973.
226.6	MISC DESULFURIZATION EQUIP				
226.61	ROTATING MACHINERY	$ 55.	$ 19.	$ 2.	76.
226.63	TANKS AND PRESSURE VESSELS	17.	22.	15.	54.
226.64	PURIFICATION+FILTRATION EQ	9.	1.	0.	11.
226.65	PIPING	124.	223.	34.	382.
226.66	VAVLES	36.	0.	0.	36.
226.67	PIPING - MISC. ITEMS	25.	0.	0.	25.
226.69	FOUNDATIONS/SKIPS	0.	17.	12.	30.
	SUBTOTAL.	$ 266.	$ 282.	$ 64.	$ 612.
226.7	INSTRUMENTATION+CONTROL	524.	109.	5.	6[illegible]8.
	SUBTOTAL.	$ 26208.	$ 23053.	$ 12541.	$ 618[illegible]3.
227.	INSTRUMENTATION + CONTROL				
227.1	BENCHBOARD, PANELS + RACKS				
227.11	BOILER - TG CONTROL PANEL	$ 285.	$ 99.	$ 5.	388.
227.17	AUXILIARY PANELS+CABINETS	134.	62.	4.	200.
227.18	INSTRUMENT RACKS	249.	43.	2.	295.
	SUBTOTAL.	$ 667.	$ 204.	$ 11.	$ 883.
227.2	PLANT COMPUTER SYSTEM	711.	455.	46.	1212.
227.3	STACK GAS MONITORING SYS	0.	0.	0.	0.
227.4	PLANT CONTROL SYSTEM				
227.41	COORDINATED CONTROL SYSTEM	$ 711.	$ 74.	$ 7.	793.
	SUBTOTAL.	$ 711.	$ 74.	$ 7.	$ 793.

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN   EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
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COMMERCIAL OPERATION: 1987.000

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227.5	INSTRUMENT TUBING+FITTINGS	133.	423.	21.	577.
	SUBTOTAL.	$ 2223.	$ 1157.	$ 85.	$ 3465.
228.	BOILER PLANT MISC ITEMS				
228.1	MISC SUSPENSE ITEMS				
228.11	FINAL ALIGNMENT + CHECKING	$ 0.	$ 801.	$ 62.	862.
228.12	FIELD PAINTING	0.	593.	246.	839.
228.13	QUALIFICATION OF WELDERS	0.	42.	12.	54.
	SUBTOTAL.	$ 0.	$ 1436.	$ 320.	$ 1756.
228.3	BOILER PLANT INSULATION	0.	556.	1540.	2095.
228.4	SAMPLING EQUIPMENT	202.	21.	1.	224.
228.7	MISC PIPE BRIDGE				
228.71	EXCAVATION WORK	$ 0.	$ 0.	$ 0.	0.
228.73	SUBSTRUCTURE CONCRETE	0.	74.	59.	133.
	SUBTOTAL.	$ 0.	$ 74.	$ 59.	$ 133.
	SUBTOTAL.	$ 202.	$ 2087.	$ 1920.	$ 4208.
	SUBTOTAL FOR ACCOUNT.	$ 124861.	$ 56208.	$ 20633.	$ 201698.
	CONTINGENCY (15.0%EQP-15.0%LABOR-15.0%MTL). . .	18729.	8431.	3095.	30255.
	TOTAL FOR ACCOUNT 22	$ 143590.	$ 64639.	$ 23728.	$ 231957.

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CRIGSNET(05-16-78)   POWER PLANT AT: MIDDLETOWN   EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
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ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
23 .	TURBINE PLANT EQUIPMENT				
231.	TURBINE GENERATOR				
231.1	TURBINE GENERATOR +ACCSSRY				
231.11	TURBINE FACTORY COST	$ 53288.	$ 0.	$ 0.	53288.
231.12	OTHER TURBINE COSTS	0.	2961.	295.	3256.
	SUBTOTAL.	$ 53288.	$ 2961.	$ 295.	$ 56544.
231.2	FOUNDATIONS				
231.21	T-G PEDESTAL	$ 0.	$ 1922.	$ 1527.	3449.
	SUBTOTAL.	$ 0.	$ 1922.	$ 1527.	$ 3449.
231.4	LUBRICATING OIL SYSTEM				
231.43	TANKS + PRESSURE VESSELS	$ 0.	$ 5.	$ 28.	33.
231.45	PIPING	4.	16.	4.	23.
231.46	VALVES	6.	0.	0.	6.
231.47	PIPING-MISC. ITEMS	1.	0.	0.	1.
231.48	INSTRUMENTATION + CONTROL	12.	1.	0.	13.
231.49	SKIDS / FOUNDATIONS	129.	66.	74.	269.
	SUBTOTAL.	$ 152.	$ 88.	$ 106.	$ 346.
231.5	GAS SYSTEMS				
231.51	HYDROGEN STORAGE SYSTEM	$ 116.	$ 92.	$ 10.	218.
231.52	CARBON DIOXIDE STORAGE SYS	75.	60.	6.	141.
	SUBTOTAL.	$ 191.	$ 152.	$ 16.	$ 359.
	SUBTOTAL.	$ 53630.	$ 5123.	$ 1944.	$ 60696.
233.	CONDENSING SYSTEMS				
233.1	CONDENSER EQUIPMENT				
233.12	HEAT TRANSFER EQUIPMENT	$ 7129.	$ 1561.	$ 156.	8846.
	SUBTOTAL.	$ 7129.	$ 1561.	$ 156.	$ 8846.
233.2	CONDENSATE SYSTEM				
233.21	ROTATING MACHINERY	$ 573.	$ 93.	$ 10.	676.
233.23	TANKS & PRESSURE VESSELS	118.	103.	10.	231.
233.25	PIPING	452.	619.	65.	1136.
233.26	VALVES	446.	0.	0.	446.
233.27	PIPING-MISC. ITEMS	72.	0.	0.	72.
233.28	INSTRUMENTATION + CONTROL	58.	6.	0.	64.
233.29	FOUNDATIONS	0.	11.	6.	17.
	SUBTOTAL.	$ 1721.	$ 832.	$ 91.	$ 2644.
233.3	GAS REMOVAL SYSTEM				
233.31	CONDENSER GAS REMOVAL SYS.	$ 437.	$ 109.	$ 12.	558.
	SUBTOTAL.	$ 437.	$ 109.	$ 12.	$ 558.
233.5	CONDENSATE POLISHING	1420.	324.	32.	1775.
	SUBTOTAL.	$ 10706.	$ 2826.	$ 291.	$ 13824.
234.	FEED HEATING SYSTEM				
234.1	FEEDWATER HEATERS	5814.	161.	16.	5991.
234.2	FEEDWATER SYSTEM				
234.21	ROTATING MACHINERY	$ 4933.	$ 523.	$ 53.	5509.
234.22	HEAT TRANSFER EQUIPMENT	580.	9.	1.	590.
234.25	PIPING	2165.	2910.	293.	5367.
234.26	VALVES	888.	0.	0.	888.
234.27	PIPING-MISC. ITEMS	504.	0.	0.	504.
234.28	INSTRUMENTATION + CONTROL	81.	9.	0.	89.
	SUBTOTAL.	$ 9151.	$ 3450.	$ 347.	$ 12948.

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
234.3	EXTRACTION STEAM SYSTEM				
234.35	PIPING	$ 818.	$ 1097.	$ 111.	2026.
234.36	VALVES	444.	0.	0.	444.
234.37	PIPING-MISCELLANEOUS	163.	0.	0.	163.
234.38	INSTRUMENTATION + CONTROL	45.	5.	0.	50.
	SUBTOTAL.	$ 1471.	$ 1102.	$ 111.	$ 2683.
234.4	FWH VENT + DRAIN SYSTEM				
234.41	ROTATING MACHINERY	$ 17.	$ 7.	$ 1.	25.
234.43	TANKS + PRESSURE VESSELS	20.	1.	0.	21.
234.45	PIPING	195.	264.	27.	486.
234.46	VALVES	178.	0.	0.	178.
234.47	PIPING-MISC. ITEMS	32.	0.	0.	32.
234.48	INSTRUMENTATION + CONTROL	67.	7.	0.	75.
	SUBTOTAL.	$ 509.	$ 279.	$ 28.	$ 817.
	SUBTOTAL.	$ 16945.	$ 4992.	$ 502.	$ 22439.
235.	OTHER TURBINE PLANT EQUIP.				
235.1	MAIN VAPOR PIPING SYSTEM				
235.11	MAIN STEAM SYSTEM	$ 5956.	$ 7079.	$ 714.	13750.
235.12	HOT REHEAT SYSTEM	4727.	5645.	568.	10940.
235.13	COLD REHEAT SYSTEM	1175.	1219.	123.	2517.
235.15	ATTEMPERATING SYSTEM	117.	65.	9.	191.
	SUBTOTAL.	$ 11976.	$ 14008.	$ 1414.	$ 27398.
235.2	TURBINE AUXILIARIES				
235.21	MAIN STM/RHT VENTS & DRAIN	$ 107.	$ 85.	$ 22.	213.
	SUBTOTAL.	$ 107.	$ 85.	$ 22.	$ 213.
235.3	TP CLOSED CLG WATER SYS				
235.31	ROTATING MACHINERY	$ 46.	$ 22.	$ 2.	71.
235.32	HEAT TRANSFER EQUIPMENT	422.	12.	1.	435.
235.33	TANKS + PRESSURE VESSELS	1.	1.	0.	2.
235.35	PIPING	282.	386.	41.	708.
235.36	VALVES	195.	0.	0.	195.
235.37	PIPING-MISC. ITEMS	57.	0.	0.	57.
235.38	INSTRUMENTATION + CONTROL	30.	2.	0.	32.
	SUBTOTAL.	$ 1033.	$ 424.	$ 44.	$ 1501.
235.4	DEMIN.WATER MAKE-UP SYSTEM	1001.	78.	7.	1086.
235.5	CHEMICAL TREATMENT SYSTEM	41.	7.	2.	51.
235.6	NEUTRALIZATION SYSTEM				
235.61	ROTATING MACHINERY	$ 18.	$ 6.	$ 1.	25.
235.63	TANKS AND PRESSURE VESSELS	47.	4.	0.	51.
235.65	PIPING	2.	4.	0.	6.
235.66	VALVES	0.	0.	0.	0.
235.67	PIPING - MISC ITEMS	0.	0.	0.	0.
235.68	INSTRUMENTATION + CONTROL	26.	6.	0.	32.
	SUBTOTAL.	$ 94.	$ 20.	$ 1.	$ 114.
	SUBTOTAL.	$ 14250.	$ 14622.	$ 1491.	$ 30364.

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMPT(05-16-78)   POWER PLANT AT: MIDDLETOWN   EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
236.	INSTRUMENTATION + CONTROL				
236.1	PROCESS I+C EQUIPMENT				
236.11	BENCHBOARD, PANELS + RACKS	$ 658.	$ 81.	$ 4.	743.
	SUBTOTAL.	$ 658.	$ 81.	$ 4.	$ 743.
236.2	PROCESS COMPUTER	0.	0.	0.	0.
236.3	TURB PLT I+C TUBING	0.	0.	0.	0.
	SUBTOTAL.	$ 658.	$ 81.	$ 4.	$ 743.
237.	TURBINE PLANT MISC ITEMS				
237.1	MISC SUSPENSE ITEMS				
237.11	PIPE	$ 0.	$ 121.	$ 108.	230.
237.12	FIELD PAINTING	0.	489.	221.	710.
237.13	QUALIFICATION OF WELDERS	0.	120.	37.	157.
	SUBTOTAL.	$ 0.	$ 730.	$ 366.	$ 1097.
237.3	TURBINE PLANT INSULATION	0.	683.	1908.	2591.
	SUBTOTAL.	$ 0.	$ 1413.	$ 2274.	$ 3687.
	SUBTOTAL FOR ACCOUNT.	$ 96189.	$ 29057.	$ 6506.	$ 131750.
	CONTINGENCY (15.0%EQP-15.0%LABOR-15.0%MTL). . .	14428.	4359.	976.	19763.
	TOTAL FOR ACCOUNT 23	$ 110617.	$ 33416.	$ 7482.	$ 151515.

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
24 .	ELECTRIC PLANT EQUIPMENT				
241.	SWITCHGEAR				
241.1	GEN EQPT SWITCHGEAR				
241.12	GEN NEUTRAL GROUNDING EQPT	$ 0.	$ 97.	$ 10.	107.
241.13	GEN CURRENT+POTENTIAL XFMR	0.	17.	1.	18.
	SUBTOTAL.	$ 0.	$ 114.	$ 11.	$ 125.
241.2	STATION SERVICE SWITCHGEAR				
241.21	MEDIUM VOLTAGE METAL CLAD	$ 4140.	$ 517.	$ 50.	4707.
241.22	STATION MOTOR CONTROL CNTR	1406.	487.	46.	1939.
	SUBTOTAL.	$ 5546.	$ 1004.	$ 96.	$ 6646.
	SUBTOTAL.	$ 5546.	$ 1117.	$ 107.	$ 6771.
242.	STATION SERVICE EQUIPMENT				
242.1	STATION SERV&STARTUP XFMR				
242.11	UNIT AUXILIARY TRANSFORMER	$ 800.	$ 137.	$ 14.	950.
242.12	RESERVE AUXILIARY XFMR	845.	82.	7.	935.
242.13	FOUNDATIONS FOR XFMRS	0.	125.	105.	230.
	SUBTOTAL.	$ 1645.	$ 345.	$ 126.	$ 2115.
242.2	UNIT SUBSTATIONS				
242.21	LOAD CENTER SWITCHGEAR	$ 1404.	$ 257.	$ 25.	1686.
242.22	LOAD CENTER TRANSFORMERS	659.	252.	24.	935.
242.23	MISCELLANEOUS XFMRS	18.	13.	1.	32.
	SUBTOTAL.	$ 2081.	$ 522.	$ 50.	$ 2653.
242.3	AUXILIARY POWER SOURCES				
242.31	BATTERY SYSTEMS	$ 97.	$ 26.	$ 2.	126.
242.32	EMERGENCY DIESEL GEN SYS	170.	33.	4.	207.
242.34	INVERTERS	60.	9.	1.	70.
	SUBTOTAL.	$ 327.	$ 68.	$ 7.	$ 403.
	SUBTOTAL.	$ 4053.	$ 935.	$ 183.	$ 5170.
243.	SWITCHBOARDS				
243.1	CONTROL PANELS				
243.11	GEN+AUX POWER SYS CTRL PNL	$ 300.	$ 73.	$ 7.	380.
243.14	GEN PROTECTIVE RELAY PANEL	288.	68.	6.	362.
	SUBTOTAL.	$ 587.	$ 141.	$ 14.	$ 742.
243.2	AUX.POWER & SIGNAL BOARDS				
243.21	POWER DISTRIBUTION PANELS	$ 8.	$ 3.	$ 0.	11.
243.22	BATTERY CNTRL+DC DIST PNL	25.	26.	62.	114.
	SUBTOTAL.	$ 34.	$ 29.	$ 62.	$ 125.
	SUBTOTAL.	$ 621.	$ 170.	$ 76.	$ 867.
244.	PROTECTIVE EQUIPMENT				
244.1	GENRL STATION GROUND SYS				
244.11	EQUIPMENT GROUNDING SYSTEM	$ 0.	$ 352.	$ 157.	509.
244.12	YARD + STRUCTURE GROUNDING	0.	337.	137.	474.
	SUBTOTAL.	$ 0.	$ 689.	$ 294.	$ 983.
244.2	FIRE DETECTION+SUPPRESSION	0.	86.	44.	130.
244.3	LIGHTNING PROTECTION	0.	21.	31.	52.
244.4	CATHODIC PROTECTION	0.	305.	373.	679.

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
244.5	HEAT TRACING + FREEZE PROT	0.	273.	93.	366.
	SUBTOTAL.	$ 0.	$ 1375.	$ 835.	$ 2210.
245.	ELECT.STRUC +WIRING CONTNR				
245.1	UNDERGROUND DUCT RUNS				
245.11	DUCT BANKS	$ 0.	$ 1009.	$ 651.	1660.
	SUBTOTAL.	$ 0.	$ 1009.	$ 651.	$ 1660.
245.2	CABLE TRAY	0.	3210.	1476.	4686.
245.3	CONDUIT	0.	4888.	1218.	6106.
	SUBTOTAL.	$ 0.	$ 9107.	$ 3345.	$ 12452.
246.	POWER & CONTROL WIRING				
246.1	GENERATOR CIRCUITS WIRING				
246.11	MAIN GENERATOR BUS DUCT	$ 581.	$ 262.	$ 25.	869.
	SUBTOTAL.	$ 581.	$ 262.	$ 25.	$ 869.
246.2	STATION SERVICE PWR WIRING				
246.21	HIGH VOLTAGE BUS+CABLE	$ 0.	$ 563.	$ 1629.	2192.
246.22	LOW VOLTAGE BUS+CABLE	0.	1104.	607.	1712.
	SUBTOTAL.	$ 0.	$ 1667.	$ 2236.	$ 3903.
246.3	CONTROL CABLE	0.	3692.	3815.	7507.
246.4	INSTRUMENT WIRE	0.	1599.	896.	2485.
	SUBTOTAL.	$ 581.	$ 7210.	$ 6973.	$ 14764.
	SUBTOTAL FOR ACCOUNT.	$ 10802.	$ 19914.	$ 11519.	$ 42234.
	CONTINGENCY (15.0%EQP-15.0%LABOR-15.0%MTL). . .	1620.	2987.	1728.	6335.
	TOTAL FOR ACCOUNT 24	$ 12422.	$ 22901.	$ 13246.	$ 48569.

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)

UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
25 .	MISCELLANEOUS PLANT EQUIPT				
251.	TRANSPORTATION & LIFT EQPT				
251.1	CRANES & HOISTS				
251.11	TURBINE BUILDING CRANE	$ 456.	$ 66.	$ 6.	528.
251.16	MISC.CRANES,HOISTS+MONORLS	0.	48.	105.	153.
251.17	DIESEL BUILDING CRANES	52.	12.	1.	65.
	SUBTOTAL.	$ 508.	$ 127.	$ 112.	$ 746.
251.2	RAILWAY EQUIPMENT				
251.21	DIESEL LOCOMOTIVE	$ 480.	$ 1.	$ 0.	481.
	SUBTOTAL.	$ 480.	$ 1.	$ 0.	$ 481.
251.3	ROADWAY EQUIPMENT				
251.34	BULLDOZERS	$ 480.	$ 1.	$ 0.	481.
	SUBTOTAL.	$ 480.	$ 1.	$ 0.	$ 481.
	SUBTOTAL.	$ 1468.	$ 129.	$ 112.	$ 1709.
252.	AIR,WATER+STEAM SERVICE SY				
252.1	AIR SYSTEMS				
252.11	COMPRESSED AIR SYSTEM	$ 175.	$ 216.	$ 59.	450.
	SUBTOTAL.	$ 175.	$ 216.	$ 59.	$ 450.
252.2	WATER SYSTEMS				
252.21	SERVICE WATER SYSTEM	$ 389.	$ 183.	$ 20.	591.
252.22	YARD FIRE PROTECTION	1799.	2155.	216.	4169.
252.24	POTABLE WATER SYSTEM	53.	61.	10.	124.
	SUBTOTAL.	$ 2240.	$ 2398.	$ 245.	$ 4884.
252.3	AUXILIARY STEAM SYSTEM				
252.31	AUXILIARY BOILER SYSTEM	$ 1141.	$ 185.	$ 20.	1346.
252.32	AUX BOILER FEEDWATER SYS	13.	7.	1.	22.
252.33	AUX FUEL OIL SYSTEM	19.	16.	2.	38.
252.34	AUX DEAR + MAKEUP SYSTEM	31.	26.	2.	60.
252.35	AUX CHEM FEED SYSTEM	37.	7.	2.	47.
252.36	AUX.STEAM+CONDENSATE RETRN	24.	16.	1.	41.
252.38	AUX BOILER BLOWDOWN	6.	4.	1.	11.
252.39	AUX STEAM SYS COMPLETE I+C	102.	10.	0.	112.
	SUBTOTAL.	$ 1374.	$ 272.	$ 31.	$ 1677.
252.4	PLANT FUEL OIL SYSTEM				
252.41	ROTATING MACHINERY	$ 1.	$ 1.	$ 0.	2.
252.43	TANKS AND PRESSURE VESSELS	0.	31.	22.	53.
252.45	PIPING	1.	2.	0.	4.
252.46	VALVES	2.	0.	0.	2.
252.47	PIPING-MISC ITEMS	0.	0.	0.	0.
252.49	FOUNDATIONS/SKIDS	0.	19.	9.	27.
	SUBTOTAL.	$ 5.	$ 53.	$ 31.	$ 89.
	SUBTOTAL.	$ 3795.	$ 2940.	$ 366.	$ 7101.
253.	COMMUNICATIONS EQUIPMENT				
253.1	LOCAL COMMUNICATIONS SYS				
253.11	GEN.PURPOSE TELEPHONE SYS	$ 0.	$ 46.	$ 44.	90.
253.15	PA + INTERCOM SYS.	0.	191.	135.	326.
	SUBTOTAL.	$ 0.	$ 237.	$ 178.	$ 415.

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
253.2	SIGNAL SYSTEMS				
253.21	FIRE DETECTION SYSTEM	120.	145.	15.	280.
	SUBTOTAL.	120.	145.	15.	280.
	SUBTOTAL.	120.	383.	193.	696.
254.	FURNISHINGS + FIXTURES				
254.1	SAFETY EQUIPMENT				
254.11	PORTABLE FIRE EXTINGUISHRS	0.	2.	11.	14.
	SUBTOTAL.	0.	2.	11.	14.
254.2	CHEMICAL LAB + INSTR SHOP				
254.22	INSTRUMENT SHOP APPARATUS	60.	2.	0.	62.
254.23	SPEC LAB FURNITURE+FIXTURE	120.	11.	1.	132.
	SUBTOTAL.	180.	14.	1.	195.
254.3	OFFICE EQUIP+FURNISHINGS				
254.31	OFFICE FURNITURE	133.	0.	0.	133.
	SUBTOTAL.	133.	0.	0.	133.
254.4	CHANGE ROOM EQUIPMENT				
254.41	LOCKERS+BENCHES	22.	1.	0.	23.
	SUBTOTAL.	22.	1.	0.	23.
254.5	ENVIRONMENT MONIT EQUIP				
254.52	METEOROLOGICAL MONIT.EQUIP	97.	11.	1.	110.
254.53	WATER QUALITY MONITORING	60.	6.	1.	67.
254.54	THERMAL EFFLUENT MONITOR	36.	4.	0.	40.
254.56	AIR QUALITY MONITORING	36.	4.	0.	40.
	SUBTOTAL.	229.	25.	2.	257.
254.6	DINING FACILITIES				
254.61	CAFETERIA EQUIPMENT	221.	56.	6.	283.
	SUBTOTAL.	221.	56.	6.	283.
	SUBTOTAL.	785.	98.	21.	904.
255.	WASTE WATER TREATMENT EQPT				
255.1	ROTATING MACHINERY				
255.11	GROUP I -	461.	31.	4.	496.
255.12	GROUP II	24.	7.	1.	33.
	SUBTOTAL.	485.	39.	5.	528.
255.3	TANKS AND PRESSURE VESSELS				
255.31	BATCH HOLDING TANK	0.	337.	240.	577.
255.32	LIME SLURRY HOLDING TANK	8.	1.	0.	10.
255.33	API SEPARATOR TANK	22.	2.	0.	24.
255.34	CAUSTIC STORAGE TANK	8.	1.	0.	10.
255.35	SULFURIC ACID STORAGE TANK	8.	1.	0.	10.
255.36	REGENERANT HOLDING TANK	0.	16.	12.	29.
255.37	PH ADJUSTMENT TANK	8.	1.	0.	10.
	SUBTOTAL.	55.	360.	253.	668.
255.5	PIPING				
255.51	2 IN + SMALLER	0.	4.	1.	5.
255.52	2.5 IN + LARGER	68.	92.	8.	169.
	SUBTOTAL.	68.	96.	10.	174.

DATE 11-10-78 CONCEPT COST ESTIMATES (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CPIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
255.6	VALVES	53.	0.	0.	53.
255.7	PIPING-MISC ITEMS				
255.71	HANGERS AND SUPPORTS	$ 14.	$ 0.	$ 0.	14.
	SUBTOTAL.	$ 14.	$ 0.	$ 0.	$ 14.
255.8	WASTE WATER I + C	24.	84.	50.	158.
	SUBTOTAL.	$ 700.	$ 579.	$ 318.	$ 1596.
	SUBTOTAL FOR ACCOUNT.	$ 6867.	$ 4129.	$ 1010.	$ 12006.
	CONTINGENCY (15.0%EQP-15.0%LABOR-15.0%MTL). . .	1030.	619.	152.	1801.
	TOTAL FOR ACCOUNT 25	$ 7897.	$ 4748.	$ 1162.	$ 13807.

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSNET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
26 .	MAIN COND HEAT REJECT SYS				
261.	STRUCTURES				
261.1	MAKEUP WTR INT + DISCH STR				
261.11	INTAKE STRUCTURE	$ 6.	$ 183.	$ 163.	352.
261.12	DISCHARGE STRUCTURE	0.	10.	10.	20.
	SUBTOTAL.	$ 6.	$ 193.	$ 173.	$ 371.
261.2	CIRC WATER PUMP HOUSE				
261.21	BUILDING STRUCTURE	$ 0.	$ 453.	$ 353.	807.
261.22	BUILDING SERVICE	65.	52.	19.	136.
	SUBTOTAL.	$ 65.	$ 506.	$ 372.	$ 943.
261.3	MAKEUP WTR PRETREATMNT BLG				
261.31	BUILDING STRUCTURE	$ 0.	$ 160.	$ 267.	427.
261.32	BUILDING SERVICES	36.	56.	16.	108.
	SUBTOTAL.	$ 36.	$ 216.	$ 283.	$ 535.
261.4	CHLORINATION BUILDING				
261.41	BUILDING STRUCTURE	$ 0.	$ 5.	$ 5.	10.
	SUBTOTAL.	$ 0.	$ 5.	$ 5.	$ 10.
	SUBTOTAL.	$ 107.	$ 919.	$ 832.	$ 1859.
262.	MECHANICAL EQUIPMENT				
262.1	HEAT REJECTION SYSTEM				
262.11	WATER INTAKE EQUIPMENT	$ 178.	$ 81.	$ 9.	268.
262.12	CIRCULATING WATER SYSTEM	3551.	878.	193.	4622.
262.13	COOLING TOWERS	8503.	1479.	147.	10130.
262.15	MAIN CT.MAKEUP+BLOWDN SYS.	1398.	655.	142.	2194.
	SUBTOTAL.	$ 13630.	$ 3093.	$ 490.	$ 17214.
	SUBTOTAL.	$ 13630.	$ 3093.	$ 490.	$ 17214.
	SUBTOTAL FOR ACCOUNT.	$ 13738.	$ 4012.	$ 1323.	$ 19072.
	CONTINGENCY (15.0%EQP-15.0%LABOR-15.0%MTL). . .	2061.	602.	198.	2861.
	TOTAL FOR ACCOUNT 26	$ 15798.	$ 4614.	$ 1521.	$ 21933.

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
91 .	CONSTRUCTION SERVICES				
911.	TEMPORARY CONSTRUCTION FAC				
911.1	TEMPORARY BUILDINGS				
911.11	FIELD OFFICE,SHOPS,WHSE.	$ 0.	$ 910.	$ 1047.	1957.
911.12	JANITOR SERVICES	0.	1053.	123.	1176.
911.13	GUARDS - SECURITY	0.	1619.	123.	1742.
	SUBTOTAL.	$ 0.	$ 3581.	$ 1293.	$ 4874.
911.2	TEMPORARY FACILITIES				
911.21	ROADS,PARKING,LAYDOWN AREA	$ 0.	$ 1215.	$ 616.	1831.
911.22	TEMPORARY ELECTRICAL SUCE	0.	2480.	2765.	5245.
911.23	TEMPORARY MECH. & PIPING	0.	2073.	1244.	3317.
911.24	TEMPORARY HEAT	0.	522.	493.	1014.
911.26	GENERAL CLEANUP	0.	3215.	166.	3381.
	SUBTOTAL.	$ 0.	$ 9504.	$ 5284.	$ 14788.
	SUBTOTAL.	$ 0.	$ 13065.	$ 6578.	$ 19663.
912.	CONSTRUCTION TOOLS & EQUIP				
912.1	MAJOR EQUIPMENT				
912.11	PURCHASE MAJOR EQUIPMENT	$ 0.	$ 0.	$ 8869.	8869.
912.13	EQUIPMENT MAINTENANCE	0.	2627.	1509.	4135.
912.14	FUEL + LUBRICANTS	0.	0.	351.	351.
	SUBTOTAL.	$ 0.	$ 2627.	$ 10729.	$ 13355.
912.3	PURCHASE OF SMALL TOOLS	0.	0.	2537.	2537.
912.4	EXPENDABLE SUPPLIES	0.	0.	2537.	2537.
	SUBTOTAL.	$ 0.	$ 2627.	$ 15804.	$ 18430.
913.	PAYROLL INSURANCE & TAXES				
913.1	SOCIAL SECUR. TAX .055 X L	0.	7910.	0.	7910.
913.2	STATE+FED.UNEMPLOY.035 X L	0.	5035.	0.	5035.
913.3	WORKMENS COMP.INS .040 X L	0.	5753.	0.	5753.
913.4	P.L.+P.D. INS. .005 X L	0.	719.	0.	719.
	SUBTOTAL.	$ 0.	$ 19417.	$ 0.	$ 19417.
914.	PERMITS,INS. & LOCAL TAXES				
914.1	BUILDERS ALL RISK INS	0.	0.	801.	801.
	SUBTOTAL.	$ 0.	$ 0.	$ 801.	$ 801.
	SUBTOTAL FOR ACCOUNT.	$ 0.	$ 35129.	$ 23182.	$ 58311.
	CONTINGENCY (15.0%EQP-15.0%LABOR-15.0%MTL). . .	0.	5269.	3477.	8747.
	TOTAL FOR ACCOUNT 91	$ 0.	$ 40399.	$ 26659.	$ 67058.

DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWF CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
92 .	HOME OFFICE ENGRG.&SERVICE				
921.	HOME OFFICE SERVICES				
921.1	SALARIES	11097.	0.	0.	11097.
921.2	EXPENSES - 15% OF SALARIES	1227.	0.	0.	1227.
921.3	DIRECT PAYROLL COST 25%	2032.	0.	0.	2032.
921.4	OVERHEAD LOADING	5580.	0.	0.	5580.
921.6	FEE FOR H/O SERVICES	1563.	0.	0.	1563.
	SUBTOTAL.	$ 21499.	$ 0.	$ 0.	$ 21499.
923.	HOME OFFICE CONSTRCTN MGMT				
923.1	SALARIES	556.	0.	0.	556.
923.2	DIRECT PAYROLL COST 25%	139.	0.	0.	139.
923.3	OVERHEAD LOADING	382.	0.	0.	382.
923.4	EXPENSES - 15% OF SALARIES	81.	0.	0.	81.
	SUBTOTAL.	$ 1158.	$ 0.	$ 0.	$ 1158.
	SUBTOTAL FOR ACCOUNT.	$ 22656.	$ 0.	$ 0.	$ 22656.
	CONTINGENCY (15.0%EQP-15.0%LABOR-15.0%MTL). . .	3398.	0.	0.	3398.
	TOTAL FOR ACCOUNT 92	$ 26055.	$ 0.	$ 0.	$ 26055.

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
93 .	FIELD OFFICE ENGNG&SERVICE				
931.	FIELD OFFICE EXPENSES				
931.1	OFFICE FURNITURE & EQUIP.	0.	0.	86.	86.
931.2	TELEPHONE & COMMUNICATIONS	0.	0.	259.	259.
931.3	OFFICE SUPPLIES	0.	0.	828.	828.
931.4	FIRST AID & MEDICAL EXP.	0.	0.	62.	62.
	SUBTOTAL.	$ 0.	$ 0.	$ 1235.	$ 1235.
932.	FIELD JOB SUPERVISION				
932.1	SALARIES	8631.	0.	0.	8631.
932.3	DIRECT PAYROLL COST 25%	2157.	0.	0.	2157.
932.4	OVERHEAD LOADING 15%	1619.	0.	0.	1619.
932.5	RELOCATION EXPENSE-ALLWNCE	624.	0.	0.	624.
932.6	FEE FOR CONSTRUCTION SRVCS	1242.	0.	0.	1242.
	SUBTOTAL.	$ 14273.	$ 0.	$ 0.	$ 14273.
933.	FIELD QA/QC				
933.1	SALARIES	169.	0.	0.	169.
933.2	DIRECT PAYROLL COST 25%	43.	0.	0.	43.
933.3	OVERHEAD LOADING 15%	31.	0.	0.	31.
933.4	EXPENSES 5%	12.	0.	0.	12.
	SUBTOTAL.	$ 255.	$ 0.	$ 0.	$ 255.
934.	PLANT STARTUP & TEST				
934.1	SALARIES	281.	0.	0.	281.
934.2	DIRECT PAYROLL COST 25%	70.	0.	0.	70.
934.3	OVERHEAD LOADING 55%	52.	0.	0.	52.
934.4	EXPENSES - 15% OF SALARIES	38.	0.	0.	38.
	SUBTOTAL.	$ 441.	$ 0.	$ 0.	$ 441.
	SUBTOTAL FOR ACCOUNT.	$ 14969.	$ 0.	$ 1235.	$ 16205.
	CONTINGENCY (15.0%EQP-15.0%LABOR-15.0%MTL). . .	2245.	0.	185.	2431.
	TOTAL FOR ACCOUNT 93	$ 17215.	$ 0.	$ 1421.	$ 18635.

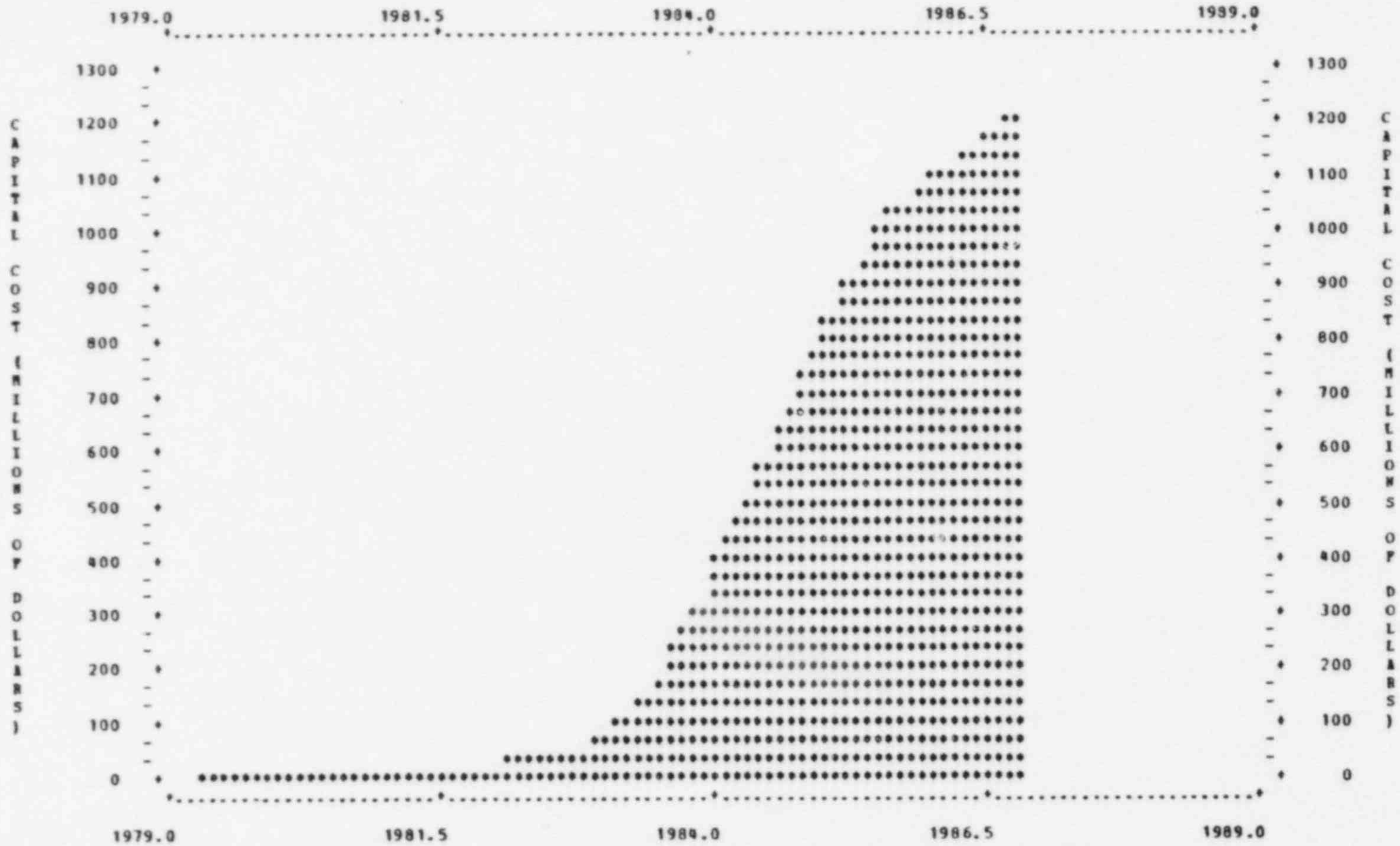
DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CPIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN   EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

ACCOUNT NUMBER	ACCOUNT TITLE	FACTORY EQUIPMENT	SITE LABOR	SITE MATERIALS	TOTAL
94 .	OWNER'S COSTS				
941.	ENGINEERING & QA	$ 5565.	$ 0.	$ 0.	5565.
942.	TAXES & INSURANCE	$ 18086.	$ 0.	$ 0.	18086.
943.	SPARE PARTS	$ 6957.	$ 0.	$ 0.	6957.
944.	STAFF TRAINING	$ 2782.	$ 0.	$ 0.	2782.
945.	OWNER'S G&A	$ 8348.	$ 0.	$ 0.	8348.
	SUBTOTAL FOR ACCOUNT.	$ 41738.	$ 0.	$ 0.	$ 41738.
	CONTINGENCY (15.0%EQP-15.0%LABOR-15.0%MTL). . .	6261.	0.	0.	6261.
	TOTAL FOR ACCOUNT 94	$ 47999.	$ 0.	$ 0.	$ 47999.

DATE 11-10-78 C O N C E P T   C O S T   E S T I M A T E S (PHASE 5)
UNIT 1   CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMET(05-16-78) POWER PLANT AT: MIDDLETOWN   EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000



DATE 11-10-78 C O N C E P T C O S T E S T I M A T E S (PHASE 5)
UNIT 1 CAPITAL INVESTMENT DETAIL COSTS (THOUSANDS OF DOLLARS)
1200 MWE CBIGSMPT(05-16-78) POWER PLANT AT: MIDDLETOWN EXAMPLE7
COST BASIS: YEAR OF STEAM SUPPLY SYSTEM PURCHASE

STEAM SUPPLY SYSTEM PURCHASE: 1979.000
CONSTRUCTION PERMIT: 1983.000
COMMERCIAL OPERATION: 1987.000

C U M U L A T I V E C A S H F L O W

BOTH THE CASH FLOW CURVE SHOWN ABOVE AND THE FOLLOWING CASH FLOW TABLE
HAVE COSTS EXPRESSED AS TOTAL COST INCURRED TO DATE (INCLUDING INTEREST CHARGES TO DATE).

DATE	COST TO DATE (MILLIONS OF DOLLARS)
1979.000	0.0
1979.160	0.0
1979.320	0.0
1979.480	2.913
1979.640	2.951
1979.800	2.990
1979.960	3.028
1980.120	3.066
1980.280	4.753
1980.440	4.813
1980.600	4.874
1980.760	4.934
1980.920	9.646
1981.080	9.768
1981.240	9.889
1981.400	10.011
1981.560	10.132
1981.720	32.181
1981.880	32.591
1982.040	33.002
1982.200	33.412
1982.360	33.823
1982.520	37.593
1982.680	38.048
1982.840	38.503
1983.000	68.347
1983.160	106.165
1983.320	126.795
1983.480	159.212
1983.640	226.007
1983.800	296.714
1983.960	328.699
1984.120	405.765
1984.280	482.628
1984.440	553.576
1984.600	598.593
1984.760	679.674
1984.920	760.534
1985.080	837.060
1985.240	871.627
1985.400	930.671
1985.560	1000.474
1985.720	1035.992
1985.880	1065.414
1986.040	1094.868
1986.200	1114.813
1986.360	1135.929
1986.520	1155.863
1986.680	1186.592
1987.000	1215.300

Appendix E

INSTRUCTIONS FOR LOADING THE PROGRAMS INTO THE COMPUTER

LOADING THE PROGRAMS INTO THE COMPUTER

The CONCEPT package is generally transmitted to a user on a nine-track magnetic tape in extended binary coded decimal interchange code (EBCDIC). The tape contains the following files:

File 1 The CONCEPT-5 source program

File 2 The CONTAC-5 source program

File 3 The CONLAM-5 source program

File 4 The sample cases for testing CONCEPT-5

File 5 The cost models to be processed by CONTAC-5

File 6 The equipment, labor, and materials cost history data used by CONLAM-5

The source programs are compiled at ORNL using an IBM Level H FORTRAN compiler and are executed on an IBM 360/95 machine with HASP-MVT. The core requirements for execution of any of the three programs on the IBM 360 is less than 270K (bytes). Example IBM job control language (JCL) instructions are given in Table E.1 to assist users in preparing JCL cards. Those using other than IBM equipment may find some help in converting IBM JCL to other systems by consulting the IBM System/360 Job Control Language Reference.[19]

As shown in Fig. 1.1, the CONTAC and CONLAM programs must be compiled and executed prior to execution of the CONCEPT program. Steps 1 through 4 do this and establish two files named COSTMOD.LIBR and CONLAM.LIBR on a permanent system direct access device identified as SYSTM1. A temporary direct access device is also needed and is identified in this JCL as SYSDA. Steps 2 and 3 employ the IBM OS utility program IEBGENER. It is described in the IBM OS Utility Reference.[20]

In Step 4, FT08F001 defines a formatted master file which should be saved on some device (not necessarily direct access) for periodic updating of the equipment, labor, and materials file.

Step 5 compiles and link edits the CONCEPT-5 program to create a stored load module for use in Step 7. Step 6 again uses the IBM OS utility program IEBGENER to read input data for the CONCEPT program.

Table E.1. Example IBM job control language instructions

```
//STEP1 EXEC FORTHCLG,REGION=270K
//FORT.SYSIN DD DSN=CONTAC5,UNIT=TAPE9,VOL=SER=X1234,
//  LABEL=(2,NL),DISP=(OLD,PASS),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//GO.FT06F001 DD SYSOUT=A
//FT04F001 DD DSN=COSTMOD5,UNIT=TAPE9,VOL=SER=X1234,
//  LABEL=(5,NL),DISP=(OLD,PASS),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//FT08F001 DD DUMMY
//FT09F001 DD DSN=COSTMOD.LIBR,VOL=SER=SYSTM1,UNIT=3330,
//  DISP=(NEW,CATLG),SPACE=(CYL,(5,1),RLSE),
//  DCB=(RECFM=VBS,LRECL=X,BLKSIZE=13030)
//FT05F001 DD *
0
/*
//STEP2 EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSIN DD DUMMY
//SYSUT2 DD DSN=&&TEMP1,UNIT=SYSDA,DISP=(NEW,PASS),
//  DCB=(RECFM=FB,LRECL=80,BLKSIZE=6400),SPACE=(TRK,(1,1),RLSE)
//SYSUT1 DD *
   30   30   23    1    0    0    0    0    0
/*
//STEP3 EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSIN DD DUMMY
//SYSUT2 DD DSN=&&TEMP2,UNIT=SYSDA,DISP=(NEW,PASS),
//  DCB=(RECFM=FB,LRECL=80,BLKSIZE=6400),SPACE=(CYL,(2,1),RLSE)
//SYSUT1 DD DSN=ELMDATA,UNIT=TAPE9,VOL=SER=X1234,LABEL=(6,NL),
//  DISP=(OLD,PASS),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//STEP4 EXEC FORTHCLG,REGION=270K
//FORT.SYSIN DD DSN=CONLAM5,UNIT=TAPE9,VOL=SER=X1234,LABEL=(3,NL),
//  DISP=(OLD,PASS),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//GO.FT06F001 DD SYSOUT=A
//FT05F001 DD DSN=&&TEMP1,DISP=(OLD,DELETE)
//          DD DSN=&&TEMP2,DISP=(OLD,DELETE)
//FT09F001 DD DSN=CONLAM.LIBR,VOL=SER=SYSTM1,UNIT=3330,
//  DISP=(NEW,CATLG),SPACE=(TRK,(9,1),RLSE),
//  DCB=(RECFM=VBS,LRECL=4860,BLKSIZE=13030)
//FT08F001 DD DSN=NEWMASTR,VOL=SER= -----  ,UNIT= -----
//  DISP=(NEW,KEEP),SPACE= ----- 278,000 BYTES,
//  DCB=(RECFM=FB,LRECL=80,BLKSIZE=6400)
//FT04F001 DD DUMMY
//STEP5 EXEC FORTHCL,REGION=270K
//FORT.SYSIN DD DSN=CONCEPT5,UNIT=TAPE9,VOL=SER=X1234,LABEL=(1,NL),
//  DISP=(OLD,PASS),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//LKED.SYSLMOD DD DSN=CONCEPT5.LOAD(CONCEPT5),VOL=SER=SYSTM1,
//  UNIT=3330,DISP=(NEW,CATLG),SPACE=(TRK,(13,1,1),RLSE),
//  DCB=(RECFM=U,BLKSIZE=13030)
//STEP6 EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSIN DD DUMMY
//SYSUT2 DD DSN=&&TEMP,UNIT=SYSDA,DISP=(NEW,PASS),
//  SPACE=(800,(8,1),RLSE),DCB=(RECFM=FB,LRECL=80,BLKSIZE=800)
//SYSUT1 DD DSN=EXAMPLE,UNIT=TAPE9,VOL=SER=X1234,LABEL=(4,NL),
//  DISP=(OLD,KEEP),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//STEP7 EXEC PGM=CONCEPT5,REGION=270K,PARM='CK=-5'
//STEPLIB DD DSN=CONCEPT5.LOAD,DISP=SHR
//FT06F001 DD SYSOUT=A
//FT04F001 DD UNIT=SYSDA,SPACE=(CYL,(1,1),RLSE),
//   DCB=(RECFM=F,LRECL=80,BLKSIZE=80),DISP=(NEW,DELETE)
//FT02F001 DD UNIT=SYSDA,SPACE=(CYL,(1,1),RLSE),
//  DCB=(RECFM=F,LRECL=80,BLKSIZE=80),DISP=(NEW,DELETE)
//FT03F001 DD UNIT=(SYSDA,SEP=FT02F001),SPACE=(CYL,(1,1),RLSE),
//  DCB=(RECFM=F,LRECL=80,BLKSIZE=80)
//FT11F001 DD UNIT=(SYSDA,SEP=(FT02F001,FT03F001)),
//  SPACE=(CYL,(1,1),RLSE),DCB=(RECFM=VS,LRECL=10900,BLKSIZE=7294)
//FT08F001 DD DSN=CONLAM.LIBR,DISP=SHR
//FT09F001 DD DSN=COSTMOD.LIBR,DISP=SHR
//FT05F001 DD DSN=*.STEP6.SYSUT2,DISP=(OLD,DELETE)
//
```

Input to the CONCEPT program must be read in Step 6, and the statement PARM='CK=-5' must be included in Step 7 when using HASP spooling systems. This is due to a HASP limitation on rewinding the input file during execution of the CONCEPT program. Users with ASP systems should not have this problem and may omit Step 6 and replace the FT05F001 card in Step 7 with

```
//FT05F001 DD DSN=EXAMPLE,UNIT=TAPE9,VOL=SER=X1234,LABEL=(4,NL),
//  DISP=(OLD,KEEP),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
```

PARM='CK=-5' may also be omitted for those with ASP control.

As given in Table E.1, the example input data will be used. Subsequent runs of CONCEPT may now be made by using only the cards in Steps 6 and 7. The SYSUT1 card in Step 6 should be changed to

```
//SYSUT1  DD *
```

followed by the input data and a /* card. Again this applies for machines with HASP spooling. Those having ASP control should replace the FT05F001 card in Step 7 with

```
//FT05F001 DD *
```

followed by the input data and a /* card.

As an additional note, the CONCEPT MAIN program and CONTAC auxiliary program utilize a local subroutine called IDAY for obtaining the date-of-run in A8 format. Your current date subroutine should be substituted where a call to IDAY occurs. CALL IDAY (DATE) is used in CONCEPT-5 at MAIN 830 and in CONTAC at CONT 1210. The variable DATE should be set to the current date-of-run in A8 format. Failure to modify this will result in an unresolved external reference.

REFERENCES

1. U.S. Atomic Energy Commission, *CONCEPT, A Computer Code for Conceptual Cost Estimates of Steam-Electric Power Plants — Status Report*, WASH-1180, April 1971.
2. R. C. DeLozier, L. D. Reynolds, and H. I. Bowers, *CONCEPT — Computerized Conceptual Cost Estimates for Steam-Electric Power Plants — Phase I User's Manual*, ORNL/TM-3276, October 1971.
3. H. I. Bowers et al., *CONCEPT — Computerized Conceptual Cost Estimates For Steam-Electric Power Plants — Phase II User's Manual*, ORNL-4809, April 1973.
4. U.S. Energy Research and Development Administration, *CONCEPT — A Computer Code for Conceptual Cost Estimates of Steam-Electric Power Plants — Phase IV User's Manual*, ERDA-108, June 1975.
5. C. R. Hudson, *User's Instruction for Preliminary Version of the CONCEPT-5 Computer Code*, ORNL/TM-6230, February 1978.
6. U.S. Nuclear Regulatory Commission, *Commercial Electric Power Cost Studies — Capital Cost: Pressurized Water Reactor Plant*, NUREG-0241, June 1977.
7. U.S. Nuclear Regulatory Commission, *Commercial Electric Power Cost Studies — Capital Cost: Boiling Water Reactor Plant*, NUREG-0242, June 1977.
8. U.S. Nuclear Regulatory Commission, *Commercial Electric Power Cost Studies — Capital Cost: High and Low Sulfur Coal Plants — 1200 MWe*, NUREG-0243, June 1977.
9. U.S. Nuclear Regulatory Commission, *Commercial Electric Power Cost Studies — Capital Cost: Low and High Sulfur Coal Plants — 800 MWe*, NUREG-0244, June 1977.
10. U.S. Nuclear Regulatory Commission, *Commercial Electric Power Cost Studies — Capital Cost Addendum: Multi-Unit Coal and Nuclear Stations*, NUREG-0245, September 1978.

11. U.S. Nuclear Regulatory Commission, *Commercial Electric Power Cost Studies — Cooling Systems Addendum: Capital and Total Generating Cost Studies*, NUREG-0247, September 1978.

12. U.S. Department of Labor, Bureau of Labor Statistics, *Monthly Labor Review*, published monthly.

13. U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings*, published monthly.

14. U.S. Department of Labor, Bureau of Labor Statistics, *Producer Prices and Price Indices*, Washington, D.C. (monthly publication).

15. U.S. Department of Labor, Bureau of Labor Statistics, *National Survey of Professional, Adminstrative, Technical, and Clerical Pay*, Washington, D.C. (annual publication).

16. *Engineering News-Record*, McGraw-Hill, New York, published weekly.

17. NUS Corporation, *Guide for Economic Evaluation of Nuclear Reactor Plant Designs*, USAEC Report NUS-531, January 1969.

18. IBM Corporation, *PLOT: A Subroutine for Plotting on a Printer*, Contributed Program Library, 360D-08.6.003 (October 1967).

19. IBM System/360 Operating System: Job Control Language Reference, Order No. GC28-7604-3.

20. IBM System/360 Operating System: Utilities, Order No. GC28-6586-15.

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