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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

Engineering Economic Model for Fish Protein Concentration Processes

K.K. ALMENAS, L.C. DURILLA, R.C. ERNST,
J.W. GENTRY, M.B. HALE, and J.M. MARCHELLO

SEATTLE, WA
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343. Report of the Bureau of Commercial Fisheries Biological Laboratory, Galveston, Texas, fiscal year 1969. By the Laboratory staff. August 1970, iii + 39 pp., 28 figs., 9 tables.

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By

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I. ABSTRACT

A process engineering economic model for fish protein concentration processes has been developed. The model predicts the construction and operating costs for fish meal plants and for plants producing fish protein concentrate (FPC) by: isopropyl alcohol extraction, biological, and press cake-isopropyl alcohol extraction.

Typical process flow sheets and a computer program were developed to be used in the design and cost computations. The model provides for each process to be studied both internally and externally in comparison with alternate processes. The program and model were prepared in such a way that changes and updating may be accomplished quite readily as new information becomes available. This report contains directions for users and descriptions of the processes. A listing of the computer program and example calculations for each process are presented in the Appendix to guide the user and to illustrate the nature of the model output.

While the model does develop construction, operating, and production aspects of the processes, it does not deal with the economics of selling the products and the resulting profit and return on investment. Problems of allocation of costs and marketing arrangements are not covered in this report, but must be considered in the final decisions relating to a complete evaluation of alternatives.

II. INTRODUCTION

Fish protein concentrate (FPC) production holds substantial promise of helping to meet the growing food and dietary requirements for the world's human population. It appears that several of the processes now being developed will be successful in making FPC available on a competitive basis with other sources of protein (1, 2). To provide for the orderly and rapid development of these processes it is necessary to continually review the internal steps of each process and to compare processes on a common basis.

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The objective of this study was to develop a process cost and design model which can predict construction and operating costs for a wide range of FPC process conditions. The model was to handle a number of the FPC processes, operated singly or in conjunction with associated operations such as fish meal manufacture. This approach of making predesign computer estimates (3, 4) is becoming a common tool of management in process industry research and development.

A. Engineering Economic Model

The model consists primarily of a digital computer program which determines the size and cost of major items of equipment for each process and then estimates the costs. The model is constructed so that new information at the bench scale, pilot plant, and demonstration plant levels can be easily incorporated to keep the program current with the available knowledge about each process.

Typical process flow sheets were developed with suitable options for each of the processes. These were used along with the available information on the process to prepare the material and energy balance portions of the program. Changes in flow sheets, types of equipment, processing sequences, and operating conditions, may be made following the internal program changes procedures.

From the material and energy calculations, the major items of equipment are sized and their cost estimated through built-in design and cost information. The program then determines the operating and manufacturing costs subject to the input data and internal assumptions of the model.

Two important features of the program are the built-in consistency of estimates for different processes and the continuity of estimates during the several stages of development of a given process. The uniformity of estimates results primarily from the use of a common set of equipment cost subroutines and a common set of assumptions regarding such cost items as indirect costs, land, engineering, etc. Since input data include the cost of labor, plant size, and cost indices, the program is useful in many broad-based studies of FPC production in different parts of the world at the present and in the future.

The model provides for each FPC process to be studied both internally and externally in comparison with alternate processes. Internal costs identify areas needing further research and development. The ability to estimate costs for a number of processes for a wide range of input conditions provides the broad comparison type information needed to guide a variety of research and development projects. The engineering economic model contains five process plant programs: fish meal; biological; isopropyl alcohol extraction; press cake-biological; and press cake-isopropyl alcohol extraction. Process descriptions and flow sheets are presented in the next chapter.

Fish meal processing is a common operation and there are many such plants throughout the world. Fish meal is used for animal feed while the other processes make products for human consumption. It was included to provide a basis for comparison and because frequently intermediate meal products are a starting point for the FPC processes. The other processes are viable candidates for commercial manufacture of FPC.

B. Cost Estimation

In the development and use of the model it is important to have accurate cost information. Equipment and capital cost data were obtained from a number of recent publications. These figures were compared and reviewed for consistency and accuracy. In several instances costs were adjusted to meet the actual experience of individuals knowledgeable in the field of marine protein manufacturing. Finally all costs were adjusted to the base of early 1970.

The adjustment of cost data from the past several years to an early 1970 value was made using the Marshall and Stevens Equipment Cost Index which is published in the periodical *Chemical Engineering*. The M & S Equipment Cost Index is based on a value of 100 in the year of 1926. The early 1970 base value of 297.5 is used for equipment costs in this report.

Adjustment in costs from one year to another is accomplished by multiplying the known cost by the ratio of the index values at the two years involved to obtain the desired cost. The choice of the M & S Index over several other indices that are available was based on the fact that the components used in the M & S Index are more nearly those present in FPC plants, and the general observation that all the indices have been moving at about the same rate in recent years.

Use of these indices over more than a few years leads to considerable uncertainty and is not recommended. It is hoped that users of the model will continually update the data from the best sources available and not resort to changing the cost index alone. Equipment is continually being developed and many specific items do not follow the average trends.

There is a wide variation in costs at any given time. This is due in part to the inventory and backlog situation of the individual manufacturers and suppliers. The best cost information is a written quotation for a specific item to be purchased during a given period. In a number of instances, particularly for the IPA-Extraction process (17), quotes on equipment were available and were used in adjusting the literature data. Essentially the same thing was done, through discussions with experienced persons, for the typical fish meal process.

The capital cost estimating procedure of Guthrie (6) was used in developing the process engineering economic model. A module technique is employed in which cost elements having similar characteristics and relationships are grouped together. This grouping is discussed in the program output section. Published equipment cost information was obtained from a number of sources (6, 7, 8, 9, 10, 12, 13, 14, and 15). The cost data were fit to appropriate equations and are contained in the cost subroutine. This portion of the computer program and procedures for changing the data are discussed later in the report.

Costs of chemicals and raw materials were taken from recent issues of the *Oil, Drug and Paint Reporter* and from actual purchasing experience. Some of these are program input items and can be changed whenever the program is used. The cost of fish is quite varied and depends greatly on local conditions. Fish meal manufacturers often make contractual arrangements with the boat owners whereby the final price paid is dependent upon the income ultimately received from selling the fish meal. This input item will require close attention of the program user. The tradition of the industry of speaking in terms of fish rather than weight can also be a point of confusion. For menhaden, one million fish is taken to be 755,000 pounds of fish.

C. Process Economics

The model develops the construction, operating, and production aspects of each process subject to specific input and internal information. It does not deal with the economics of selling the products and the resulting profits and return on investment.

Each of the processes makes several products and consequently requires the managerial decisions of cost allocation to establish selling prices of products. Marketing, inventory management, product distribution, and sales contracting are important factors in the final decision on commercial operation. The model is intended to provide processing information upon which preliminary deliberations and decisions of the venture risk type can be made.

It is most important in using the model to recognize its limitations. Of the processes in the model only fish meal processing is a commercial operation at present. Even in this case the model attempts only to give representative information for a somewhat typical kind of plant under average conditions in the United States. Several IPA extraction plants for FPC production are under construction. The model IPA process is based on a modified analysis of the National Marine Fisheries Service Experiment and Demonstration Plant at Aberdeen, Washington. In all other instances the processes are in the early pilot plant level of development.

The model is also generally limited to use for plants handling 50 or more tons per day of fish. Modern domestic fish meal plants handle 1,000 or more tons per day and it is expected that FPC plants will be in the range of 100 or more tons per day. There is significant interest in processing FPC on board ships and developing small village industry operations. Use of the model in the 10 to 50 tons per day range will require some modification or at least close attention and judgment about the details of the output.

The model is presently applicable to coastal plants. To place one of these processes on board a ship will require significant changes. Generally space is a limiting factor on board ship and the processes would need to be redesigned for compactness. Special modifications to the ship could be costly, while certain land operation requirements, such as pollution control, might be eliminated, resulting in savings.

Village industry operation, and operation in foreign countries in general, will require a number of changes. The model provides for modern, instrumented, continuously operating plants. Equipment costs are for the United States and, in general, the plants are custom-made large facilities. Smaller plants, in the 10 ton per day sizes, might be mass-produced and thereby benefit from unit cost reduction much like appliances. If the appliance approach is not used on-site fabrication of village level plant would probably be of the batch type. Such plants would have additional difficulties with quality control. A training program for village plant operators might be necessary to overcome potential health and operating problems.

III. DESCRIPTION OF PROCESS MODELS

A. Fish Meal Process

The diagram of the fish meal plant is given in Figure 1. On the drawing, the streams are labeled. The fish are processed for three products, fish meal, fish oil, and fish solubles (50% water). An option is provided as to whether fish solubles are produced as a product or added to the fish meal.

Fish are unloaded from the boat by fish pumps. A weighing conveyor carries the fish to a storage unit which has a three-day capacity. A bucket conveyor takes fish from storage and drops them into a cooker. Oil is removed from the cooked fish in a continuous screw press.

The press cake leaving the press contains 50% solids. This stream in tons/day is labeled AA(91,2). The press liquor contains the oil and water from the fish and 15% of the total fish protein. It is labeled AA(91,3). The cookers are available in 100 ton/day and 250 ton/day sizes. Similarly two different sizes of screw presses are available. The selection of cookers, presses, and screens is internally handled in the program.

The program then branches to two processing streams. The stream containing most of the oil and water is discussed below. The first input option considered is whether to add the fish solubles streams to the fish meal stream [IPTION(1) = 2], or to market them as separate products, [IPTION(1) = 1].

From the presses, stream AA(91,2) passes through a mixer where the recycled fish solubles may be combined with the main stream. The stream then goes to steam tube drying in which approximately one-half of the weight is evaporated. Antioxidant, corresponding to 0.01 #/# of oil retained in the fish meal, is then added. The meal passes through a mixer to a storage unit where it is cured for 15 days. The meal is milled prior to bagging.

Stream AA(91,3) is centrifuged. The centrifuge is sized from the flow in gallons/hour. The oil is then polished with hot water (10% of the oil weight of water is used) in a second centrifuge. The dummy variable TONSA is used for this stream at this point in the program. The fish oil product is designated AA(90,5). All hold tanks in the stream have a one-hour holding time. The fish oil storage capacity is 15 days.

The water and soluble protein are conveyed into an acid mix tank where it is mixed with sulfuric acid. This stream TONSWW then passes into a triple effect evaporator. The streams TONA and TONC are in tons/hr rather than tons/day. TONA is the inlet stream to the triple effect evaporator. TONC is the stream from the third effect going to the concentrator. The resulting fish solubles stream is 50% protein. It may be marketed as a product AA(90,4) or returned to the mixer and processed as fish meal. The storage capacity for fish solubles is 15 days.

In summary, three products may be produced—fish oil, fish solubles, and fish meal. Also, by an appropriate choice of option the fish solubles may be recycled and processed with the fish meal.

B. Biological Process

In the biological processes the proteins of the fish are partially hydrolyzed with enzymes to permit separation of the oil, bone, and proteinaceous material. The distinguishing feature of the process is large heated and stirred vessels into which the ground fish is fed and in which the digestion takes place. The subroutine handling this process is labeled "Subroutine Biolog"; the flow streams and equipment blocks of this subroutine are identified in Figure 2. In addition to the standard four-card input discussed in Section IVD, "Biolog" requires 5 input items which are entered on a fifth card in E12 format.

1. ULOADING, STORAGE AND GRINDING

The handling of the fish up to the digester stage includes fish pumps, conveyors with wash

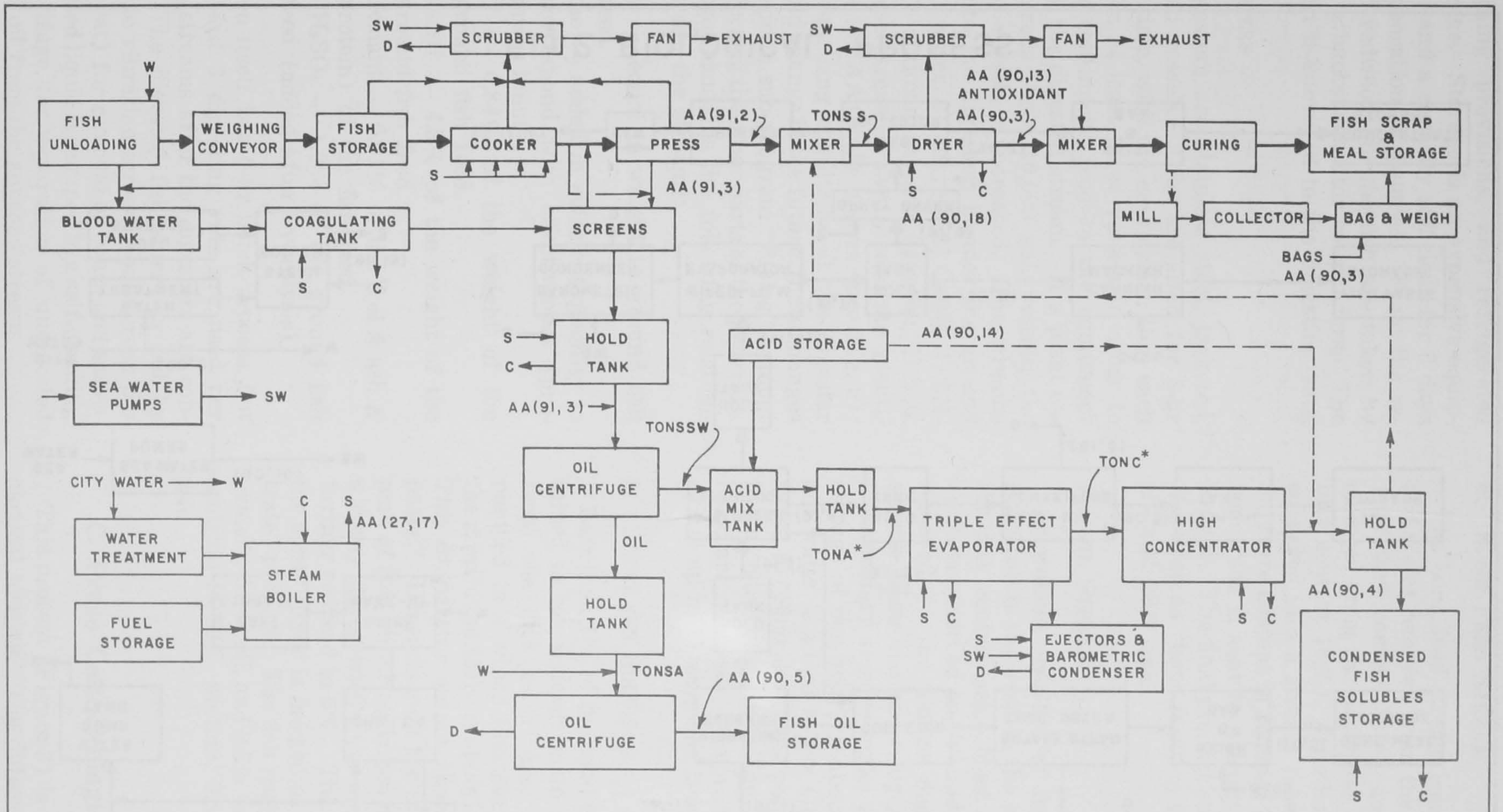


Fig. I FISH MEAL PROCESS

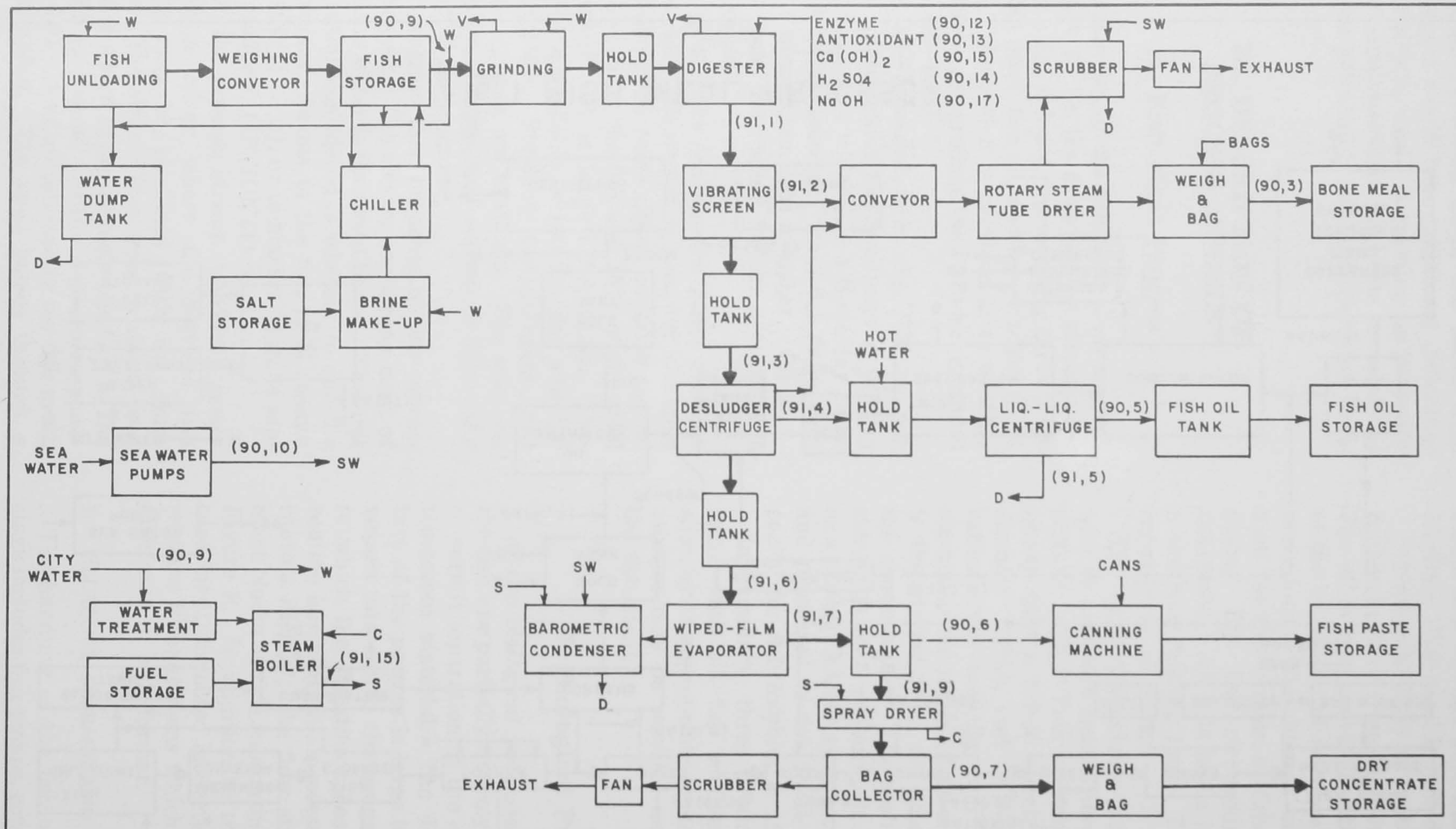


Fig. 2 BIOLOGICAL PROCESS

and weighing provisions, and refrigerated brine storage. Storage is an expensive equipment item and a capacity sufficient for 3 days of plant operation is assumed. From the refrigerated redwood bin the fish are taken by means of a bucket elevator to grinders. The ground fish is conveyed to the digesting vats.

2. Digesters

The digesters are stainless steel, jacketed, and stirred vessels. They are sized for 5-hr residence time, with the assumption that each plant needs at least three vessels in order to provide a continuous feed to the equipment processing the digested stream. If a plant capacity exceeds three 10,000 gal. vessels, the number of vessels is increased. The streams feeding into the digesters besides the ground fish are 1) water, 2) enzyme, 3) CaOH, 4) 5N-NaOH, 5) antioxidant, and 6) conc. H_2SO_4. All of these streams have a separate identification in the AA(90,J) matrix (see Fig. 2); thus if processing conditions at the digester stage should change in the future, these changes can be made in sub-program "Biolog" without unduly affecting the other parts of the program. The program contains the following relationships between the streams:

a water — equal in weight to ground fish feed.
b enzyme — added in sufficient quantity to correspond with effectiveness (program input).
c CaOH — 0.84% of the weight of the ground fish feed.
d 5N-NaOH — 4.3% of the weight of the ground fish feed.
e Antioxidant — 0.01% of the (oil & ash & protein) of the fish feed.
f conc. H_2SO_4 — 1.9% of the ground fish feed (added after hydrolysis).

Digestion itself is a 5-hr batch process, but since at least 3 digesting vats are used per plant, the streams after the digesters are continuous. The digested fish slurry is fed by gravity into vibrating screens (one screen per digesting vat) for removal of bones and scales. The screened liquid is pumped to a self-cleaning disk centrifuge for separation of undigested solids and oil from the aqueous stream.

3. Bone Feed Stream

The bone feed stream consists of the bones and scales removed from the vibrating screens (moisture content 50%) and the sludge discharged from the desludger centrifuge (moisture content 76%). The bone feed stream is conveyed into a stream tube dryer where the moisture content is reduced to 10%. The dry bone feed is sent to a hammer mill and then bagged. The final product stream [AA(90,3)] identified as "bone feed" is 40% protein, 22% oil, and 28% ash.

4. Oil Stream

Approximately 75% of the lipid content of fatty fish is removed in the oil discharge from the disk centrifuges. Most of the balance of lipids is adsorbed on the undigested solids and removed in the sludge discharge. The oil stream from the centrifuges is pumped into intermediary storage tanks (with a maximum storage of one hour). About 10% additional hot water is added to the oil and the mixture is fed to "Sharples" type polishing centrifuges in which the water including solvated solids and blood are removed. The product fish oil can be stored up to 15 days and is sold in bulk.

5. Dissolved Solids

Less than 1% of the total fish lipids are contained in the aqueous main stream discharge from the disk centrifuge. This stream is pumped to a wiped film evaporator in which the stream moisture content is reduced to 50%. This evaporator output stream is called "fish paste." Depending on the input option, all or part of it is either packaged in cans or fed into a spray dryer where the moisture content is further reduced to 5%. The exit stream from the spray dryer is bagged as the "dry concentrate" product. The fish paste product is 41% protein, 0.3% oil, and 8.3% ash. The dry concentrate is 79% protein, 0.5% oil, and 16% ash.

C. Press Cake-Biological Process

This process (Figure 3) is similar to the Biological process. The differences are that be-

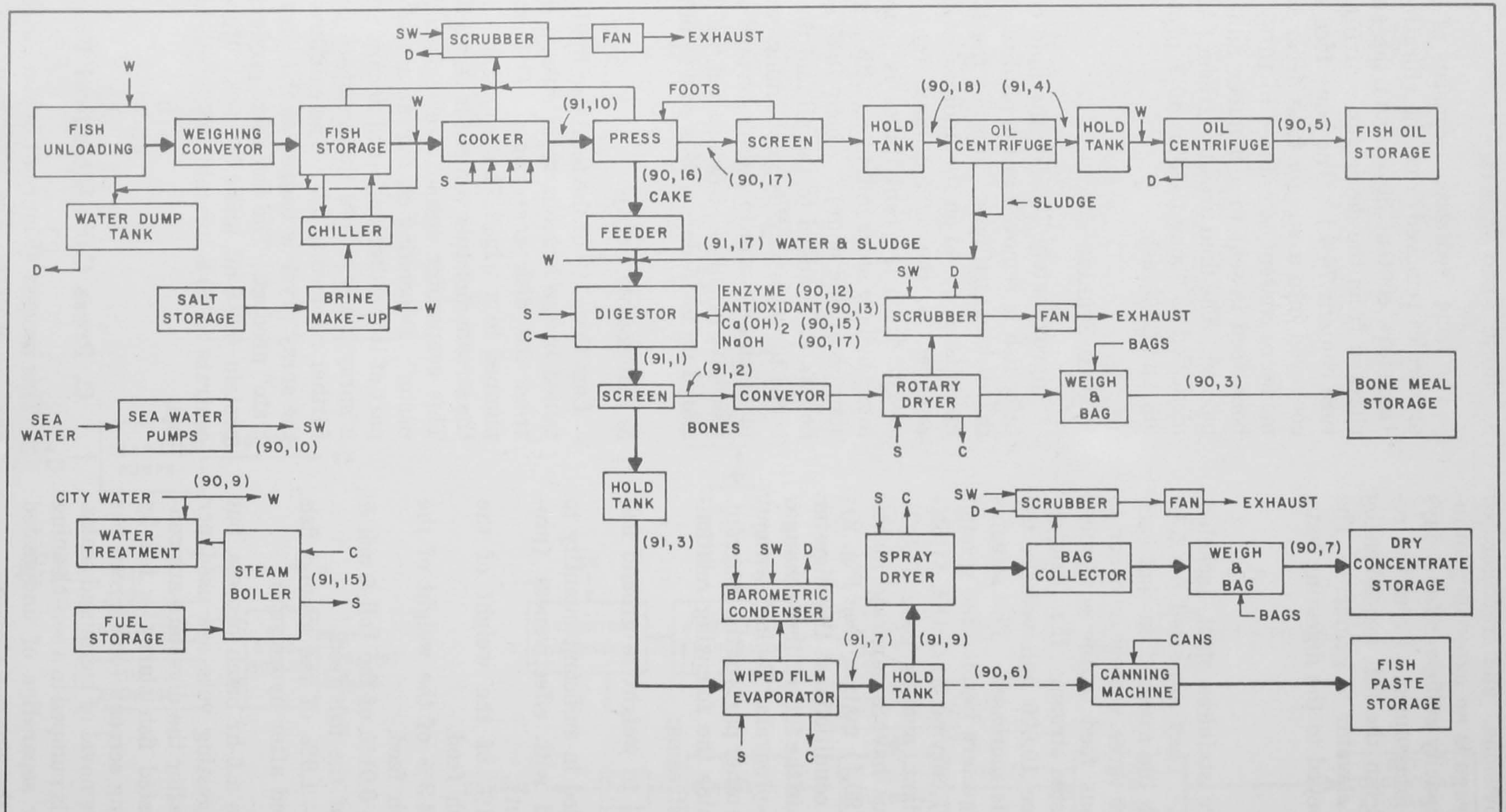


Fig. 3 PRESS CAKE-BIOLOGICAL PROCESS

fore being fed to the digestion vats the fish are cooked and pressed as in the Fish Meal Process. The separation of oil and stick water takes place before rather than after the digestion stage. Process description: a) Input (besides the standard input) is the same as for the Biological process, except that in this case the enzyme which is added to the digester is based on 100 lb. of cooked and pressed fish (referred to as press cake) rather than on raw ground fish; b) Unloading and storage processes include fish pumps, conveyors with wash and weighing provisions, and refrigerated brine storage for up to 3 days of plant operation. The stored fish is lifted by bucket elevators into steam cookers. The fish are cooked and pass into screw presses where the moisture content of the "press cake" is reduced to 60%.

The press liquor is screened and pumped from a hold tank to a centrifuge for oil separation and "foots" removed by screening are recycled to the press. The separated oil is polished with hot water in a second liquid-liquid centrifuge, as in the Biological process, and pumped to bulk storage.

The aqueous "stickwater" stream from the first centrifuge contains both soluble and insoluble solids. It is added to the press cake in the digesting vats along with additional water to form a press cake slurry for enzymatic hydrolysis. For hydrolysis with the alkaline enzyme the pH is adjusted with 5N NaOH at 2.2% of the weight of raw fish feed.

After a 4-hr hydrolysis the slurry is passed through a vibrating screen. Bones and scales with a 50% moisture content are conveyed from the screen to a stream tube dryer where the moisture content is reduced to 10%. The dry bone meal is sent to a hammer mill and then bagged.

The screened hydrolysate is concentrated to a fish paste containing 50% solids in a wiped film evaporator. Depending on the input option, all or part of it is either packaged in cans or fed into a spray dryer where the moisture content is further reduced to 5%.

The final products are bone meal (36% protein, 9.7% oil, 47.4% ash), fish paste (39% protein, 6% oil, 5% ash), dry concentrate (75% protein, 11% oil, 9% ash) and fish oil. Insoluble solids are not removed by centrifugation as in Biological process.

D. IPA Extraction Process

The IPA process is shown in Figure 4. This is a solvent extraction process in which water and lipids are removed using isopropyl alcohol (17). Solvent recovery and recycle is an important part of the process. The first decision variable is whether wet deboning or no deboning is used. In wet deboning the bones are dried, ground in a hammer mill, packaged and sold as bone meal. This option is activated when IPTION(1) is equal to one. If no deboning is desired, no option is specified. In this case, the dried concentrate product will contain both protein concentrate and bone meal.

Unloading and storage processes include fish pumps, conveyors with wash and weighing provisions, and refrigerated brine storage for 3 days of plant operation. The ground fish is pumped to a slurry mix tank where solvent miscella M-2 is added. The solids go through four stages of extraction. They are separated from the miscella between stages by screens and presses.

For the material balance on the extraction vessels the miscella stream are designated STRMM(I) where I is the stage number. The constituent streams of oil, protein, ash, water, and isopropyl alcohol are designated STRM (I, J). Here, however, the index I designates the stream entering the Ith stage or leaving the I + 1 stage. The unit operation of this part of the process is a 4-stage liquid-slurry extraction process in which an azeotrope of isopropyl alcohol and water is used as the extractive solvent. The solvent to fish ratio is 2:1.

1. Fish Protein Concentrate Stream

The slurry stream leaving the fourth stage of extraction contains the ash, most of the protein, and a small residual amount of oil. This stream enters a series of dryers (dryer, stripper dryer, and conditioner) in order to reduce the moisture of the stream to approximately 8% and to reduce the IPA residual to below 250 ppm. The amount of material leaving the conditioner is designated TASB. The fraction

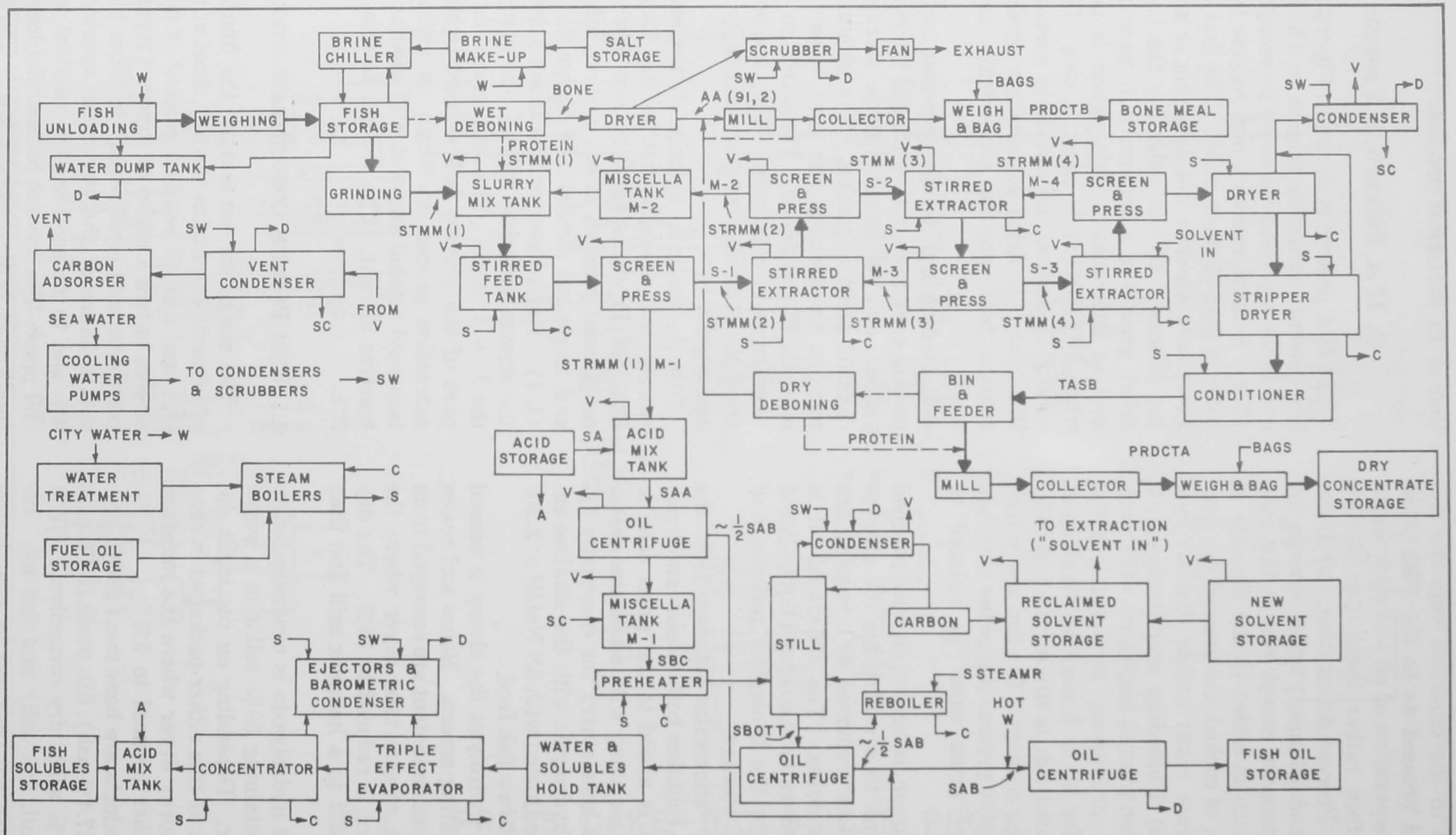


Fig. 4 ISOPROPYL ALCOHOL EXTRACTION PROCESS

of protein retained in the fish protein concentrate is designated as ZA7 and the amount of bone meal in the FPC is ZA8. The original fractions chosen are 0.96 and 0.04 respectively. They can be changed readily without affecting the main body of the program. The finished concentrate and bone meal are then milled and packaged.

2. Oil Stream

The stream containing the bulk of the oil is the miscella stream leaving the first stage. This stream is acidified (conc. H_2SO_4 at 1.9% of fish feed) and enters an oil-water centrifuge. Approximately one-half of the oil is removed. This oil plus the oil from the still bottoms product, which was centrifuged, are combined into one stream. About 10% hot water is added to this stream before it enters a polishing centrifuge. This oil can be stored up to 15 days and is sold in bulk.

3. Solvent Recovery

The rest of the oil and solvent from the first oil-water centrifuge is heated prior to the distillation process. The solvent, which is mostly isopropyl alcohol, is distilled in a 25-tray column. SBOT(I) designates the constituent bottoms consisting of isopropyl alcohol, water, oil, and soluble protein. The product at the top of the column is designated STOP(I) and consists of isopropyl alcohol and water. The recovered solvent is then pumped to the storage tank where make-up isopropyl alcohol is added as needed.

4. Fish Solubles

The non-oil portion of the centrifuged column's bottoms is fed to a triple effect evaporator. The product is further concentrated to 50% protein in a concentrator evaporator.

The products stream consists of fish protein concentrate AA(90,7), bone meal AA(90,3) (if wet deboning is specified), fish oil AA (90,5), and fish solubles AA(90,4).

E. Press Cake--IPA Process

The Press Cake-IPA process combines the proved technology of IPA extraction with a pre-processing of the raw fish in order to provide a more concentrated and more easily stored feed. A diagramatic representation of the process is shown in Figure 5.

1. Unloading, Storage, and Press Cake Production

The fish is unloaded by means of fish pumps, weighed and washed and stored in refrigerated brine. A storage capacity sufficient to provide 3 days of feed to the press cake production unit is provided. From the brine storage vat the fish is lifted by bucket elevators into steam cookers. The fish is cooked, crushed, and passes into a screw press which reduces its moisture content to 60%. The excess liquid passes through a vibrating screen filter into a hold tank. This liquid is processed separately in order to recover the oil and dissolved solids. The compressed bulk fish, called "press cake," is ground, transported by screw conveyors either into a closed redwood bin for intermediate storage in IPA or directly into the IPA extraction stages. The capacity of the intermediate storage is sufficient to provide a 50-day backlog for the IPA extraction portion of the plant.

2. IPA Extraction

The press cake is turned into the final FPC product through multistage countercurrent IPA extraction. The program is set up in such a way that the number of extraction stages and their individual efficiencies can be changed readily. The standard number of stages is assumed to be four; however, any number up to eight can be specified in the input. If the desired number of stages is *other than four,* that number should be entered in column 40 of the first input card.

After each separation stage a detailed material balance on each component of the input-output streams is performed. The separation efficiencies for each component and each stage can be specified separately. They are stored in the library subprogram LIBRE and can be

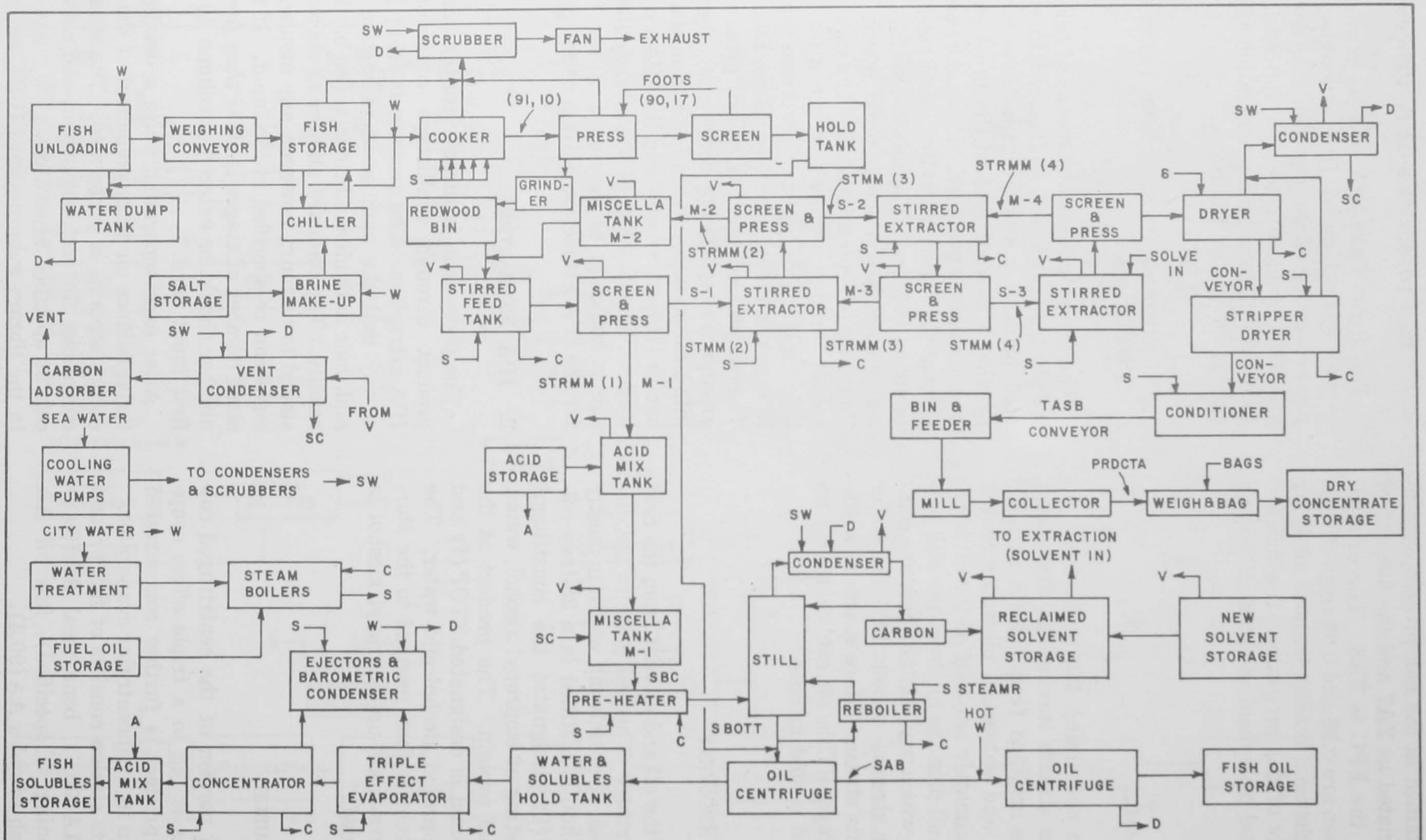
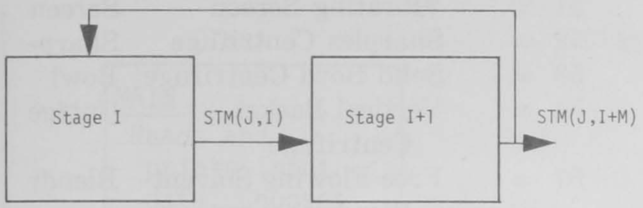


Fig. 5 PRESS CAKE ISOPROPYL ALCOHOL EXTRACTION PROCESS

changed readily without modifying the main program.

Consider two sequential stages I and I + 1:



The J index describes the five main components of the stream. The relationship is as follows:

J = 1 — Oil
J = 2 — Protein
J = 3 — Ash
J = 4 — Water
J = 5 — IPA

The quantity for each component exiting from stage I + 1 is computed by the following relationship:

STM (J,I+1) = STM(J,I) * DATB(I,J)

Where: 1-DATB(I,J) is the extraction efficiency for component J in the I + 1 stage. These quantities are thus stored in the readily accessible LIBRE subprogram.

The above definition has to be modified for the case of the IPA content leaving the first extraction stage. The modification is:

STM(5,1) = STM(4,1) * DATB(1,5)

3. Fish Protein Concentrate Stream

The slurry stream leaving the final extraction stage contains the ash, most of the protein, and a small residual amount of oil. The stream enters—in sequence—a dryer, a stripper dryer, and a conditioner in which its moisture content is reduced to about 8% and the IPA residual falls below 250 ppm. The solid stream leaving the conditioner is labeled TASB. It is milled, weighed, and packaged.

4. Oil Stream

The stored liquid from the press cake production process and the still bottoms from the solvent recovery still are fed into a liquid-liquid centrifuge. Oil separation efficiency is assumed to be 94%. Bottoms containing the dissolved solids are fed into a storage tank in order to be processed through evaporators, the top oil containing fraction is pumped into a polishing '"Sharples" type centrifuge. Here 10% volume fraction of hot water is added. The purpose of this centrifugation is to remove entrained blood and remaining solids. The polished oil is fed into final oil storage tanks. A storage capacity sufficient for 15 days production is designed.

5. Fish Solubles

The stream containing dissolved solids from the liquid-liquid oil separation centrifuge is fed into a triple effect evaporator followed by a concentrator. The moisture content is reduced to about 50%, the product is acidified and stored as fish solubles.

6. Solvent Recovery

The solvent-containing stream is preheated and passed into a 25-tray distillation column. The bottoms of the column pass, as noted, into the liquid-liquid centrifuge of the oil separation stream, the solvent-containing tops go through a charcoal filter and, after addition of requisite amounts of makeup solvent, are recycled to the IPA separation stages.

IV. COMPUTER USER INFORMATION

A. Program Outline

The programs making up the FPC cost analysis code can be divided into three classes.

1 Programs handling input and output data and performing calculations which are common to all FPC production processes. This class includes the MAIN program and the subprograms MATER, CAPTOL, and OPERAT.

2 The programs describing each of the five separate processes. The main portion of the computations is performed by these programs. The material and energy balances are computed. On the basis of this information and on

built-in decisions regarding equipment sizes (see Section B) the required capacity for the major equipment items are calculated. The six programs in this class and the process which they analyze are:

Program Name	*Process*
FPCXXI	Fish meal plant
BIOLOG	Biological process
PRESCK	Press cake biological process
XXIPA	Isopropyl alcohol extraction
PRSIPA	Press cake-IPA extraction process

3 The service and information subprograms. These consist of a large number of largely similar subprograms which calculate the cost for individual equipment items and of the library subprogram LIBRE which contains all of the costing data. The costing subroutines are discussed in more detail in Section C. Usually they are named directly by the equipment name and given an equipment capacity return, its cost and the cost breakdown. In some cases similar types of equipment are handled by single subroutines. The list of the equipment subroutines is:

Identification Number		*Equipment*	*Subroutine Name*
6	=	Conical Hopper	Hopper
7	=	Fish Storage	Silo
8	=	Scrubbers	Conden
11	=	Pulveriser	Pulver
17	=	Screw Conveyor	Screwr
18	=	Hammer Mill	Hammer
19	=	Drum Dryer	Dryer
20	=	Pan Dryer	Deyerp
21	=	Rotary Vacuum Dryer	Dryerr
27	=	Boiler	Boiler
30	=	Spray Evaporator	Evpspr
31	=	Wiped Film Evaporator	Evpflm
32	=	Forced Circulation Evaporator	Evpfrc
33	=	Vertical Evaporator	Evphor
40	=	Shop Fabricated Tank	Storag
42	=	Pressure Vessel	Vessel
43	=	Distillation Column	Column
49	=	Jacketed Reacting Vessel	Reactr
50	=	Fish Grinder	Grinder
51	=	Vibrating Screen	Screen
52	=	Sharples Centrifuge	Sharp
53	=	Solid Bowl Centrifuge	Bowl
54	=	Vertical Basket Centrifuge	Cntfge
57	=	Free Flowing Solvent Blender	Blendr
65	=	Reciprocal Pumps	Pmprec
66	=	Centrifugal Pumps	Pmpcnt
67	=	Shell-Tube Heat Exchangers	Heatex
70	=	Belt Conveyor	Belt
71	=	Bucket Conveyor	Bucket
72	=	Scale	Scale
73	=	Agitator-Propeller	Agitor
74	=	Ball Mill	Balmil
75	=	Bagging Machine	Baggma
78	=	Rotary Drum Filter	Filter
80	=	Overhead Crane	Cranes
81	=	Drag Conveyor	Dragma
85	=	Mechanical Refrigeration	Refrig
99	=	Facilities	Fascil

The library program LIBRE performs no other function besides storing the cost data for all equipment items and those process raw materials which are not given in the input data. These data are made available to all the subroutines by reading the contents of LIBRE into a large common block which is made up of two rectangular matrices and a linear matrix, namely AA (100,20), IA (100,5), and BB (100). The first index of the AA and IA matrix usually refers to the identification number of specific equipment items. The BB matrix contains raw material cost data. Thus LIBRE has to be called just once for each individual cost calculation. This is done from the MAIN program.

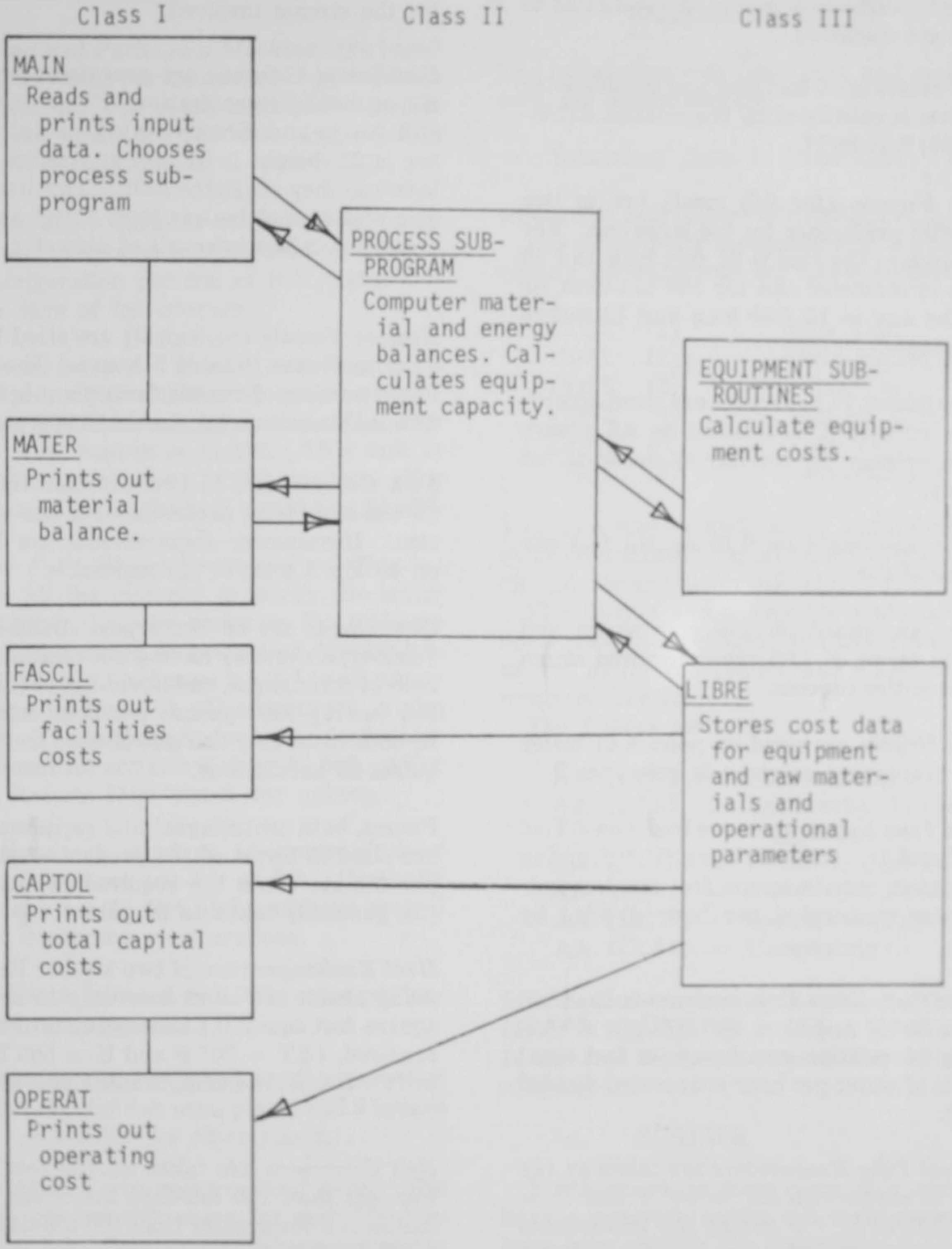
Most of the program changes which will be necessary as cost data change or become more accurately known can be done in LIBRE. This is discussed in more detail in Appendix A.

The interrelationship of programs during a typical calculation is shown diagrammatically in Figure 6.

Figure 6

Simplified Flow Diagram for the

FPC Cost Analysis Program



B. Equipment Sizing

This section follows the listing of equipment in subroutine LIBRE. Only those items of equipment about which design decisions had to be made are discussed.

Pulp Presses are 6 feet long and the diameter in inches is calculated by the relation 8(ton-days/50)$^{1/2}$ up to 24.

Screw Presses (for fish meal) are in two sizes with preference for the large one. For 250 ton-days the size is 21 feet long and 16 inches in diameter and for 100 ton-days, or less, the size is 15 feet long and 12 inches in diameter.

Rotary Steam Tube Dryers are sized according to amount of feed based on 2.5 square feet to process one ton-day of material fed per day.

Cookers are based on 0.25 square feet per ton-day of fish.

Boilers are based on 150 psig steam and sized in terms of 1.05 times required steam for the entire process.

Spray Dryers are sized on pounds of water to be evaporated as given in reference 7.

Wiped Film Evaporators are based on $\Delta T = 50°$ F and U = 500 BTU/hr ft^2 ° F giving the relation area in square feet equal pounds of water evaporated per hour divided by 25.

Forced Circulation Evaporators are based on $\Delta T = 50°$ F and U = 400 BTU/hr ft^2 ° F giving the relation area in square feet equal pounds of water per hour evaporated divided by 20.

Vertical Tube Evaporators are taken as (a) three in series with $\Delta T = 50°$ F and U = 400 BTU/hr ft^2 ° F giving the relationship area in square feet equal pounds of water evaporated divided by 20, or (b) the concentrator evaporator which has $\Delta T = 50°$ F and U = 500 BTU/hr ft^2 ° F giving the area in square feet equal to the pounds of water evaporated divided by 25.

Storage Tanks are based on the holding time for the stream involved.

Distillation Columns are prorated from the Experiment-Demonstration Plant (EDP) still design and directly scaled. Stage number is 25, height is 54 feet and reflux ratio is two as they are in the EDP. The diameter of a still cannot be less than 4 feet and increases in 2-foot intervals of diameter (4, 6, 8, etc.).

Reactor Vessels (biological) are sized based on a residence time of 5 hours. The minimum number of vessels for a plant is three. The maximum vessel size is 10,000 gallons.

Fish Grinders are in two sizes for 150 and 75 ton-days with preference for the larger size. Horsepower requirements are based on 40 Hp/3 tons/hr throughout.

Centrifuges are of two types. Solid-liquid (disk-type slimers) having 2000 gallons per hour of throughput, and liquid-liquid (Sharples) having 1000 gallons per hour capacity. In both cases only one size is used and it requires 20 horsepower.

Pumps, both centrifugaal and reciprocating, are sized in terms of the product of gallons per minute times the required pressure in psi, generally taken as 30 psi.

Heat Exchangers are of two kinds. Heaters using steam are sized according to area in square feet equals 0.1 times pounds of steam required, ($\Delta T = 20°$ F and U = 500 BTU/hr ft^2 ° F and the cooling water rise is 20° F).

Belt Conveyors are taken as 100 feet long. For less than 150 ton-days the width is 36 inches and for greater than 150 ton-days the width is 48 inches.

Bucket Conveyors are based on a lifting height of 20 feet.

Agitators are for two purposes. For slurries the required horsepower is 0.01 times the tank volume in gallons. For waterlike liquids the horsepower is 0.005 times the tank volume in gallons.

Bagging and Packaging Machines are based on bags or cans per minute. 100-pound bags are used for fish meal, 25-pound bags for FPC and other dry products, and 5-gallon cans for paste products.

Refrigeration includes brine recycle pump and heat exchanger and is based on 0.5 tons of refrigeration per ton of fish stored and three days of fish storage.

Brine make-up — This is a unit called a Brinopac, which delivers 50 gal/hr of 100° brine. It is 24 inches in diameter. The price FOB with hopper is $1,190. This unit is good for any plant up to 300 ton-days. For any larger plant, the unit would cost $1,880.

Boiler Feed Water Treatment — This includes all the material to purify the boiler feed water, i.e., the water in the make-up tank is deaerated to get rid of dissolved O_2 and CO_2. Ion exchange is used to eliminate Mg and Ca ions. A pH adjustment is also made. The initial unit for boiler feed water treatment for any size is about $1,000. After that, it costs $100/month for upkeep.

Buildings are sized at 14 square feet of ground floor per ton-day of fish. Generally buildings are 40 feet high and have several levels depending on operations.

Real Estate is based on 0.0050 acres per ton-day of plant capacity.

Warehouse space is taken as 15 square feet per ton-day for fish meal plants and 3 square feet per ton-day for other plants.

Fish Pumps are reciprocating type. The plants use one fish pump for each 500 ton-days of fish. Smaller plants have one pump.

Dock Facilities are 2,400 square feet for each fish pump.

C. Equipment Subroutine

The material base cost of almost all pieces of equipment are estimated by the equation

$$\text{Base Cost} = a\,(\text{SIZE})^{b} \qquad (1)$$

The installation cost, labor cost, and incidental costs are determined by

$$\text{Subsidiary Costs} = (\text{Base Cost}) \cdot d^{i} \qquad (2)$$

where d = cost factors in LIBRE, $i = 1, 2, 3, 4$.

The subprogram associated with the fisheries costing programs uses the following variables:

COST (1)	Base Cost
COST (2)	Field Materials Cost
COST (3)	Labor Cost
COST (4)	Indirect Cost
COST (5)	Total Cost
COST (6)	Uncertainty in Cost

The base cost is updated by multiplying the value determined in equation (2) by the Marshall and Stevens index BB (1).

The factors accounting for materials cost, labor cost, indirect cost, and uncertainty cost as well as the constants a and b are stored in program LIBRE.

The factors are:

AA (IX,7)	= Unit Cost (a)
AA (IX,8)	= Exponential in Cost Equation (b)
AA (IX,11)	= Materials Cost Factor
AA (IX,12)	= Direct Cost Factor
AA (IX,13)	= Indirect Cost Factor
AA (IX,14)	= Uncertainty Cost Factor

In a limited number of the subprograms, the factor a depends on a second size variable. In this case the cost is entered directly into the subprogram:

i.e. SCREWR

Furthermore, in some cases, it is desired to have a materials option. Several approaches have been used in the program:

i.e. PMPCNT
STORAG

In subsequent changes it is recommended that the following procedure be used. The material is selected in the program and designated by IA (IX,5) = INTEGER. For example if the equipment is to be constructed of monel then IA (IX,5) = 8: it is not necessary that the integer be associated with the same material for each item of equipment. In the subprogram one has the statements

```
IF (IA (IX,5). EQ. 8) BB (2) = 6.1
COST (1) = COST (1) * BB (2)
```

The second card comes after the computation of the indirect, labor, and materials cost based on the initial base cost.

The factor BB (2) can be entered from the main program (XXIPA, BIOLOG, etc.) as well. In addition a print statement is added to be consistent with the new option.

Usually the sizing equation is adequately represented by one sizing variable. This term is designated AA (IX,17). Occasionally it is necessary to have two variables, in which case the variable is usually AA (IX, 18), although on occasion AA (IX,20) has been used.

To illustrate the costing program we consider a typical subprogram BUCKET, the program for the bucket conveyor.

SUBROUTINE BUCKET*

```
1.  IX + 71

2.  Q = AA (IX,7)

3.  IF (AA (IX,18). GR. 30. and. AA (IX,
       18). LE. 75),
       AA (IX,7) = AA (IX,7) + 180

4.  IF (AA (IX,18). GR. 75.) AA (IX,7) =
       AA (IX,7) + 280.

5.  COST (1) = AA (IX,7 * AA (IX,17)
       ** AA (IX,8) * BB (1)

6.  COST (1) = COST (1) * .001

7.  COST (2) = COST (1) * AA (IX,11)

8.  COST (3) = COST (1) * AA (IX,12)

9.  COST (4) = COST (1) * AA (IX,13)

10. COST (5) = COST (1) + COST (2) +
       COST (3) + COST (4)

11. COST (6) = COST (5) * AA (IX,15)

12. DO 1 I = 1,6

13. 1 COST A (I) = COST A (I) +
       COST (I)

14. AA (IX,7) = Q
```

* FORMAT, DIMENSION, PRINT, common statements have been omitted.

Statements 2 and 14 are necessary in order that the values in LIBRE remain constant when the subroutine is used repeatedly.

Statements 3 and 4 adjust the value of the constant *a* [AA (IX,7)] for different values of AA (IX,18) which is the capacity of the conveyor in tons. The size unit AA (IX,17) is the height in feet.

Statements 5 and 6 determine the base cost in thousand dollar groupings. In 7-11 the costs of materials, labor, incidentals, and cost variation as well as total cost are determined.

In statements 12 and 13 the running cost of the plant option (IPA, Biological, etc.) is computed.

If different materials of construction were used then one would add the statement

```
COST (1) = COST (1) * BB (2)
```

between statements 9 and 10.

D. Program Input

The input to the FPC program can be divided into two parts: a) the "standard" input which is common to all of the different processes; b) the "optional" input presented in Section III, which discusses the individual processer; here we shall explain the standard input.

The standard input consists of four cards. The first of these enters integer input data, the remaining three enter input data in the floating point format.

Program Variable	*Columns*	*Description*
I. Card 1:	Format: (8I10)	
A. Iz	1-10	Fixes process to be analyzed. 1 = fish meal 2 = IPA 3 — biological 4 = press cake — biological 7 = press cake — IPA extraction
B. Options	11-20	
1. fish meal		
IPTION(1)		1 = solubles are product
IPTION(2)		2 = solubles recycled
2. IPA		1 = wet deboning
IPTION(1)		blank = no deboning
II. Card 2:	Format (3E 12.5)	
tons	1-12	The tons of fish to be processed per day.
BB(1)	13-24	The Marshall-Stevens index taking the 1970 index of 297.5 as one.
BB(50)	25-36	The operating days per year.
III. Card 3:	Format (5E 12.5)	
BB(5)	1-12	Cost of the fish in ¢/lb.
BB(6)	13-24	Cost of electricity in ¢/KWHr.
BB(7)	25-36	Labor and supervisory costs in dollars/hr.
BB(8)	37-48	Depreciation and interest in percent per year.
BB(10)	49-60	Fuel cost in dollars per therm.
IV. Card 4:	Format (3E 12.5)	
BB(30)	1-12	Oil composition of the fish in weight percent.
BB(31)	13-24	Protein composition percent.
BB(32)	25-36	Ash composition in percent.
V. (For Biological and Presscake programs only)		
Card 5:	Format (5E 12.5)	
BB(40)	1-12	The effectiveness of the enzyme being used in lbs. of enzyme required per 100 lb. of fish being processed. (For press cake Biological, it is per 100 lb. of press cake being processed.)
BB(41)	13-24	Price of enzyme is $/lb.

BB(42)	25-36	The percentage of the total dissolved solids stream coming out of the wiped film evaporator (see Figure 2) which is packaged in paste form.
BB(43)	37-48	The effectiveness of the antioxidant being used, in lbs. of antioxidant required per 100 lb. of fish or 100 lb. of press cake.
BB(44)	49-60	Price of antioxidant in $/lb.

VI. (For Press cake — IPA extraction only)

Card 1:	Format (8I10)	
	40	The number of IPA extraction stages (if different than four) should appear.

E. Program Output

The output of the cost analysis program is presented in seven separate sections:

1) Printout of input data.
2) Detailed equipment costs.
3) Material and energy balance.
4) Cost of facilities.
5) Capital costs.
6) Operating costs.
7) Production Cost of FPC.

Each of these sections is printed out in the form of a table. The contents of these tables will now be taken up in turn.

1) *Input Data.*—Identifies the process being analyzed, prints out all of the external input data and operating options.

2) *Detailed Equipment Costs.*—This is the most extensive table of the output. It presents the total cost and the cost breakdown of each major item of equipment required in a given process. Each equipment item is identified, its capacity, capacity units, and major construction material is printed. Following this information the total cost and the cost breakdown for this equipment are given. The cost breakdown uses the scheme of Reference (6) which is identified in the table headings. That is, the first column labelled "Base Cost" gives the FOB. to manufacturer cost for this type and capacity equipment. This cost is multiplied by the Marshall and Stevens index given in the input data. The methods used computing this cost, the sources of the required internal data and the means for modifying these data are presented in Appendix A.

The subsequent three columns present additional costs which are incurred before the purchased equipment becomes operable.

Column 2, the "Material Costs" includes such diverse items as piping, electrical wiring, equipment base, and heat insulation. Column 3, the "Labor Costs" are the labor costs incurred during installation, and Column 4, the "Indirect Costs", summarizes remaining expenses such as shipping, insurance, construction overhead, and construction engineering costs.

All of these cost items are calculated as factors of the first column. These factors vary with equipment type but not with capacity. For each equipment item they are tabulated in the subprogram LIBRE and are easily accessible for modification.

The fifth column, titled "Module Cost", is a summation of the four previous columns and represents the capital investment required to design, order, ship, and install a given equipment item. Finally, the last column, titled "Range", is an estimate of the reliability of these cost figures. This estimate is based upon the cost data available at the end of 1969 and summarized in the LIBRE subprogram. As time passes and cost figures are modified, the range estimate should be changed as well.

The information described above is printed out individually for each major piece of equipment even if multiple items of identical type and capacity of equipment are required. The sequence of printing out this information starts with equipment required to unload and store the fish (that is, the first item is always the fish pumps), and after that follows the main process streams. For example, in the fish meal plant analysis the equipment required to process the solids stream is presented first, then come the centrifuges required for oil separation, the evaporators required to concentrate the dissolved solids, and finally equipment items which do not really fit into the process stream, as the boiler, fork lift, or the cost of the instrumentation loops.

3) *Material and Energy Balance.*—This table presents first the overall, then the detailed material and energy balance. In the overall section of the table the total steam, electricity, and cooling water used in the process is given. The fish feed is broken down into the oil, protein, and ash components.

The detailed portion of the table prints out the process stream balances in terms of hourly throughput. The sequence of printout generally follows the process stream flow lines as shown in Figures 1 to 6. Where branches in the process stream occur (for example at the separation of oil and stickwater for the fish meal plant) the balance calculation follows one of the streams to completeness and returns to the branch point to pick up the remaining stream.

4) *Cost of Facilities and Site Development.*—This table summarizes the cost of land, docks, warehouses, and process buildings. The cost breakdown is similar to that described for Table 2. The data used in the calculations are stored in subroutine LIBRE and are printed out for easy reference in the table.

5) *Summary of Fixed Costs.*—This is a summation of total capital costs. It includes the already detailed costs for equipment and facilities plus provisions for spare parts, engineering of the plant, and contingencies. The latter three are calculated as fractions of the summarized equipment cost.

6) *Operating Costs.*—This table presents the total and detailed plant operating costs on a daily and yearly basis. The quantities of all the materials used in the process and their daily costs are printed out first. This portion of the table contains also such items as electricity, packaging, and labor and supervision man-hours. Under the title "City Water" only the water used in the process which must be of drinking quality is included. The cost of process water (i.e. for scrubbers and condensers) is calculated in terms of the electricity needed to pump it.

The second portion of the table includes items which are calculated as fractions of the total capital or equipment costs. These are depreciation (at a percentage figure given in the input), maintenance, and insurance. The factors used to calculate these costs appear in subroutine OPERAT. Where not supplied in the input, the prices of the process material are stored under the designation BB(I) in subroutine LIBRE.

The third portion of the table summarizes the production rate of various products on a daily and yearly basis.

7) *Production Cost of FPC.*—The last table is entitled "Production Cost of FPC." In this table the following are listed:

a) by-products of the process
b) the assumed selling price in cents/pound
c) the by-products total worth.

Two prices of FPC appear at the end of the printout. The first price is calculated by dividing total operating cost by the FPC produced per year. The second price takes into account the process by-products by subtracting their total worth from the total operating cost before dividing by the FPC produced per year. The calculations and printout take place in the subprogram OPERAT. The assumed selling prices of the by-products are found in LIBRE [BB(66) to BB(68)] and can easily be changed.

APPENDIX

A. Internal Program Changes

A-1. Internal Data Changes

There are several occasions when it may be necessary to update the program. These include the following:

1) The estimated cost of an item of equipment is in error
2) a new piece of equipment is to be added
3) the equipment sizing routine is to be altered
4) a new option is to be added to the plant options
5) a change in the cost of chemicals.

Most changes, especially of the types 1 and 5, may be made directly in the program LIBRE. Changes in bare cost, incidentals, labor, and materials for the process equipment may be made by substitution of the appropriate cards in LIBRE.

Example 1

The cards in LIBRE for a Rotary Dryer are:
AA (21,7) = 1000.
AA (21,8) = .5
AA (21,11) = .30
AA (21,12) = .30
AA (21,14) = .30

For these values the base cost of a dryer with 400 square feet is estimated to be $20,000.

The manufacturer's estimates for this equipment were $30,000, with the installed cost, labor cost, and incidentals estimated correctly.

Solution:

The base cost of the equipment too low. The simplest adjustment is to alter the base cost AA (21,7) to give the correct value. However, an increase of the base cost results in a incidental increase as well. The recommended solution is to substitute for the above cards in LIBRE the new cards.

AA (21,7) = 1500.
AA (21,8) = .50
AA (21,11) = .20
AA (21,12) = .20
AA (21,14) = .20

Example 2

The price of sulfuric acid is 30% more expensive at Plant A than it is at the other plants.

Solution:

The card [AA (100,14) = 1.00] in LIBRE is replaced with AA (100,14) = 1.30.

Occasionally in some items of equipment, such as a screw conveyor, one cannot alter the program by a single change of cards in LIBRE. The reason for this is that the base cost is a function of the diameter of the conveyor, which is an additional input variable to the costing subroutine. In this case it is necessary to alter the costing subroutine itself.

Example 3

The cost of the screw conveyor with a diameter greater than 2″ has been found to overestimate the cost by a factor of 12. The labor cost, the incidentals, and the installation costs are correctly estimated. All other estimates are correct.

Here one cannot simply change LIBRE since the modification would appear for other sizes as well. There are many ways of modifying the program; one way would be to add the card to the subroutine SCREWR.

If (AA (IX,18).GT.12.) AA (IX,7) = .5* AA (IX,7) which states that if the diameter is greater than 12 then the base cost is reduced by 50%.

The addition of a new equipment item requires three changes to the program.

1) First the new subroutine is named and given a previously unassigned index number. The Fortran statement of the program would be closely modeled after existing subroutines. It is strongly recommended that AA (IX,17) be used to designate the principal variable in the costing equation.

2) The variables for the costing equations are added to LIBRE. These should include

AA (IX,7)	Base Cost
AA (IX,8)	EXPONENT
AA (IX,11)	Materials
AA (IX,12)	Labor
AA (IX,13)	Incidentals
AA (IX,15)	Range of COSTS

3) The calling subroutine must be added to the primary subroutines. This calling sequence will include at least a sizing equation and the call statement.

```
AA (IX,17) = SIZE * .01/24
CALL EQUIPM
```

A-2. EQUIPMENT SIZING AND PROCESS CHANGES

The equipment sizing routine is altered by changing statements in the primary subroutines.

Example 4

The area of heat exchangers in square feet was found to be 12% of the water evaporated rather than 10%, for the preheater to the distillation column.

Solution:

The subprogram XXIPA has the statement

```
FF = STEAMS * .1
AA (67,17) = FF
```

These two cards are removed and replaced with

```
AA (67,17) = STEAMS * .12
```

Which not only makes the desired change but increases the efficiency of the program as well.

Major changes in program options must be made in the subprograms. In addition changes must be made in the main program as well. In general, there is no simple way of making these modifications.

Example 5

It is wished to add a costing subprogram for the VIOBIN program.

The procedure is to write a subprogram in Fortran for the VIOBIN program analogous to the program for the IPA process.

In addition changes are required in the program MAIN and the program OPERAT.

The user by referring to the above programs and using the example of the IPA process, can by analogy make the appropriate changes necessary for VIOBIN.

The printout can be modified by substitution of Format cards in the appropriate program.

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16. Kapfer, W. H., "Appraising Rate of Return Methods," Chem. Engr., Progress, 65, 55, November, 1969.
17. Ernst, R. C., "FPC: The NMFS Experiment and Demonstration Plant Process," Commercial Fisheries Review, 33(2), 22-28, February, 1971.

C. FORTRAN Listing of Program

The FORTRAN listing of the program appears as Table I.

D. Sample Problems

To illustrate the capabilities of the program a cost study spanning the feasible range of plant sizes was conducted. The plant capacities chosen were 50, 200, and 1,000 tons of fish per day. Fish availability time in each case was 200 days per year. For all processes except the Press cake-IPA this corresponds also to the plant operation time. For the Press cake-IPA process the IPA extraction portion of the plant can operate for an additional 50 days to process the stored press cake. Fish food composition corresponded to a "lean" species (oil fraction = 0.04) and a "fat" species (oil fraction = 0.12). The price of fish was taken as 1¢/lb. for these examples.

1. Sample Output

The entire output printout for an IPA process plant having a capacity of 200 tons/day and sized for a "lean" fish feed is presented in the subsequent pages. The number headings identifying the tables are explained in Section IV-E. The detailed equipment printout table, IPA Plant Cost Analysis, (Table II,) can be interpreted by following the process description given in Section III-C.

E. Study Summarization

The output of the study is summarized in Tables III to VI. The first three present data for each of the three plant capacities producing FPC. Table VI summarizes the results of the bench mark fish meal process.

349. Use of abstracts and summaries as communication devices in technical articles. By F. Bruce Sanford. February 1971, iii + 11 pp., 1 fig.

350. Research in fiscal year 1969 at the Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N.C. By the Laboratory staff. November 1970, ii + 49 pp., 21 figs., 17 tables.

351. Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base, Pascagoula, Mississippi, July 1, 1967 to June 30, 1969. By Harvey R. Bullis, Jr., and John R. Thompson. November 1970. iv + 29 pp., 29 figs., 1 table.

352. Upstream passage of anadroomus fish through navigation locks and use of the stream for spawning and nursery habitat, Cape Fear River, N.C., 1962-66. By Paul R. Nichols and Darrell E. Louder. October 1970, iv + 12 pp., 9 figs., 4 tables.

354. Sanitation guidelines for the control of *Salmonella* in the production of fish meal. By E. Spencer Garrett and Richard Hamilton. October 1971, iv + 7 pp., 9 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Price 25 cents. Stock number 0320-0023.

356. Floating laboratory for study of aquatic organisms and their environment. By George R. Snyder, Theodore H. Blahm, and Robert J. McConnell. May 1971, iii + 16 pp., 11 figs.

361. Regional and other related aspects of shellfish consumption — some preliminary findings from the 1969 Consumer Panel Survey. By Morton M. Miller and Darrel A. Nash. June 1971, iv + 18 pp., 19 figs., 3 tables, 10 apps.

Table I.—FORTRAN listing of program.

```
@FOR,S MAIN.MAIN
FOR S9A-07/12-11:03 (0,)

  MAIN PROGRAM

  STORAGE USED: CODE(1) 000407; DATA(0) 000330; BLANK COMMON(2) 000000

   COMMON BLOCKS:

   0003     BLOCK1 005050
   0004     BLOCK2 000016
   0005     BLOCK4 000012

  EXTERNAL REFERENCES (BLOCK, NAME)

   0006     IBRE
   0007     FPCXX1
   0010     XXIPA
   0011     BIOLOG
   0012     PRESCK
   0013     PRSIPA
   0014     FASCIL
   0015     CAPTOL
   0016     OPERAT
   0017     NINTR$
   0020     NRDU$
   0021     NIO2$
   0022     NRDC$
   0023     NPRT$
   0024     NSTOP$

  STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

   0000   000010 100F     0000   000052 1000F    0000   000062 1001F     0000   000072 1002F    0000   000102 1003F
   0000   000041 1007F    0000   000011 101F     0000   000114 1010F     0000   000120 1011F    0000   000132 1012F
   0000   000142 1013F    0000   000154 1014F    0000   000166 1015F     0000   000201 1016F    0000   000213 1017F
   0000   000013 102F     0000   000226 1020F    0000   000233 1021F     0000   000244 1022F    0000   000255 1023F
   0000   000015 103F     0000   000264 1030F    0000   000271 1031F     0000   000277 1032F    0000   000305 1033F
   0000   000313 1034F    0000   000017 1040F    0000   000030 1041F     0001   000004 106G     0001   000002 2L
   0001   000304 200L     0001   000403 999L     0003   000000 AA        0003 R 004704 BB       0004 R 000000 COST
   0004 R 000007 COSTA    0003   003720 IA       0005 I 000000 IPTION    0000 I 000006 IU       0000 I 000005 IV
   0000 I 000004 IW       0000 I 000003 IX       0000 I 000002 TY        0000 I 000001 IZ       0000 I 000000 J
   0000 R 000007 TONS


00100      1*    C  FPC PROCESS  COST ANALYSIS PROGRAM
00101      2*          COMMON/BLOCK1/AA(100,20),IA(100,5),BB(100)
00103      3*          COMMON/BLOCK2/ COST(7),COSTA(7)
00104      4*          COMMON/BLOCK4/  IPTION(10)
00105      5*     2    DO 1 J = 1,7
00110      6*          COST(J) = 0.0
00111      7*     1    COSTA(J) =0.0
```

Table I.-- Continued.

```
00113            CALL LIBRE
00114           READ(5,100,END=999) IZ,IY,IX,IW,IV,IU
00124      100   FORMAT(8I10)
00125            READ 101,TONS,BB(1),BB(50)
00132      101   FORMAT(3E12.5)
00133            BB(1) = BB(1)*297./280.
00134            READ 102,BB(5),BB(6),BB(7),BB(8),BB(10)
00143      102   FORMAT(5E12.5)
00144            READ 103,BB(30),BB(31),BB(32)
00151      103   FORMAT(3E12.5)
00152            BB(91) = IZ
00153            IPTION(1)=IY
00154            IF(IZ.EQ.7)  IPTION(5) =IW
00156      1040  FORMAT(//44H       THE WET DEBONING OPTION IS APPROPRIATE)
00157      1041  FORMAT(//44H       THE DRY DEBONING OPTION IS APPROPRIATE)
00160            IF(IZ .EQ. 1)  PRINT 1000
00163            IF(IZ .EQ. 2)  PRINT 1001
00166            IF(IZ .EQ. 3)  PRINT 1002
00171            IF(IZ .EQ. 4) PRINT 1003
00174            IF(IZ.EQ.7)  PRINT 1007
00177      1007  FORMAT(1H1//20X,40H PRESS CAKE IPA PROCESS COST ANALYSIS         )
00200      1000  FORMAT(1H1//20X30H FISH MEAL PLANT COST ANALYSIS  )
00201      1001  FORMAT(1H1//20X30H IPA PLANT COST ANALYSIS        )
00202      1002  FORMAT(1H1//20X35H BIOLOGICAL PROCESS COST ANALYSIS  )
00203      1003  FORMAT(1H1//20X44H PRESS CAKE BIOLOGICAL PROCESS COST ANALYSIS )
00204            PRINT 1010
00206      1010  FORMAT(///16H      INPUT DATA  )
00207            PRINT 1011,TONS
00212            PRINT 1012,BB(1)
00215            PRINT 1013,BB(5)
00220            PRINT 1014,BB(6)
00223            PRINT 1017,BB(10)
00226            PRINT 1015,BB(7)
00231            PRINT 1016,BB(8)
00234            PRINT 1030
00236            BB(33)=100.0-BB(30)-BB(31)-BB(32)
00237            PRINT 1031,BB(30)
00242            PRINT 1032,BB(31)
00245            PRINT 1033,BB(32)
00250            PRINT 1034,BB(33)
00253      1011  FORMAT(//8X31H PLANT SIZE                     =,F10.2,9H TONS/DAY )
00254      1012  FORMAT(/8X31H MARSHAL/STEVENS INDEX          =,F10.3      )
00255      1013  FORMAT(/8X31H COST OF FISH                   =,F10.2,9H CENTS/LB )
00256      1014  FORMAT(/8X31H ELECTRICITY COSTS              =,F10.2,10H CENTS/KWH)
00257      1015  FORMAT(/8X31H LABOR AND SUPV. COSTS          =,F10.2,12H DOLLARS/HR
00257          C  )
00260      1016  FORMAT(/8X31H DEPRECIATION AND INT. CHARGE =,F10.2,10H PERCENT  )
00261      1017  FORMAT(/8X31H FUEL COST                      =,F10.2,15H DOLLARS/TH
00261          CERM    )
00262            PRINT 1020
00264            PRINT 1023,BB(50)
00267            IF(IZ.NE.1)  GO TO 200
00271           IF(IY .EQ. 1) PRINT 1022
00274           IF(IY .EQ. 2) PRINT 1021
00277       200  CONTINUE
00300      1020  FORMAT(//23H      OPERATING OPTIONS  )
```

Table I.--Continued.

```
00302        1022  FORMAT(/8X45H SOLUBLE FISH SOLIDS REMOVED AS PRODUCT TY=1 )
00303         1023  FORMAT(/8X26H OPERATING DAYS PER YEAR =,F8.0)
00304         1030  FORMAT(//8X18H FISH COMPOSITION   )
00305         1031  FORMAT(/13X11H OIL         =,F6.2,8H PERCENT)
00306         1032  FORMAT( 13X11H PROTEIN     =,F6.2,8H  ''-''  )
00307         1033  FORMAT( 13X11H ASH         =,F6.2,8H  ''-'' )
00310         1034  FORMAT( 13X11H WATER       =,F6.2,8H  ''-'' )
00311               IPTION(5)=IV
00312               IF(IX.EQ.1)  PRINT 1040
00315               IF(IX.EQ.2)  PRINT 1041
00320               IF(IZ .EQ. 1) CALL FPCXX1(TONS)
00322               IF(IZ.EQ.2) CALL XXTPA(TONS)
00324               IF(IZ .EQ. 3) CALL BIOLOG(TONS)
00326               IF(IZ .EQ. 4) CALL PRESCK(TONS)
00330               IF(IZ.EQ.7)  CALL  PRSIPA(TONS)
00332               CALL FASCIL(TONS)
00333               CALL CAPTOL(TONS)
00334               CALL  OPERAT(TONS)
00335               GO TO 2
00336         999  STOP
00337               END

        END OF COMPILATION:        NO DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S FPCXX1,FPCXX1
FOR S9A-07/12-11:03 (0,)

   SUBROUTINE FPCXX1     ENTRY POINT 002231

   STORAGE USED: CODE(1) 002315; DATA(0) 000600; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK4 000012
    0004    BLOCK1 005050
    0005    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0006    PMPREC
    0007    RELT
    0010    STORAG
    0011    PMPCNT
    0012    BUCKET
    0013    DRYERR
    0014    SCREWR
    0015    SCREEN
    0016    BLENDR
    0017    HAMMER
    0020    SCALE
    0021    BAGGMA
    0022    CNTFGE
    0023    SHARP
    0024    EVPHOR
    0025    BOILER
    0026    CONDEN
    0027    MATER
    0030    NPRT$
    0031    NIO2$
    0032    NIO1$
    0033    NEXP6$
    0034    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000214 1010F      0000    000065 1021F      0000    000047 1022F      0000    000203 1034F      0000    000174 1041F
    0000    000215 1060F      0000    000226 1061F      0000    000237 1062F      0000    000250 1063F      0000    000261 1064F
    0000    000272 1065F      0000    000303 1066F      0000    000314 1067F      0000    000325 1068F      0000    000336 1069F
    0000    000347 1070F      0000    000360 1071F      0000    000371 1072F      0000    000413 1073F      0000    000402 1074F
    0001    000027 111G       0001    000111 136G       0001    000146 155G       0001    000220 176G       0000    000103 2000F
    0001    000377 250G       0001    000514 3L         0000    000116 3000F      0001    000602 327G       0001    000530 4L
    0001    001032 422G       0000    000156 4242F      0001    001073 437G       0001    001457 51L        0001    000563 52L
    0001    001663 664G       0004 R  000000 AA         0004 R  004704 BB         0000 R  000024 BULK       0005 R  000000 COST
    0005 R  000007 COSTA      0000 R  000046 FISH       0000 R  000013 G          0000 R  000032 GAL        0000 R  000031 GALL
    0000 R  000007 GALLON     0000 R  000010 GALS       0000 R  000014 HP         0000 R  000016 HPOWER     0000 I  000000 I
    0004 I  003720 IA         0000    000557 INJP$      0003 I  000000 IPTION     0000 I  000041 IXX        0000 I  000040 J
    0000 I  000021 NA         0000 I  000023 NB         0000 I  000012 NUM        0000 I  000026 N1         0000 R  000042 PXX
```

Table I.-- Continued.

```
0000 R 000044 SCRUB      0000 R 000043 SOL        0000 R 000045 STM        0000 R 000011 SUMHP      0000 R 000015 TANK
0000 R 000033 TONA       0000 R 000034 TONB       0000 R 000035 TONC       0000 R 000037 TOND       0000 R 000006 TONSA
0000 R 000020 TONSB      0000 R 000022 TONSS      0000 R 000030 TONSSW     0000 R 000025 TONST      0000 R 000036 XLOOPS
0000 R 000017 XNUM       0000 R 000002 Z1         0000 R 000003 Z2         0000 R 000004 Z3         0000 R 000005 Z4
0000 R 000001 Z6         0000 R 000027 Z7
```

```
00101            SUBROUTINE FPCXX1(TONS)
00101      C
00101      C   FISH MEAL PRODUCTION
00101      C
00103            COMMON/BLOCK4/  IPTION(10)
00104            COMMON/BLOCK1/AA(100,20),IA(100,5),BB(100)
00105            COMMON/BLOCK2/ COST(7),COSTA(7)
00106            BB(3)=1.
00107            BB(2)=1.
00110            DO 10 I=30,33
00113       10   BB(I) = BB(I)*0.01
00115            BB(33)= 1.-BB(30)-BB(31)-BB(32)
00116            AA(91,2)= ((BB(31)*.85) + BB(32))* TONS*2.
00117            AA(91,3) = (1.2*TONS)-AA(91,2)
00120            Z6= TONS*(BB(31)*.15)/AA(91,3)
00121            Z1=AA(91,3)/TONS
00122            Z2=AA(91,2)*.5/AA(91,3)
00123            Z3=TONS * BB(30)/(AA(91,3)+(.5*AA(91,2)))
00124            Z4=AA(91,2)/TONS
00125       1022 FORMAT(/ 25H PAYLOADER AND FORK LIFT , 10X ,15H                   ,10H
00125         1            ,F10.3,30X,F10.3)
00126       1021 FORMAT(/ 25H CONTROL INSTRUMENTATION , 10X ,15H                   ,10H
00126         1            ,F10.3,30X,F10.3)
00127            PRINT 2000
00131       2000 FORMAT(1H1//55H DETAILED EQUIPMENT COSTS (ALL COSTS IN 1000.0 DOL
00131         CLARS) )
00132            PRINT 3000
00134       3000 FORMAT (//18H     EQUIPMENT TYPE,10X10H  CAPACITY,12X9H MATERIAL,
00134         C60H     BASE     MATERIALS    LABOR    INDIRECT    MODULE      RANGE ,/6
00134         C0X60H   COST       COSTS      COSTS     COSTS       COST       + OR - )
00135            DO 1 I=1,7
00140            COSTA(I)=0.
00141            COST(I)=0.
00142         1  CONTINUE
00142      C
00142      C   UNLOADING AND STORAGE OF FISH
00142      C
00144            TONSA=TONS*2000./8.33
00145            GALLON= TONSA/(24.*60.)
00146            GALS =GALLON*1.3
00147            SUMHP=  0.
00150            IA(65,1) = 0
00151            IA(65,2) = 1.0
00152            AA(65,17) = GALS*15
00153            NUM = TONS/600.  +1
00154            DO 143 I=1,NUM
00157          SUMHP=SUMHP+(AA(65,17)*.001*1.5)
00160       143  CALL PMPREC
```

Table I.--Continued.

```
00162            IA(65,2) = 0.0
00163            IF(TONSA.LT.30000.) G=(30000./(24.*60.))*15.
00165            IF(TONSA.GE.30000.) G=(450000./(24.*60.))*15.
00167            IF(TONS.LE.150.) AA(70,18)= 36.
00171            IF(TONS.GT.150.) AA(70,18)= 48.
00173            AA(70,17)=100.
00174            CALL BELT
00175           DO 81 I=1,2
00200           AA(40,17)=TONS*32.05*3.
00201           IA(40,1)=0
00202           IA(40,2)=2
00203           CALL STORAG
00204           IA(40,2)=0
00205      81   CONTINUE
00207           AA(66,17)=30.*30.*TONS/(24.*60.)
00210           CALL PMPCNT
00211           HP=.001*AA(66,17)
00212           SUMHP=HP+SUMHP
00213           TANK=240.*TONS*1.
00214            IA(40,1)=2
00215            AA(40,17)=TANK
00216            AA(40,18)=1.0
00217            CALL STORAG
00220            TONSA=TONS*.8*2000./(8.33*16.)
00221            TONSA=TONSA*71/.8
00222            HPOWER=  .01*TONSA
00223            NUM=(HPOWER/20.)+ 1.
00224            XNUM=NUM
00225            TONSB=TONS/24.
00226            AA(71,18)= TONSB
00227            AA(71,17)= 20.
00230            CALL BUCKET
00230      C
00230      C   FISH COOKERS AND SCREW PRESS
00230      C
00231            BB(2) = 0.67
00232            IA(21,5)= 2
00233            AA(21,17) = 0.25*TONS
00234            CALL DRYERR
00235            IA(21,5) = 0
00236            IF (TONS.GT.300.)  NA=(TONS/250.) +1.
00240            IF (TONS.LE.300.)  NA=(TONS/100.) +1.
00240      C PUMP TO PRESS
00242           AA(66,17)=(AA(91,3)+AA(91,2))*2000.*30./(16.*60.*8.33)
00243           IA(66,1)=0
00244           CALL PMPCNT
00245           HP=.001*AA(66,17)
00246           SUMHP=SUMHP+HP
00247            DO 2 I= 1,NA
00252           IA(17,5)=3
00253            BB(2)=1.1
00254            IF(TONS.GT.300.)   AA(17.17) = 21.
00256            IF(TONS.GT.300.)   AA(17.18) = 16.
00260            IF(TONS.LE.300.)   AA(17.18) = 12.
00262            IF(TONS.LE.300.)   AA(17.17) = 15.
00264            CALL SCREWR
00264      C PUMP FROM PRESS TO SCREEN
```

Table I.--Continued.

```
00265          AA(66,17)=AA(91,3)*2000.*30./(16.*60.*8.33)
00266          IA(66,1)=0
00267          CALL PMPCNT
00270          HP=.001*AA(66,17)
00271          SUMHP=SUMHP+HP
00272           IF(TONS.GT.300.)  AA(51,17) =5.0
00274           IF(TONS.LE.300.)  AA(51,17) = 2.0
00276           CALL SCREEN
00277       2   CONTINUE
00301           TONSS=TONS*Z4
00302           IF(IPTION(1).EQ.2)  TONSS=TONSS + (TONS*Z1*2.*Z6)
00304           IF(TONSS.GT.300.) GO TO 3
00306           NB=(TONSS/100.)+1
00307           AA(21,17)= 100.*3.8
00310           GO TO 4
00311       3   NB=(TONSS/250.) +1.
00312           AA(21,17)=250.*3.8
00313       4   CONTINUE
00313    C
00313    C    FISH MEAL STREAM
00313    C
00314          IF(IPTION(1).EQ.1) GO TO 52
00314    C PUMP FROM PRESS TO MIXER
00316          AA(66,17)=AA(91,2)*2000.*30./(16.*60.*8.33)
00317          IA(66,1)=0
00320          CALL PMPCNT
00321          HP=.001*AA(66,17)
00322          SUMHP=SUMHP+HP
00323          AA(57,17)=(AA(91,2)+TONS*Z1*Z6*2.)*2000./62.4
00324          CALL BLENDR
00325     52   CONTINUE
00326           DO 5 I=1,NB
00331           IA(21,5)=3
00332           CALL DRYERR
00333       5  CONTINUE
00333    C PUMP TO DRYER
00335          AA(66,17)=TONSS*2000.*30./(16.*60.*8.33)
00336          IA(66,1)=0
00337          CALL PMPCNT
00340          HP=.001*AA(66,17)
00341          SUMHP=SUMHP+HP
00342           AA(81,18)=10.
00343           AA(81,17)= TONSS* 0.33
00344           BULK= 15. * TONSS
00345           TONST    =(TONS*Z4*.5) + (TONS*Z4*.5* Z3)
00346           AA(90,18)  =  TONSS-  TONST
00347           IF(IPTION(1).EQ.2)   AA(90,18)=AA(90,18) +(TONS*Z1*Z6)
00351           AA(90,18)=AA(90,18)*2000./ 16.
00352           IF(IPTION(1).EQ.2) TONST= TONST + (TONS*Z1*Z6)
00354           AA(90,13) = TONS*Z4*.5*Z3*2000.*.01
00355          AA(57,17)=(AA(90,3)+AA(90,13)/2000.)*2000./62.4
00356          CALL BLENDR
00357          AA(90,3)=TONST
00357    C PUMP FROM DRYER TO MIXER
00360          AA(66,17)=AA(90,3)*2000.*30./(24.*60.*8.33)
00361          CALL PMPCNT
00362          HP=.001*AA(66,17)
```

Table I.-- Continued.

```
00363          SUMHP=SUMHP+HP
00364          AA(40,17)=(AA(90,3)+AA(90,13)/2000.)*2000./8.33*15.
00365          IA(40,1)=0
00366          CALL STORAG
00366    C PUMP TO CURING
00367          IA(66,1)=0
00370          AA(66,17)=AA(40,17)*30./(15.*16.*60.)
00371          CALL PMPCNT
00372          HP=.001*AA(66,17)
00373          SUMHP=SUMHP+HP
00374           AA(18,17)= 1.30 * TONST/16.
00375           CALL HAMMER
00376           AA(72,17) = 18.
00377           CALL SCALE
00400          IA(75,1)=0.0
00401          IA(75,2)=0.0
00402          AA(75,17)=AA(90,3)*20./(60.*16.)
00403           CALL BAGGMA
00404           AA(75,17) = AA(75,17)*60*16
00405           HP=XNUM*20.
00406           SUMHP=SUMHP    +  (.001*HP)
00407           AA(54,17)=HP
00407    C
00407    C   FISH OIL STREAM
00407    C
00410          AA(40,17)=AA(91,3)*2000./(16.*8.33)*1.
00411          IA(40,1)=0
00412          CALL STORAG
00413          AA(66,17)=AA(40,17)*30./60.
00414          CALL PMPCNT
00415          CALL PMPCNT
00416          HP=.001*AA(66,17)
00417          SUMHP=SUMHP+HP
00420          SUMHP=SUMHP+HP
00421           DO  11  I=1,NUM
00424           AA(54,17)=20.
00425       11  CALL  CNTFGE
00427           TONSA= TONSA* Z3*1.1
00430           HP= .025*TONSA
00431           AA(52,17)= HP
00432           N1=(HP/20.)  +1.
00433           HP=20*N1
00434           SUMHP= SUMHP+ HP
00435           AA(52,17)=20.
00436           DO  12  I=1,N1
00441       12   CALL  SHARP
00443           TONSA=TONS*3.0*.8*.13*2000./8.33
00444           TONSA=TONSA*Z1*Z3/(.8*.13)
00445           Z7= 1.-Z3
00446           IA(40,1)=2
00447          AA(40,17)=TONSA*7./3.
00450           AA(40,18)=1.0
00451           CALL STORAG
00452           IA(66,1)=0
00453          AA(66,17)=TONSA*30./(3.*16.*60.)
00454           SUMHP=  SUMHP +(AA(66,17)*.001)
00455           SUMHP=  SUMHP +(AA(66,17)*.001)
```

Table I.-- Continued.

```
00456              AA(66,17)= AA(66,17)*30.
00457              CALL PMPCNT
00460              CALL PMPCNT
00460        C
00460        C FISH OIL STORAGE (15DAYS)
00460        C
00461             AA(90,5)=TONS*Z1*Z3
00462             AA(40,17)=AA(90,5)*2000./8.33*15.
00463             IA(40,1)=0
00464             CALL STORAG
00465             AA(66,17)=AA(40,17)*30./(60.*15.*16.)
00466             CALL PMPCNT
00467             HP=.001*AA(66,17)
00470             SUMHP=SUMHP+HP
00470        C    FISH SOLUABLES STREAM
00470        C
00470        C PUMP TO ACID MIX TANK
00471             TONSSW=TONS*Z1*Z7
00472             IA(66,1)=0
00473             AA(66,17)=30.*TONSSW*2000./(8.33*16.*60.)
00474             CALL PMPCNT
00475             HP=.001*AA(66,17)
00476             SUMHP=SUMHP+HP
00477              GALL=TONSSW*.2
00500              GAL= TONSSW*.01
00501              IA(40,1)=2
00502              AA(40,17)= GAL*2000./(8.33)
00503              AA(40,18)=1.0
00504              CALL STORAG
00505              IA(40,1)=2
00506              AA(40,18)=1.0
00507              AA(40,17)=  GALL*2000./(8.33)
00510              CALL STORAG
00511             GAL=TONSSW*2000./(8.33*16.)
00512             AA(66,17)=GAL*30./60.
00513              SUMHP=  SUMHP +(AA(66,17)*.001)
00514              SUMHP=  SUMHP +(AA(66,17)*.001)
00515              IA(66,1) =0
00516              CALL PMPCNT
00517              CALL PMPCNT
00520              TONA=TONS*.87*.8*2000.*.001/(8.33* 1.82)
00521              TONA=TONS*Z7*Z1/(.87*.8)
00522              AA(90,14)= TONS*Z7*Z1*.001
00523              AA(40,17)= TONA* 70.0
00524              IA(40,1) = 1.0
00525              IA(40,2) = 1.0
00526              CALL STORAG
00527              IA(40,1) = 0.0
00530              IA(40,2) = 0.0
00531              TONB= TONA/(16.*60.)
00532              AA(66,17)= 30.*TONB
00533              IA(66,1) = 2
00534              CALL PMPCNT
00535             SUMHP=SUMHP+(AA(66.17)*.001)
00536              IA(66,1) =0.0
00537              TONA= TONS*.80*0.87* 2000./16.
00540              TONA=TONA*Z1*Z7/(.8*.87)
```

Table I.--Continued.

```
00541          AA(33,17) = TONA / 20.
00542          CALL EVPHOR
00543          CALL EVPHOR
00544          CALL EVPHOR
00545          TONC =  TONA*.06/(.87*.3)
00546          TONC=TONC*Z6*.87/(Z7*.06)
00546    C PUMP TO CONCENTRATOR
00547         AA(66,17)=TONC*2000.*30./(8.33*60.)
00550         IA(66,1)=0
00551         CALL PMPCNT
00552         HP=.001*AA(66,17)
00553         SUMHP=SUMHP+HP
00554         AA(33,17)=TONC/25.
00555          CALL EVPHOR
00556         AA(90,4)=TONS*Z1*Z6*2.*1.
00557         AA(40,17)=AA(90,4)*2000./(8.33*16.)*1.
00560         IA(40,1)=0
00561         CALL STORAG
00562         AA(66,17)=30.*AA(40,17)/60.
00563         CALL PMPCNT
00564         CALL PMPCNT
00565         HP=.001*AA(66,17)
00566         SUMHP=SUMHP+HP
00567         SUMHP=SUMHP+HP
00570         IF(IPTION(1).EQ.2) GO TO 51
00570    C
00570    C CONDENSED FISH SOLUBLES STORAGE (15 DAYS)
00570    C
00572         AA(40,17)=AA(90,4)*2000./8.33*15.
00573         IA(40,1)=0
00574         CALL STORAG
00575      51 CONTINUE
00575    C
00575    C   SUMMATION OF STEAM, WATER, AND ELECTRICITY
00575    C
00576          AA(27,18)= 150.
00577          AA(27,17)= TONS*2.*2000./(3.*16.)
00577    C
00577    C BOILER WATER TREATMENT
00577    C
00600         COST(5)=1.000
00601         COST(1)=COST(5)
00602         PRINT 4242,COST(1),COST(5)
00606    4242  FORMAT(/25H BOILER WATER TREATMENT  , 10X ,15H              ,10H
00606        1       ,F10.3,30X,F10.3)
00607         COSTA(1)=COSTA(1)+COST(1)
00610         COSTA(5)=COSTA(5)+COST(5)
00610    C
00610    C FUEL OIL STORAGE
00610    C
00611         IA(40,1)=2
00612         AA(40,17)=TONS*6000./387.*15.
00613         CALL STORAG
00614         AA(66,17)=30.*AA(40,17)/(15.*60.)
00615         CALL PMPCNT
00616         HP=.001*AA(66,17)
00617         SUMHP=SUMHP+HP
```

Table I.-- Continued.

```
00620          CALL BOILER
00621          XLOOPS=  9 + NA +NB
00622          TOND=TONA/2.4 -TONC/2.4 +(TONC*.4)
00623          AA(91,5) = (TONA-TOND)/(0.6*8.33)
00624          AA(90,17)= (TONC*.4)
00625          AA(90,16)= (TONA-TONC)/2.4
00626          AA(66,17)=4*(AA(90,16) +AA(90,17)) +1.5*TONS
00626    C
00626    C SEA WATER PUMPS
00626    C
00627         IA(66,1)=1
00630         IA(66,4)=2
00631         CALL PMPCNT
00632         IA(66,1)=0
00633         IA(66,4)=0
00634          SUMHP= SUMHP +(AA(66,17)*.001*1.5)
00635          COST(1)=XLOOPS *AA(100,1)
00636          COST(5)=COST(1)
00637          COSTA(1)    = COSTA(1)    + COST(1)
00640         COSTA(5)=COSTA(5)      + COST(5)
00641          PRINT 1021 COST(1),COST(5)
00645          AA(8,17) = TONS
00646          CALL CONDEN
00647           COST(1)=AA(100,2)
00650          COST(5)=COST(1)
00651          COSTA(1)=COST(1)          + COSTA(1)
00652          COSTA(5)=COSTA(5) + COST(5)
00653          PRINT 1022, COST(1).COST(5)
00657          AA(72,17)=18.
00660          CALL  SCALE
00661          CALL  SCALE
00662          PRINT 1041,(COSTA(J),J=1,6)
00670     1041 FORMAT(//25H  TOTAL COSTS  -          ,35X6F10.3)
00671          COSTA(7)=0.02*COSTA(1)
00672          IF(IPTION(1).EQ.2) AA(90,4)=0.
00674     1034 FORMAT(// 40H      TOTAL COST OF FEPC  PLANT          ,F16.3)
00675          PRINT 1010
00677     1010  FORMAT(1H1)
00700          HP = TONS*0.00124 +13.6
00701          SUMHP = HP + SUMHP
00702          HP = 40*TONS/3.
00703          SUMHP = HP + SUMHP
00704          AA(90,2)= SUMHP* .7457 * 16.
00705          AA(90,1)= TONS* 6000./387.
00706          AA(100,10)=COSTA(5)
00707          IXX =(16.0*(TONS/50.0)**.31) +0.5
00710          PXX =IXX
00711          AA(90,9) =PXX*10.
00712          AA(90,8) =IXX*8.0
00712    C
00712    C  MATERIAL BALANCE INFORMATION PRINTOUT
00712    C
00713          CALL MATER(TONS)
00714          TONS = TONS/16
00715          AA(90,15)= TONS*2000.*.2
00716          PRINT 1060,AA(90,15)
00721     1060  FORMAT(/8X26H COOKERS STEAM              ,F8.0,7H LB/HR  )
```

Table I.--Continued.

```
00722           AA(91,3)= AA(91,3)* 2000./16.
00723           AA(91,2)= AA(91,2)* 2000./16.
00724           PRINT 1061,AA(91,3)
00727           PRINT 1062,AA(91,2)
00732     1061  FORMAT(/8X26H PRESS LIQUOR              ,F8.0,7H LB/HR   )
00733     1062  FORMAT(/8X26H PRESS CAKE                ,F8.0,7H LB/HR   )
00734           AA(91,1)= AA(91,3)*77
00735           PRINT 1063,AA(91,1)
00740     1063  FORMAT(/8X26H STICK WATER               ,F8.0,7H LB/HR   )
00741           AA(90,5) = AA(90,5)*2000.0/16
00742           PRINT 1064, AA(90,5)
00745     1064  FORMAT(/8X26H FISH OIL                  ,F8.0,7H LB/HR   )
00746           PRINT 1065,AA(90,16)                   ,
00751     1065  FORMAT(/8X26H TRIPLE EVAP. STEAM        ,F8.0,7H LB/HR   )
00752           AA(91,4)= 0.15*BB(31)*.01*TONS*2000.0/0.30
00753           PRINT 1066 ,AA(91,4)
00756     1066  FORMAT(/8X26H TRIPLE EVAP. CONCENTRATE ,F8.0,7H LB/HR   )
00757           AA(91,5)=AA(90,16)*4.0
00760           PRINT 1067 ,AA(91,5)
00763     1067  FORMAT(/8X26H TRIPLE EVAP. COOLING      ,F8.0,7H.GAL/HR )
00764           PRINT 1068,AA(90,17)
00767     1068  FORMAT(/8X26H CONCENTRATOR EVAP. STEAM ,F8.0,7H LB/HR   )
00770           AA(91,6) =AA(90,17)*4.0
00771           PRINT 1069,AA(91,6)
00774     1069  FORMAT(/8X26H CONC. COOLING WATER       ,F8.0,7H GAL/HR )
00775           SOL =AA(90,4)*2000.0/16
00776           PRINT 1070,SOL
01001     1070  FORMAT(/8X26H FISH SOLUBLES             ,F8.0,7H LB/HR   )
01002           AA(90,18)=AA(90,18)/16
01003           PRINT 1071,AA(90,18)
01006     1071  FORMAT(/8X26H DRYER STEAM               ,F8.0,7H LB/HR   )
01007           SCRUB=180*TONS
01010           PRINT 1072,SCRUB
01013     1072  FORMAT(/8X26H SCRUBER WATER             ,F8.0,7H GAL/HR )
01014           STM=AA(27,17)-AA(90,18)-AA(90,17)-AA(90,16)
01015           PRINT 1074,STM
01020     1074  FORMAT(/8X26H MISCELANEOUS STEAM        ,F8.0,7H LB/HR   )
01021           FISH =AA(90,3)*2000.0/16
01022           PRINT 1073,FISH
01025     1073  FORMAT(/8X26H FISH MEAL                 ,F8.0,7H LB/HR   )
01026           TONS = TONS*16
01027           AA(90,5) = AA(90,5)*16.0/2000.0
01030           AA(91,2)= AA(91,2)*16./2000.
01031           AA(91,3)= AA(91,3)*16./2000.
01032           AA(90,13)  =  AA(90,13) + (AA(90,3)+AA(90,7)+AA(90,20)+AA(90,4))
01033         AA(90,14)=AA(90,14)*2000.
01034           RETURN
01035           END

      END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S PRSIPA,PRSIPA
FOR S9A-07/12-11:03 (1,)

   SUBROUTINE PRSIPA     ENTRY POINT 003537

   STORAGE USED: CODE(1) 003617; DATA(0) 001410; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK2 000016
    0004    DATA1  000050
    0005    BLOCK1 005050
    0006    BLOCK4 000012

   EXTERNAL REFERENCES (BLOCK, NAME)

    0007    PMPREC
    0010    BELT
    0011    SCALE
    0012    STORAG
    0013    REFRIG
    0014    SILO
    0015    BUCKET
    0016    DRYERR
    0017    SCREWR
    0020    SCREEN
    0021    PMPCNT
    0022    GRINDR
    0023    REACTR
    0024    AGITOR
    0025    HEATEX
    0026    COLUMN
    0027    VESSEL
    0030    CNTFGE
    0031    SHARP
    0032    EVPHOR
    0033    HAMMER
    0034    BAGGMA
    0035    BOILER
    0036    CONDEN
    0037    MATER
    0040    SQRT
    0041    NPRT$
    0042    NIO2$
    0043    NIO1$
    0044    NEXP6$
    0045    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000453 1003F    0000    000364 1021F    0000    000375 1022F    0000    000443 1041F    0001    000020 113G
    0000    000464 1201F    0000    000476 1202F    0000    000510 1203F    0000    000522 1204F    0001    003005 1204G
    0000    000534 1205F    0000    000546 1206F    0000    000560 1207F    0000    000572 1208F    0000    000617 1209F
```

Table I.-- Continued.

```
0001   000025 121G      0000   000604 1210F     0000   000632 1211F     0000   000644 1212F     0000   000656 1213F
0000   000674 1214F     0000   000705 1215F     0000   000716 1216F     0000   000727 1217F     0000   000740 1218F
0000   000751 1219F     0000   000762 1220F     0000   000773 1221F     0000   001004 1222F     0000   001015 1223F
0000   001026 1224F     0000   001040 1225F     0000   001052 1226F     0000   001064 1227F     0000   001076 1228F
0000   001110 1230F     0000   001122 1231F     0000   001134 1232F     0000   001146 1233F     0001   000032 127G
0001   003210 1330G     0001   003221 1336G     0001   003232 1344G     0001   003243 1352G     0001   003254 1360G
0001   003265 1366G     0001   003276 1374G     0001   003307 1402G     0001   003320 1410G     0001   003331 1416G
0001   000144 163G      0001   000341 237G      0000   000340 3000F     0000   000352 3006F     0001   000605 323G
0001   000671 345G      0001   000702 350G      0001   000734 361G      0001   000735 364G      0001   000755 372G
0001   000760 377G      0000   000407 4242F     0000   000425 4243F     0001   001145 433G      0001   002574 44L
0001   001226 450G      0001   002574 49L       0001   001336 507G      0001   002273 51L       0001   001400 516G
0001   002417 52L       0001   002137 716G      0001   002206 734G      0005 R 000000 AA        0000 R 000240 ABC
0000 R 000245 ACID      0005 R 004704 BB        0003 R 000000 COST      0003 R 000007 COSTA     0004 R 000000 DATB
0000 R 000172 DAYS      0000 R 000173 DAYSR     0000 R 000273 DAZOIL    0000 R 000201 DENS      0000 R 000216 DRYSLD
0000 R 000241 DX        0000 R 000203 FACT10    0000 R 000310 FISH      0000 R 000211 G         0000 R 000246 GAL
0000 R 000206 GALLON    0000 R 000207 GALS      0000 R 000272 HOTH20    0000 R 000171 HOUR      0000 R 000212 HP
0000 R 000276 HWAT      0000 I 000167 I         0005 I 003720 IA        0000   001346 INJP$     0000 I 000234 IP
0006 I 000000 IPTION    0000 I 000230 IR        0000 I 000231 IRR       0000 I 000235 IU        0000 I 000337 IXX
0000 I 000224 J         0000 I 000325 K         0000 I 000176 LOOPS     0000 R 000166 MATRL     0000 I 000214 NA
0000 I 000204 NOREAC    0000 I 000225 NQUIP     0000 I 000210 NUM       0000 I 000223 NUMZ      0000 I 000242 NUTH
0000 I 000302 NZ        0000 I 000271 N2        0000 I 000266 N3        0000 R 000265 OIL       0000 R 000262 PRDCTA
0000 R 000263 PRDCTB    0000 R 000247 SAA       0000 R 000267 SAB       0000 R 000244 SACID     0000 R 000233 SAG
0000 R 000300 SAQT      0000 R 000161 SBOT      0000 R 000255 SBOTT     0000 R 000275 SBQQT     0000 R 000274 SBQT
0000 R 000270 SCB       0000 R 000175 SOLLIQ    0000 R 000177 STEAM     0000 R 000256 STEAMR    0000 R 000200 STEAMW
0000 R 000250 STEAM1    0000 R 000251 STEAM2    0000 R 000252 STEAM3    0000 R 000253 STEAM4    0000 R 000306 STEAM6
0000 R 000254 STEAM9    0000 R 000000 STM       0000 R 000143 STMM      0000 R 000154 STOP      0000 R 000055 STRM
0000 R 000132 STRMM     0000 R 000170 SUMHP     0000 R 000232 TANK      0000 R 000257 TANKA     0000 R 000301 TASA
0000 R 000303 TASB      0000 R 000304 TASC      0000 R 000305 TASD      0000 R 000277 TONA      0000 R 000205 TONSA
0000 R 000213 TONSG     0000 R 000222 TONSX     0000 R 000226 VES       0000 R 000227 VESS      0000 R 000261 WASTE
0000 R 000174 WATAD     0000 R 000264 WATER     0000 R 000202 WATOIL    0000 R 000260 WIDTH     0000 R 000236 XIP
0000 R 000237 XIR       0000 R 000243 XIRR      0000 R 000217 XLIQD     0000 R 000307 XLOOPS    0000 R 000215 XNA
0000 R 000220 XOIL      0000 R 000221 XSOL      0000 R 000326 XXA       0000 R 000327 XXB       0000 R 000330 XXC
0000 R 000331 XXD       0000 R 000332 XXE       0000 R 000333 XXG       0000 R 000334 XXH       0000 R 000335 XXI
0000 R 000336 XXJ       0000 R 000311 YYA       0000 R 000312 YYB       0000 R 000313 YYC       0000 R 000314 YYD
0000 R 000315 YYE       0000 R 000316 YYG       0000 R 000317 YYH       0000 R 000320 YYI       0000 R 000321 YYJ
0000 R 000322 YYK       0000 R 000323 YYL       0000 R 000324 YYM
```

```
00101              SUBROUTINE PRSIPA(TONS)
00103              COMMON/BLOCK2/ COST(7),COSTA(7)
00104              COMMON/ DATA1 / DATB(8,5)
00105              COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00106              COMMON/BLOCK4/ IPTION(10)
00107              DIMENSION  STM(5,9),STRM(5,9),STRMM(9),STMM(9)
00110              DIMENSION  STOP(5) ,SBOT(5)
00111              REAL   MATRL
00111        C
00111        C   NORMALIZATION
00111        C
00112              DO 1 I=1,7
00115              COST(I) = 0.
00116            1 COSTA(I)= 0.
00120              DO 2 I=1,20
00123              AA(90,I)=0.
00124          2   AA(91,I)=0.
```

Table I.--Continued.

```
00126            DO 10 I =30,33
00131       10   BB(I)= BB(I)* 0.01
00133            SUMHP= 0.
00134            HOUR= 24.
00135            DAYS= 30.
00136            AA(72,17)=18.
00137            DAYSR =  3.
00140            WATAD =  0.2
00141            SOLLIQ=  2.5
00141     C   STEAMW IS THE STEAM REQUIRED FOR THE WET DEBONING OPTION
00142            LOOPS=0
00143            STEAM=0.
00144            STEAMW = 0.
00145            DENS  =  0.9
00146            WATOIL=2.
00147            FACT10=1.
00150            NOREAC=  IPTION(5)
00151            IF(NOREAC.EQ.0)  NOREAC = 4
00151     C
00151     C UNLOADING AND STORAGE OF FISH
00151     C
00153            TONSA =  TONS* 2000./8.33
00154            GALLON=  TONSA / (HOUR* 60.)
00155            GALS  =  GALLON * 1.3
00156            IA(65,1) = 0.
00157            IA(65,2) = 1.0
00160            AA(65,17)= GALS * 30.
00161            NUM =(TONS/500.) +  1
00162            DO 143  I=1,NUM
00165            SUMHP=  SUMHP +(2.*AA(65,17)*.0015)
00166      143   CALL PMPREC
00170            IA(65,2) = 0.
00171            IF(TONSA.LT.30000.)    G = 30000./(24.*60.) * 15.
00173            IF(TONSA.GE.30000.)    G = 450000./(24.*60.) * 15.
00175            IF(TONS.LE.150.)  AA(70,18) = 36.
00177            IF(TONS.GT.150.)  AA(70,18) = 48.
00201            AA(70,17)= 100.
00202            CALL BELT
00203            CALL SCALE
00204            HP=(TONS * 0.00124 )  + 13.6
00205            SUMHP =  HP + SUMHP
00206            AA(40,17) = DAYS * TONS
00207            IA(40,1) = 0.
00210            IA(40,2) = 2
00211            CALL STORAG
00212            IA(40,2) = 0
00213            AA(85,17) =   0.5* TONS * DAYSR
00214            IA(85,1)  =  30
00215            CALL REFRIG
00216            SUMHP=  SUMHP +(4.72*AA(85,17))
00217            IA(7,1) = 1
00220            AA(7,17) = 27.4* TONS
00221            CALL SILO
00222            TONSG =  TONS/24.
00223            AA(71,18) = TONSG
00224            AA(71,17) = 20.
00225            CALL BUCKET
```

```
00226          HP= TONS * 0.00106
00227          SUMHP = HP  + SUMHP
00227    C
00227    C FISH COOKERS AND SCREW PRESS
00227    C
00230          AA(91,16) = WATAD* TONS
00231          AA(91,10) = TONS + AA(91,16)
00232          IF(TONS.GT.450) NA= (TONS/250.)+ 1.
00234          IF(TONS.LE.450) NA= (TONS/100.)+ 1.
00236          DO 3 I=1,NA
00241          BB(2)=2.1
00242          XNA=NA
00243          IA(21,5) = 4
00244          AA(21,17)= TONS/XNA
00245          CALL DRYERR                                                    6
00246          IA(17,5) = 3
00247          BB(2)=2.6
00250          IF(TONS.GT.450.) AA(17,17)= 21.
00252          IF(TONS.GT.450.) AA(17,18)= 16.
00254          IF(TONS.LE.450.) AA(17,18)= 12.
00256          IF(TONS.LE.450.) AA(17,17)= 15.
00260          CALL SGREWR                                                    7
00261          IF(TONS.GT.450)  AA(51,17)= 10.
00263          IF(TONS.LE.450)  AA(51,17)=  4.
00265          CALL SCREEN                                                    9
00266        3 CONTINUE
00270          DRYSLD=(BB(32)+0.85*BB(31))*TONS
00271          XLIQD= (BB(31)*0.15+ BB(30)+ BB(33))* TONS  +AA(91,16)
00272          XOIL=  BB(30) * TONS/XLIQD
00273          XSOL=  BB(31) * 0.15* TONS/XLIQD
00274          AA(90,16)=      DRYSLD *          SOLLIQ
00275          AA(90,18)=AA(91,10)-AA(90,16)
00275    C
00275    C SOLIDS  STREAM - AA(90,16)
00275    C
00276          TONSX=TONS
00277          TONS=AA(90,16)*FACT10
00300          TONSG     = AA(90,16) / HOUR
00301          AA(7,17) = 50.0* AA(90,16) /(62.4*DENS)  * 2000.
00302          IA(7,1)  =  1
00303          CALL  SILO                                                     11
00304          AA(66,17) = AA(90,16)*2000./(HOUR*8.33*60.) * 25.
00305          CALL PMPCNT                                                    10
00306          HP= AA(66,17)/25.
00307          SUMHP = HP+ SUMHP
00310          CALL PMPCNT                                                    11
00311          SUMHP=  HP + SUMHP
00312          IF (TONSG .GT.6) AA(50,17)= 6.
00314          IF (TONSG .GT.6) NUMZ = (TONSG/6.) + 1.
00316          IF (TONSG .LE.6) AA(50,17)= 3.
00320          IF (TONSG .LE.6) NUMZ = (TONSG/3.) + 1.
00322          DO  720   J= 1,NUMZ
00325      720 CALL GRINDR
00327          HP=        40.* TONSG/3.
00330          SUMHP= HP + SUMHP
00330    C
00330    C EXTRACTION VESSELS  MATERIAL BALANCE
```

Table I.-- Continued.

```
00330  C    1-OIL 2-PROTEIN  3-ASA 4-WATER 5-IPA  NOREAC=NUMBER OF REACTORS
00330  C
00331              NQUIP= NOREAC + 1
00332         STM(1,1) = (SOLLIQ-1.)*DRYSLD*XOIL
00333         STM(3,1)=DRYSLD*BB(32)/(BB(32) + (0.85*BB(31)))
00334         STM(2,1)=(DRYSLD-STM(3,1)) + ((SOLLIQ-1.)*DRYSLD*XSOL)
00335         STM(4,1) =(SOLLIQ-1.)*DRYSLD*(1.-     XSOL-XOIL)
00336         STM(5,1) = 0.0
00337         STRM(1,NQUIP)=0.
00340         STRM(2,NQUIP)=0.
00341         STRM(3,NQUIP)=0.
00342         STRM(4,NQUIP) = WATOIL*2.804*AA(90,16)/22.264
00343         STRM(5,NQUIP) = STRM(4,NQUIP)*19.46/2.804
00344         DO 121  I=1,NOREAC
00347         DO 121  J=1,5
00352         STM(J,I+1)= STM(J,I)*DATB(I,J)
00353         IF(I.EQ.1.AND.J.EQ.5)    STM(5,2)= STM(4,1)*DATB(1,5)
00355     121 CONTINUE
00360         DO 122  I=NOREAC,1,-1
00363         DO 122  J=1,5
00366     122 STRM(J,I)= STRM(J,I+1)- STM(J,I+1)+STM(J,I)
00371         DO 123  I=1,NQUIP
00374         STMM(I)=0.
00375         STRMM(I)=0.
00376         DO 123 J=1,5
00401           STMM(I)=STMM(I)+ STM(J,I)
00402         STRMM(I)= STRMM(I) + STRM(J,I)
00403     123 CONTINUE
00403  C
00403  C REACTOR VESSELS
00403  C
00406         VES= TONS* 30.
00407         AA(49,17) = VES
00410         VESS =  TONS* 16.
00411         IR= 1
00412         IF(VES.GT.10000.) IR= (VES/10000.) + 1.
00414         IF(VES.GT.10000.) VES = 10000.
00416         IRR=1
00417         IF(VESS.GT.10000. )  IRR=(VESS/10000.) + 1.
00421         TANK =  800.* TONS / 50.
00422         AA(40,18)=3.2
00423         AA(41,18)=3.2
00424         AA(40,17)= TANK
00425         CALL STORAG
00426         SAG= STRMM(2) * 2000./(24.*8.33*60.) *(24./HOUR)
00427         IP=1
00430         IF(SAG.GT.1250.) IP=(SAG/1250.) + 1.
00432         DO 93 IU=1,IP
00435         XIP=IP
00436         AA(66,17) =(SAG/XIP) * 24.
00437         CALL PMPCNT
00440      93 CONTINUE
00442         IF (VESS.GT.10000.)  VESS = 10000.
00442  C  MISCELLA TANK
00444         XIP=IR
00445         IP=(TONS*60./(50.*144.*XIP)) + 2.
00446         AA(51,17) = IP
```

Table I.--Continued.

```
00447        DO 41 I =1,IR
00452        LOOPS=  LOOPS + 3
00453        AA(49,17) = VFS
00454        CALL REACTR
00455        CALL SCREEN
00456        AA(73,17) = 0.005* VFS
00457        IF(AA(73,17).LT.2.) AA(73,17)=2.
00461        IA(73,5) = 2.
00462        CALL AGITOR
00463        SUMHP = SUMHP + 2.5
00464        XIR=IR
00465        SUMHP= SUMHP+ AA(73,17)
00466        AA(66,17)= TONS* 2000./(HOUR*8.33*XIR) * (22./60.)
00467        CALL PMPCNT
00470        ABC= AA(66,17)/22.
00471        IF(ABC.LE.2.)  HP= 2.
00473        IF(ABC.GT.2.)  HP= ABC
00475        SUMHP= HP + SUMHP
00476        IA(17,5) = 5
00477        DX=  SQRT(TONS/50.) * 8. /SQRT(XIP)
00500        AA(17,17) = 6
00501        AA(17,18) = DX
00502        CALL      SCREWR
00503     41 CONTINUE
00505        NUTH=NOREAC - 1
00505  C
00505  C OTHER REACTION VESSELS
00505  C
00506        DO 42 J = 1,IRR
00511        XIP=IRR
00512        IP=(TONS*60./(50.*XIP*144.)) + 2.
00513        AA(51,17)=IP
00514        LOOPS= LOOPS + (3*NUTH)
00515        DO 42 I = 1,3
00520        XIRR=IRR
00521        SUMHP=SUMHP + 2.5
00522        AA(66,17)= TONS*2000./(24.*8.33*XIRR)*(22./60.)
00523          CALL PMPCNT
00524        ABC= AA(66,17)/ 22.
00525        IF(ABC.GT.2.) HP=ABC
00527        IF(ABC.LE.2.) HP=2.
00531        SUMHP= SUMHP + HP
00532        AA(49,17)= VESS
00533        CALL REACTR
00534        CALL SCREEN
00535        AA(73,17)= 0.005*VESS
00536        IF(AA(73,17).LT.2.) AA(73,17)= 2.
00540        IA(73,5) = 2
00541        SUMHP = SUMHP + AA(73,17)
00542        CALL AGITOR
00543        DX=  SQRT(TONS/50 )* 8. / SQRT(XIP)
00544        AA(17,18)= DX
00545        AA(17,17)= 6.
00546        IA(17,5)=  5
00547        CALL SCREWR
00550     42 CONTINUE
00553        TONS=TONSX
```

Table I.--Continued.

```
00553   C
00553   C  MIXING TANK SECTION
00553   C
00554         SACID= STRMM(1)*.001*70.
00555         IA(40,1)= 1
00556         IA(40,2)= 1
00557         AA(40,17) = SACID
00560         CALL STORAG
00560   C ACID STORAGE TANK
00561         IA(40,2) = 0
00562         LOOPS=LOOPS+ 2
00563         ACID = STRMM(1) *.001
00564         IA(66,1) = 2
00565         AA(66,17)= 30.*ACID* 2000./ (8.33*60.*HOUR*1.8)
00566         CALL PMPCNT
00566   C PUMP FROM ACID STORAGE TO MIX TANK
00567         GAL=STRMM(1)* 2000./(8.33                    )
00570         SUMHP= SUMHP + (.0015*AA(66,17))
00571         AA(40,17) = GAL * .01
00572         AA(66,17) = GAL *30./(HOUR*60.)
00573         IA(66,1)  = 0
00574         IA(40,1)  = 2
00575         SUMHP= SUMHP + (AA(66,17)*.0015)
00576         CALL PMPCNT
00576   C PUMP FROM PRESS TO  ACID MIX TANK
00577         CALL STORAG
00577   C     ACID MIX TANK
00600         CALL PMPCNT
00600   C PUMP FROM ACID MIX TANK TO MISCELLA TANK
00600   C
00600   C  MISCELLA TANK BEFORE PREHEATER ( 1 HOUR HOLDUP)
00600   C
00601         SAA= 1.001* STRMM(1)
00602         AA(40,17)= SAA*2000./(HOUR*8.33)
00603         IA(40,1)  = 1
00604         CALL STORAG
00605         AA(66,17) = 30. * AA(40,17)
00606         IA(66,1) = 0
00607         CALL PMPCNT
00610         SUMHP =  SUMHP + (.0015*AA(66,17))
00611         PRINT 3000
00613    3000 FORMAT(/50H STORAGE TANK BEFORE PREHEATER
00613   C
00613   C  STEAM REQUIREMENTS
00613   C
00614         STEAM1 = AA(90,16)*FACT10*35./50.
00615         STEAM2 = AA(90,16)*FACT10*20./50.
00616         STEAM3 = AA(90,16)*FACT10*20./50.
00617         STEAM4 = AA(90,16)*FACT10*20./50.
00620         STEAM = STEAM1+STEAM2+STEAM3+STEAM4
00620   C  PREHEATER FOR DISTILLATION COLUMN
00621         STEAM9=  STRMM(1)*1.001 * 2000./HOUR  * .1
00622         STEAM=   STEAM + STEAM9
00623         AA(67,17) = STEAM9 * .1
00624         CALL HEATEX
00624   C
00624   C  DISTILLATION COLUMN - MATERIAL BALANCE
```

Table I.-- Continued.

```
00624   C
00625         STOP(1) = STRM(5,1) * .99887
00626         STOP(2) = STOP(1) *  .1445
00627         SBOT(1) = STRM(5,1) * .00113
00630         SBOT(2) = STRM(4,1)- STOP(2)
00631         SBOT(3) = STRM(1,1) + STRM(1,2) + STRM(1,3) +(.001*STRMM(1))
00632         SBOTT   = SBOT(1) + SBOT(2) + SBOT(3)
00632   C
00632   C  DISTILLATION  COLUMN
00632   C   REBOILER
00632   C
00633         STEAMR=AA(90,16) * FACT10*10709./50.
00634         AA(67,17) = .1* STEAMR
00635         CALL HEATEX
00636         STEAM= STEAM + STEAMR
00637         TANKA=  FACT10* AA(90,16)* 100./50.
00637   C  TANK  ASSOCIATED WITH DISTILLATION COLUMN
00640         IA(40,1) = 1
00641         AA(40,17) = TANKA
00642         CALL STORAG
00643         WIDTH=  4.* SQRT(AA(90,16)*FACT10/75.)
00644         I= WIDTH/2 .
00645         WIDTH= 2*I
00646         IF(WIDTH.LT.4.001) WIDTH = 4.
00650         AA(43,18) =24.
00650   C  AA(43,18) =  THE TRAY SPACING IN INCHES
00651         AA(43,20)= WIDTH
00652         AA(43,17)= 54.
00652   C  AA(43,17) =  THE COLUMN HEIGHT IN FEET
00653         AA(43,1) = .4
00654         CALL COLUMN
00655         IA(42,4)=2
00656         IA(42,2)=1
00657         IA(42,3)=1
00660         AA(42,18)=WIDTH
00661         AA(42,19)=54.
00662         CALL  VESSEL
00663         LOOPS = LOOPS+5
00664         WASTE = (.00113*STRM(5,1)) + (.0001*(PRDCTA+PRDCTB))
00665         AA(40,17) = WASTE* 2000./ 8.33  * DAYSR
00666         IA(40,1) = 0
00667         CALL STORAG
00670         LOOPS = LOOPS + 1
00670   C  IPA STORAGE TANK(MAKEUP IPA)
00670   C  CONDENSER FOR DISTILLATION COLUMN
00671         WATER = 669.* FACT10* AA(90,16)/ 50.
00672         AA(67,17) = WATER* 8.33 * 60. * .01
00673         CALL HEATEX
00674         AA(66,17) = 105. * (AA(90,16)*FACT10/75.) * 20.
00675         CALL PMPCNT
00676         HP= 2.* (AA(90,16)* FACT10/75.)
00677         SUMHP =  HP + SUMHP
00677   C  CENTRIFUGE  SECTION
00700         MATRL =  SBOTT + AA(90,18)
00701         OIL   =  STRM(1,1)  + (AA(90,18)*XOIL)
00702         AA(40,17) = MATRL* 2000. /(HOUR*8.33)
00703         IA(40,1) = 1
```

Table I.--Continued.

```
00704          CALL STORAG
00705          AA(66,17) = 30.* AA(40,17)
00706          IA(66,1) = 0
00707          CALL PMPCNT
00710          SUMHP= SUMHP +  0.0015*AA(66,17)
00710    C  NUMBER OF CENTRIFUGES
00711          HP =  MATRL*0.01* 2000./(HOUR*8.33)
00712          N3 = (HP/20.)  + 1.
00713          HP = 20* N3
00714          SUMHP =  SUMHP + HP
00715          DO 47    I =1,N3
00720          AA(54,17) = 20.
00721          CALL CNTFGE
00722       47 CONTINUE
00724          LOOPS =  LOOPS + N3
00725          SAB= OIL * 1.1
00726          SCB= MATRL - OIL
00726    C  SECOND CENTRIFUGE
00727          HP= SAB *0.025* 2000./(HOUR*24.)
00730          N2= (HP/20.) + 1.
00731          HP= N2* 20
00732          SUMHP=  SUMHP  + HP
00733          DO 46 I=1,N2
00736          AA(52,17) =20.
00737          CALL SHARP
00740       46 CONTINUE
00742          HOTH2O = 0.1 * OIL
00742    C  OIL STORAGE
00743          DAZOIL=15.
00744          AA(40,17) =DAZOIL*OIL*2000./8.33
00745          IA(40,1)  = 0
00746          CALL STORAG
00747          AA(66,17)=AA(40,17)*30./(60.*HOUR*DAZOIL)
00750          IA(66,1)=0.
00751          CALL PMPCNT
00752          CALL PMPCNT
00753          SUMHP=SUMHP + (2.*AA(66,17)*.001)
00753    C
00753    C  DISSOLVED SOLIDS STREAM
00753    C
00754          SBQT =  SCB
00755          SBQQT= (STRM(2,1)+(XLIQD*XSOL)) * 2.
00756          HWAT= SBQT - SBQQT
00757          IF(HWAT.GE.0.) GO TO 51
00761          PRINT 3006
00763    3006  FORMAT(/50H FISH SOLUABLES ARE MORE THAN 50 PERCENT PROTEIN   )
00764          AA(90,4) = SBQT
00765          GO TO 52
00766       51 CONTINUE
00767          AA(90,4) = SBQQT
00770          TONA=SBQQT/HOUR*2000.
00771          AA(33,17)  =  TONA/ 20.
00772          CALL EVPHOR
00773          CALL EVPHOR
00774          CALL EVPHOR
00775          SAQT =   STRM(2,1)/0.3
00776          IF(SAQT.GE.SBQT) SAQT = SBQT
```

Table I.--Continued.

```
            AA(33,17) = SAQT * 2000. /(HOUR* 25.)
            STEAM = STEAM + (HWAT * 2000./HOUR)
            CALL  EVPHOR
            IA(66,1)=0.
            AA(66,17)=30.*SBQQT        *2000./(10.*60.*HOUR)
            CALL  PMPCNT
            HP=.001*AA(66,17)
            SUMHP=SUMHP + HP
      C
      C  ACID MIX TANK
      C
            AA(40,17)=SBQQT        *2000./(10.*1.)*.01
            IA(40,1)=2
            CALL  STORAG
            IA(40,1)=0
      C
      C  STORAGE OF FISH SOLUABLES(15 DAYS)
      C
            IA(66,1)=0
            AA(66,17)=30.*AA(40.17)/(60.*HOUR)
            CALL  PMPCNT
            HP=.001*AA(66,17)
            SUMHP=SUMHP  + HP
            IA(40,1)=2
            AA(40,17)=SBQQT        *2000./10. *15.
            CALL  STORAG
            IA(40,1)=0.
         52 CONTINUE
      C
      C ACID TANK AND  FISH SOLUABLES  STORAGE
      C
      C
      C DRYING AND CONDITIONING OPERATION(SOLIDS FROM EXTRACTION VESSELS)
      C
            TASA= STMM(NOREAC+1)/2.
            NZ= NOREAC + 1
            TASB= STM(1,NZ) + STM(2,NZ) + STM(3,NZ) +(0.05*STM(4.NZ))
           1 +  (STM(5,NZ)*1.E-04 * 1.0 )
            TASC= STM(4.NZ) * .95
            TASD= STM(5.NZ) * .9999
            STEAM6 = (TASC + (1.0  * TASD)) *  2000. / HOUR
            STEAM=  STEAM + STEAM6
      C DRYER - CONDITIONER
            AA(21,17) = 3.8* 16.* TASA/ 24.
            IA(21,5)  = 6.
            BB(2)     = 0.9
            CALL DRYERR                                                   D
            BB(2) = 1.0
            IA(21,5) = 7
            CALL DRYERR                                                   SD
            BB(2) =  1.0
            IA(21,5) = 7
            CALL DRYERR                                                   SD
            IA(21,5) = 8
            BB(2) = 1.0                                                   C
            CALL DRYERR
            LOOPS =  LOOPS + 4
```

Table I.-- Continued.

```
01053          AA(17,18)  = 6.
01054          AA(17,17)  = 20.
01055          IA(17,5)   = 1
01056          CALL SCREWR
01056    C  CONVEYER FOR MILL
01057          IF(IPTION(2).EQ.3)  GO TO 44
01061          AA(18,17) = (TASB/8.)
01062          CALL HAMMER
01063          HP = TASB * 2000.* 75./(HOUR*700.)
01064          SUMHP =  SUMHP + HP
01065          PRDCTA=  STM(2,NOREAC+1)         + STM(3,NOREAC+1)
01066          PRDCTA=PRDCTA/0.95
01067          PRDCTB=  0.
01070          AA(75,17) = PRDCTA * 2000./(25. * HOUR * 60.)
01071          CALL BAGGMA
01072          CALL SCALE
01073          AA(75,17) =  AA(75,17) * HOUR * 60.
01074          GO TO 49
01075       44 CONTINUE
01075    C
01075    C  AT THE TIME THIS CODE WAS COMPILED THERE IS NO SATISFACTORY METHOD
01075    C  OF SEPARATING ASH AND DRY PROTEIN- SPACE IS PROVIDED WHEN THIS
01075    C  TECHNOLOGY BECOMES AVAILABLE
01075    C
01076       49 CONTINUE
01076    C     BOILER
01077          AA(27,18) =150.
01100          AA(27,17)=STEAM
01101          CALL BOILER
01102          IA(40,1)=2
01103          AA(40,17)=STEAM*1000.*HOUR/(8.33*140000.)*15.
01104          CALL  STORAG
01105          IA(66,1)=0
01106          AA(66,17)=30.*AA(40.17)/(60.*15.*HOUR)
01107          CALL  PMPCNT
01110          HP=.001*AA(66,17)
01111          SUMHP=SUMHP
01111    C  CONTROL LOOPS
01112          XLOOPS = LOOPS
01113          COST(1) = XLOOPS*AA(100,1)
01114          COST(5) = COST(5)
01115          COSTA(1) = COSTA(1) + COST(1)
01116          COSTA(5) = COSTA(5) + COST(5)
01117          PRINT 1021, COST(1),COST(5)
01117    C  FORK LIFT
01123     1021 FORMAT(/25H CONTROL INSTRUMENTATION ,35X,F10.3,30X,F10.3)
01124          COST(1) = AA(100,20)
01125          COST(5) = COST(1)
01126          COSTA(1) = COSTA(1)+ COST(1)
01127          COSTA(5) = COSTA(5)+ COST(5)
01130          PRINT 1022, COST(1),COST(5)
01134          AA(8,17) = TONS
01135          CALL CONDEN
01136     1022 FORMAT(/ 25H PAYLOADER              ,10X,25X,F10.3,30X,F10.3)
01136    C
01136    C   BOILER WATER TREATMENT
01136    C
```

Table I.-- Continued.

```
01137           COST(5)=1.
01140           COST(1)=COST(5)
01141           PRINT 4242,  COST(1),COST(5)
01145     4242  FORMAT(/25H BOILER WATER TREATMENT   , 10X ,15H                 ,10H
01145        1         ,F10.3,30X,F10.3)
01146           COSTA(1)=COSTA(1) + COST(1)
01147           COSTA(5)=COSTA(5) + COST(5)
01147     C
01147     C   SEA WATER PUMPS
01147     C
01150           AA(90,10)=WATER*60.  + 4.*STEAM
01151           AA(66,17)  =  AA(90,10)*1.2/60.
01152           IA(66,1)=1.
01153           IA(66,4)=2.
01154           CALL  PMPCNT
01155           IA(66,1)=0
01156           IA(66,4)=0
01157           HP= .001*AA(66,17)
01160           SUMHP=SUMHP + HP
01160     C
01160     C   CARBON ADSORBER
01160     C
01161           COST(1)=2.
01162           COST(5)=COST(1)
01163           PRINT  4243, COST(1),COST(5)
01167           COSTA(1)=COSTA(1) + COST(1)
01170           COSTA(5)=COSTA(5) + COST(5)
01171     4243  FORMAT(/25H CARBON ADSORBER          , 10X ,15H                 ,10H
01171        1         ,F10.3,30X,F10.3)
01171     C
01171     C    VENT CONDENSER
01171     C
01172           AA(66,17)=20.
01173           IA(67,1)=1
01174           IA(67,4)=     4
01175           CALL  HEATEX
01176           IA(67,1)=0
01177           IA(67,4)=0
01200           CALL SCALE
01201           CALL SCALE
01202           PRINT 1041,(COSTA(J),J=1,6)
01210     1041  FORMAT(//25H  TOTAL COSTS            ,35X,6F10.3)
01211           AA(90,2) =  SUMHP*.7457 * 24.
01212           AA(100,10)= COSTA(5)
01213           AA(90,1) = STEAM*1000.*24./140000.
01213     C      MATERIAL  BALANCE
01214           AA(90,3) = PRDCTB
01215           AA(90,7) = PRDCTA
01216           AA(90,5)=OIL
01217           AA(90,18)=WASTE
01220           AA(90,19)=ACID
01221           CALL MATER(TONS)
01222           FISH = TONS*2000./24.
01223           PRINT 1003 , FISH
01226     1003  FORMAT(/7X27H FISH TO EXTRACTION VESSELS,F8.0,7H LB/HR )
01227           YYA=STEAM1
01230           PRINT 1201,YYA
```

Table I.--Continued.

```
01233   1201  FORMAT(/8X,35H STEAM(STIRRED VESSEL 1 )          ,F8.0,7H LB/HR )
01234         YYB=STEAM2
01235         PRINT 1202,YYB
01240   1202  FORMAT(/8X,35H STEAM(STIRRED VESSEL 2 )          ,F8.0,7H LB/HR )
01241         YYC= STEAM3
01242         PRINT 1203,YYC
01245   1203  FORMAT(/8X,35H STEAM(STIRRED VESSEL 3 )          ,F8.0,7H LB/HR )
01246         YYD= STEAM4
01247         PRINT 1204,YYD
01252   1204  FORMAT(/8X,35H STEAM(STIRRED VESSEL 4 )          ,F8.0,7H LB/HR )
01253         YYE = STEAM9
01254         PRINT 1205,YYE
01257   1205  FORMAT(/8X,35H STEAM(PREHEATER-DISTILLATION)     ,F8.0,7H LB/HR )
01260         YYG= STEAMR
01261         PRINT 1206,YYG
01264   1206  FORMAT(/8X,35H STEAM(REBOILER)                   ,F8.0,7H LB/HR )
01265         YYH = STEAM6
01266         PRINT 1207,YYH
01271   1207  FORMAT(/8X,35H STEAM(ROTARY DRYER  FPC  )        ,F8.0,7H LB/HR )
01272         YYI= STEAMW
01273         PRINT 1208,YYI
01276   1208  FORMAT(/8X,35H STEAM(ROTARY DRYER BONE MEAL      ,F8.0,7H LB/HR )
01277         YYJ=(STEAM*4.)
01300         PRINT 1209,YYJ
01303         YYK= WATER
01304         PRINT 1210,YYK
01307   1210  FORMAT(/8X,35H COOLING WATER DISTILLATION COND.  ,F8.0,9H GAL/MIN )
01307        C )
01310   1209  FORMAT(/8X,35H COOLING WATER CONDENSER           ,F8.0,9H GAL/MIN
01310        C )
01311         YYL= STEAM
01312         PRINT 1211,YYL
01315   1211  FORMAT(/8X,35H TOTAL STEAM                       ,F8.0,7H LB/HR )
01316         YYM = (STEAM*4.) + WATER
01317         PRINT 1212,YYM
01322   1212  FORMAT(/8X,35H TOTAL WATER                       ,F8.0,7H LB/HR )
01323         PRINT 1213
01325   1213  FORMAT(//40X, 9H STREAM 1,7X,9H STREAM 2,7X,9H STREAM 3,7X,9H STR
01325        CEAM 4,7X,9H STREAM 5,/)
01326         PRINT 1214,(STRM(1,K),K=1,5)
01334         PRINT 1215,(STRM(3,K),K=1,5)
01342         PRINT 1216,(STRM(2,K),K=1,5)
01350         PRINT 1217,(STRM(4,K),K=1,5)
01356         PRINT 1218,(STRM(5,K),K=1,5)
01364         PRINT 1219,(STM (1,K),K=1,5)
01372         PRINT 1220,(STM (3,K),K=1,5)
01400         PRINT 1221,(STM (2,K),K=1,5)
01406         PRINT 1222,(STM (4,K),K=1,5)
01414         PRINT 1223,(STM (5,K),K=1,5)
01422   1214  FORMAT(/10X20H RAFFINATE  OIL      ,10X,4(F10.3, 8X),F10.3)
01423   1215  FORMAT(/10X20H RAFFINATE  ASH      ,10X,4(F10.3, 8X),F10.3)
01424   1216  FORMAT(/10X20H RAFFINATE  PROTEIN  ,10X,4(F10.3, 8X),F10.3)
01425   1217  FORMAT(/10X20H RAFFINATE  WATER    ,10X,4(F10.3, 8X),F10.3)
01426   1218  FORMAT(/10X20H RAFFINATE  ALCOHOL  ,10X,4(F10.3, 8X),F10.3)
01427   1219  FORMAT(/10X20H EXTRACT    OIL      ,10X,4(F10.3, 8X),F10.3)
01430   1220  FORMAT(/10X20H EXTRACT    ASH      ,10X,4(F10.3, 8X),F10.3)
01431   1221  FORMAT(/10X20H EXTRACT    PROTEIN  ,10X,4(F10.3, 8X),F10.3)
```

Table I.--Continued.

```
01432   1222  FORMAT(/10X20H EXTRACT     WATER    ,10X,4(F10.3, 8X),F10.3)
01433   1223  FORMAT(/10X20H EXTRACT     ALCOHOL  ,10X,4(F10.3, 8X),F10.3)
01434         XXA= STMM(5)* 2000./24.
01435         PRINT 1224, XXA
01440   1224  FORMAT(/8X,35H FLOW FROM EXTRACTION VESSEL 4      ,F8.0,7H LB/HR )
01441         XXB= STRMM(1)* 2000./24.
01442   1225  FORMAT(/8X,35H FLOW FROM EXTRACTION VESSEL 1      ,F8.0,7H LB/HR )
01443         PRINT 1225, XXB
01446         XXC=MATRL*2000./HOUR
01447         PRINT 1226,XXC
01452   1226  FORMAT(/8X,35H AQUEOUS STREAM(CENTRIFUGE)         ,F8.0,7H LB/HR )
01453         XXD=(STOP(1)+STOP(2))*2000./24.
01454         PRINT 1227,XXD
01457   1227  FORMAT(/8X,35H TOPS FROM DISTILLATION COLUMN      ,F8.0,7H LB/HR )
01460         XXE= SBOTT*2000./24.
01461         PRINT 1228,XXE
01464   1228  FORMAT(/8X,35H BOTTOMS FROM DISTILLATION COLUMN  ,F8.0,7H LB/HR )
01465         XXG= AA(90,5)*2000./24.
01466         PRINT 1230,XXG
01471   1230  FORMAT(/8X,35H FISH OIL PRODUCT                   ,F8.0,7H LB/HR )
01472         XXH=AA(90,3)*2000./24.
01473   1231  FORMAT(/8X,35H FISH PROTEIN CONCENTRATE           ,F8.0,7H LB/HR )
01474         XXI=AA(90,7)*2000./24.
01475         PRINT 1232, XXH
01500         PRINT 1231, XXI
01503   1232  FORMAT(/8X,35H BONE MEAL CONCENTRATE              ,F8.0,7H LB/HR )
01504         AA(95,1)=SBOOT
01505        XXJ =  AA(95,1)* 2000./24.
01506         PRINT 1233, XXJ
01511   1233  FORMAT(/8X,35H FISH SOLUABLES                     ,F8.0,7H LB/HR )
01512         IXX=(14.0*(TONS/50.)**.31)  + 0.5
01513         AA(90,8)=IXX*8
01514         AA(90,9)=(YYJ+YYK)*24.
01515         AA(90,13)  =  AA(90,13) + (AA(90,3)+AA(90,7)+AA(90,20)+AA(90,4))
01516         RETURN
01517         END

      END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S BIOLOG,BIOLOG
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE BIOLOG    ENTRY POINT 002306

   STORAGE USED: CODE(1) 002350; DATA(0) 000733; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    PMPREC
    0006    RELT
    0007    STORAG
    0010    REFRIG
    0011    PMPCNT
    0012    SILO
    0013    BUCKET
    0014    GRINDR
    0015    REACTR
    0016    AGITOR
    0017    SCREEN
    0020    SCREWR
    0021    DRYERR
    0022    HAMMER
    0023    BAGGMA
    0024    SCALE
    0025    SHARP
    0026    EVPFLM
    0027    EVPSPR
    0030    BOILER
    0031    CONDEN
    0032    MATER
    0033    NRDC$
    0034    NIO2$
    0035    NPRT$
    0036    NIO1$
    0037    NEXP6$
    0040    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001  000367 100L     0000  000041 1000F    0000  000050 1001F    0000  000065 1002F    0000  000252 1003F
    0000  000263 1004F    0000  000274 1005F    0000  000342 1006F    0000  000353 1007F    0000  000364 1008F
    0000  000375 1009F    0001  000564 101L     0000  000406 1010F    0000  000417 1011F    0000  000430 1012F
    0000  000441 1013F    0000  000452 1014F    0000  000305 1015F    0000  000463 1016F    0000  000474 1017F
    0000  000505 1018F    0000  000516 1019F    0001  000627 102L     0000  000527 1020F    0000  000207 1021F
    0000  000225 1022F    0000  000540 1023F    0000  000551 1024F    0001  000712 103L     0000  000316 1033F
    0000  000243 1041F    0001  000006 106G     0000  000027 111F     0000  000327 1111F    0001  000013 114G
    0001  000020 122G     0000  000100 2000F    0001  000134 201G     0000  000113 3000F    0000  000171 4242F
```

Table I.--Continued.

```
0000     000153 4249F     0001     001160 470G      0000     000031 5000F     0001     001234 510G      0001     001730 707G
0001     001757 722G      0003 R 000000 AA          0000 R 000012 ADDT        0003 R 004704 BB          0000 R 000024 COOL
0004 R 000000 COST        0004 R 000007 COSTA       0000 R 000023 FISH        0000 R 000006 G           0000 R 000002 GALLON
0000 R 000003 GALS        0000 R 000007 HP          0000 I 000000 I           0003 I 003720 IA          0000     000720 INJP$
0000 I 000014 INST        0000 I 000025 IXX         0000 I 000022 J           0000 I 000010 LOOPS       0000 I 000005 NUM
0000 R 000026 PXX         0000 R 000016 SLDS        0000 R 000004 SUMHP       0000 R 000001 TONSA       0000 R 000011 TONSG
0000 R 000015 VOLD        0000 R 000013 VOLT        0000 R 000017 WATER       0000 R 000020 WATEVP      0000 R 000021 XLOOPS
```

```
00101              SUBROUTINE BIOLOG(TONS)
00103              COMMON/BLOCK1/AA(100,20),IA(100,5),BB(100)
00104              COMMON /BLOCK2/ COST(7),COSTA(7)
00105              DO 1 I=1,7
00110              COST(I) =0.0
00111        1     COSTA(I)=0.0
00113              DO 2 I=1,20
00116              AA(90,I) =0.0
00117        2     AA(91,I) =0.0
00121              DO 10 I=30,33
00124       10     BB(I) = BB(I)*0.01
00126            READ 111 ,BB(40),BB(41),BB(42),BB(43),BB(44)
00135      111   FORMAT(5E12.5)
00136            PRINT 5000
00140     5000   FORMAT(/8X36H ANTIOXIDANT PRICE AND EFFECTIVENESS )
00141            PRINT 1001,BB(44),BB(43)
00145              PRINT 1000
00147     1000     FORMAT(/8X31H ENZYME PRICE AND EFFECTIVENESS )
00150              PRINT 1001,BB(41),BB(40)
00154     1001     FORMAT(/8X8H PRICE =,F5.2,12H DOLLARS/LB,,F8.3,32H LB REQUIRED PE
00154           CR 100 LB OF FISH    )
00155              IF(BB(42) .GT. 0.0) PRINT 1002,BB(42)
00161     1002     FORMAT(/8XF8.2,51H PERCENT OF DISOLVED PROTEIN PACKAGED AS BCF PA
00161           CSTE )
00162              PRINT 2000
00164     2000     FORMAT(1H1//55H DETAILED EQUIPMENT COSTS (ALL COSTS IN 1000.0 DOL
00164           CLARS) )
00165              PRINT 3000
00167     3000     FORMAT (//18H     EQUIPMENT TYPE,10X10H  CAPACITY,12X9H MATERIAL,
00167           C60H     BASE     MATERIALS    LABOR    INDIRECT    MODULE      RANGE ,/6
00167           C0X60H   COST        COSTS       COSTS      COSTS       COST         + OR - )
00167      C
00167      C UNLOADING AND STORAGE OF FISH
00167      C
00170              TONSA=TONS*2000./8.33
00171              GALLON= TONSA/(24.*60.)
00172              GALS =GALLON*1.3
00173              SUMHP=  0.
00174              IA(65,1) = 0
00175              IA(65,2) = 1.0
00176              AA(65,17)= GALS*30.
00177              NUM = TONS/500 + 1
00200              DO 143 I=1,NUM
00203      143     CALL PMPREC
00205              IA(65,2) = 0.0
00206              SUMHP=  SUMHP +(AA(65,17)*.001*1.5)
```

Table I.-- Continued.

```
00207          SUMHP=  SUMHP +(AA(65,17)*.001*1.5)
00210          IF(TONSA.LT.30000.) G=(30000./(24.*60.))*15.
00212          IF(TONSA.GE.30000.) G=(450000./(24.*60.))*15.
00214          IF(TONS.LE.150.) AA(70,18)= 36.
00216          IF(TONS.GT.150.) AA(70,18)= 48.
00220          AA(70,17)=100.
00221          CALL BELT
00222          HP = TONS*0.00124 +13.6
00223          SUMHP = HP + SUMHP
00224          AA(40,17)=30.0*TONS
00225          IA(40,1)=0.0
00226          IA(40,2)=2
00227          CALL STORAG
00230          IA(40,2)=0
00231          AA(85,17)=0.5*TONS*3.0
00232          IA(85,1) =30
00233          CALL REFRIG
00234          SUMHP = SUMHP + 4.72*AA(85,17)
00235         COST(1)=1.19
00236         IF(TONS.GE.300) COST(1)=1.88
00240         COST(5)=COST(1)
00241         PRINT 4249, COST(1), COST(5)
00245         COSTA(1)=COSTA(1)+COST(1)
00246         COSTA(5)=COSTA(5)+COST(5)
00247   4249   FORMAT(/25H BRINE MAKE-UP+SALT STOR., 10X ,15H                    ,10H
00247      1          ,F10.3,30X,F10.3)
00247   C PUMP FOR BRINE MAKE-UP (BRONZE)
00250         IA(66,1)=1
00251         AA(66,17)=TONS*3.*2000./(24.*60.*62.4)*.69*7.75
00252         CALL PMPCNT
00253         IA(66,1)=0
00254         HP=.001*AA(66,17)
00255         SUMHP=SUMHP+HP
00255   C PUMP FOR WATER INTO BRINE MAKE-UP
00256         AA(66,17)=AA(66,17)*.917
00257         IA(66,1)=0
00260         CALL PMPCNT
00261         HP=.001*AA(66,17)
00262         SUMHP=SUMHP+HP
00262   C
00262   C FISH STORAGE FOR 3 DAYS
00262   C
00263         IA(7,1)=1
00264         AA(7,17)=3.*TONS*2000.*1.69/62.4
00265         CALL SILO
00266         LOOPS=0.0
00267         LOOPS=LOOPS+3.
00270          CALL SILO
00271          TONSG=TONS/24.
00272          AA(71,18)= TONSG
00273          AA(71,17)= 20.
00274          CALL BUCKET
00275          HP = TONS*0.00106
00276          SUMHP = HP + SUMHP
00276   C
00276   C FISH GRINDING AND DIGESTION
00276   C
```

Table I.--Continued.

```
00277        100   IF(TONSG .LT. 3) AA(50,17)=3
00301              IF(TONSG .GT. 6) AA(50,17)=6
00303              IF(AA(50,17) .GT. 0.0) CALL GRINDR
00305              TONSG = TONSG-AA(50,17)
00306              IF(TONSG .GT. 0.2) GO TO 100
00310              HP = 40*TONSG/3
00311             SUMHP=HP+SUMHP
00311      C PUMP AFTER GRINDER
00312             AA(66,17)=30.*TONS*2000./(24.*60.*8.33)
00313             IA(66,1)=0
00314             CALL PMPCNT
00315             SUMHP=SUMHP+.001*AA(66,17)
00315      C PUMP BEFORE DIGESTER
00316             CALL PMPCNT
00317             SUMHP=.001*AA(66,17)+SUMHP
00320              AA(40,17) = 2*TONS*2000./(8.33*24)
00321              IA(40,1) = 1
00322              CALL STORAG
00323              IA(40,1) =0
00324             AA(90,15)=TONS*.0084
00325             AA(90,13)=(BB(30)+BB(31)+BB(32))*TONS*.0001
00326             AA(90,17)=TONS*0.0432
00327             AA(90,14)=TONS*0.0192
00330              AA(90,12)=TONS*(BB(40)/100.0)
00331             ADDT=0.0
00332             ADDT=AA(90,12)+AA(90,13)+AA(90,15)+AA(90,17)+AA(90,14)
00333             AA(91,1)=ADDT+2.*TONS
00334              VOLT=AA(91,1)*2000/(8.33*4.8)
00335              AA(51,2) =2.0
00336              AA(51,17) = 2.0
00337              AA(49,17)=VOLT/3
00340              IF(AA(49,17) .LT. 10000) AA(73,17) = AA(49,17)*0.005
00342              IF(AA(49,17) .LT. 10000) GO TO 101
00344              IF( AA(49,17) .GT. 10000) AA(73,17) = 50.
00346              IF(AA(49,17) .GT. 10000) AA(49,17)=10000
00350        101  AA(66,17)=30.*AA(49,17)*4.8/(60.*24.)
00351             IA(66,1)=0
00352             CALL REACTR
00353             CALL AGITOR
00354              CALL SCREEN
00355              CALL REACTR
00356              CALL AGITOR
00357              CALL SCREEN
00360              CALL REACTR
00361              CALL AGITOR
00362              CALL SCREEN
00363              INST = 3
00364              HP = 3*AA(73,17)
00365              SUMHP = HP + SUMHP
00366              VOLD =VOLT -AA(49,17)*3
00367        102   IF(VOLD .LT. 500) GO TO 103
00371              IF(VOLD .LT. 10000) AA(49,17)=VOLD
00373              IF(AA(49,17) .LT. 10000) AA(73,17) = AA(49,17)*0.005
00375              IF(VOLD .GT. 10000) AA(49,17)=10000
00377              IF( AA(49,17) .GT. 10000) AA(73,17) = 50.
00401              CALL REACTR
00402              CALL AGITOR
```

Table I.-- Continued.

```
00403            CALL SCREEN
00404            INST = INST + 1
00405            VOLD = VOLD -AA(49,17)
00406            HP = AA(73,17)
00407            SUMHP = HP + SUMHP
00410            GO TO 102
00411     103    CONTINUE
00411     C
00411     C BONE FEED STREAM
00411     C
00412           BB(2)=1.
00413           SLDS=(((40./667.)*BB(31))+((110./250.)*BB(32))+((10./500.)*BB(30))
00413          C)*TONS+((125./299.3)*ADDT*(110./250.))
00414           WATER=TONS*(1.+BB(33))+(174.3/299.3)*ADDT
00415           AA(91,10)=(((180./667.)*BB(31))+((112./500.)*BB(30))+((50./250.)*B
00415          CB(32)))*TONS+((125./299.3)*ADDT*(50./250.))+((1058./7216.5)*WATER)
00416           AA(91,2)=(320./160.)*SLDS
00416     C PUMP FOR SLUDGE FROM CENTRIFUGE
00417           IA(66,1)=0
00420           AA(66,17)=AA(91,10)*30.*2000./(24.*8.33*60.)
00421           CALL PMPCNT
00422           HP=.001*AA(66,17)
00423           SUMHP=HP+SUMHP
00423     C
00423     C SCREW CONVEYOR
00423     C
00424           AA(17,18)=6
00424     C FISH OIL STREAM
00424     C
00425           AA(91,3)=AA(91,1)-AA(91,2)
00425     C PUMPS BEFORE AND AFTER HOLD TANK OF FIRST CENTRIFUGE
00426           IA(66,1)=0
00427           AA(17,17)=20
00430           IA(17,5)=1
00431           CALL SCREWR
00432           IA(21,5)=3
00433            AA(21,17)=AA(91,2)*2.5
00434            CALL DRYERR
00435           AA(90,3)=(SLDS+AA(91,10)-((1058./7216.5)*WATER))/.9
00436           AA(91,12)=AA(91,2)+AA(91,10)-AA(90,3)
00436     C
00436     C BAGGING MACHINE FOR BONE MEAL
00436     C
00437           AA(75,17)=AA(90,3)*2000./(24.*60.*25.)
00440           IA(75,2)=0
00441           IA(75,1)=0
00442           AA(18,17)=AA(90,3)/24.
00443           CALL HAMMER
00444           CALL BAGGMA
00445           AA(75,5)=AA(75,17)
00446            AA(72,17) = 18.
00447            CALL SCALE
00447     C
00450           AA(66,17)=AA(91,3)*30.*2000./(8.33*24.*60.)
00451           CALL PMPCNT
00452           CALL PMPCNT
00453           SUMHP=2.*.001*AA(66,17)+SUMHP
```

Table I.-- Continued.

```
00454        AA(72,17)=18.
00455        CALL SCALE
00456         AA(40,17) = AA(91,3)*2000./(8.33*24.)
00457         IA(40,1) = 1
00460         CALL STORAG
00461         IA(40,1) =0
00462        AA(91,6)=(((447./667.)*BB(31))+((3./500.)*BB(30))+((90./250.)*BB(3
00462       C2)))*TONS+((125./299.3)*ADDT*(90./250.))+((5998./7216.5)*WATER)
00463        AA(91,4)=AA(91,3)-AA(91,6)-AA(91,10)
00464         HP= 0.01*AA(91,3)*2000.0/(8.33*24.0)
00465         SUMHP =HP+SUMHP
00466         NUM = HP/20. +1
00467         DO 20 I=1,NUM
00472        AA(52,17)=20.
00473   20   CALL SHARP
00475         HP = 0.025*AA(91,4)*2000.0/(8.33*24.0)
00476        SUMHP=SUMHP+HP
00476  C PUMPS BEFORE AND AFTER HOLD TANK FOR SECOND CENTRIFUGE
00477        IA(66,1)=0
00500        AA(66,17)=AA(91,4)*2000.*30./(8.33*24.*60.)
00501        CALL PMPCNT
00502        CALL PMPCNT
00503        SUMHP=2.*.001*AA(66,17)+SUMHP
00504         AA(40,17) = AA(91,4)*2000./(8.33*24.)
00505         CALL STORAG
00506         NUM= HP/20. +1
00507         DO 30 I=1,NUM
00512         AA(52,17) =20.0
00513   30    CALL SHARP
00513  C
00513  C HOLD TANK FOR FISH OIL
00513  C
00515        AA(90,5)=TONS*BB(30)*.75
00516        AA(40,17)=AA(90,5)*2000./(8.33*24.)
00517        CALL STORAG
00517  C
00517  C FISH OIL STORAGE (15 DAYS)
00517  C
00520        AA(40,17)=15.*AA(90,5)*2000./8.33
00521         IA(40,1) =0.0
00522         CALL STORAG
00523         AA(66,17)=AA(90,5)*30.0*2000.0/(8.33*24*60)
00524         SUMHP= SUMHP+(AA(66,17)*0.001)
00525         SUMHP= SUMHP+(AA(66,17)*0.001)
00526        IA(66,1)=0
00527         CALL PMPCNT
00530         CALL PMPCNT
00530  C
00530  C DISSOLVED SOLIDS STREAM
00530  C
00530  C PUMPS BEFORE AND AFTER HOLD TANK
00531        IA(66,1)=0
00532        AA(66,17)=AA(91,6)*2000./(8.33*24.*60.)*30.
00533        CALL PMPCNT
00534        CALL PMPCNT
00535        SUMHP=SUMHP+2.*.001*AA(66,17)
00536         AA(40,17) = AA(91,6)*2000./(8.33*24.)
```

Table I.--Continued.

```
00537         IA(40,1) = 1
00540         CALL STORAG
00541         IA(40,1) =0
00542        WATEVP=(5998./7216.5)*WATER-(AA(91,6)-(5998./7216.5)*WATER)
00543         AA(91,13)=WATEVP
00544         AA(31,17)=AA(91,13)*2000.0/(24*25)
00545         CALL EVPFLM
00546        AA(91,7)=2.*(AA(91,6)-(5998./7216.5)*WATER)
00547         AA(90,6)=AA(91,7)*BB(42)*0.01
00550         AA(72,17) = 18.
00551        CALL SCALE
00551  C
00551  C HOLD TANK
00551  C
00552        AA(40,17)=AA(91,7)*2000./(8.33*24.)*1.
00553        IA(40,1)=1
00554        CALL STORAG
00555        IA(40,1)=0
00555  C PUMP AFTER WIPED FILM EVAPORATOR
00556        IA(66,1)=0
00557        AA(66,17)=AA(91,7)*2000.*30./(8.33*24.*60.)
00560        CALL PMPCNT
00561        HP=.001*AA(66,17)
00562        SUMHP=HP+SUMHP
00562  C PUMP BEFORE CANNING MACHINE
00563        AA(66,17)=AA(90,6)*2000.*30./(8.33*24.*60.)
00564        IF(BB(42).GT.0.0) CALL PMPCNT
00566        HP=.001*AA(66,17)
00567        SUMHP=HP+SUMHP
00570         AA(75,17)=AA(90,6)*2000.0/(8.33*24.0*60.0*5.0)
00571        IA(75,1)=1.0
00572        IA(75,2)=2.0
00573         IF(BB(42) .GT. 0.0) CALL BAGGMA
00575         IA(75,1) =0.0
00576        AA(75,4)=AA(75,17)
00577        AA(75,4)=AA(75,4)*60.*24.
00600        IA(75,2)=0.0
00601        AA(91,9)=AA(91,7)-AA(90,6)
00601  C PUMP BEFORE SPRAY DRYER
00602        AA(66,17)=AA(91,9)*2000.*30./(8.33*60.*24.)
00603        CALL PMPCNT
00604        HP=.001*AA(66,17)
00605        SUMHP=HP+SUMHP
00606        AA(90,7)=AA(91,9)/(2.*.95)
00607         AA(91,14)=AA(91,9)-AA(90,7 )
00610         AA(30,17)=AA(91,14)*2000.0/24.0
00611         CALL EVPSPR
00612         AA(72,17) = 18.
00613        CALL SCALE
00614        IA(75,1)=0.
00615        IA(75,2)=0.
00616         AA(75,17)=AA(90,7 )*2000.0/(24*60*25)
00617         IF(BB(42) .LT. 100) CALL BAGGMA
00621        AA(75,17)=AA(75,17)+AA(75.5)
00622        AA(75,17)=AA(75,17)*60.*24.
00622  C
00622  C SUMMATION OF STEAM,WATER AND ELECTRICITY
```

Table I.--Continued.

```
00622     C
00623             AA(91,15)=(AA(91,11)+AA(91,12)+AA(91,13)+AA(91,14))*1.05
00624             AA(27,17)=AA(91,15)*2000.0/24
00624     C
00624     C BOILER WATER TREATMENT
00624     C
00625           COST(5)=1.000
00626           COST(1)=COST(5)
00627           PRINT 4242,COST(1),COST(5)
00633           COSTA(1)=COSTA(1)+COST(1)
00634           COSTA(5)=COSTA(5)+COST(5)
00635      4242  FORMAT(/25H BOILER WATER TREATMENT  , 10X ,15H                    ,10H
00635          1          ,F10.3,30X,F10.3)
00635     C
00635     C SEA WATER PUMPS
00635     C
00636           AA(90,10)=33.1*(AA(91,13)+AA(91,14))*1.2
00637             AA(66,17)=AA(90,10)*2000.0/(8.33*24*60*0.066)
00640           IA(66,1)=1
00641           IA(66,4)=2
00642           CALL PMPCNT
00643           IA(66,1)=0
00644           IA(66,4)=0
00645           CALL BOILER
00645     C
00645     C FUEL OIL STORAGE (15 DAYS)
00645     C
00646           IA(40,1)=2
00647           AA(40,17)=AA(27,17)/8.33*24.*.0112*15.
00650           CALL STORAG
00651           IA(66,1)=0
00652           AA(66,17)=30.*AA(40,17)/(15.*60.*24.)
00653           CALL PMPCNT
00654           HP=.001*AA(66,17)
00655           SUMHP=SUMHP+HP
00656             SUMHP = SUMHP+(AA(66,17)*.001*1.5)
00657           AA(90,9)=4.*TONS+(174.3/299.3)*ADDT+.1*AA(91,4)+.1*AA(91,15)
00660           XLOOPS=LOOPS+10.+3.*INST
00661             COST(1)=XLOOPS *AA(100,1)
00662             COST(5)=COST(1)
00663             COSTA(1)     = COSTA(1)    + COST(1)
00664           COSTA(5)=COSTA(5)       + COST(5)
00665             PRINT 1021 COST(1),COST(5)
00671      1021 FORMAT(/ 25H CONTROL INSTRUMENTATION , 10X ,15H                    ,10H
00671          1          ,F10.3,30X,F10.3)
00672             AA(8,17) = TONS
00673             CALL CONDEN
00674              COST(1)=AA(100,2)
00675             COST(5)=COST(1)
00676             COSTA(1)=COST(1)          + COSTA(1)
00677             COSTA(5)=COSTA(5) + COST(5)
00700             PRINT 1022, COST(1),COST(5)
00704      1022 FORMAT(/ 25H PAYLOADER AND FORK LIFT , 10X ,15H                    ,10H
00704          1          ,F10.3,30X,F10.3)
00705             PRINT 1041,(COSTA(J),J=1,6)
00713      1041 FORMAT(//25H  TOTAL COSTS                 ,35X6F10.3)
00714             COSTA(7)=0.02*COSTA(1)
```

Table I.--Continued.

```
00715           AA(100,10)=COSTA(5)
00715      C
00715      C MATERIAL BALANCE INFORMATION PRINTOUT. ALL STREMS HERE CONVERTED TO
00715      C LB/HR
00716           AA(90,2)= SUMHP* .7457 * 24.
00717          AA(90,10)=AA(90,10)/8.33*2000./24.
00720          CALL MATER(TONS)
00721           DO 40 I=1,20
00724           AA(90,I)=AA(90,I)*2000/24
00725       40  AA(91,I)=AA(91,I)*2000/24
00727           FISH=TONS*2000/24
00730           PRINT 1003,FISH
00733     1003  FORMAT(/8X26H FISH FEED TO GRINDERS     ,F8.0,7H LB/HR  )
00734           PRINT 1004,AA(90,12)
00737     1004  FORMAT(/8X26H ENZYME TO DIGESTERS       ,F8.2,7H LB/HR  )
00740           PRINT 1005,AA(90,15)
00743     1005  FORMAT(/8X26H.CA0H TO DIGESTERS         ,F8.0,7H LB/HR  )
00744          PRINT 1015,AA(90,13)
00747    1015  FORMAT(/8X26H ANTIOXIDANT TO DIGESTERS ,F8.2,7H LB/HR  )
00750          PRINT 1033,AA(90,17)
00753    1033  FORMAT(/8X26H 5N NAOH TO DIGESTERS       ,F8.2,7H LB/HR  )
00754          PRINT 1111,AA(90,14)
00757    1111  FORMAT(/8X41H CONCENTRATED SULFURIC ACID TO DIGESTERS ,F8.2,7H LB/
00757         CHR  )
00760          PRINT 1006,AA(91,2)
00763     1006  FORMAT(/8X26H FEED TO ROTARY DRYER      ,F8.0,7H LB/HR  )
00764           PRINT 1007,AA(91,12)
00767     1007  FORMAT(/8X26H ROTARY DRYER STEAM        ,F8.0,7H LB/HR  )
00770           PRINT 1008,AA(90,3)
00773     1008  FORMAT(/8X26H BONE FEED                 ,F8.0,7H LB/HR  )
00774           PRINT 1009,AA(91,3)
00777     1009  FORMAT(/8X26H DIGESTER LIQUOR           ,F8.0,7H LB/HR  )
01000           PRINT 1010,AA(90,5)
01003     1010  FORMAT(/8X26H FISH OIL                  ,F8.0,7H LB/HR  )
01004           PRINT 1011,AA(91,6)
01007     1011  FORMAT(/8X26H FEED TO FILM EVAPORATOR  ,F8.0,7H LB/HR  )
01010           PRINT 1012,AA(91,13)
01013     1012  FORMAT(/8X26H FILM EVAPORATOR STEAM    ,F8.0,7H LB/HR  )
01014           COOL =AA(91,13)*4
01015           PRINT 1013,COOL
01020     1013  FORMAT(/8X26H FILM EVAPORATOR COOLING  ,F8.0,7H.GAL/HR )
01021           PRINT 1014,AA(91,7)
01024     1014  FORMAT(/8X26H BFC PASTE                 ,F8.0,7H LB/HR  )
01025           AA(90,13) = 0.0005*(AA(91,7) +AA(90,3))
01026           PRINT 1016,AA(90,6)
01031     1016  FORMAT(/8X26H PACAGED AS BFC PASTE      .F8.0,7H LB/HR )
01032           PRINT 1017,AA(91,9)
01035     1017  FORMAT(/8X26H FEED TO SPRAY EVAPORATOR ,F8.0,7H LB/HR  )
01036           PRINT 1018,AA(91,14)
01041     1018  FORMAT(/8X26H SPRAY EVAPORATOR STEAM   ,F8.0.7H LB/HR  )
01042           COOL=4*AA(91,14)
01043           PRINT 1019,COOL
01046     1019  FORMAT(/8X26H SPRAY EVAP. COOLING       ,F8.0,7H GAL/HR )
01047           PRINT 1020,AA(90,7 )
01052     1020  FORMAT(/8X26H BFC POWDER                ,F8.0,7H LB/HR, )
01053           AA(91,16)=AA(91,15)-AA(91,13)-AA(91,14)-AA(91,12)
01054           PRINT 1023,AA(91,16)
```

Table I.--Continued.

```
01057   446*    1023  FORMAT(/8X26H MISCELLALEOUS STEAM          ,F8.0,7H LB/HR  )
01060   447*          AA(90,9)=AA(90,9)/8.33
01061   448*          PRINT 1024 ,AA(90,9)
01064   449*    1024  FORMAT(/8X26H CITY WATER                   ,F8.0,7H GAL/HR )
01065   450*          AA(90,1) = AA(27,17)*24*0.0112
01066   451*          AA(90,2)= SUMHP* .7457 * 24.
01067   452*          AA(90,3) = AA(90,3)*24/2000
01070   453*          AA(90,5) = AA(90,5)*24/2000
01071   454*          AA(90,6) = AA(90,6)*24/2000
01072   455*          AA(90,7) = AA(90,7)*24/2000
01073   456*          IXX =(14.0*(TONS/50.0)**.31) +0.5
01074   457*          PXX =IXX
01075   458*          AA(90,8) =IXX*8.0
01076   459*          AA(90,9) =AA(90,9)*24
01077   460*          AA(90,12)=AA(90,12)*24
01100   461*          AA(90,13)=AA(90,13)*24
01101   462*          AA(90,15)=AA(90,15)*24
01102   463*         AA(90,14)=AA(90,14)*24
01103   464*         AA(90,17)=AA(90,17)*24
01104   465*          RETURN
01105   466*          END

        END OF COMPILATION:            NO DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S XXIPA,XXIPA
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE XXIPA      ENTRY POINT 004256

   STORAGE USED: CODE(1) 004346; DATA(0) 001463; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003     BLOCK1 005050
    0004     BLOCK2 000016
    0005     BLOCK4 000012

   EXTERNAL REFERENCES (BLOCK, NAME)

    0006     PMPREC
    0007     RELT
    0010     STORAG
    0011     REFRIG
    0012     SILO
    0013     PMPCNT
    0014     BUCKET
    0015     PULVER
    0016     AGITOR
    0017     REACTR
    0020     SCREEN
    0021     SCREWR
    0022     HEATEX
    0023     DRYERR
    0024     HAMMER
    0025     BAGGMA
    0026     CNTFGE
    0027     SHARP
    0030     VESSEL
    0031     COLUMN
    0032     EVPHOR
    0033     BOILER
    0034     CONDEN
    0035     SCALE
    0036     MATER
    0037     NPRT$
    0040     NIO2$
    0041     NIO1$
    0042     SQRT
    0043     NEXP6$
    0044     NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001     000342 100L      0000    000477 1003F     0001    000527 101L      0000    000410 1021F     0000    000421 1022F
    0000     000467 1041F     0001    002322 1044G     0001    002374 1063G     0000    000365 1110F     0000    000246 1113F
    0000     000354 1120F     0001    002566 1142G     0001    000014 116G      0000    000510 1201F     0000    000522 1202F
    0000     000534 1203F     0000    000546 1204F     0000    000560 1205F     0000    000572 1206F     0000    000604 1207F
```

Table I.-- Continued.

```
0000     000616 1208F     0000     000642 1209F     0000     000630 1210F     0000     000654 1211F     0000     000666 1212F
0000     000700 1213F     0000     000716 1214F     0000     000727 1215F     0000     000740 1216F     0000     000751 1217F
0000     000762 1218F     0000     000773 1219F     0000     001004 1220F     0000     001015 1221F     0000     001026 1222F
0000     001037 1223F     0000     001050 1224F     0000     001062 1225F     0000     001074 1226F     0000     001106 1227F
0000     001120 1228F     0000     001132 1229F     0000     001144 1230F     0000     001156 1231F     0000     001170 1232F
0000     001202 1233F     0001     000041 132G      0001     000046 140G      0001     003504 1442G     0001     003713 1566G
0001     003724 1574G     0001     003735 1602G     0001     003746 1610G     0001     003757 1616G     0001     003770 1624G
0001     000114 163G      0001     004001 1632G     0001     004012 1640G     0001     004023 1646G     0001     004034 1654G
0000     000263 2000F     0001     000426 300G      0001     002105 300L      0000     000276 3001F     0000     000376 3006F
0001     000475 320G      0001     000517 332G      0001     000652 402G      0001     000653 405G      0001     000670 413G
0001     000673 420G      0000     000433 4242F     0000     000451 4243F     0000     000336 4249F     0001     002141 44L
0001     001015 453G      0001     003264 48L       0001     002161 49L       0001     003016 51L       0001     001231 517G
0001     003164 52L       0001     001263 535G      0001     001366 573G      0001     001372 577G      0003 R 000000 AA
0000 R 000165 AABAG       0000 R 000143 ABC        0000 R 000167 ACID       0003 R 004704 BB         0004 R 000000 COST
0004 R 000007 COSTA       0000 R 000144 DX         0000 R 000146 FF         0000 R 000216 FISH       0000 R 000177 FT
0000 R 000112 G           0000 R 000127 GAA        0000 R 000170 GAL        0000 R 000106 GALLON     0000 R 000107 GALS
0000 R 000172 HOP         0000 R 000113 HP         0000 R 000211 HWAT       0000 I 000104 I          0003 I 003720 IA
0000     001426 INJP$     0000 I 000130 IP         0005 I 000000 IPTION     0000 I 000131 IQ         0000 I 000134 IR
0000 I 000135 IRR         0000 I 000140 IU         0000 I 000245 IXX        0000 I 000121 J          0000 I 000122 K
0000 I 000103 LOOPS       0000 I 000120 NA         0000 I 000117 NB         0000 I 000111 NUM        0000 I 000174 N2
0000 I 000201 N3          0000 R 000163 PRDCTA     0000 R 000102 PRDCTB     0000 R 000166 SA         0000 R 000171 SAA
0000 R 000173 SAB         0000 R 000137 SAG        0000 R 000213 SAQT       0000 R 000175 SBC        0000 R 000077 SBOT
0000 R 000200 SBOTT       0000 R 000210 SBQQT      0000 R 000207 SBQT       0000 R 000126 SLMXTK     0000 R 000153 STEAM
0000 R 000202 STEAMR      0000 R 000214 STEAMW     0000 R 000152 STEAM1     0000 R 000147 STEAM2     0000 R 000150 STEAM3
0000 R 000151 STEAM4      0000 R 000160 STEAM6     0000 R 000176 STEAM9     0000 R 000000 STM        0000 R 000062 STMM
0000 R 000123 STON        0000 R 000074 STOP       0000 R 000031 STRM       0000 R 000067 STRMM      0000 R 000110 SUMHP
0000 R 000136 TANK        0000 R 000203 TANKA      0000 R 000154 TASA       0000 R 000155 TASB       0000 R 000156 TASC
0000 R 000157 TASD        0000 R 000212 TONA       0000 R 000105 TONSA      0000 R 000125 TONSB      0000 R 000114 TONSG
0000 R 000132 VES         0000 R 000133 VESS       0000 R 000205 WASTE      0000 R 000206 WATER      0000 R 000204 WIDTH
0000 R 000164 XAA         0000 R 000141 XIP        0000 R 000142 XIR        0000 R 000145 XIRR       0000 R 000215 XLOOPS
0000 R 000233 XXA         0000 R 000234 XXB        0000 R 000235 XXC        0000 R 000236 XXD        0000 R 000237 XXE
0000 R 000240 XXF         0000 R 000241 XXG        0000 R 000242 XXH        0000 R 000243 XXI        0000 R 000244 XXJ
0000 R 000217 YYA         0000 R 000220 YYB        0000 R 000221 YYC        0000 R 000222 YYD        0000 R 000223 YYE
0000 R 000224 YYG         0000 R 000225 YYH        0000 R 000226 YYI        0000 R 000227 YYJ        0000 R 000230 YYK
0000 R 000231 YYL         0000 R 000232 YYM        0000 R 000115 ZA1        0000 R 000124 ZA2        0000 R 000116 ZA3
0000 R 000161 ZA7         0000 R 000162 ZA8
```

```
00101      1*          SUBROUTINE XXIPA(TONS)
00101      2*    C
00101      3*    C   ISOPROPYL ALCOHOL EXTRACTION PROCESS
00101      4*    C
00101      5*    C
00103      6*          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      7*          COMMON/BLOCK2/ COST(7),COSTA(7)
00105      8*          COMMON/BLOCK4/ IPTION(10)
00106      9*          DIMENSION STM(5,5),STRM(5,5) , STMM(5), STRMM(5)
00107     10*          DIMENSION  STOP(3),SBOT(3)
00110     11*          AA(72,17)=18.
00111     12*           PRDCTB=0.
00112     13*    1113  FORMAT(/ 25H WET DEBONER                    ,F10.3,25H  TONS       SST
00112     14*      C         ,6F10.3)
00113     15*          IPTION(2)=IPTION(1)
00114     16*          LOOPS=0
00115     17*          DO 1 I=1,7
```

Table I.--Continued.

```
          COST(I)=0.0
        1 COSTA(I)=0.0
          IF(IPTION(1).EQ.2)  PRINT 1120
            IF(IPTION(1).EQ.1)  PRINT 1110
          DO 2 I= 1,20
          AA (90,I)=0.0
        2 AA (91,I)=0.0
          DO 10 I =30,33
       10 BB(I)=BB(I)*.01
         PRINT 2000
 2000     FORMAT(1H1//55H DETAILED EQUIPMENT COSTS (ALL COSTS IN 1000.0 DOL
        CLARS) )
         PRINT 3001
 3001     FORMAT (//18H    EQUIPMENT TYPE,10X10H  CAPACITY,12X9H MATERIAL,
        C60H     BASE     MATERIALS    LABOR    INDIRECT    MODULE      RANGE ,/6
        C0X60H   COST          COSTS       COSTS      COSTS       COST        + OR - )
C UNLOADING AND STORAGE OF FISH
          TONSA =  TONS*2000./8.33
          GALLON=  TONSA/(24.*60.)
          GALS  =  1.3* GALLON
          SUMHP=0.
          IA(65,1) =0.
          IA(65,2) =1.0
          AA(65,17)= GALS*30.
          NUM = TONS/500 + 1
          DO 143 I=1,NUM
         SUMHP=SUMHP+(1.*AA(65,17)*.001*1.5)
  143     CALL PMPREC
          IA(65,2)=0.
          IF(TONSA.LT.30000.)  G=(30000./(24.*60.))*15.
         IF(TONSA.GE.30000.) G=(450000./(24.*60.))*15.
          IF(TONS.LE.150.) AA(70,18)=36.
          IF(TONS.GE.150.) AA(70,18)=48.
          AA(70,17)=100.
          CALL BELT
          HP=  TONS*0.00124 + 13.6
          SUMHP=  SUMHP + HP
          AA(40,17)= 30.0* TONS
          IA(40,1) = 0
          IA(40,2) = 2
          CALL STORAG
          IA(40,2)= 0
          AA(85,17)= 0.5* TONS* 3.0
          IA(85,1) = 30
          CALL REFRIG
          IA(7,1) = 1
C
C FISH STORAGE FOR 3 DAYS
C
         AA(7,17)=3.*TONS*2000.*1.69/62.4
         CALL SILO
         COST(1)=1.19
         IF(TONS.GE.300) COST(1)=1.88
         COST(5)=COST(1)
         PRINT 4249, COST(1), COST(5)
         COSTA(1)=COSTA(1)+COST(1)
         COSTA(5)=COSTA(5)+COST(5)
```

```
00232      4249    FORMAT(/25H BRINE MAKE-UP+SALT STOR., 10X ,15H              ,10H
00232          1            ,F10.3,30X,F10.3)
00232      C
00232      C PUMP FOR BRINE MAKE-UP (BRONZE)
00232      C
00233             IA(66,1)=1
00234             AA(66,17)=TONS*3.*2000./(24.*60.*62.4)*.69*7.75
00235             CALL PMPCNT
00236             IA(66,1)=0
00237             HP=.001*AA(66,17)
00240             SUMHP=SUMHP+HP
00240      C
00240      C PUMP FOR WATER INTO BRINE MAKE-UP
00240      C
00241             AA(66,17)=AA(66,17)*.917
00242             IA(66,1)=0
00243             CALL PMPCNT
00244             HP=.001*AA(66,17)
00245             SUMHP=SUMHP+HP
00246              TONSG= TONS/24.
00247              AA(71,18)= TONSG
00250              AA(71,17)= 20.
00251              CALL BUCKET
00252              HP= TONS* 0.00106
00253              SUMHP=HP+SUMHP
00253      C     FISH GRINDING AND EXTRACTION
00254             IF(IPTION(1).EQ.1) GO TO 100
00254      C
00254      C  DRY DEBONING
00256              AA(11,17)= TONS* 2000./24.
00257              BB(2) =  3.0
00260              CALL PULVER
00261       1120   FORMAT(//44H       THE DRY DEBONING OPTION IS APPROPRIATE)
00262       1110   FORMAT(//44H       THE WET DEBONING OPTION IS APPROPRIATE)
00263              ZA1=0.
00264              ZA3=1.
00265              GO TO 101
00266        100   CONTINUE
00266      C
00266      C  WET DEBONING
00266      C
00267              ZA1=0.04
00270              ZA3=0.
00271              NB= 1
00272              NA= (TONS/75.) + 1.
00273              IF(NA.GT.3) NB = 2
00275              IF(NA.GT.3) NA = (TONS/150.)+1.
00277              DO 113  J = 1,NA
00302              LOOPS = LOOPS + 1
00303              COST(1) = 22.*BB(1)
00304              IF(NB.EQ.2) COST(1)= 40.* BB(1)
00306              HP=10.
00307              IF(NB.EQ.2) HP= 20.
00311              SUMHP =          SUMHP +                  HP
00312              COST(2)= COST(1)* .25
00313              COST(3)= COST(1)* .25
00314              COST(4)= COST(1)* .4
```

Table I.-- Continued.

```
00315            COST(5)= COST(1)+ COST(2) + COST(3) +COST(4)
00316            COST(6)= .1 * COST(1)
00317            DO 114  K=1,7
00322       114  COSTA(K)= COSTA(K) + COST(K)
00324            STON= 75.
00325            IF(NB.EQ.2)  STON =  150.
00327            PRINT    1113 ,STON,(COST(K),K=1,6)
00336            LOOPS=LOOPS + 1
00337       113  CONTINUE
00341       101  CONTINUE
00342            ZA2=1. -ZA1
00342     C
00342     C  EXTRACTION VESSELS  MATERIAL BALANCE
00342     C 1=OIL 2=PROTEIN 3=ASH 4=WATER 5= IPA
00342     C
00343          STM(1,1)=TONS*BB(30)*ZA2
00344          STM(1,2)=.17*STM(1,1)
00345          STM(1,3)=.29*STM(1,2)
00346          STM(1,4)=.5*STM(1,3)
00347          STM(1,5)=.25*STM(1,4)
00350          STM(2,1)=TONS*ZA2*BB(31)
00351          STM(2,2)=.8*STM(2,1)
00352          STM(2,3)=.98*STM(2,2)
00353          STM(2,4)=1.0*STM(2,3)
00354          STM(2,5)=.99*STM(2,4)
00355          STM(3,1)=TONS*ZA3*BB(32)
00356          STM(3,2)=.81*STM(3,1)
00357          STM(3,3)=.98*STM(3,2)
00360          STM(3,4)=.99*STM(3,3)
00361          STM(3,5)=.99*STM(3,4)
00362          STM(4,1)=TONS*ZA2*BB(33)
00363          STM(4,2)=.29*STM(4,1)
00364          STM(4,3)=.56*STM(4,2)
00365          STM(4,4)=.60*STM(4,3)
00366          STM(4,5)=.12*STM(4,4)
00367          STM(5,1)=0.
00370          STM(5,2)=TONS/50.*1.5
00371          STM(5,3)=1.29*STM(5,2)
00372          STM(5,4)=1.87*STM(5,3)
00373          STM(5,5)=1.84*STM(5,4)
00374            STRM(1,5)=0.
00375            STRM(2,5)=0.
00376            STRM(3,5)=0.
00377          STRM(5,5)=TONS*2.
00400          STRM(4,5)=0.
00401            DO 122  I=4,1,-1
00404            DO 122  J=1,5
00407       122  STRM(J,I)=  STRM(J,I+1) -STM(J,I+1) +STM(J,I)
00412            DO 123         I=1,5
00415            STMM(I)=0.
00416            STRMM(I)=0.
00417            DO 123      J= 1,5
00422            STMM(I)=STMM(I) + STM(J,I)
00423            STRMM(I)=STRMM(I)+ STRM(J,I)
00424       123  CONTINUE
00424     C
00424     C  EXTRACTION VESSEL
```

Table I.--Continued.

```
00424   C
00427          TONSA=(TONS*ZA1) + (TONS*BB(32)*ZA2*(1.-ZA3))
00430          TONSB= TONS-TONSA
00431          SLMXTK=  875.* TONSB / 50.
00431   C      MIX TANK
00432          GALS= 875.* TONS/50.
00433          AA(73,17)=   GALS*.005
00434          IA(66,1)= 2
00435          IA(73,5)= 2
00436          AA(40,17)= GALS
00437          AA(40,18)= 3.2
00440          AA(41,12)=3.2
00441          IA(40,1)= 1
00442          CALL STORAG
00443          GAA= STMM(1)*2000./(24.*60.)
00444        GAA=GAA/8.33
00445        AA(66,17)=GAA*30.
00446          IF(GAA.GT.125.) IP= (GAA/125.) + 1
00450          IF(GAA.LE.125.) IP=1
00452          DO  40  IQ=1,IP
00455        HP=(AA(66,17)*.001)
00456        SUMHP=HP+SUMHP
00457        CALL PMPCNT
00460        AA(66,17)=(STMM(1)+STRMM(2))*2000.*30./(24.*60.*8.33)
00461        SUMHP=.001*AA(66,17)+SUMHP
00462     40 CALL PMPCNT
00464          IF (GALS. GT. 10000.)  AA(73,17)=50.
00466          CALL AGITOR
00466   C
00466   C      REACTOR  VESSELS
00466   C
00467          AA(51,17)=TONS*60./50.
00470            IP=(AA(51,17)/144.) +2.
00471            AA(51,17) =IP
00472          VES= TONS* 30.
00473          AA(49,17) = VES
00474          VESS= TONS*16.
00475          IR=1
00476          IF(VES.GT.10000.) IR= (VES/10000.) + 1.
00500          IRR=1
00501          IF(VESS.GT.10000.) IRR= (VESS/10000.)+1.
00503          IF(VES.GT.10000.)   VES = 10000.
00505          TANK= 800.* TONS/50.
00506          AA(40,18) = 3.2
00507          AA(41,18) = 3.2
00510          AA(40,17) = TANK
00511          CALL STORAG
00512          SAG= STRMM(2)*2000./(24.*8.33*60.)
00513          IP=1
00514          IF(SAG.GT.1250.) IP =(SAG/1250.) + 1.
00516            DO 93  IU=1,IP
00521          XIP = IP
00522          AA(66,17) = (SAG/XIP)* 24.
00523        CALL PMPCNT
00524        CALL PMPCNT
00525        HP=.001*AA(66,17)
00526        SUMHP=SUMHP+HP
```

Table I.--Continued.

```
00527            SUMHP=SUMHP+HP
00530      93    CONTINUE
00532            IF(VESS.GT.10000.) VESS=10000.
00534            DO 41 I = 1,IR
00537            LOOPS =  LOOPS  + 3
00540            AA(49,17)= VES
00541            CALL REACTR
00542            CALL SCREEN
00543            AA(73,17)= .005*VES
00544            IF(AA(73,17).LT.2.)  AA(73,17)=2.
00546            IA(73,5)= 2
00547            CALL AGITOR
00550            SUMHP=SUMHP + 2.5
00551            XIR= IR
00552            SUMHP =  SUMHP +  AA(73,17)
00553            AA(66,17) = TONS*2000./(24.*8.33*XIR)  *(22./60.)
00554            CALL PMPCNT
00555            ABC=  AA(66,17)/22.
00556            IF(ABC.LE.2.)  HP=2.
00560            IF(ABC.GT.2.)  HP=ABC
00562            SUMHP=  HP + SUMHP
00563            IA(17,5)=5
00564            DX= SQRT(TONS/50.) * 8.
00565            AA(17,17) = 6
00566            AA(17,18) = DX
00567            CALL  SCREWR
00570      41    CONTINUE
00572            DO 42 J=  1,IRR
00575            LOOPS =  LOOPS  + 9
00576            DO 42 I = 1,3
00601            XIRR=IRR
00602            SUMHP=SUMHP + 2.5
00603            AA(66,17) = TONS*2000./(24.*8.33*XIRR) *(22./60.)
00604            CALL PMPCNT
00605            ABC=  AA(66,17)/22.
00606            IF(ABC.GT.2.)  HP=ABC
00610            IF(ABC.LE.2.)  HP=2.
00612            SUMHP=  HP + SUMHP
00613            AA(49,17)=VESS
00614            CALL REACTR
00615            CALL SCREEN
00616            AA(73,17)= .005*VES
00617            IF(AA(73,17).LT.2.)  AA(73,17)=2.
00621            IA(73,5) = 2
00622            SUMHP =  SUMHP +  AA(73,17)
00623            CALL AGITOR
00624            DX= SQRT(TONS/50.) * 8.
00625            AA(17,18) = DX
00626            AA(17,17) = 6.
00627            IA(17,5)=5
00630            CALL  SCREWR
00631      42    CONTINUE
00631      C PUMPS IN THE EXTRACTION PROCESS
00631      C PUMPS FOR S-1
00634           AA(66,17)=STMM(2)*30.*2000./(24.*60.*8.33)
00635           CALL PMPCNT
00636           SUMHP=.001*AA(66,17)+SUMHP
```

Table I.-- Continued.

```
00636   C PUMP FOR S-2
00637         AA(66,17)=STMM(3)*2000.*30./(24.*60.*8.33)
00640         CALL PMPCNT
00641         SUMHP=.001*AA(66,17)+SUMHP
00641   C PUMP FOR S-3
00642         AA(66,17)=STMM(4)*2000.*30./(24.*60.*8.33)
00643         CALL PMPCNT
00644         SUMHP=.001*AA(66,17)+SUMHP
00644   C PUMP FOR M-3
00645         AA(66,17)=STRMM(3)*2000.*30./(24.*60.*8.33)
00646         CALL PMPCNT
00647         SUMHP=.001*AA(66,17)+SUMHP
00647   C PUMP FOR SOLIDS INTO DRYER
00650         AA(66,17)=STMM(5)*2000.*30./(24.*60.*8.33)
00651         CALL PMPCNT
00652         SUMHP=.001*AA(66,17)+SUMHP
00652   C PUMP FOR M-4
00653         AA(66,17)=STRMM(4)*2000.*30./(24.*60.*8.33)
00654         CALL PMPCNT
00655         SUMHP=.001*AA(66,17)+SUMHP
00655   C PUMP FOR SOLVENT
00656         AA(66,17)=TONS*2.*2000.*30./(24.*60.*8.33)
00657         CALL PMPCNT
00660         SUMHP=.001*AA(66,17)+SUMHP
00660   C  REFLUX  CONDENSER
00660   C
00661          FF = 25.* TONS/ 50.
00662          AA(67,17) = FF
00663          CALL HEATEX
00663   C
00663   C   STEAM REQUIREMENTS
00664          STEAM2=  TONS* 20./50.
00665          STEAM3=  TONS* 20./50.
00666          STEAM4=  TONS* 20./50.
00667          STEAM1=  TONS* 35./50.
00670          STEAM= STEAM1+STEAM2+STEAM3+STEAM4
00670   C
00670   C  SOLIDS FROM THE EXTRACTION VESSEL
00670   C
00671          TASA= STMM(5)/2.
00672         TASB=STM(1,5)+STM(2,5)+STM(3,5)+.05*STM(4,5)+STM(5,5)*.126*.05+STM
00672        1(5,5)*.0001*.874
00673         TASC=.95*.126*STM(5,5)+.95*STM(4,5)
00674         TASD=STM(5,5)*.874*.9999
00675          STEAM6=    (TASC + (1.0*TASD)) *  2000. /24.
00676          STEAM=  STEAM6 + STEAM
00676   C   DRYERS
00677          AA(21,17) = 3.8* 16.* TASA/24.
00700          IA(21,5)  = 6
00701          BB(2)     = .9
00702          CALL DRYERR
00703          BB(2)=1.0
00704          AA(21,17)=AA(21,17)
00705          IA(21,5)  = 7
00706          CALL  DRYERR
00707         AA(17,18)=6.
00710         AA(17,17)=6.
```

Table I.--Continued.

```
00711          IA(17,5)=1
00712          CALL SCREWR
00713          BB(2)=1.
00714           IA(21,5)=7
00715           AA(21,17)=AA(21,17)
00716           CALL DRYERR
00717           AA(21,17)=AA(21,17)
00720           IA(21,5)  = 8
00721           BB(2)=1.0
00722          CALL DRYERR
00723          AA(17,18)=6
00724          AA(17,17)=6
00725          IA(17,5)=1
00726          CALL SCREWR
00727           LOOPS = LOOPS  + 2
00730           LOOPS = LOOPS + 2
00731           AA(17,18) = 6.
00732           AA(17,17) = 20.
00733           IA(17,5)  = 1
00734           CALL SCREWR
00735           ZA7= .96
00736          IF(IPTION(2).NE.1) ZA7=1.
00740          ZA8=1.-ZA7
00741          IF(IPTION(2).NE.1.AND.IPTION(2).NE.2) GO TO 300
00743           AA(18,17) =(TASB/ 8.)
00744           CALL HAMMER
00745           HP = (TASB *2000.*75./(8. * 700.))
00746           HP = HP/3.
00747          SUMHP=SUMHP+HP
00750          IF(IPTION(2).EQ.1) GO TO 44
00750    C      DRY DEBONING OPTION
00752           PRDCTA=((STM(2,5)*ZA7)    + (STM(3,5)*ZA8))/.95
00753           PRDCTB=((STM(2,5)*ZA8)    + (STM(3,5)*ZA7))/.95
00754           AA(75,17)=PRDCTA*2000./(25.*24.*60.)
00755           CALL  BAGGMA
00756           XAA=AA(75,17)
00757           AA(75,17)=PRDCTB*2000./(25.*24.*60.)
00760           CALL  BAGGMA
00761           AA(75,17)=AA(75,17) +XAA
00762           AA(75,17)=AA(75,17)*24.*60.
00763           GO TO 49
00764      300 CONTINUE
00765          AA(18,17)=TASB/8.
00766          CALL HAMMER
00767          HP=(TASB*2000.*75./(8.*700.))
00770          HP=HP/3.
00771          SUMHP=SUMHP+HP
00772          PRDCTA=((STM(2.5)+STM(3,5))/.95)
00773          AA(75,17)=PRDCTA*2000./(25.*24.*60.)
00774          CALL BAGGMA
00775          AA(75,17)=AA(75,17)*24.*60.
00776          GO TO 49
00777       44 CONTINUE
00777    C   WET DEBONING OPTION
01000           AA(75,17) =((STM(2,5)*ZA7) + (STM(3,5)*ZA8))/.95
01001           PRDCTA=AA(75,17)
01002           AA(75,17) = AA(75,17)* 2000./(24.*60.*100.) * 4.
```

Table I.-- Continued.

```
01003            CALL  BAGGMA
01004            AABAG=AA(75,17)
01005        49  CONTINUE
01005     C
01005     C  MIXING TANK SECTION
01005     C
01006            SA = STRMM(1)*.001*70.
01007            IA(40,1) =1
01010            IA(40,2)= 1
01011            AA(40,17) = SA
01012            CALL STORAG
01013              IA(40,2) =0
01014            LOOPS =  LOOPS  + 2
01015            ACID= STRMM(1)*.001
01016            IA(66,1) = 2
01017            AA(66,17)= 30.*ACID     *2000./(8.33*60.*24.* 1.8)
01020            CALL PMPCNT
01021            GAL= STRMM(1) * 2000. / (8.33               )
01022          HP=.001*AA(66,17)
01023            SUMHP =  HP + SUMHP
01024            AA(40,17)= GAL *.01
01025            AA(66,17)= GAL*30./(24.*60.)
01026            IA(66,1) = 0
01027            IA(40,1) = 2
01030          HP=.001*AA(66,17)
01031            SUMHP = SUMHP + HP
01032          SUMHP=SUMHP+HP
01033            CALL PMPCNT
01034            CALL STORAG
01035            CALL PMPCNT
01035     C
01035     C  CENTRIFUGE SECTION
01035     C
01036            SAA=STRMM(1)*1.001
01037            HOP= SAA*2000.*.01/(24.*8.33               )
01040            NUM=(HOP/20.)  + 1.
01041            HP= NUM* 20
01042            SUMHP= HP + SUMHP
01043            DO 45 I =1,NUM
01046            AA(54,17)=20.
01047            CALL CNTFGE
01050        45  CONTINUE
01052            SAB= STRM(1,1)*1.1
01053            HP=SAB*.025*2000./(8.33*24.)
01054            N2= (HP/20.) + 1.
01055            HP=N2*20
01056          SUMHP=SUMHP+HP
01056     C PUMP BETWEEN CENTRIFUGES
01057          AA(66,17)=SAB*2000.*30./(24.*60.*8.33)
01060          CALL PMPCNT
01061          SUMHP=.001*AA(66,17)+SUMHP
01062            DO 46 I =1,N2
01065            AA(52,17)= 20.
01066          CALL SHARP
01066     C
01066     C      FISH OIL STORAGE TANK (15 DAYS)
01066     C
```

Table I.-- Continued.

```
01067         AA(90,5)=STRM(1,1)
01070         AA(40,17)=AA(90,5)*2000.*15./7.75
01071         IA(40,1)=1
01072         CALL STORAG
01073         AA(66,17)=AA(40,17)*30./(24.*15.*60.)
01074         CALL PMPCNT
01075         SUMHP=.001*AA(66,17)+SUMHP
01076      46  CONTINUE
01076   C
01076   C      MISCELLA TANK (M-1)
01076   C
01100         SBC=STRMM(1)-(.5*STRM(1,1))
01101         AA(40,18)=3.2
01102         AA(41,18)=3.2
01103         AA(40,17)=SBC*2000./(24.*8.33)
01104         IA(40,1)=1
01105         CALL STORAG
01106         AA(66,17)=30.*(AA(40.17)/60.)
01107         IA(66,1)=0
01110         CALL PMPCNT
01111         CALL PMPCNT
01112         HP=.001*AA(66,17)
01113         SUMHP=SUMHP+HP
01114         SUMHP=SUMHP+HP
01114   C  PREHEATER FOR DISTILLATION COLUMN
01114   C
01115          SBC=STRMM(1) -(.5*STRM(1.1))
01116          STEAM9=SBC*2000./24.*.1
01117          STEAM =  STEAM + STEAM9
01120          FT=  STEAM9* .1
01121          AA(67,17) = FT
01122          CALL HEATEX
01122   C
01122   C  DISTILLATION  COLUMN         (MATERIAL BALANCE)
01122   C
01123         STOP(1)=STRM(5,1)*.99887*.874
01124          STOP(2) =STOP(1) *.1445
01125         SBOT(1)=STRM(5,1)*.00113*.874
01126         SBOT(2)=STRM(4,1)+.125*STRM(5,1)-STOP(2)
01127          SBOT(3) = STRM(1,1)* .5
01130          SBOTT=  SBOT(1) + SBOT(2) + SBOT(3)
01130   C
01130   C  CENTRIFUGE
01130   C
01131         AA(66,17)=30.*SBOTT*2000./(60.*24.*8.33)
01132          IA(66,1)  = 0
01133          CALL PMPCNT
01134         SUMHP=.001*AA(66,17)+SUMHP
01135          HP= SBOTT*2000./(24.*8.33           ) *.01
01136          N3=(HP/20.) + 1
01137          HP= 20* N3
01140          SUMHP=  HP + SUMHP
01141          DO  47   I=1,N3
01144          AA(54,17) = 20.
01145          CALL CNTFGE
01146      47  CONTINUE
01150          LOOPS = LOOPS +(NUM+ N2 + N3)
```

Table I.--Continued.

```
C
C  DISTILLATION COLUMN
C
      STEAMR=TONS*10709./50.*(STRM(5,5)/(TONS*2.))
       AA(67,17)= .1*STEAMR
       CALL  HEATEX
       STEAM =  STEAM + STEAMR
       TANKA =  TONS* 100. /50.
       IA(40,1)= 1
      AA(40,17)=TANKA*2000./(24.*8.33)
      CALL STORAG
      AA(66,17)=(TANKA-(.01*STRM(5,5)))*(2000.*30.)/(24.*60.*8.33)
      CALL PMPCNT
      SUMHP=.001*AA(66,17)+SUMHP
       WIDTH =   4. * SQRT(TONS/75.)
       I = WIDTH/2.
       WIDTH =  2 * I
       IF (WIDTH.LT.4.001)  WIDTH = 4.
       AA(43,18) = 24.
       AA(43,20)=WIDTH
       AA(43,17)= 54.
       AA(43,1) = .4
      IA(42,4)=2
      IA(42,2)=1
      IA(42,3)=1
      AA(42,18)=WIDTH
      AA(42,19)=54
      CALL VESSEL
      CALL COLUMN
       LOOPS = LOOPS + 5
      WASTE=.01*STRM(5,5)
      AA(40,17)=(WASTE*2000./8.33*15.)
       IA(40,1)  = 0
      CALL STORAG
      AA(66,17)=AA(40,17)*30./(24.*60.*15.)
      CALL PMPCNT
      SUMHP=.001*AA(66,17)+SUMHP
       LOOPS =  LOOPS  + 1
C  CONDENSER(DISTILLATION COLUMN)
      WATER=669.*TONS/50.*(STRM(5,5)/(TONS*2.))
       AA(67,17)=WATER*8.33*60.*.01
        CALL  HEATEX
      AA(66,17)=(TANKA/60.)*30.
       CALL PMPCNT
       HP = 2. *(TONS /75.)
      SUMHP=SUMHP+HP
C
C     FISH SOLUABLES
C
       SBQT=SBOT(2) + STRM(2,1)
       SBQQT=STRM(2,1)*2.
       HWAT=SBQT-SBQQT
 3006 FORMAT(/50H FISH SOLUABLES ARE MORE THAN 50 PERCENT PROTEIN
       IF(HWAT.GE.0.)  GO TO 51
        PRINT 3006
       AA(90,4)=SBQT
       GO TO 52
```

Table I.-- Continued.

```
01236        51 CONTINUE
01236     C
01236     C     WATER SOLUBLES HOLD TANK (1 HR)
01236     C
01237           AA(40,17)=SBQT*2000./(24.*8.4)*1.
01240           IA(40,1)=1
01241           CALL STORAG
01242           IA(40,1)=0
01243           IA(66,1)=0
01244           AA(66,17)=30.*AA(40,17)/60.
01245           CALL PMPCNT
01246           HP=.001*AA(66,17)
01247           SUMHP=SUMHP+HP
01250            AA(90,4)=SBQQT
01251            TONA=SBQT*2000./24.
01252            AA(33,17)=TONA/20.
01253            CALL  EVPHOR
01254            CALL  EVPHOR
01255            CALL  EVPHOR
01256           SAQT= STRM(2,1)/.3
01257            IF(SAQT.GE.SBQT)    SAQT=SBQT
01261            AA(33,17)=SAQT*2000./(24.*25.)
01262           CALL EVPHOR
01263           STEAM=STEAM+(HWAT*2000./24.)
01264           IA(66,1)=0
01265           AA(66,17)=30.*STRM(2,1)*2.*2000./(10.*60.*24.)
01266           CALL PMPCNT
01267           HP=.001*AA(66,17)
01270           SUMHP=SUMHP+HP
01270     C
01270     C     ACID MIX TANK
01270     C
01271           AA(40,17)=STRM(2,1)*2.*2000./(10.*1.)*.01
01272           IA(40,1)=2
01273           CALL STORAG
01274           IA(40,1)=0
01274     C
01274     C     STORAGE OF  FISH SOLUBLES (15 DAYS)
01274     C
01275           IA(66,1)=0
01276           AA(66,17)=30.*AA(40,17)/(60.*24.)
01277           CALL PMPCNT
01300           HP=.001*AA(66,17)
01301           SUMHP=SUMHP+HP
01302           IA(40,1)=2
01303           AA(40,17)=STRM(2,1)*2.*2000./(10.)*15.
01304           CALL STORAG
01305           IA(40,1)=0
01306        52  CONTINUE
01307           IF(IPTION(2).NE.1) GO TO 48
01311            IF (IPTION(2).EQ.1)  LOOPS = LOOPS + 1
01311     C  WET DEBONING OPTION
01313            AA(91,2) = TONS - STMM(1)
01313     C PUMP FOR BONE FEED TO DRYER
01314           AA(66,17)=AA(91,2)*2000.*30./(24.*60.*8.33)
01315           CALL PMPCNT
01316           SUMHP=.001*AA(66,17)+SUMHP
```

Table I.-- Continued.

```
01317              IA(21,5)=3
01320               AA(21,7)=AA(91,2)*3.8*2./3.
01321               STEAMW=AA(91,2)*2000./24.
01322               STEAM=STEAM + STEAMW
01323               CALL DRYERR
01324               AA(90,3)=((TONS*(BB(31)+BB(32)+BB(30))) - STM(1,1) -STM(2,1)
01324               - STM(3,1) ) * 1.1
01324        C     HAMMER MILL FOR WET DEBONING OPTION
01325               AA(18,17) = AA(90.3) / 24.
01326               CALL HAMMER
01327              AA(75,17)=AA(90,3)*2000.*.04/(24.*60.)
01330               CALL BAGGMA
01331               AA(75,17)=(AA(75,17) +AABAG) *24.*60.
01332           48  CONTINUE
01332        C      BOILER
01333               AA(27,18) =150.
01334               AA(27,17)=STEAM
01335               CALL BOILER
01336              IA(40,1)=2
01337              AA(40,17)=STEAM*1000.*24./(8.33*140000.)*15.
01340              CALL STORAG
01341              IA(66,1)=0
01342              AA(66,17)=30.*AA(40,17)/(60.*15.*24.)
01343              CALL PMPCNT
01344              HP=.001*AA(66,17)
01345              SUMHP=SUMHP+HP
01345        C      CONTROL LOOP
01346               XLOOPS = LOOPS
01347               COST(1) = XLOOPS*AA(100,1)
01350               COST(5) = COST(5)
01351               COSTA(1) = COSTA(1) + COST(1)
01352               COSTA(5) = COSTA(5) + COST(5)
01353               PRINT 1021, COST(1),COST(5)
01353        C  FORK LIFT
01357         1021  FORMAT(/25H CONTROL INSTRUMENTATION ,35X,F10.3,30X,F10.3)
01360               COST(1) = AA(100,20)
01361               COST(5) = COST(1)
01362               COSTA(1) = COSTA(1)+ COST(1)
01363               COSTA(5) = COSTA(5)+ COST(5)
01364               PRINT 1022, COST(1),COST(5)
01370               AA(8,17) = TONS
01371               CALL CONDEN
01372         1022  FORMAT(/ 25H PAYLOADER                     ,10X,25X,F10.3,30X,F10.3)
01372        C
01372        C BOILER WATER TREATMENT
01372        C
01373              COST(5)=1.000
01374              COST(1)=COST(5)
01375              PRINT 4242,COST(1),COST(5)
01401         4242  FORMAT(/25H BOILER WATER TREATMENT  , 10X ,15H              ,10H
01401            1             ,F10.3,30X,F10.3)
01402              COSTA(1)=COSTA(1)+COST(1)
01403              COSTA(5)=COSTA(5)+COST(5)
01403        C
01403        C SEA WATER PUMPS
01403        C
01404              AA(90,10)=WATER*60.+4.*STEAM
```

Table I.--Continued.

```
01405          AA(66,17)=AA(90,10)*1.2/60.
01406          IA(66,1)=1
01407          IA(66,4)=2
01410          CALL PMPCNT
01411          IA(66,1)=0
01412          IA(66,4)=0
01413          HP=.001*AA(66,17)
01414          SUMHP=SUMHP+HP
01414    C
01414    C CARBON ADSORBER
01414    C
01415          COST(1)=2.000
01416          COST(5)=COST(1)
01417          PRINT 4243,COST(1),COST(5)
01423          COSTA(1)=COSTA(1)+COST(1)
01424          COSTA(5)=COSTA(5)+COST(5)
01425    4243   FORMAT(/25H CARBON ADSORBER                10X ,15H                    ,10H
01425      1        ,F10.3,30X,F10.3)
01425    C
01425    C VENT CONDENSER
01425    C
01426          AA(67,17)=20
01427          IA(67,1)=1
01430          IA(67,4)=4
01431          CALL HEATEX
01432          IA(67,1)=0
01433          IA(67,4)=0
01434          CALL SCALE
01435            CALL SCALE
01436            CALL SCALE
01437            CALL SCALE
01440            PRINT 1041,(COSTA(J),J=1,6)
01446     1041   FORMAT(//25H  TOTAL COSTS              ,35X,6F10.3)
01447            AA(90,2) =  SUMHP*.7457 * 24.
01450            AA(100,10)= COSTA(5)
01451            AA(90,1) = STEAM*1000.*24./140000.
01451    C     MATERIAL  BALANCE
01452          IF(IPTION(2).EQ.2)  AA(90.3)=PRDCTB
01454            AA(90,7) = PRDCTA
01455            AA(90,18)=WASTE
01456            AA(90,19)=ACID
01457            CALL MATER(TONS)
01460            FISH = TONS*2000./24.
01461            PRINT 1003 , FISH
01464     1003   FORMAT(/7X27H FISH TO EXTRACTION VESSELS,F8.0,7H LB/HR )
01465            YYA=STEAM1
01466            PRINT 1201,YYA
01471     1201   FORMAT(/8X,35H STEAM(STIRRED VESSEL 1 )            ,F8.0,7H LB/HR )
01472            YYB=STEAM2
01473            PRINT 1202,YYB
01476     1202   FORMAT(/8X,35H STEAM(STIRRED VESSEL 2 )            ,F8.0,7H LB/HR )
01477            YYC= STEAM3
01500            PRINT 1203,YYC
01503     1203   FORMAT(/8X,35H STEAM(STIRRED VESSEL 3 )            ,F8.0,7H LB/HR )
01504            YYD= STEAM4
01505            PRINT 1204,YYD
01510     1204   FORMAT(/8X,35H STEAM(STIRRED VESSEL 4 )            ,F8.0,7H LB/HR )
```

Table I.--Continued.

```
            YYE = STEAMO
            PRINT 1205,YYF
      1205  FORMAT(/8X,35H STEAM(PREHEATER-DISTILLATION)      ,F8.0,7H LB/HR )
            YYG= STEAMR
            PRINT 1206,YYG
      1206  FORMAT(/8X,35H STEAM(REBOILER)                    ,F8.0,7H LB/HR )
            YYH = STEAM6
            PRINT 1207,YYH
      1207  FORMAT(/8X,35H STEAM(ROTARY DRYER  FPC  )         ,F8.0,7H LB/HR )
            YYI= STEAMW
            PRINT 1208,YYI
      1208  FORMAT(/8X,35H STEAM(ROTARY DRYER BONE MEAL)      ,F8.0,7H LB/HR )
            YYJ=(STEAM*4.)
            PRINT 1209,YYJ
            YYK= WATER
            PRINT 1210,YYK
      1210  FORMAT(/8X,35H COOLING WATER DISTILLATION COND.   ,F8.0,8H GAL/MIN)
      1209  FORMAT(/8X,35H COOLING WATER CONDENSER            ,F8.0,8H GAL/HR )
            YYL= STEAM
            PRINT 1211,YYL
      1211  FORMAT(/8X,35H TOTAL STEAM                        ,F8.0,7H LB/HR )
           YYM=((STEAM*4.)+WATER*60.)*8.33
            PRINT 1212,YYM
      1212  FORMAT(/8X,35H TOTAL WATER                        ,F8.0,7H LB/HR )
            PRINT 1213
      1213  FORMAT(//40X, 9H STREAM 1,7X,9H STREAM 2,7X,9H STREAM 3,7X,9H STR
           CEAM 4,7X,9H STREAM 5,/)
            PRINT 1214,(STRM(1,K),K=1,5)
            PRINT 1215,(STRM(3,K),K=1,5)
            PRINT 1216,(STRM(2,K),K=1,5)
            PRINT 1217,(STRM(4,K),K=1,5)
            PRINT 1218,(STRM(5,K),K=1,5)
            PRINT 1219,(STM (1,K),K=1,5)
            PRINT 1220,(STM (3,K),K=1,5)
            PRINT 1221,(STM (2,K),K=1,5)
            PRINT 1222,(STM (4,K),K=1,5)
            PRINT 1223,(STM (5,K),K=1,5)
      1214  FORMAT(/10X20H RAFFINATE  OIL     ,10X,4(F10.3, 8X),F10.3)
      1215  FORMAT(/10X20H RAFFINATE  ASH     ,10X,4(F10.3, 8X),F10.3)
      1216  FORMAT(/10X20H RAFFINATE  PROTEIN ,10X,4(F10.3, 8X),F10.3)
      1217  FORMAT(/10X20H RAFFINATE  WATER   ,10X,4(F10.3, 8X),F10.3)
      1218  FORMAT(/10X20H RAFFINATE  ALCOHOL ,10X,4(F10.3, 8X),F10.3)
      1219  FORMAT(/10X20H EXTRACT    OIL     ,10X,4(F10.3, 8X),F10.3)
      1220  FORMAT(/10X20H EXTRACT    ASH     ,10X,4(F10.3, 8X),F10.3)
      1221  FORMAT(/10X20H EXTRACT    PROTEIN ,10X,4(F10.3, 8X),F10.3)
      1222  FORMAT(/10X20H EXTRACT    WATER   ,10X,4(F10.3, 8X),F10.3)
      1223  FORMAT(/10X20H EXTRACT    ALCOHOL ,10X,4(F10.3, 8X),F10.3)
            XXA= STMM(5)* 2000./24.
            PRINT 1224, XXA
      1224  FORMAT(/8X,35H FLOW FROM EXTRACTION VESSEL 4      ,F8.0,7H LB/HR )
            XXB= STRMM(1)* 2000./24.
      1225  FORMAT(/8X,35H FLOW FROM EXTRACTION VESSEL 1      ,F8.0,7H LB/HR )
            PRINT 1225, XXB
            XXC =   (SAA-(.5*STRM(1,1)))*2000./24.
            PRINT 1226,XXC
      1226  FORMAT(/8X,35H AQUEOUS STREAM(CENTRIFUGE)         ,F8.0,7H LB/HR )
            XXD=(STOP(1)+STOP(2))*2000./24.
```

Table I.--Continued.

```
01712          PRINT 1227,XXD
01715   1227   FORMAT(/8X,35H TOPS FROM DISTILLATION COLUMN         ,F8.0,7H LB/HR )
01716          XXE= SBOTT*2000./24.
01717          PRINT 1228,XXE
01722   1228   FORMAT(/8X,35H BOTTOMS FROM DISTILLATION COLUMN      ,F8.0,7H LB/HR )
01723          XXF =(.5*STRM(1,1)*2000./24.)
01724          PRINT 1229,XXF
01727   1229   FORMAT(/8X,35H OIL FROM SECOND CENTRIFUGE            ,F8.0,7H LB/HR )
01730          XXG= AA(90,5)*2000./24.
01731          PRINT 1230,XXG
01734   1230   FORMAT(/8X,35H FISH OIL PRODUCT                      ,F8.0,7H LB/HR )
01735          XXH=AA(90,3)*2000./24.
01736   1231   FORMAT(/8X,35H FISH PROTEIN CONCENTRATE              ,F8.0,7H LB/HR )
01737          XXI=AA(90,7)*2000./24.
01740          PRINT 1232, XXH
01743          PRINT 1231, XXI
01746   1232   FORMAT(/8X,35H BONE MEAL CONCENTRATE                 ,F8.0,7H LB/HR )
01747         AA(95,1) =  STRM(1,2) *  2.
01750         XXJ =  AA(95,1)* 2000./24.
01751          PRINT 1233, XXJ
01754   1233   FORMAT(/8X,35H FISH SOLUABLES                        ,F8.0,7H LB/HR )
01755          IXX=(14.0*(TONS/50.)**.31)  + 0.5
01756          AA(90,8)=IXX*8
01757         AA(90,9)=(YYJ+YYK*60.)*24.
01760          AA(90,13)  =  AA(90.13) + (AA(90,3)+AA(90,7)+AA(90,20)+AA(90,4))
01761          RETURN
01762          END

        END OF COMPILATION:          NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S PRESCK,PRESCK
FOR S9A-07/12-11:04 (1,)

   SUBROUTINE PRESCK     ENTRY POINT 002401

   STORAGE USED: CODE(1) 002445; DATA(0) 001006; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003     BLOCK1 005050
    0004     BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005     PMPREC
    0006     BELT
    0007     STORAG
    0010     REFRIG
    0011     SILO
    0012     PMPCNT
    0013     BUCKET
    0014     DRYERR
    0015     SCREWR
    0016     SCREEN
    0017     REACTR
    0020     AGITOR
    0021     HAMMER
    0022     BAGGMA
    0023     EVPFLM
    0024     EVPSPR
    0025     SHARP
    0026     BOILER
    0027     CONDEN
    0030     SCALE
    0031     MATER
    0032     NRDC$
    0033     NIO2$
    0034     NPRT$
    0035     NIO1$
    0036     NEXP6$
    0037     NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000   000046 1000F    0000   000055 1001F    0000   000073 1002F    0000   000260 1003F    0000   000271 1004F
    0000   000302 1005F    0000   000313 1006F    0000   000324 1007F    0000   000335 1008F    0000   000370 1009F
    0001   000722 101L     0000   000401 1010F    0000   000412 1011F    0000   000423 1012F    0000   000434 1013F
    0000   000445 1014F    0000   000456 1015F    0000   000467 1016F    0000   000346 1017F    0000   000500 1018F
    0000   000511 1019F    0001   000757 102L     0000   000522 1020F    0000   000533 1021F    0000   000544 1022F
    0000   000555 1023F    0001   001042 103L     0000   000566 1030F    0000   000577 1031F    0000   000610 1032F
    0000   000357 1033F    0000   000251 1041F    0000   000215 1050F    0000   000233 1051F    0001   000024 106G
    0000   000034 111F     0001   000031 114G     0001   000036 122G     0000   000106 2000F    0001   000152 201G
    0000   000121 3000F    0001   000446 305G     0000   000177 4242F    0000   000161 4249F    0000   000036 5000F
```

Table I.-- Continued.

```
0001       001450 600G     0001       001525 622G     0001       002001 727G     0001       002027 742G     0003 R 000000 AA
0003 R 004704 BB           0000 R 000030 COOL         0004 R 000000 COST         0004 R 000007 COSTA        0000 R 000014 DRYSLD
0000 R 000027 FISH         0000 R 000006 G            0000 R 000002 GALLON       0000 R 000003 GALS         0000 R 000007 HP
0000 I 000000 I            0003 I 003720 IA           0000   000771 INJP$        0000 I 000017 INST         0000 I 000032 IXX
0000 I 000026 J            0000 I 000010 LOOPS        0000 I 000012 NA           0000 I 000005 NUM          0000 R 000022 PROD
0000 R 000033 PXX          0000 R 000021 SLDS         0000 R 000031 STEAM        0000 R 000004 SUMHP        0000 R 000001 TONSA
0000 R 000011 TONSG        0000 R 000020 VOLD         0000 R 000016 VOLT         0000 R 000023 WATER        0000 R 000024 WATEVP
0000 R 000015 XLIQD        0000 R 000025 XLOOPS       0000 R 000013 XNA
```

```
00101               SUBROUTINE PRESCK(TONS)
00103               COMMON/BLOCK1/AA(100,20),IA(100,5),BB(100)
00104               COMMON /BLOCK2/ COST(7),COSTA(7)
00105               DO 1 I=1,7
00110               COST(I) =0.0
00111          1    COSTA(I)=0.0
00113               DO 2 I=1,20
00116               AA(90,I) =0.0
00117          2    AA(91,I) =0.0
00121               DO 10 I=30,33
00124         10    BB(I) = BB(I)*0.01
00126             READ 111 ,BB(40),BB(41),BB(42),BB(43),BB(44)
00135        111  FORMAT(5E12.5)
00136             PRINT 5000
00140       5000  FORMAT(/8X36H ANTIOXIDANT PRICE AND EFFECTIVENESS )
00141             PRINT 1001,BB(44),BB(43)
00145               PRINT 1000
00147        1000   FORMAT(/8X31H ENZYME PRICE AND EFFECTIVENESS )
00150               PRINT 1001,BB(41),BB(40)
00154        1001   FORMAT(/8X8H PRICE =,F5.2,12H DOLLARS/LB,,F8.3,38H LB REQUIRED PE
00154            CR 100 LB OF PRESS CAKE          )
00155               IF(BB(42) .GT. 0.0) PRINT 1002,BB(42)
00161        1002   FORMAT(/8XF8.2,51H PERCENT OF DISOLVED PROTEIN PACKAGED AS BCF PA
00161            CSTE )
00162               PRINT 2000
00164        2000   FORMAT(1H1//55H DETAILED EQUIPMENT COSTS (ALL COSTS IN 1000.0 DOL
00164            CLARS) )
00165               PRINT 3000
00167        3000   FORMAT (//18H    EQUIPMENT TYPE,10X10H  CAPACITY,12X9H MATERIAL,
00167            C60H     BASE     MATERIALS   LABOR    INDIRECT   MODULE      RANGE ,/6
00167            C0X60H    COST         COSTS      COSTS      COSTS      COST         + OR - )
00167       C
00167       C UNLOADING AND STORAGE OF FISH
00167       C
00170               TONSA=TONS*2000./8.33
00171               GALLON= TONSA/(24.*60.)
00172               GALS =GALLON*1.3
00173               SUMHP=  0.
00174               IA(65,1) = 0
00175               IA(65,2) = 1.0
00176               AA(65,17)= GALS*30.
00177               NUM = TONS/500 + 1
00200               DO 143 I=1,NUM
00203        143    CALL PMPREC
00205               IA(65,2) = 0.0
```

Table I.--Continued.

```
00206        SUMHP=  SUMHP +(AA(65,17)*.001*1.5)
00207        SUMHP=  SUMHP +(AA(65,17)*.001*1.5)
00210        IF(TONSA.LT.30000.) G=(30000./(24.*60.))*15.
00212        IF(TONSA.GE.30000.) G=(450000./(24.*60.))*15.
00214        IF(TONS.LE.150.) AA(70,18)= 36.
00216        IF(TONS.GT.150.) AA(70,18)= 48.
00220        AA(70,17)=100.
00221        CALL BELT
00222        HP = TONS*0.00124 +13.6
00223        SUMHP = HP + SUMHP
00224        AA(40,17)=30.0*TONS
00225        IA(40,1)=0.0
00226        IA(40,2)=2
00227        CALL STORAG
00230        IA(40,2)=0
00231        AA(85,17)=0.5*TONS*3.0
00232        IA(85,1) =30
00233        CALL REFRIG
00234        SUMHP = SUMHP + 4.72*AA(85,17)
00235        IA(7,1)=1
00235  C
00235  C FISH STORAGE FOR 3 DAYS
00235  C
00236       AA(7,17)=3.*TONS*2000.*1.69/62.4
00237       CALL SILO
00240       COST(1)=1.19
00241       IF(TONS.GE.300) COST(1)=1.88
00243       COST(5)=COST(1)
00244       PRINT 4249, COST(1), COST(5)
00250       COSTA(1)=COSTA(1)+COST(1)
00251       COSTA(5)=COSTA(5)+COST(5)
00252  4249  FORMAT(/25H BRINE MAKE-UP+SALT STOR., 10X ,15H
00252      1           ,F10.3,30X,F10.3)
00252  C
00252  C PUMP FOR BRINE MAKE-UP (BRONZE)
00252  C
00253       IA(66,1)=1
00254       AA(66,17)=TONS*3.*2000./(24.*60.*62.4)*.69*7.75
00255       CALL PMPCNT
00256       IA(66,1)=0
00257       HP=.0010*AA(66,17)
00260       SUMHP=SUMHP+HP
00260  C
00260  C PUMP FOR WATER INTO BRINE MAKE-UP
00260  C
00261       AA(66,17)=AA(66,17)*.917
00262       IA(66,1)=0
00263       CALL PMPCNT
00264       HP=.0010*AA(66,17)
00265       SUMHP=SUMHP+HP
00266       LOOPS=0.0
00267       LOOPS=LOOPS+3.
00270        TONSG=TONS/24.
00271        AA(71,18)= TONSG
00272        AA(71,17)= 20.
00273        CALL BUCKET
00274        HP = TONS*0.00106
```

```
00275              SUMHP = HP + SUMHP
00275       C
00275       C FISH COOKERS AND SCREW PRESS
00275       C
00276              AA(91,16) = 0.2*TONS
00277            AA(91,10)=TONS+AA(91,16)
00300              IF (TONS .GT. 450) NA=(TONS/250) +1.
00302              IF (TONS .LE. 450) NA=(TONS/100) +1.
00304              DO 3 I=1,NA
00307              BB(2)=2.1
00310              XNA = NA
00311              IA(21,5)=4
00312              AA(21,17)=TONS/XNA
00313            CALL DRYERR
00313       C PUMP TO PRESS
00314            AA(66,17)=AA(91,10)*30.*2000./(24.*8.33*60.)
00315            IA(66,1)=0
00316            CALL PMPCNT
00317            HP=.001*AA(66,17)
00320            SUMHP=HP+SUMHP
00321              IA(17,5)=3
00322              BB(2)=2.6
00323              IF(TONS .GT. 450)  AA(17,17)= 21.
00325              IF(TONS .GT. 450)  AA(17,18)= 16.
00327              IF(TONS .LE. 450)  AA(17,18)= 12.
00331              IF(TONS .LE. 450)  AA(17,17)= 15.
00333              CALL SCREWR
00334              IF(TONS .GT. 450)  AA(51,17)= 10.0
00336              IF(TONS .LE. 450)  AA(51,17)=  4.0
00340              CALL SCREEN
00341        3     CONTINUE
00343            DRYSLD=(.8*BB(32)+.94*BB(31))*TONS
00344            XLIQD=(BB(30)+BB(33)+.06*BB(31)+.2*BB(32))*TONS+AA(91,16)
00345            AA(90,16)=2.86*DRYSLD
00345       C
00345       C FISH DIGESTION AND SCREENING
00345       C
00345       C
00345       C SCREW CONVEYOR
00345       C
00346            AA(17,18)=6
00347            AA(17,17)=20
00350            IA(17,5)=1
00351            CALL SCREWR
00352            AA(90,18)=AA(91,10)-AA(90,16)
00353            AA(90,5)=TONS*BB(30)*(397./500.)
00354            AA(7,17)=27.4*AA(90,16)*50.
00355            CALL SILO
00356            AA(91,17)=AA(91,10)-AA(90,16)-AA(90,5)
00356       C PUMP FOR WATER AND SLUDGE
00357            AA(66,17)=AA(91,17)*2000.*30./(24.*60.*8.33)
00360            IA(66,1)=0
00361            CALL PMPCNT
00362            HP=.001*AA(66,17)
00363            SUMHP=HP+SUMHP
00364            AA(90,15)=AA(90,16)*.0084
00365            AA(90,13)=(BB(30)+BB(31)+BB(32))*TONS*.0001
```

Table I.-- Continued.

```
00366          AA(90,17)=TONS*0.022
00367          AA(90,12)=AA(90,16)*BB(40)/100.0
00370          AA(91,1)=AA(90,16)+AA(90,17)+AA(90,15)+AA(90,12)+AA(91,17)+AA(90,1
00370         C3)
00371           VOLT=AA(91,1)*2000/(8.33*4.8)
00372           AA(51,2) =2.0
00373           AA(51,17) = 2.0
00374           AA(49,17)=VOLT/3
00375           IF(AA(49,17) .LT. 10000) AA(73,17) = AA(49,17)*0.005
00377           IF(AA(49,17) .LT. 10000) GO TO 101
00401           IF( AA(49,17) .GT. 10000) AA(73,17) = 50.
00403           IF(AA(49,17) .GT. 10000) AA(49,17)=10000
00405     101   CALL REACTR
00406           CALL AGITOR
00407           CALL SCREEN
00410           CALL REACTR
00411           CALL AGITOR
00412           CALL SCREEN
00413           CALL REACTR
00414           CALL AGITOR
00415           CALL SCREEN
00416           INST = 3
00417           HP = 3*AA(73,17)
00420           SUMHP = HP + SUMHP
00421           VOLD =VOLT -AA(49,17)*3
00422     102   IF(VOLD .LT. 500) GO TO 103
00424           IF(VOLD .LT. 10000) AA(49,17)=VOLD
00426           IF(AA(49,17) .LT. 10000) AA(73,17) = AA(49,17)*0.005
00430           IF(VOLD .GT. 10000) AA(49,17)=10000
00432           IF( AA(49,17) .GT. 10000) AA(73,17) = 50.
00434           CALL REACTR
00435           CALL AGITOR
00436           CALL SCREEN
00437           INST = INST + 1
00440           VOLD = VOLD -AA(49,17)
00441           HP = AA(73,17)
00442           SUMHP = HP + SUMHP
00443           GO TO 102
00444     103   CONTINUE
00444     C
00444     C BONE FEED STREAM
00444     C
00445          BB(2)=1.
00446          SLDS=(((55./667.)*BB(31))+((68./145.)*BB(32))+((103./500.)*(14./10
00446         C3.)*BB(30)))*TONS+((20./112.)*(AA(90,12)+AA(90,13)+AA(90,15)+AA(90
00446         1,17))*(68./145.))
00447          AA(91,2)=(340./137.)*SLDS
00447     C
00447     C SCREW CONVEYOR
00447     C
00450          AA(17,18)=6
00451          AA(17,17)=20
00452          IA(17,5)=1
00453          CALL SCREWR
00454          IA(21,5)=3
00455           AA(21,17)=AA(91,2)*2.5
00456           CALL DRYERR
```

Table I.-- Continued.

```
00457          AA(90,3)=1.05*SLDS
00460          AA(91,12)=AA(91,2)-AA(90,3)
00460    C
00460    C BAGGING MACHINE AND HAMMER MILL FOR BONE FEED
00460    C
00461          AA(75,17)=AA(90,3)*2000./(24.*60.*25.)
00462          IA(75,2)=0
00463          IA(75,1)=0
00464          AA(18,17)=AA(90,3)/24.
00465          CALL HAMMER
00466          CALL BAGGMA
00467          AA(75,5)=AA(75,17)
00467    C
00467    C
00467    C DIGESTED SOLIDS STREAM
00467    C
00470           AA(91,3) =AA(91,1)-AA(91,2)
00471           AA(40,17) = AA(91,3)*2000/(8.33*24)
00472          IA(40,1)=1
00473           CALL STORAG
00474           IA(40,1) = 0
00474    C PUMPS BEFORE AND AFTER HOLD TANK
00475          IA(66,1)=0
00476          AA(66,17)=AA(40,17)*30./60.
00477          CALL PMPCNT
00500          CALL PMPCNT
00501          SUMHP=SUMHP+2.*.001*AA(66,17)
00502          AA(91,6)=AA(91,3)
00503          PROD=(((612./667.)*BB(31))+((89./103.)*(103./500.)*BB(30))+((77./1
00503         C45.)*BB(32)))*TONS+((20./112.)*(AA(90,12)+AA(90,13)+AA(90,15)+AA(9
00503         10,17))*(77./145.))
00504          WATER=AA(91,3)-PROD
00505           WATEVP =WATER-PROD
00506           HP=0.01*AA(91,3)*2000./(8.33*24.)
00507           SUMHP=HP+SUMHP
00510           AA(91,13)=WATEVP
00511           AA(31,17)=AA(91,13)*2000./(24.*25)
00512           CALL EVPFLM
00512    C
00512    C HOLD TANK FOR DIGESTED SOLIDS
00512    C
00513          AA(91,7)=2.*PROD
00514          AA(40,17)=AA(91,7)*2000./(8.33*24.)
00515          IA(40,1)=0
00516          CALL STORAG
00516    C PUMP AFTER WIPED FILM EVAPORATOR
00517          AA(66,17)=AA(40,17)*30./60
00520          IA(66,1)=0
00521          CALL PMPCNT
00522          HP=.001*AA(66,17)
00523          SUMHP=HP+SUMHP
00524          AA(90,6)=AA(91,7)*BB(42)*.01
00524    C PUMP BEFORE CANNING MACHINE
00525          AA(66,17)=AA(90,6)*2000.*30./(8.33*24.*60.)
00526          IF(BB(42).GT.0.0) CALL PMPCNT
00530          HP=.001*AA(66,17)
00531          SUMHP=HP+SUMHP
```

Table I.-- Continued.

```
00532            AA(75,17)=AA(90,6)*2000.0/(8.33*24.0*60.0*5.0)
00533          IA(75,1)=1.0
00534          IA(75,2)=2.0
00535           IF(BB(42) .GT. 0.0) CALL BAGGMA
00537          AA(75,4)=AA(75,17)
00540          IA(75,1)=0.0
00541          IA(75,2)=0.0
00542           AA(75,4)=AA(75,4)*60.*24.
00543           AA(91,9)=AA(91,7)-AA(90,6)
00544          AA(90,7)=AA(91,9)/(2.*.95)
00544    C PUMP BEFORE SPRAY DRYER
00545          AA(66,17)=AA(90,7)*2000.*30./(8.33*60.*24.)
00546          IA(66,1)=0
00547          CALL PMPCNT
00550          HP=.001*AA(66,17)
00551          SUMHP=HP+SUMHP
00552           AA(91,14)=AA(91,9)-AA(90,7 )
00553           AA(30,17)=AA(91,14)*2000.0/24.0
00554           CALL EVPSPR
00555          AA(75,17)=(AA(75,17)+AA(75,5))*60.*24.
00556           IF(BB(42) .LT. 100) CALL BAGGMA
00560          AA(75,17)=AA(75,17)*60.*24.
00560    C
00560    C FISH OIL STREAM
00560    C
00561          AA(40,17)=AA(90,18)*2000/(8.33*24)
00562           IA(40,1) = 0
00563          CALL STORAG
00563    C PUMPS AFTER SCREEN AND BEFORE CENTRIFUGE
00564          AA(66,17)=AA(40,17)*30./60.
00565          IA(66,1)=0
00566          CALL PMPCNT
00567          CALL PMPCNT
00570          HP=.001*AA(66,17)
00571          SUMHP=HP+SUMHP
00572          SUMHP=HP+SUMHP
00573           AA(91,4) = 1.1*AA(90,5)
00574           HP = 0.01*AA(90,18)*2000.0/(8.33*24.0)
00575           SUMHP =HP+SUMHP
00576           NUM = HP/20. +1
00577           DO 40 I=1,NUM
00602          AA(52,17)=20.
00603     40   CALL SHARP
00605           AA(40,17) = AA(91,4)*2000/(8.33*24)
00606          CALL STORAG
00606    C PUMP BEFORE AND AFTER HOLD TANK
00607          AA(66,17)=AA(40,17)*30./60.
00610          IA(66,1)=0
00611          CALL PMPCNT
00612          CALL PMPCNT
00613          HP=.001*AA(66,17)
00614          SUMHP=HP+SUMHP
00615          SUMHP=HP+SUMHP
00616           HP = 0.025*AA(91,4)*2000.0/(8.33*24.0)
00617           SUMHP =HP+SUMHP
00620           NUM= HP/20. +1
00621           DO 30 I=1,NUM
```

Table I.-- Continued.

```
00624          AA(52,17) =20.0
00625      30  CALL SHARP
00625   C
00625   C FISH OIL STORAGE (15 DAYS)
00625   C
00627         AA(40,17)=AA(90,5)*2000./8.33*15.
00630          IA(40,1) =0.0
00631          CALL STORAG
00632          AA(66,17)=AA(90,5)*30.0*2000.0/(8.33*24*60)
00633          SUMHP= SUMHP+(AA(66.17)*0.001)
00634          IA(66,1) =1
00635          CALL PMPCNT
00635   C
00635   C SUMMATION OF STEAM.WATER AND ELECTRICITY
00635   C
00636          AA(91,15)=(AA(91,11)+AA(91,12)+AA(91,13)+AA(91,14))*1.05   +
00636        C 1.05*(AA(91,16) +AA(91,18) +AA(91,19))
00637          AA(27,17)=AA(91,15)*2000.0/24
00640         CALL BOILER
00640   C
00640   C BOILER WATER TREATMENT
00640   C
00641         COST(1)=1.00n
00642         COST(5)=COST(1)
00643         PRINT 4242,COST(1),COST(5)
00647    4242  FORMAT(/25H BOILER WATER TREATMENT  , 10X ,15H              ,10H
00647      1           ,F10.3,30X,F10.3)
00650         COSTA(5)=COSTA(5)+COST(5)
00651         COSTA(1)=COSTA(1)+COST(1)
00651   C
00651   C FUEL OIL STORAGE (15 DAYS)
00651   C
00652         IA(40,1)=2
00653         AA(40,17)=AA(27,17)/8.33*24.*.0012*15.
00654         CALL STORAG
00655         AA(66,1)=0
00656         AA(66,17)=30.*AA(40,17)/(15.*60.)
00657         CALL PMPCNT
00660         HP=.0010*AA(66.17)
00661         SUMHP=SUMHP+HP
00661   C
00661   C  SEA WATER PUMPS
00661   C
00662         AA(90,10)=4.*8.33*(AA(91,13)+AA(91,14)+AA(91,18)+AA(91,19))*1.2
00663          AA(66,17)=AA(90,10)*2000.0/(8.33*24*60*0.066)
00664         IA(66,1)=1
00665         IA(66,4)=2
00666         CALL PMPCNT
00667         IA(66,4)=0
00670         IA(66,1)=0
00671          SUMHP = SUMHP+(AA(66,17)*.001*1.5)
00672          AA(90,9) =1.1*(3*TONS+AA(90,15)/.15 +0.1*AA(91,4)+AA(91,16))
00673         XLOOPS=LOOPS+18.+3.*INST+NA
00674          COST(1)=XLOOPS *AA(100,1)
00675          COST(5)=COST(1)
00676          COSTA(1)    = COSTA(1)   + COST(1)
00677         COSTA(5)=COSTA(5)     + COST(5)
```

Table I.--Continued.

```
00700          PRINT 1050 COST(1),COST(5)
00704     1050 FORMAT(/ 25H CONTROL INSTRUMENTATION , 10X ,15H                  ,10H
00704        1           ,F10.3,30X,F10.3)
00705          AA(8,17) = TONS
00706          CALL CONDEN
00707          AA(72,17) = 18.
00710          CALL SCALE
00711          CALL SCALE
00712          CALL SCALE
00713        CALL SCALE
00714           COST(1)=AA(100,2)
00715          COST(5)=COST(1)
00716          COSTA(1)=COST(1)        + COSTA(1)
00717          COSTA(5)=COSTA(5) + COST(5)
00720          PRINT 1051, COST(1),COST(5)
00724     1051 FORMAT(/ 25H PAYLOADER AND FORK LIFT , 10X ,15H                  ,10H
00724        1           ,F10.3,30X,F10.3)
00725          PRINT 1041,(COSTA(J),J=1,6)
00733     1041 FORMAT(//25H  TOTAL  COSTS              ,35X6F10.3)
00734          COSTA(7)=0.02*COSTA(1)
00735          AA(100,10)=COSTA(5)
00735    C
00735    C MATERIAL BALLANCE INFORMATION PRINTOUT. ALL STREAMS HERE IN LB/HR
00735    C
00736          AA(90,2)= SUMHP* .7457 * 24.
00737        AA(90,10)=AA(90,10)*2000./(24.*8.33)
00740        CALL MATER(TONS)
00741          DO 50 I=1,20
00744          AA(90,I)=AA(90,I)*2000/24
00745     50   AA(91,I)=AA(91,I)*2000/24
00747          FISH=TONS*2000/24
00750          PRINT 1003,FISH
00753     1003  FORMAT(/8X26H FISH FED To COOKERS       ,F8.0,7H LB/HR  )
00754          PRINT 1004,AA(91,16)
00757     1004  FORMAT(/8X26H COOKERS STEAM            ,F8.0,7H LB/HR  )
00760          PRINT 1005,AA(90,16)
00763     1005  FORMAT(/8X26H PRESS CAKE TO DIGESTERS  ,F8.0,7H LB/HR  )
00764          PRINT 1006,AA(91,17)
00767     1006  FORMAT(/8X26H FISH SOL. TO DIGESTERS   ,F8.0,7H LB/HR  )
00770          PRINT 1007,AA(90,12)
00773     1007  FORMAT(/8X26H ENZYME TO DIGESTERS      ,F8.2,7H LB/HR  )
00774          PRINT 1008,AA(90,15)
00777     1008  FORMAT(/8X26H CAOH TO DIGESTERS        ,F8.2,7H LB/HR  )
01000        PRINT 1017,AA(90,13)
01003    1017  FORMAT(/8X26H ANTIOXIDANT TO DIGESTERS ,F8.2,7H LB/HR  )
01004        PRINT 1033,AA(90,17)
01007    1033  FORMAT(/8X26H 5N NAOH TO DIGESTERS     ,F8.2,7H LB/HR  )
01010        PRINT 1009,AA(91,2)
01013     1009  FORMAT(/8X26H FEED TO ROTARY DRYER     ,F8.0,7H LB/HR  )
01014          PRINT 1010,AA(91,12)
01017     1010  FORMAT(/8X26H ROTARY DRYER STEAM       ,F8.0,7H LB/HR  )
01020          PRINT 1011,AA(90,3)
01023     1011  FORMAT(/8X26H BONE FEED PRODUCT        ,F8.0,7H  LB/HR  )
01024          PRINT 1012,AA(91,3)
01027     1012  FORMAT(/8X26H DIGESTER LIQUOR          ,F8.0,7H LB/HR  )
01030          PRINT 1013,AA(91,6)
01033     1013  FORMAT(/8X26H FEED TO FILM EVAPORATOR  ,F8.0,7H LB/HR  )
```

Table I.--Continued.

```
01034            PRINT 1014,AA(91,13)
01037      1014  FORMAT(/8X26H FILM EVAPORATOR STEAM       ,F8.0,7H LB/HR  )
01040            COOL =AA(91,13)*4
01041            PRINT 1015,COOL
01044      1015  FORMAT(/8X26H FILM EVAPORATOR COOLING     ,F8.0,7H.GAL/HR )
01045            PRINT 1016,AA(91,7)
01050      1016  FORMAT(/8X26H FISH PASTE                  ,F8.0,7H LB/HR  )
01051            AA(90,13)=0.05*AA(91,7)*0.01
01052            PRINT 1018,AA(90,6)
01055      1018  FORMAT(/8X26H PACKAGED AS FISH PASTE      ,F8.0,7H LB/HR )
01056            PRINT 1019,AA(91,9)
01061      1019  FORMAT(/8X26H FEED TO SPRAY EVAPORATOR    ,F8.0,7H LB/HR  )
01062            PRINT 1020,AA(91,14)
01065      1020  FORMAT(/8X26H SPRAY EVAPORATOR STEAM      ,F8.0,7H LB/HR  )
01066            COOL=4*AA(91,14)
01067            PRINT 1021,COOL
01072      1021  FORMAT(/8X26H SPRAY EVAP. COOLING         ,F8.0,7H GAL/HR )
01073            PRINT 1022,AA(90,7 )
01076      1022  FORMAT(/8X26H DRY CONCENTRATE             ,F8.0,7H LB/HR  )
01077            PRINT 1023,AA(90,5)
01102      1023  FORMAT(/8X26H FISH OIL                    ,F8.0,7H LB/HR  )
01103            STEAM=AA(27,17)-AA(91,12)-AA(91,13)-AA(91,14)-AA(91,18)-AA(91,19)
01103           C-AA(91,16)
01104            PRINT 1030,STEAM
01107      1030  FORMAT(/8X26H MISCELANEOUS STEAM          ,F8.0,7H LB/HR  )
01110            AA(90,9)=AA(90,9)/8.33
01111            PRINT 1031,AA(90,9)
01114      1031  FORMAT(/8X26H CITY WATER                  ,F8.0,7H GAL/HR )
01115           AA(90,10)=AA(90,10)*24./2000.
01116            PRINT 1032,AA(90,10)
01121      1032  FORMAT(/8X26H PROCESS WATER               ,F8.0,7H GAL/HR )
01122            AA(90,1) = AA(27,17)*24*0.0112
01123            AA(90,2)= SUMHP* .7457 * 24.
01124            AA(90,3) = AA(90,3)*24/2000
01125            AA(90,5) = AA(90,5)*24/2000
01126            AA(90,6) = AA(90,6)*24/2000
01127            AA(90,7) = AA(90,7)*24/2000
01130            IXX =(14.0*(TONS/50.0)**.31) +0.5
01131            PXX =IXX
01132            AA(90,8) =IXX*8.0
01133            AA(90,9) =AA(90,9)*24
01134            AA(90,12)=AA(90,12)*24
01135            AA(90,13)=AA(90,13)*24
01136            AA(90,15)=AA(90,15)*24
01137           AA(90,17)=AA(90,17)*24
01140            RETURN
01141            END

      END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S HOPPER,HOPPER
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE HOPPER     ENTRY POINT 00007*

   STORAGE USED: CODE(1) 000100; DATA(0) 000031; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000003 1000F       0001     000043 116G       0001    000055 125G       0003 R 000000 AA        0003 R 004704 BB
    0004 R 000000 COST         0004 R 000007 COSTA        0000 I 000001 I          0003    003720 IA        0000    000021 INJP$
    0000 I 000000 IX           0000 I 000002 J

00101      1*          SUBROUTINE HOPPER
00103      2*           IX = 6
00104      3*           COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00105      4*           COMMON /BLOCK2/ COST(7),COSTA(7)
00106      5*           COST(1) = COST(1)*AA(IX,18)
00107      6*           COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00110      7*           COST(2) = COST(1)*AA(IX,11)
00111      8*           COST(3) = COST(1)*AA(IX,12)
00112      9*           COST(4) = COST(1)*AA(IX,13)
00113     10*           COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00114     11*           COST(6) = COST(5)*AA(IX,15)
00115     12*           DO 1 I=1,6
00120     13*        1  COSTA(I)=COST(I)+COSTA(I)
00122     14*           PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00131     15*     1000  FORMAT(/25H CONICAL HOPPER           ,F10.3,15H CUBIC FT.     ,10H
00131     16*         C SST        ,6F10.3)
00132     17*           RETURN
00133     18*           END

      END OF COMPILATION:         NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S SILO,SILO
FOR S9A-07/12-11:04 (0,)

 SUBROUTINE SILO      ENTRY POINT 000116

 STORAGE USED: CODE(1) 000122; DATA(0) 000050; BLANK COMMON(2) 000000

  COMMON BLOCKS:

  0003   BLOCK1 005050
  0004   BLOCK2 000016

 EXTERNAL REFERENCES (BLOCK, NAME)

  0005   NEXP6$
  0006   NPRT$
  0007   NIO1$
  0010   NIO2$
  0011   NERR3$

 STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

  0000   000003 1000F    0000   000020 1001F    0001   000047 120G     0001   000063 130G     0001   000101 140G
  0003 R 000000 AA       0003 R 004704 BB       0004 R 000000 COST     0004 R 000007 COSTA    0000 I 000001 I
  0003 I 003720 IA       0000   000040 INJP$    0000 I 000000 IX       0000 I 000002 J


00101            SUBROUTINE SILO
00103            IX=7
00104            COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00105            COMMON/BLOCK2/ COST(7),COSTA(7)
00106            IF(IA(7,1) .EQ.1) AA(7,11)=0.20
00110            COST(1)= BB(1)* AA(7,7)*AA(7,17)**AA(7,8)
00111            COST(1)= .001* COST(1)
00112            COST(2) = COST(1)* AA(7,11)
00113            COST(3)=  COST(1)* AA(7,12)
00114            COST(4)=  COST(1)* AA(7,13)
00115            COST(5)=  COST(1)+ COST(2)+COST(3) +COST(4)
00116           COST(6)= COST(1)*AA(IX,15)
00117            DO 1  I =1,7
00122        1   COSTA(I)=COST(I) + COSTA(I)
00124            IF(IA(7,1) .EQ.0) PRINT 1000 ,AA(7,17),(COST(I),I=1,6)
00134            IF(IA(7,1) .EQ.1) PRINT 1001,AA(7,17),(COST(J),J=1,6)
00144     1000  FORMAT(/ 25H STORAGE BIN              ,F10.3,15H GALLONS X E+03,10H
00144          1 STEEL     ,6F10.3)
00145     1001  FORMAT(/25H REDWOOD STORAGE BIN      ,F10.0,15H CUBIC FEET    ,10H
00145          CREDWOOD   ,6F10.3        )
00146            RETURN
00147            END

     END OF COMPILATION:        NO DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S CONDEN,CONDEN
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE CONDEN    ENTRY POINT 000065

   STORAGE USED: CODE(1) 000071; DATA(0) 000031; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F      0001    000036 116G       0001    000050 125G       0003 R 000000 AA        0003 R 004704 BB
    0004 R 000000 COST        0004 R 000007 COSTA       0000 I 000001 I           0003   003720 IA        0000   000022 INJP$
    0000 I 000000 IX          0000 I 000002 J


00101      1*          SUBROUTINE CONDEN
00103      2*          IX=8
00104      3*          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00105      4*          COMMON/BLOCK2/ COST(7),COSTA(7)
00106      5*          COST(1)=BB(1)*AA(8,7)*AA(8,17)**AA(8,8)
00107      6*          COST(1) = COST(1)*0.001
00110      7*          COST(2) = COST(1) * AA(8,11)
00111      8*          COST(3) = COST(1) * AA(8,12)
00112      9*          COST(4) = COST(1) * AA(8,13)
00113     10*          COST(5)= COST(1)+ COST(2) + COST(3) + COST(4)
00114     11*          COST(6)= COST(1)*AA(8,15)
00115     12*          DO 1 I= 1,7
00120     13*        1 COSTA(I) = COSTA(I) + COST(I)
00122     14*          PRINT 1000,  AA(8,17), (COST(J),J=1,6)
00131     15*     1000 FORMAT(/ 25H SCRUBBERS                   ,F10.3,15H TONS PROCESSED,10H
00131     16*        1 STEEL      ,6F10.3)
00132     17*          RETURN
00133     18*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S PULVER,PULVER
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE PULVER     ENTRY POINT 000073

   STORAGE USED: CODE(1) 000100; DATA(0) 000033; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F       0001    000043 117G       0001    000055 126G       0003 R 000000 AA       0003 R 004704 BB
    0004 R 000000 COST         0004 R 000007 COSTA       0000 I 000001 I           0003   003720 IA       0000   000022 INJP$
    0000 I 000000 IX           0000 I 000002 J


00101      1*          SUBROUTINE PULVER
00103      2*          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON/BLOCK2/  COST(7), COSTA(7)
00105      4*           IX=11
00106      5*     1000 FORMAT(/ 25H PULVERIZER               ,F10.3,15H POUNDS/HOUR   ,10H
00106      6*        1  SS        ,6F10.3)
00107      7*          COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00110      8*           COST(1)=COST(1)*.001
00111      9*          COST(2)= COST(1)*AA(IX,11)
00112     10*          COST(3)= COST(1)*AA(IX,12)
00113     11*          COST(4)= COST(1)*AA(IX,13)
00114     12*          COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00115     13*          COST(6)= COST(5)*AA(IX,15)
00116     14*          DO 1 I=1,6
00121     15*        1 COSTA(I)=COST(I)+COSTA(I)
00123     16*          PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00132     17*          RETURN
00133     18*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S SCREWR,SCREWR
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE SCREWR    ENTRY POINT 000246

   STORAGE USED: CODE(1) 000257; DATA(0) 000126; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000052 1000F     0000    000020 1001F     0000    000003 1002F     0000    000035 1006F     0001    000212 13L
    0001    000224 14L       0001    000117 140G      0001    000135 150G      0001    000161 162G      0001    000201 174G
    0001    000220 206G      0001    000036 31L       0003 R 000000 AA         0003 R 004704 BB         0004 R 000000 COST
    0004 R 000007 COSTA      0000 I 000001 I          0003 I 003720 IA         0000    000105 INJP$     0000 I 000000 IX
    0000 I 000002 J


00101      1*          SUBROUTINE SCREWR
00103      2*          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON/BLOCK2/  COST(7), COSTA(7)
00105      4*           IX=17
00106      5*          IF(AA(IX,18).LT.6.1)  GO TO 31
00110      6*          AA(17,7) =  270.
00111      7*          AA(17,8) =  0.80
00112      8*          IF(AA(IX,18).LT.12.1) GO TO 31
00114      9*          AA(17,7) =  290.
00115     10*          AA(17,8) =  0.75
00116     11*          IF(AA(IX,18).LT.14.1) GO TO 31
00120     12*          AA(17,7) =  300.
00121     13*          AA(17,8) =  0.60
00122     14*       31 CONTINUE
00123     15*           IF(IA(17,5) .EQ. 2) BB(2) = 5.0
00125     16*           IF(IA(17,5).EQ.5)  BB(2) =5.3
00127     17*          COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00130     18*           COST(1)=COST(1)*.001
00131     19*          COST(1)=BB(2)*COST(1)
00132     20*          COST(2)= COST(1)*AA(IX,11)
00133     21*          COST(3)= COST(1)*AA(IX,12)
00134     22*          COST(4)= COST(1)*AA(IX,13)
```

Table I.-- Continued.

```
00135         COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00136         COST(6)= COST(1)*AA(IX,15)
00137         DO 1 I=1,6
00142       1 COSTA(I)=COST(I)+COSTA(I)
00144           IF(IA(17,5).EQ.5)  PRINT 1006, AA(17,17),(COST(J),J=1,6)
00154           IF(IA(17,5).EQ.5)  GO TO 14
00156           IF(IA(17,5) .EQ. 3) PRINT 1002,AA(IX,17),(COST(J),J=1,6)
00166           IF(IA(17,5) .EQ. 3) GO TO 14
00170    1002   FORMAT(/25H SCREW PRESS              ,F10.0,15H FEET          ,10H
00170         C SST     ,6F10.3)
00171         PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00200           IF(IA(17,5).EQ.2) GO TO 13
00202           GO TO 14
00203  13     PRINT 1001,AA(17,17),(COST(J),J=1,6)
00212    1001 FORMAT(/ 25H SCREW PRESS              ,F10.3,15H FEET          ,10H
00212         1 STEEL    ,6F10.3)
00213     14  CONTINUE
00214           IA(17,5) = 1
00215    1006   FORMAT(/25H PULP PRESS               ,F10.3,15H FEET          ,10H
00215         1 STEEL     ,6F10.3)
00216    1000 FORMAT(/ 25H SCREW CONVEYER           ,F10.3,15H FEET          ,10H
00216         1  SS       ,6F10.3)
00217         BB(2)=1.
00220         RETURN
00221         END

     END OF COMPILATION:        NO DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S HAMMER,HAMMER
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE HAMMER     ENTRY POINT 000107

   STORAGE USED: CODE(1) 000114; DATA(0) 000034; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000003 1000F     0001     000057 121G     0001     000071 130G     0001     000034 2L     0003 R 000000 AA
    0003 R 004704 BB          0004 R 000000 COST       0004 R 000007 COSTA      0000 I 000001 I       0003   003720 IA
    0000     000023 INJP$     0000 I 000000 IX         0000 I 000002 J


00101      1*            SUBROUTINE HAMMER
00103      2*            COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*            COMMON /BLOCK2/ COST(7),COSTA(7)
00105      4*            IX = 18
00106      5*          IF(AA(18,17).LT.1.) COST(1)=.5
00110      6*          IF(AA(18,17).LT.1.) GO TO 2
00112      7*            COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00113      8*    2     COST(2)=COST(1)*AA(IX,11)
00114      9*            COST(3) = COST(1)*AA(IX,12)
00115     10*            COST(4) = COST(1)*AA(IX,13)
00116     11*            COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00117     12*            COST(6) = COST(5)*AA(IX,15)
00120     13*            DO 1 I=1,6
00123     14*         1  COSTA(I)=COST(I)+COSTA(I)
00125     15*            PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00134     16*     1000   FORMAT(/25H HAMMER MILL              ,F10.3,15H TONS PER HR.  ,10H
00134     17*          C SST      ,6F10.3)
00135     18*            RETURN
00136     19*            END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S DRYER,DRYER
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE DRYER      ENTRY POINT 000073

   STORAGE USED: CODE(1) 000100; DATA(0) 000033; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000003 1000F      0001    000043 117G      0001    000055 126G      0003 R 000000 AA      0003 R 004704 BB
    0004 R 000000 COST         0004 R 000007 COSTA      0000 I 000001 I          0003    003720 IA      0000   000022 INJP$
    0000 I 000000 IX           0000 I 000002 J


00101      1*          SUBROUTINE DRYER
00103      2*          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON/BLOCK2/ COST(7),COSTA(7)
00105      4*          IX=19
00106      5*     1000 FORMAT(/ 25H DRUM DRYER             ,F10.3,15H SQUARE FEET   ,10H
00106      6*        1  SS       ,6F10.3)
00107      7*          COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00110      8*           COST(1)=COST(1)*.001
00111      9*          COST(2)= COST(1)*AA(IX,11)
00112     10*          COST(3)= COST(1)*AA(IX,12)
00113     11*          COST(4)= COST(1)*AA(IX,13)
00114     12*          COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00115     13*          COST(6)= COST(5)*AA(IX,15)
00116     14*          DO 1 I=1,6
00121     15*        1 COSTA(I)=COST(I)+COSTA(I)
00123     16*          PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00132     17*          RETURN
00133     18*          END

      END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S DRYERP,DRYERP
FOR S9A-07/12-11:04 (0,)

  SUBROUTINE DRYERP     ENTRY POINT 000073

  STORAGE USED: CODE(1) 000100; DATA(0) 000033; BLANK COMMON(2) 000000

   COMMON BLOCKS:

   0003    BLOCK1 005050
   0004    BLOCK2 000016

  EXTERNAL REFERENCES (BLOCK, NAME)

   0005    NEXP6$
   0006    NPRT$
   0007    NIO1$
   0010    NIO2$
   0011    NERR3$

  STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

   0000    000003 1000F      0001    000043 117G      0001    000055 126G      0003 R 000000 AA      0003 R 004704 BB
   0004 R 000000 COST       0004 R 000007 COSTA      0000 I 000001 I         0003   003720 IA      0000   000022 INJP$
   0000 I 000000 IX         0000 I 000002 J


00101      1*          SUBROUTINE DRYERP
00103      2*          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON/BLOCK2/ COST(7),COSTA(7)
00105      4*          IX=20
00106      5*     1000 FORMAT(/ 25H PAN DRYER                 ,F10.3,15H SQUARE FEET   ,10H
00106      6*        1 SS       ,6F10.3)
00107      7*          COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00110      8*           COST(1)=COST(1)*.001
00111      9*          COST(2)= COST(1)*AA(IX,11)
00112     10*          COST(3)= COST(1)*AA(IX,12)
00113     11*          COST(4)= COST(1)*AA(IX,13)
00114     12*          COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00115     13*          COST(6)= COST(5)*AA(IX,15)
00116     14*          DO 1 I=1,6
00121     15*        1 COSTA(I)=COST(I)+COSTA(I)
00123     16*          PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00132     17*          RETURN
00133     18*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S DRYERR,DRYERR
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE DRYERR      ENTRY POINT 000300

   STORAGE USED: CODE(1) 000305; DATA(0) 000153; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK2 000016
    0004    BLOCK1 005050

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000052 1000F     0000     000121 1001F     0000     000067 1003F     0000     000104 1004F     0001     000073 122G
    0001     000247 13L       0001     000111 132G      0001     000261 14L       0001     000127 142G      0001     000145 152G
    0001     000176 171G      0001     000222 203G      0001     000242 217G      0001     000255 227G      0000     000003 3006F
    0000     000020 3007F     0000     000035 3008F     0004 R 000000 AA         0004 R 004704 BB         0003 R 000000 COST
    0003 R 000007 COSTA       0000 I 000001 I          0004 I 003720 IA         0000     000142 INJP$      0000 I 000000 IX
    0000 I 000002 J

00101      1*          SUBROUTINE DRYERR
00103      2*          COMMON/BLOCK2/ COST(7),COSTA(7)
00104      3*          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00105      4*          IX=21
00106      5*          COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107      6*           COST(1)=COST(1)*.001
00110      7*          COST(1)=BB(2)*COST(1)
00111      8*          COST(2)= COST(1)*AA(IX,11)
00112      9*          COST(3)= COST(1)*AA(IX,12)
00113     10*          COST(4)= COST(1)*AA(IX,13)
00114     11*          COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00115     12*           IF(IA(21,5).GE.6.AND.IA(21,5).LE.8)  BB(2)=3.2*BB(2)
00117     13*           COST(1)=BB(2)*COST(1)
00120     14*          COST(6)= COST(5)*AA(IX,15)
00121     15*          DO 1 I=1,6
00124     16*        1 COSTA(I)=COST(I)+COSTA(I)
00126     17*           IF(IA(21,5).EQ.6)  PRINT 3006,AA(21,17),(COST(I),I=1,6)
00136     18*           IF(IA(21,5).EQ.7)  PRINT 3007,AA(21,17),(COST(I),I=1,6)
00146     19*           IF(IA(21,5).EQ.8)  PRINT 3008,AA(21,17),(COST(I),I=1,6)
00156     20*           IF(IA(21,5).GE.6)  GO TO 14
00160     21*    3006  FORMAT(/25H DRYER                 ,F10.3,25H  AREA(SQ.FEET  SST
```

Table I.-- Continued.

```
00160      C         ,6(F10.3))
00161      3007  FORMAT(/25H STRIPPER DRYER          ,F10.3,25H  AREA(SQ.FEET  SST
00161      C         ,6(F10.3))
00162      3008  FORMAT(/25H CONDITIONER             ,F10.3,25H  AREA(SQ.FEET  SSTT
00162      C         ,6(F10.3))
00163            IF(IA(21,5).EQ.2) GO TO 13
00165             IF(IA(21,5).EQ.3)   PRINT 1003,AA(IX,17),(COST(J),J=1,6)
00175             IF(IA(21,5).EQ. 3)   GO TO 14
00177             IF(IA(21,5) .EQ. 4) PRINT 1004,AA(IX,17),(COST(J),J=1,6)
00207             IF(IA(21,5) .EQ. 4) GO TO 14
00211      1000 FORMAT(/ 25H ROTARY VACUUM DRYER     ,F10.3,15H SQUARE FEET   ,10H
00211         1  SS          ,6F10.3)
00212      1003 FORMAT(/ 25H STEAM TUBE DRYER         F10.3,15H SQUARE FEET   ,10H
00212         1 STEEL       ,6F10.3)
00213      1004  FORMAT(/25H STEAM COOKER            ,F10.0,15H SQUARE FEET   ,10H
00213        C SST          ,6F10.3)
00214            PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00223            GO TO 14
00224        13  PRINT 1001,AA(21,17),(COST(J),J=1,6)
00233      1001 FORMAT(/ 25H STEAM COOKER            ,F10.3,15H SQUARE FEET   ,10H
00233         1 STEEL      ,6F10.3)
00234        14  CONTINUE
00235            IA(21,5)= 1
00236            BB(2)=1.
00237            BB(3)=1.
00240            RETURN
00241            END

      END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S BOILER,BOILER
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE BOILER     ENTRY POINT 000114

   STORAGE USED: CODE(1) 000120; DATA(0) 000040; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003     BLOCK1 005050
    0004     BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005     NEXP6$
    0006     NPRT$
    0007     NI01$
    0010     NI02$
    0011     NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000004 1000F       0001     000060 122G       0001     000077 132G       0003 R 000000 AA       0003 R 004704 BB
    0004 R 000000 COST          0004 R 000007 COSTA       0000 I 000002 I           0003   003720 IA       0000   000030 INJP$
    0000 I 000000 IX            0000 I 000003 J           0000 R 000001 S


00101      1*          SUBROUTINE BOILER
00103      2*          COMMON/BLOCK1/ AA(100,20).IA(100,5),BB(100)
00104      3*          COMMON/BLOCK2/ COST(7),COSTA(7)
00105      4*          IX=27
00106      5*          S=AA(27,7) +(0.3*AA(27,18))
00107      6*          IF(AA(27,18).GT.150.) S= 500.
00111      7*          IF(AA(27,18).GT.300.) S= 560.
00113      8*          S=0.001*S
00114      9*          COST(1)=  S*BB(1)*AA(27,17)**AA(27,8)
00115     10*          COST(2)=  COST(1)*AA(27,11)
00116     11*          COST(3)=  COST(1)*AA(27,12)
00117     12*          COST(4)= COST(1)*AA(27,13)
00120     13*          COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00121     14*          DO 1 I=1,6
00124     15*          COST(6)= COST(5)*AA(27,15)
00125     16*        1 COSTA(I) =COSTA(I) + COST(I)
00127     17*          PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00136     18*     1000  FORMAT(/25H BOILER                          ,F10.3,15H POUNDS/HOUR    ,10H
00136     19*        1  SS        ,6F10.3)
00137     20*          RETURN
00140     21*          END

     END OF COMPILATION:        NO DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S EVPSPR,EVPSPR
FOR S9A-07/12-11:04 (0,)

   SUBROUTINE EVPSPR      ENTRY POINT 000070

   STORAGE USED: CODE(1) 000075; DATA(0) 000031; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK2 000016
    0004    BLOCK1 005050

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000003 1000F      0001   000040 115G      0001   000052 124G      0004 R 000000 AA      0004 R 004704 BB
    0003 R 000000 COST         0003 R 000007 COSTA     0000 I 000001 I        0004   003720 IA      0000   000021 INJP$
    0000 I 000000 IX           0000 I 000002 J

00101      1*          SUBROUTINE EVPSPR
00103      2*          COMMON /BLOCK2/ COST(7),COSTA(7)
00104      3*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00105      4*          IX=30
00106      5*          COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107      6*          COST(2) = COST(1)*AA(IX,11)
00110      7*          COST(3) = COST(1)*AA(IX,12)
00111      8*          COST(4) = COST(1)*AA(IX,13)
00112      9*          COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00113     10*          COST(6) = COST(5)*AA(IX,15)
00114     11*          DO 1 I=1,6
00117     12*        1 COSTA(I)=COST(I)+COSTA(I)
00121     13*          PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00130     14*     1000 FORMAT(/25H SPRAY EVAPORATOR          ,F10.2,15H LB/HR EVAP.    ,10H
00130     15*         CSST       ,6F10.3)
00131     16*          RETURN
00132     17*          END

        END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S  EVPFLM,EVPFLM
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE EVPFLM    ENTRY POINT 000067

   STORAGE USED: CODE(1) 000073; DATA(0) 000030; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK2 000016
    0004    BLOCK1 005050

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F       0001    000044 117G       0001    000052 124G       0004 R 000000 AA        0004 R 004704 BB
    0003 R 000000 COST        0003 R 000007 COSTA      0000 I 000002 I          0004   003720 IA        0000   000021 INJP$
    0000 I 000000 IX          0000 I 000001 J


00101     1*           SUBROUTINE EVPFLM
00103     2*           COMMON /BLOCK2/ COST(7),COSTA(7)
00104     3*           COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00105     4*           IX=31
00106     5*           COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107     6*           COST(2) = COST(1)*AA(IX,11)
00110     7*           COST(3) = COST(1)*AA(IX,12)
00111     8*           COST(4) = COST(1)*AA(IX,13)
00112     9*           COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00113    10*           COST(6) = COST(5)*AA(IX,15)
00114    11*           PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00123    12*           DO 1 I=1,6
00126    13*         1 COSTA(I)=COST(I)+COSTA(I)
00130    14*      1000 FORMAT(/25H WIPED FILM EVAPORATOR    ,F10.2,15H SQUARE FT.    ,10H
00130    15*          CSST       ,6F10.3)
00131    16*           RETURN
00132    17*           END

      END OF COMPILATION:        NO DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S EVPSPR,EVPSPR
FOR S9A-07/12-11:04 (0,)

  SUBROUTINE EVPSPR    ENTRY POINT 000070

  STORAGE USED: CODE(1) 000075; DATA(0) 000031; BLANK COMMON(2) 000000

   COMMON BLOCKS:

   0003   BLOCK2 000016
   0004   BLOCK1 005050

  EXTERNAL REFERENCES (BLOCK, NAME)

   0005   NEXP6$
   0006   NPRT$
   0007   NIO1$
   0010   NIO2$
   0011   NERR3$

  STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

   0000    000003 1000F      0001    000040 115G      0001    000052 124G      0004 R 000000 AA      0004 R 004704 BB
   0003 R 000000 COST       0003 R 000007 COSTA     0000 I 000001 I         0004   003720 IA      0000   000021 INJP$
   0000 I 000000 IX         0000 I 000002 J


00101     1*        SUBROUTINE EVPSPR
00103     2*        COMMON /BLOCK2/ COST(7),COSTA(7)
00104     3*        COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00105     4*        IX=30
00106     5*        COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107     6*        COST(2) = COST(1)*AA(IX,11)
00110     7*        COST(3) = COST(1)*AA(IX,12)
00111     8*        COST(4) = COST(1)*AA(IX,13)
00112     9*        COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00113    10*        COST(6) = COST(5)*AA(IX,15)
00114    11*        DO 1 I=1,6
00117    12*      1 COSTA(I)=COST(I)+COSTA(I)
00121    13*        PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00130    14*   1000 FORMAT(/25H SPRAY EVAPORATOR         ,F10.2,15H LB/HR EVAP.   ,10H
00130    15*       CSST       ,6F10.3)
00131    16*        RETURN
00132    17*        END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S  EVPFLM,EVPFLM
FOR S9A-07/12-11:05 (0,)

  SUBROUTINE EVPFLM    ENTRY POINT 000067

  STORAGE USED: CODE(1) 000073; DATA(0) 000030; BLANK COMMON(2) 000000

   COMMON BLOCKS:

   0003     BLOCK2 000016
   0004     BLOCK1 005050

  EXTERNAL REFERENCES (BLOCK, NAME)

   0005     NEXP6$
   0006     NPRT$
   0007     NIO1$
   0010     NIO2$
   0011     NERR3$

  STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

   0000     000003 1000F      0001    000044 117G      0001    000052 124G      0004 R 000000 AA      0004 R 004704 BB
   0003 R 000000 COST         0003 R 000007 COSTA      0000 I 000002 I          0004   003720 IA      0000   000021 INJP$
   0000 I 000000 IX           0000 I 000001 J


00101      1*          SUBROUTINE EVPFLM
00103      2*          COMMON /BLOCK2/ COST(7),COSTA(7)
00104      3*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00105      4*          IX=31
00106      5*          COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107      6*          COST(2) = COST(1)*AA(IX,11)
00110      7*          COST(3) = COST(1)*AA(IX,12)
00111      8*          COST(4) = COST(1)*AA(IX,13)
00112      9*          COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00113     10*          COST(6) = COST(5)*AA(IX,15)
00114     11*          PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00123     12*          DO 1 I=1,6
00126     13*        1 COSTA(I)=COST(I)+COSTA(I)
00130     14*     1000 FORMAT(/25H WIPED FILM EVAPORATOR     ,F10.2,15H SQUARE FT.    ,10H
00130     15*         CSST         ,6F10.3)
00131     16*          RETURN
00132     17*          END

      END OF COMPILATION:        NO DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S STORAG,STORAG
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE STORAG     ENTRY POINT 000177

   STORAGE USED: CODE(1) 000204; DATA(0) 000104; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001     000012 10L      0001     000121 1001L    0000     000004 1010F    0000     000021 1011F    0000     000036 1028F
    0000     000053 1029F    0001     000064 130G     0001     000114 147G     0001     000130 157G     0001     000144 167G
    0001     000160 177G     0001     000016 20L      0001     000041 21L      0001     000151 28L      0001     000135 29L
    0001     000165 30L      0003 R 000000 AA         0003 R 004704 BB         0000 R 000001 CAST       0004 R 000000 COST
    0004 R 000007 COSTA      0000 I 000002 I          0003 I 003720 IA         0000     000074 INJP$    0000 I 000000 IX
    0000 I 000003 J


00101      1*          SUBROUTINE STORAG
00103      2*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON /BLOCK2/ COST(7),COSTA(7)
00105      4*          AA(40,17) = AA(40,17)*0.01
00106      5*          IF (AA(40,17) .GT. 10.0) GO TO 10
00110      6*          IX = 40
00111      7*          GO TO 20
00112      8*     10   IX = 41
00113      9*          AA(41,17) = AA(40,17)
00114     10*     20   COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00115     11*          CAST = COST(1)
00115     12*   C SST MATERIAL FACTOR = AA(40,18), INDEX = IA(40,U) = 1
00116     13*          IF(IA(40,1) - 1) 21,22,21
00121     14*     22   COST(1) = COST(1)*AA(IX,18)
00122     15*     21   COST(2) = COST(1)*AA(IX,11)
00123     16*          COST(3) = CAST*AA(IX,12)
00124     17*          COST(4) = COST(1)*AA(IX,13)
00125     18*          COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00126     19*          COST(6) = COST(5)*AA(IX,15)
00127     20*          DO 1 I=1,6
00132     21*      1   COSTA(I)=COST(I)+COSTA(I)
```

Table I.-- Continued.

```
00134                 AA(IX,17) = AA(IX,17)*100.0
00135                 IF(IA(40,2) .EQ. 1) GO TO 29
00137                 IF(IA(40,2) .EQ. 2) GO TO 28
00141                 IF (IA(40,1) - 1)1000,1001,1000
00144         1000    PRINT 1010,AA(IX,17),(COST(J),J=1,6)
00153                 GO TO 30
00154         1001    PRINT 1011,AA(IX,17),(COST(J),J=1,6)
00163                 GO TO 30
00164         29      PRINT 1029,AA(IX,17),(COST(J),J=1,6)
00173                 GO TO 30
00174         28      PRINT 1028,AA(IX,17),(COST(J),J=1,6)
00203                 GO TO 30
00204         1010    FORMAT(/25H SHOP FAB. STORAGE TANK  ,F10.0,15H GALLONS       ,10H
00204               C STEEL    ,6F10.3)
00205         1011    FORMAT(/25H SHOP FAB. STORAGE TANK  ,F10.0,15H GALLONS       ,10H
00205               C SST      ,6F10.3)
00206         1028    FORMAT(/25H WATER DUMP TANK         ,F10.0,15H GALLONS       ,10H
00206               CSTEEL     ,6F10.3)
00207         1029    FORMAT(/25H ACID STORAGE TANK       ,F10.0,15H GALLONS       ,10H
00207               C SST      ,6F10.3)
00210          30     CONTINUE
00211                 RETURN
00212                 END

      END OF COMPILATION:      NO DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S VESSEL,VESSEL
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE VESSEL     ENTRY POINT 000210

   STORAGE USED: CODE(1) 000215; DATA(0) 000065; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000004 1000F      0001    000141 144G      0001    000157 156G      0001    000172 165G      0000    000021 2000F
    0001    000077 3L         0001    000105 4L        0001    000163 5L        0003 R 000000 AA       0003 R 004704 BB
    0004 R 000000 COST        0004 R 000007 COSTA      0000 R 000001 F          0000 I 000003 I        0003 I 003720 IA
    0000    000054 INJP$      0000 I 000000 IX         0000 R 000002 U


00101              SUBROUTINE VESSEL
00103              COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104              COMMON/BLOCK2/  COST(7),COSTA(7)
00105              IX=42
00106              IF(IA(42,3).EQ.1) F=AA(42,1)
00110              IF(IA(42,3).EQ.2)  F =AA(42,2)
00112              IF(IA(42,3).EQ.3)  F =AA(42,3)
00114              U= AA(42,18)**1.6*AA(42,19)*0.132
00115              IF(IA(42,2).EQ.1)  COST(1)=.313*U**0.81 *BB(1)
00117              IF(IA(42,2).EQ.2)  COST(2)=.260*U**0.759*BB(I)
00121              IF(IA(42,2).NE.1)  GO TO 3
00123              AA(42,11)= 1.038
00124              AA(42,12)=  .992
00125              AA(42,13)= 1.20
00126              GO TO 4
00127          3   AA(42,11) = 0.645
00130              AA(42,12) = 0.615
00131              AA(42,13) = 0.916
00132          4   CONTINUE
00133              COST(4)= COST(1)* AA(IX,13)
00134              COST(3)= COST(1)* AA(IX,12)
00135              COST(2)= COST(1)* AA(IX,11)
00136              COST(1) =COST(1)*F
```

Table I.--Continued.

```
00137            COST(5)=COST(1)+COST(2)+COST(3)+COST(4)
00140            AA(42,17)=3.14159*.25*AA(42,18)*AA(42,18)*AA(42,19)
00141          COST(7)=0.
00142            COST(6)= COST(1)*AA(IX,15)
00143            DO 1 I=1,7
00146        1   COSTA(I) = COSTA(I) +COST(I)
00150     1000 FORMAT(/ 25H PRESSURE VESSEL          ,F10.3,15H CUBIC FEET    ,10H
00150          1 SS        ,6F10.3)
00151          IF(IA(42,4).EQ.2) GO TO 5
00153            PRINT 1000,  AA(IX,17), (COST(I),I=1,6)
00162        5 PRINT 2000, AA(IX,17),(COST(I),I=1,6)
00171   2000   FORMAT(/25H DIST. COLUMN SHELL        ,F10.3,15H CUBIC FEET    ,10H
00171          1 SS        ,6F10.3)
00172            RETURN
00173            END

      END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S COLUMN,COLUMN
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE COLUMN     ENTRY POINT 000157

   STORAGE USED: CODE(1) 000163; DATA(0) 000044; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000005 1000F     0001    000130 136G     0001    000142 145G      0003 R 000000 AA      0003 R 004704 BB
    0004 R 000000 COST       0004 R 000007 COSTA     0000 R 000002 FM         0000 R 000001 FS      0000 R 000003 FT
    0000 I 000004 I          0003 I 003720 IA        0000    000034 INJP$     0000 I 000000 IX


00101              SUBROUTINE COLUMN
00103              COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104              COMMON/BLOCK2/  COST(7),COSTA(7)
00105              IX=43
00106        1000 FORMAT(/ 25H DISTILLATION COLUMN      ,F10.3,15H FEET(HIGHT)    ,10H
00106            1 SS        ,6F10.3)
00107              FS=1.0+ (0.4)**((24.-AA(43,18))/6.)
00110              FM=AA(43,1)
00111              FT=0.
00112              IF(AA(43,2).GT.2.)  FT=AA(43,4)
00114              IF(AA(43,2).GT.4.)  FT=AA(43,5)
00116              IF(IA(43,3).EQ.2)    FM=0.
00120              IF(AA(43,17).LE.4.)   AA(43,7)=8.3*(AA(43,20) )
00122              IF(AA(43,17).GE.4.)   AA(43,7)=AA(43,20)*(AA(43,20)+4.3)
00124              COST(1)= (AA(43,17)**AA(43,8))*AA(43,7)*BB(1)*(FS+FT)
00125              COST(1)=COST(1)*.001
00126              COST(2)= COST(1)* AA(IX,11)
00127              COST(3)= COST(1)* AA(IX,12)
00130              COST(4)= COST(1)* AA(IX,13)
00131            COST(7)=0.
00132              COST(1)= COST(1)*(1.+FM)
00133              COST(5)=COST(1)+COST(2)+COST(3)+COST(4)
00134              COST(6)= COST(1)*AA(IX,15)
00135              DO 1 I=1,7
```

Table I.--Continued.

```
00140    25*      1  COSTA(I) = COSTA(I) +COST(I)
00142    26*         PRINT 1000, AA(43,17),(COST(I),I=1,6)
00151    27*         RETURN
00152    28*         END

     END OF COMPILATION:          NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S REACTR,REACTR
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE REACTR     ENTRY POINT 000072

   STORAGE USED: CODE(1) 000077; DATA(0) 000031; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F      0001    000042 116G      0001    000054 125G      0003 R 000000 AA      0003 R 004704 BB
    0004 R 000000 COST        0004 R 000007 COSTA      0000 I 000001 I          0003   003720 IA      0000   000021 INJP$
    0000 I 000000 IX          0000 I 000002 J


00101                SUBROUTINE REACTR
00103                COMMON/BLOCK1/AA(100,20),IA(100,5),BB(100)
00104                COMMON/BLOCK2/ COST(7),COSTA(7)
00105                IX=49
00106                COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107                COST(1) = COST(1)*AA(49,18)
00110                COST(2) = COST(1)*AA(IX,11)
00111                COST(3) = COST(1)*AA(IX,12)
00112                COST(4) = COST(1)*AA(IX,13)
00113                COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00114                COST(6) = COST(5)*AA(IX,15)
00115                DO 1 I=1,6
00120             1  COSTA(I)=COST(I)+COSTA(I)
00122                PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00131          1000  FORMAT(/25H JACKETED REACTOR VESSEL ,F10.0,15H GALLONS        ,10H
00131              CSST       ,6F10.3)
00132                RETURN
00133                END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S GRINDR,GRINDR
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE GRINDR    ENTRY POINT 000072

   STORAGE USED: CODE(1) 000077; DATA(0) 000031; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   BLOCK1 005050
    0004   BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005   NEXP6$
    0006   NPRT$
    0007   NIO1$
    0010   NIO2$
    0011   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000   000003 1000F       0001   000042 116G       0001   000054 125G       0003 R 000000 AA       0003 R 004704 BB
    0004 R 000000 COST        0004 R 000007 COSTA      0000 I 000001 I          0003   003720 IA       0000   000021 INJP$
    0000 I 000000 IX          0000 I 000002 J


00101     1*         SUBROUTINE GRINDR
00103     2*         COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104     3*         COMMON /BLOCK2/ COST(7),COSTA(7)
00105     4*         IX=50
00106     5*         COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107     6*         COST(1) = COST(1)*AA(50,18)
00110     7*         COST(2) = COST(1)*AA(IX,11)
00111     8*         COST(3) = COST(1)*AA(IX,12)
00112     9*         COST(4) = COST(1)*AA(IX,13)
00113    10*         COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00114    11*         COST(6) = COST(5)*AA(IX,15)
00115    12*         DO 1 I=1,6
00120    13*      1  COSTA(I)=COST(I)+COSTA(I)
00122    14*         PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00131    15*   1000  FORMAT(/25H FISH GRINDER         ,F10.3,15H TONS/HR       ,10H
00131    16*       CSST      ,6F10.3)
00132    17*         RETURN
00133    18*         END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S SCREEN,SCREEN
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE SCREEN     ENTRY POINT 000072

   STORAGE USED: CODE(1) 000077; DATA(0) 000031; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000003 1000F      0001     000042 116G     0001     000054 125G     0003 R 000000 AA       0003 R 004704 BB
    0004 R 000000 COST         0004 R 000007 COSTA      0000 I 000001 I          0003   003720 IA       0000   000021 INJP$
    0000 I 000000 IX           0000 I 000002 J


00101      1*          SUBROUTINE SCREEN
00103      2*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON /BLOCK2/ COST(7),COSTA(7)
00105      4*          IX = 51
00106      5*          COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107      6*          COST(1) = COST(1)*AA(IX,18)
00110      7*          COST(2) = COST(1)*AA(IX,11)
00111      8*          COST(3) = COST(1)*AA(IX,12)
00112      9*          COST(4) = COST(1)*AA(IX,13)
00113     10*          COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00114     11*          COST(6) = COST(5)*AA(IX,15)
00115     12*          DO 1 I=1,6
00120     13*        1 COSTA(I)=COST(I)+COSTA(I)
00122     14*          PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00131     15*     1000 FORMAT(/25H VIBRATING SCREEN         ,F10.3,15H SURFACE SQ FT.,10H
00131     16*        C SST      ,6F10.3)
00132     17*          RETURN
00133     18*          END

      END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S SHARP,SHARP
FOR S9A-07/12-11:05 (0,)

 SUBROUTINE SHARP     ENTRY POINT 000073

 STORAGE USED: CODE(1) 000100; DATA(0) 000033; BLANK COMMON(2) 000000

  COMMON BLOCKS:

  0003    BLOCK1 005050
  0004    BLOCK2 000016

 EXTERNAL REFERENCES (BLOCK, NAME)

  0005    NEXP6$
  0006    NPRT$
  0007    NIO1$
  0010    NIO2$
  0011    NERR3$

 STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

  0000    000003 1000F     0001    000043 116G     0001    000055 125G     0003 R 000000 AA     0003 R 004704 BB
  0004 R 000000 COST       0004 R 000007 COSTA     0000 I 000001 I         0003   003720 IA     0000   000022 INJP$
  0000 I 000000 IX         0000 I 000002 J


00101              SUBROUTINE SHARP
00103            COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104            COMMON/BLOCK2/ COST(7),COSTA(7)
00105            IX=52
00106            COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107             COST(1)=COST(1)*.001
00110            COST(2)= COST(1)*AA(IX,11)
00111            COST(3)= COST(1)*AA(IX,12)
00112            COST(4)= COST(1)*AA(IX,13)
00113            COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00114            COST(6)= COST(5)*AA(IX,15)
00115            DO 1 I=1,6
00120          1 COSTA(I)=COST(I)+COSTA(I)
00122            PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00131     1000  FORMAT(/25H SHARPLES CENTRIFUGE      ,F10.3,15H HORSEPOWER    ,10H
00131         1  SS           ,6F10.3)
00132            RETURN
00133            END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S BOWL,BOWL
FOR S9A-07/12-11:05 (0,)

  SUBROUTINE BOWL      ENTRY POINT 000073

  STORAGE USED: CODE(1) 000100; DATA(0) 000033; BLANK COMMON(2) 000000

   COMMON BLOCKS:

   0003     BLOCK1 005050
   0004     BLOCK2 000016

  EXTERNAL REFERENCES (BLOCK, NAME)

   0005     NEXP6$
   0006     NPRT$
   0007     NIO1$
   0010     NIO2$
   0011     NERR3$

  STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

   0000     000003 1000F      0001     000043 116G      0001     000055 125G      0003 R 000000 AA      0003 R 004704 BB
   0004 R 000000 COST         0004 R 000007 COSTA       0000 I 000001 I          0003   003720 IA      0000   000022 INJP$
   0000 I 000000 IX           0000 I 000002 J


00101              SUBROUTINE    BOWL
00103              COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104              COMMON/BLOCK2/ COST(7),COSTA(7)
00105              IX=53
00106              COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107               COST(1)=COST(1)*.001
00110              COST(2)= COST(1)*AA(IX,11)
00111              COST(3)= COST(1)*AA(IX,12)
00112              COST(4)= COST(1)*AA(IX,13)
00113              COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00114              COST(6)= COST(5)*AA(IX,15)
00115              DO 1 I=1,6
00120            1 COSTA(I)=COST(I)+COSTA(I)
00122              PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00131       1000    FORMAT(/25H SOLID BOWL CENTRIFUGE    ,F10.3,15H HORSEPOWER     ,10H
00131            1  SS       ,6F10.3)
00132              RETURN
00133              END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S CNTFGE,CNTFGE
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE CNTFGE     ENTRY POINT 000067

   STORAGE USED: CODE(1) 000074; DATA(0) 000033; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F      0001    000037 116G     0001    000051 125G     0003 R 000000 AA     0003 R 004704 BB
    0004 R 000000 COST        0004 R 000007 COSTA     0000 I 000001 I         0003   003720 IA     0000   000022 INJP$
    0000 I 000000 IX          0000 I 000002 J

00101      1*         SUBROUTINE CNTFGE
00103      2*         COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*         COMMON/BLOCK2/  COST(7), COSTA(7)
00105      4*         IX=54
00106      5*         COST(1)=  BB(1)*AA(54,7)*AA(54,17)**AA(54,8)
00107      6*          COST(1)=COST(1)*.001
00110      7*         COST(2)=  COST(1)* AA(54,11)
00111      8*         COST(3)=  COST(1)* AA(54,12)
00112      9*         COST(4)=  COST(1)* AA(54,13)
00113     10*         COST(5)=  COST(1) + COST(2) + COST(3)+COST(4)
00114     11*         COST(6)=  COST(5)* AA(54,15)
00115     12*         DO 1 I=1,6
00120     13*       1 COSTA(I) =COST(I) + COSTA(I)
00122     14*         PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00131     15*    1000  FORMAT(/25H DISK TYPE CENTRIFUGE    ,F10.3,15H HORSEPOWER    ,10H
00131     16*        1  SS        ,6F10.3)
00132     17*         RETURN
00133     18*         END

      END OF COMPILATION:          NO DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S BLENDR,BLENDR
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE BLENDR   ENTRY POINT 000070

   STORAGE USED: CODE(1) 000075; DATA(0) 000031; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F      0001    000040 115G     0001    000052 124G     0003 R 000000 AA     0003 R 004704 BB
    0004 R 000000 COST        0004 R 000007 COSTA     0000 I 000001 I         0003   003720 IA     0000   000021 INJP$
    0000 I 000000 IX          0000 I 000002 J


00101      1*          SUBROUTINE BLENDR
00103      2*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON /BLOCK2/ COST(7),COSTA(7)
00105      4*          IX = 57
00106      5*          COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107      6*          COST(2) = COST(1)*AA(IX,11)
00110      7*          COST(3) = COST(1)*AA(IX,12)
00111      8*          COST(4) = COST(1)*AA(IX,13)
00112      9*          COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00113     10*          COST(6) = COST(5)*AA(IX,15)
00114     11*          DO 1 I=1,6
00117     12*        1 COSTA(I)=COST(I)+COSTA(I)
00121     13*          PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00130     14*     1000 FORMAT(/25H SOLIDS BLENDER         ,F10.3,15H CUBIC FT / HR.,10H
00130     15*        C SST        ,6F10.3)
00131     16*          RETURN
00132     17*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S PMPREC,PMPREC
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE PMPREC     ENTRY POINT 000212

   STORAGE USED: CODE(1) 000217; DATA(0) 000107; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    ALOG
    0006    NEXP6$
    0007    NPRT$
    0010    NIO1$
    0011    NIO2$
    0012    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000005 1000F    0000    000022 1001F    0000    000037 1002F    0000    000054 1003F    0001    000054 11L
    0001    000060 12L      0001    000103 130G     0001    000135 14L      0001    000130 145G     0001    000151 15L
    0001    000144 155G     0001    000200 16L      0001    000160 165G     0001    000165 17L      0001    000174 175G
    0003 R  000000 AA       0003 R  004704 BB       0000 R  000002 CAST     0004 R  000000 COST     0004 R  000007 COSTA
    0000 R  000000 EXP      0000 I  000003 I        0003 I  003720 IA       0000    000076 INJP$    0000 I  000001 IX
    0000 I  000004 J

00101      1*          SUBROUTINE PMPREC
00103      2*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON /BLOCK2/ COST(7),COSTA(7)
00105      4*          IX = 65
00106      5*          AA(IX,17) = AA(IX,17)*0.001
00107      6*          EXP = AA(IX,8) + AA(IX,9)*LOG(AA(IX,17))
00110      7*          COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**EXP
00111      8*          IF(AA(IX,17) .LT. 0.1) COST(1) = 0.9
00113      9*          CAST = COST(1)
00114     10*          IF (IA(IX,1) - 1) 12,11,10
00117     11*     10   COST(1) = COST(1)*AA(IX,19)
00120     12*          GO TO 12
00121     13*     11   COST(1) = COST(1)*AA(IX,18)
00122     14*     12   COST(2) = COST(1)*AA(IX,11)
00123     15*          COST(3) = CAST*AA(IX,12)
00124     16*          COST(4) = COST(1)*AA(IX,13)
00125     17*          COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00126     18*          COST(6) = COST(5)*AA(IX,15)
00127     19*          DO 1 I=1,6
00132     20*        1 COSTA(I)=COST(I)+COSTA(I)
```

Table I.-- Continued.

```
00134            AA(IX,17) = 1000.0*AA(IX,17)
00135            IF(IA(IX,2) .EQ. 1) GO TO 17
00137            IF(IA(IX,1) - 1) 13,14,15
00142      13    PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00151            GO TO 16
00152      14    PRINT 1001,AA(IX,17),(COST(J),J=1,6)
00161            GO TO 16
00162      15    PRINT 1002,AA(IX,17),(COST(J),J=1,6)
00171            GO TO 16
00172      17    PRINT 1003,AA(IX,17),(COST(J),J=1,6)
00201      16    CONTINUE
00202      1000  FORMAT(/25H RECIPROCATING PUMP       ,F10.0,15H GPM TIMES PSI ,10H
00202          C STEEL     ,6F10.3)
00203      1001  FORMAT(/25H RECIPROCATING PUMP       ,F10.0,15H GPM TIMES PSI ,10H
00203          C BRONZE    ,6F10.3)
00204      1002  FORMAT(/25H RECIPROCATING PUMP       ,F10.0,15H GPM TIMES PSI ,10H
00204          C SST       ,6F10.3)
00205      1003  FORMAT(/25H FISH PUMPS               ,F10.0,15H GPM TIMES PSI ,10H
00205          C STEEL     ,6F10.3)
00206            RETURN
00207            END

      END OF COMPILATION:        NO DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S PMPCNT,PMPCNT
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE PMPCNT     ENTRY POINT 000212

   STORAGE USED: CODE(1) 000217; DATA(0) 000107; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    ALOG
    0006    NEXP6$
    0007    NPRT$
    0010    NIO1$
    0011    NIO2$
    0012    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000022 1000F      0000    000037 1001F      0000    000054 1002F      0000    000005 1003F      0001    000054 11L
    0001    000060 12L        0001    000103 130G       0001    000151 14L        0001    000130 145G       0001    000165 15L
    0001    000144 155G       0001    000200 16L        0001    000160 166G       0001    000135 17L        0001    000174 176G
    0003 R 000000 AA          0003 R 004704 BB          0000 R 000002 CAST        0004 R 000000 COST        0004 R 000007 COSTA
    0000 R 000000 EXP         0000 I 000003 I           0003 I 003720 IA          0000    000076 INJP$      0000 I 000001 IX
    0000 I 000004 J


00101      1*             SUBROUTINE PMPCNT
00103      2*             COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*             COMMON /BLOCK2/ COST(7),COSTA(7)
00105      4*             IX = 66
00106      5*             AA(IX,17) = AA(IX,17)*0.001
00107      6*             EXP = AA(IX,8) + AA(IX,9)*LOG(AA(IX,17))
00110      7*             COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**EXP
00111      8*             IF(AA(IX,17) .LT. 0.1) COST(1) = 0.4
00113      9*             CAST = COST(1)
00114     10*             IF (IA(IX,1) - 1) 12,11,10
00117     11*      10     COST(1) = COST(1)*AA(IX,19)
00120     12*             GO TO 12
00121     13*      11     COST(1) = COST(1)*AA(IX,18)
00122     14*      12     COST(2) = COST(1)*AA(IX,11)
00123     15*             COST(3) = CAST*AA(IX,12)
00124     16*             COST(4) = COST(1)*AA(IX,13)
00125     17*             COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00126     18*             COST(6) = COST(5)*AA(IX,15)
00127     19*             DO 1 I=1,6
00132     20*           1 COSTA(I)=COST(I)+COSTA(I)
```

Table I.--Continued.

```
00134                 AA(IX,17) = 1000.0*AA(IX,17)
00135                IF(IA(66,4).EQ.2) GO TO 17
00137                 IF(IA(IX,1) - 1) 13,14,15
00142          13     PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00151                 GO TO 16
00152           17   PRINT 1003,AA(IX,17),(COST(J),J=1,6)
00161                GO TO 16
00162        1003     FORMAT(/25H SEA WATER PUMPS            ,F10.3,15H GPM TIMES PSI ,10H
00162               1 BRONZE    ,6F10.3)
00163          14     PRINT 1001,AA(IX,17),(COST(J),J=1,6)
00172                 GO TO 16
00173          15     PRINT 1002,AA(IX,17),(COST(J),J=1,6)
00202          16     CONTINUE
00203        1000     FORMAT(/25H CENTRIFUGAL PUMP           ,F10.3,15H GPM TIMES PSI ,10H
00203               C STEEL     ,6F10.3)
00204         1001    FORMAT(/25H CENTRIFUGAL PUMP           ,F10.0,15H GPM TIMES PSI ,10H
00204               C BRONZE    ,6F10.3)
00205        1002     FORMAT(/25H CENTRIFUGAL PUMP           ,F10.3,15H GPM TIMES PSI ,10H
00205               C SST       ,6F10.3)
00206                 RETURN
00207                 END

      END OF COMPILATION:        NO DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S HEATEX,HEATEX
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE HEATEX     ENTRY POINT 000164

   STORAGE USED: CODE(1) 000171; DATA(0) 000101; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK2 000016
    0004    BLOCK1 005050

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001    000107 1001L     0001    000123 1002L    0000    000004 1010F    0000    000021 1011F    0000    000036 1013F
    0000    000053 1014F     0001    000025 11L      0001    000031 12L      0001    000060 126G     0001    000035 13L
    0001    000102 142G      0001    000116 152G     0001    000132 162G     0001    000145 174G     0001    000152 30L
    0001    000136 4L        0004 R  000000 AA       0004 R  004704 BB       0000 R  000001 CAST     0003 R  000000 COST
    0003 R  000007 COSTA     0000 I  000002 I        0004 I  003720 IA       0000    000071 INJP$    0000 I  000000 IX
    0000 I  000003 J

00101              SUBROUTINE HEATEX
00103              COMMON /BLOCK2/ COST(7),COSTA(7)
00104              COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00105              IX=67
00106              COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107              CAST = COST(1)
00110              IF (IA(67,1) - 1)  10,11,12
00113         10   GO TO 13
00114         11   COST(1) = COST(1)*AA(67,18)
00115              GO TO 13
00116         12   COST(1) = COST(1)*AA(67,19)
00117              GO TO 13
00120         13   COST(2) = COST(1)*AA(IX,11)
00121              COST(3) = CAST*AA(IX,12)
00122              COST(4) = COST(1)*AA(IX,13)
00123              COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00124              COST(6) = COST(5)*AA(IX,15)
00125              DO 1 I=1,6
00130          1   COSTA(I)=COST(I)+COSTA(I)
00130       C MATERIAL FACTORS IA(67,1) = 0,1,2  IMPLIES  SHELL/TUBE =ST/ST,ST/SST
00130       C AND SST/SST
```

Table I.-- Continued.

```
00132            IF(IA(67,4).EQ.4) GO TO 4
00134             IF (IA(67,1) - 1) 1000,1001,1002
00137     1000   PRINT 1010,AA(IX,17),(COST(J),J=1,6)
00146            GO TO 30
00147     1001   PRINT 1011,AA(IX,17),(COST(J),J=1,6)
00156            GO TO 30
00157     1002   PRINT 1013,AA(IX,17),(COST(J),J=1,6)
00166     1010   FORMAT(/25H HEAT EXCHANGER            ,F10.3,15H SURFACE SQ FT.,10H
00166          C ST/ST     ,6F10.3)
00167     1011   FORMAT(/25H HEAT EXCHANGER            ,F10.3,15H SURFACE SQ FT.,10H
00167          C ST/SST    ,6F10.3)
00170     1013   FORMAT(/25H HEAT EXCHANGER            ,F10.3,15H SURFACE SQ FT.,10H
00170          C SST/SST   ,6F10.3)
00171        4  PRINT 1014,AA(IX,17),(COST(J),J=1,6)
00200           GO TO 30
00201    1014   FORMAT(/25H VENT CONDENSER             ,F10.3,15H SURFACE SQ FT.,10H
00201          1 ST/SST    ,6F10.3)
00202      30    CONTINUE
00203            RETURN
00204            END

     END OF COMPILATION:        NO DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S BELT,BELT
FOR S9A-07/12-11:05 (1,)

   SUBROUTINE BELT      ENTRY POINT 000123

   STORAGE USED: CODE(1) 000130; DATA(0) 000041; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000004 1000F       0001    000071 124G       0001    000103 133G       0003 R 000000 AA       0003 R 004704 BB
    0004 R  000000 COST        0004 R  000007 COSTA      0000 I  000002 I          0003   003720 IA       0000   000027 INJP$
    0000 I  000000 IX          0000 I  000003 J          0000 R  000001 Q


00101      1*          SUBROUTINE     BELT
00103      2*          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON/BLOCK2/ COST(7),COSTA(7)
00105      4*           IX=70
00106      5*           Q=  AA(IX,7)
00107      6*           IF(AA(IX,18).GT.35.) AA(IX,7)=AA(IX,7)+ 80.
00111      7*           IF(AA(IX,18).GT.47.) AA(IX,7)=AA(IX,7)+ 210.
00113      8*     1000  FORMAT(/25H BELT CONVEYER              ,F10.3,15H FEET(LENGTH)   ,10H
00113      9*      1           ,6F10.3)
00114     10*          COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00115     11*           COST(1)=COST(1)*.001
00116     12*          COST(2)= COST(1)*AA(IX,11)
00117     13*          COST(3)= COST(1)*AA(IX,12)
00120     14*             COST(4)= COST(1)*AA(IX,13)
00121     15*          COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00122     16*          COST(6) = COST(5) * AA(IX,15)
00123     17*          DO 1 I = 1,6
00126     18*        1 COSTA(I) = COST(I) + COSTA(I)
00130     19*          PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00137     20*           AA(IX,7)=Q
00140     21*          RETURN
00141     22*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S BUCKET,BUCKET
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE BUCKET      ENTRY POINT 000134

   STORAGE USED: CODE(1) 000141; DATA(0) 000041; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003     BLOCK1 005050
    0004     BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005     NEXP6$
    0006     NPRT$
    0007     NIO1$
    0010     NIO2$
    0011     NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000004 1000F      0001   000102 124G      0001   000114 133G      0003 R 000000 AA       0003 R 004704 BB
    0004 R 000000 COST       0004 R 000007 COSTA      0000 I 000002 I        0003   003720 IA       0000   000027 INJP$
    0000 I 000000 IX         0000 I 000003 J          0000 R 000001 Q


00101      1*         SUBROUTINE BUCKET
00103      2*         COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*         COMMON/BLOCK2/ COST(7),COSTA(7)
00105      4*         IX=71
00106      5*          Q=  AA(IX,7)
00107      6*    1000  FORMAT(/25H BUCKET CONVEYER           ,F10.3,15H FEET(HEIGHT)  ,10H
00107      7*       1  SS        ,6F10.3)
00110      8*         IF(AA(IX,18).GT.30..AND.AA(IX,18).LE.75.)  AA(IX,7)=AA(IX,7)+180.
00112      9*          IF(AA(IX,18).GT.75.) AA(IX,7)=AA(IX,7)+ 280.
00114     10*         COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00115     11*          COST(1)=COST(1)*.001
00116     12*         COST(2)= COST(1)*AA(IX,11)
00117     13*         COST(3)= COST(1)*AA(IX,12)
00120     14*         COST(4)= COST(1)*AA(IX,13)
00121     15*         COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00122     16*         COST(6)= COST(5)*AA(IX,15)
00123     17*         DO 1 I=1,6
00126     18*       1 COSTA(I)=COST(I)+COSTA(I)
00130     19*          PRINT 1000, AA(IX,I7),(COST(J),J=1,6)
00137     20*          AA(IX,7)=Q
00140     21*         RETURN
00141     22*         END

     END OF COMPILATION:          NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S SCALE,SCALE
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE SCALE     ENTRY POINT 000116

   STORAGE USED: CODE(1) 000123; DATA(0) 000036; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   BLOCK1 005050
    0004   BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005   NPRT$
    0006   NIO1$
    0007   NIO2$
    0010   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000   000005 1000F      0001   000066 126G      0001   000100 135G      0003 R 000000 AA      0003 R 004704 BB
    0004 R 000000 COST       0004 R 000007 COSTA     0000 I 000003 I         0003   003720 IA      0000   000025 INJP$
    0000 I 000002 IS         0000 I 000000 IX        0000 I 000004 J         0000 R 000001 SIZE


00101    1*          SUBROUTINE  SCALE
00103    2*          COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104    3*          COMMON/BLOCK2/  COST(7),COSTA(7)
00105    4*          IX=72
00106    5*    1000  FORMAT(/ 25H SCALE                    ,F10.3,15H TONS           ,10H
00106    6*        1  SS       ,6F10.3)
00107    7*          SIZE=AA(IX,17)
00110    8*          IS = SIZE/17.9
00111    9*          IF(IS.EQ.1)  COST(1)=AA(72,20)*BB(1)
00113   10*          IF(IS.EQ.2)  COST(1)=AA(72,18)*BB(1)
00115   11*          IF(IS.EQ.3)  COST(1)=AA(72,19)*BB(1)
00117   12*          COST(2)=      AA(72,11) * COST(1)
00120   13*          COST(3)= 0.00
00121   14*          COST(4)= AA(IX,13)*COST(1)
00122   15*          COST(5)= COST(1)+COST(2)+COST(3) +COST(4)
00123   16*          COST(6)=COST(1)*AA(IX,15)
00124   17*          COST(7)=0.
00125   18*          DO 1  I=1,7
00130   19*        1 COSTA(I)=COST(I)+COSTA(I)
00132   20*          PRINT 1000 , AA(IX,17),(COST(J),J=1,6)
00141   21*          RETURN
00142   22*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S AGITOR,AGITOR
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE AGITOR     ENTRY POINT 000073

   STORAGE USED: CODE(1) 000100; DATA(0) 000033; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F     0001    000043 116G     0001    000055 125G     0003 R 000000 AA     0003 R 004704 BB
    0004 R 000000 COST      0004 R 000007 COSTA    0000 I 000001 I        0003   003720 IA     0000   000022 INJP$
    0000 I 000000 IX        0000 I 000002 J


00101     1*        SUBROUTINE AGITOR
00103     2*        COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104     3*        COMMON/BLOCK2/ COST(7),COSTA(7)
00105     4*        IX=73
00106     5*        COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107     6*         COST(1)=COST(1)*.001
00110     7*        COST(2)= COST(1)*AA(IX,11)
00111     8*        COST(3)= COST(1)*AA(IX,12)
00112     9*        COST(4)= COST(1)*AA(IX,13)
00113    10*        COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00114    11*        COST(6)= COST(5)*AA(IX,15)
00115    12*        DO 1 I=1,6
00120    13*      1 COSTA(I)=COST(I)+COSTA(I)
00122    14*        PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00131    15*   1000 FORMAT(/ 25H AGITATOR-PROPELLAR      ,F10.3,15H HORSEPOWER     ,10H
00131    16*     1  SS        ,6F10.3)
00132    17*        RETURN
00133    18*        END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S BALMIL,BALMIL
FOR S9A-07/12-11:06 (0,)

   SUBROUTINE BALMIL     ENTRY POINT 000072

   STORAGE USED: CODE(1) 000077; DATA(0) 000031; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F      0001    000042 1166       0001    000054 125G       0003 R 000000 AA       0003 R 004704 BB
    0004 R 000000 COST        0004 R 000007 COSTA       0000 I 000001 I           0003   003720 IA       0000   000021 INJP$
    0000 I 000000 IX          0000 I 000002 J


00101      1*            SUBROUTINE BALMIL
00103      2*            COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*            COMMON /BLOCK2/ COST(7),COSTA(7)
00105      4*            IX = 74
00106      5*            COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107      6*            COST(1) = COST(1)*AA(IX,18)
00110      7*            COST(2) = COST(1)*AA(IX,11)
00111      8*            COST(3) = COST(1)*AA(IX,12)
00112      9*            COST(4) = COST(1)*AA(IX,13)
00113     10*            COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00114     11*            COST(6) = COST(5)*AA(IX,15)
00115     12*            DO 1 I=1,6
00120     13*          1 COSTA(I)=COST(I)+COSTA(I)
00122     14*            PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00131     15*       1000 FORMAT(/25H BALL MILL                 ,F10.3,15H TONS PER HR.   ,10H
00131     16*          C SST      ,6F10.3)
00132     17*            RETURN
00133     18*            END

      END OF COMPILATION:         NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S BAGGMA,BAGGMA
FOR S9A-07/12-11:06 (0,)

   SUBROUTINE BAGGMA     ENTRY POINT 000125

   STORAGE USED: CODE(1) 000132; DATA(0) 000051; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F      0000    000020 1001F      0001    000053 120G      0001    000070 130G      0001    000107 140G
    0003 R  000000 AA         0003 R  004704 BB         0004 R  000000 COST      0004 R  000007 COSTA     0000 I  000001 I
    0003 I  003720 IA         0000    000037 INJP$      0000 I  000000 IX        0000 I  000002 J


00101      1*           SUBROUTINE BAGGMA
00103      2*           COMMON/BLOCK1/ AA(100,20).IA(100,5),BB(100)
00104      3*           COMMON/BLOCK2/ COST(7),COSTA(7)
00105      4*            IX=75
00106      5*            IF(IA(75,2).EQ.2) AA(75,7)=AA(75,1)
00110      6*           COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00111      7*            COST(1)=COST(1)*.001
00112      8*           COST(2)= COST(1)*AA(IX,11)
00113      9*           COST(3)= COST(1)*AA(IX,12)
00114     10*           COST(4)= COST(1)*AA(IX,13)
00115     11*           COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00116     12*           COST(6)= COST(5)*AA(IX,15)
00117     13*           DO 1 I=1,6
00122     14*         1 COSTA(I)=COST(I)+COSTA(I)
00124     15*            IF(IA(IX,1) .EQ. 0) PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00134     16*           IF(IA(IX,1).EQ.1)PRINT 1001,AA(IX,17),(COST(J),J=1,6)
00144     17*      1000 FORMAT(/ 25H BAGGING MACHINE           ,F10.3,15H BAGS/MIN      ,10H
00144     18*          1  SS        ,6F10.3)
00145     19*     1001  FORMAT(/ 25H CANNING MACHINE           ,F10.3,15H CANS/MIN      ,10H
00145     20*          CSST        ,6F10.3)
00146     21*           RETURN
00147     22*           END

     END OF COMPILATION:          NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S FILTER,FILTER
FOR S9A-07/12-11:06 (0,)

   SUBROUTINE FILTER     ENTRY POINT 000072

   STORAGE USED: CODE(1) 000077; DATA(0) 000031; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F       0001    000042 116G      0001    000054 125G      0003 R 000000 AA       0003 R 004704 BB
    0004 R 000000 COST         0004 R 000007 COSTA      0000 I 000001 I          0003   003720 IA       0000   000021 INJP$
    0000 I 000000 IX           0000 I 000002 J


00101               SUBROUTINE FILTER
00103               COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104               COMMON /BLOCK2/ COST(7),COSTA(7)
00105               IX= 78
00106               COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107               COST(1) = COST(1)*AA(IX,18)
00110               COST(2) = COST(1)*AA(IX,11)
00111               COST(3) = COST(1)*AA(IX,12)
00112               COST(4) = COST(1)*AA(IX,13)
00113               COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00114               COST(6) = COST(5)*AA(IX,15)
00115               DO 1 I=1,6
00120             1 COSTA(I)=COST(I)+COSTA(I)
00122               PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00131          1000 FORMAT(/25H ROT. DRUM FILTER          ,F10.3,15H SURFACE SQ.FT.,10H
00131             C SST        ,6F10.3)
00132               RETURN
00133               END

      END OF COMPILATION:         NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S CRANES,CRANES
FOR S9A-07/12-11:06 (0,)

   SUBROUTINE CRANES    ENTRY POINT 000141

   STORAGE USED: CODE(1) 000146; DATA(0) 000063; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NI01$
    0010    NI02$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F      0000    000020 1001F      0000    000035 1002F      0001    000026 11L        0001    000032 12L
    0001    000055 123G       0001    000073 135G       0001    000100 14L        0001    000107 145G       0001    000114 15L
    0001    000123 155G       0001    000127 16L        0003 R 000000 AA          0003 R 004704 BB          0004 R 000000 COST
    0004 R 000007 COSTA       0000 I 000001 I           0003 I 003720 IA          0000    000053 INJP$      0000 I 000000 IX
    0000 I 000002 J


00101                     SUBROUTINE CRANES
00103                     COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104                     COMMON /BLOCK2/ COST(7),COSTA(7)
00105                     IX= 80
00106                     COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107                     IF (IA(80,1) - 1) 12,11,10
00112          10         COST(1) = COST(1)*AA(IX,19)
00113                     GO TO 12
00114          11         COST(1) = COST(1)*AA(IX,18)
00115          12         COST(2) = COST(1)*AA(IX,11)
00116                     COST(3) = COST(1)*AA(IX,12)
00117                     COST(4) = COST(1)*AA(IX,13)
00120                     COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00121                     COST(6) = COST(5)*AA(IX,15)
00122                     DO 1 I=1,6
00125               1     COSTA(I)=COST(I)+COSTA(I)
00127                     IF (IA(80,1) - 1) 13,14,15
00132          13         PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00141                     GO TO 16
00142          14         PRINT 1001,AA(IX,17),(COST(J),J=1,6)
00151                     GO TO 16
00152          15         PRINT 1002,AA(IX,17),(COST(J),J=1,6)
```

Table I.--Continued.

```
00161     23*     16     CONTINUE
00162     24*     1000   FORMAT(/25H OVERHEAD CRANE 20FT SPAN,F10.3,15H TONS LIFT     ,10H
00162     25*          C STEEL     ,6F10.3)
00163     26*     1001   FORMAT(/25H OVERHEAD CRANE 30FT SPAN,F10.3,15H TONS LIFT     ,10H
00163     27*          C STEEL     ,6F10.3)
00164     28*     1002   FORMAT(/25H OVERHEAD CRANE 40FT SPAN,F10.3,15H TONS LIFT     ,10H
00164     29*          C STEEL     ,6F10.3)
00165     30*            RETURN
00166     31*            END

        END OF COMPILATION:          NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S DRAGMA,DRAGMA
FOR S9A-07/12-11:06 (0,)

   SUBROUTINE DRAGMA    ENTRY POINT 000143

   STORAGE USED: CODE(1) 000151; DATA(0) 000051; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F     0001    000110 141G     0001    000122 150G     0001    000026 2L       0001    000050 3L
    0003 R  000000 AA        0003 R  004704 BB       0004 R  000000 COST     0004 R  000007 COSTA    0000 I  000002 I
    0003    003720 IA        0000    000036 INJP$    0000 I  000000 IX       0000 R  000001 Q


00101              SUBROUTINE DRAGMA
00103              COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104              COMMON/BLOCK2/  COST(7),COSTA(7)
00105              IX=81
00106              Q=  AA(IX,7)
00107              IF(AA(81,18).GT.15.)  GO TO 2
00111              AA(81,11)= 0.27
00112              AA(81,12)= 0.42
00113              IF(AA(81 ,18).LE.13.) AA(81,7)=7.
00115              GO TO 3
00116            2 CONTINUE
00117              IF(AA(81,18).LE.20.)  AA(81,7)=10.
00121              IF(AA(81,18).LE.18.)  AA(81,7)=9.
00123              AA(81,11)=0.278
00124              AA(81,12)=0.382
00125            3 CONTINUE
00126         1000 FORMAT(/ 25H DRAG CONVEYER          ,F10.3,15H FEET            ,10H
00126            1 SS       ,6F10.3)
00127              COST(1)=BB(1)*AA(81,7)*AA(81,17)**AA(81,8)
00130              COST(1)=COST(1)*.001
00131              COST(2)= COST(1)* AA(IX,11)
00132              COST(3)= COST(1)* AA(IX,12)
00133              COST(4)= COST(1)* AA(IX,13)
00134              COST(5)=COST(1)+COST(2)+COST(3)+COST(4)
```

Table I.-- Continued.

```
00135     25*          AA(IX,15)=.1
00136     26*        COST(7)=0.
00137     27*          COST(6)= COST(1)*AA(IX,15)
00140     28*          DO 1 I=1,7
00143     29*        1 COSTA(I) = COSTA(I) +COST(I)
00145     30*          PRINT 1000,  AA(IX,17), (COST(I),I=1,6)
00154     31*          AA(IX,7)=Q
00155     32*          RETURN
00156     33*          END

     END OF COMPILATION:         NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S REFRIG,REFRIG
FOR S9A-07/12-11:06 (0,)

   SUBROUTINE REFRIG    ENTRY POINT 000120

   STORAGE USED: CODE(1) 000125; DATA(0) 000031; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NEXP6$
    0006    NPRT$
    0007    NIO1$
    0010    NIO2$
    0011    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1000F     0001    000036 11L     0001    000042 12L     0001    000070 126G     0001    000045 13L
    0001    000102 135G      0003 R  000000 AA      0003 R  004704 BB      0004 R  000000 COST     0004 R  000007 COSTA
    0000 I  000001 I         0003 I  003720 IA      0000    000021 INJP$   0000 I  000000 IX       0000 I  000002 J


00101      1*             SUBROUTINE REFRIG
00103      2*             COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*             COMMON /BLOCK2/ COST(7),COSTA(7)
00105      4*             IX =85
00106      5*             COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107      6*             IF (IA(85,1) .GT. 40) GO TO 13
00111      7*             IF (IA(85,1) .GT. 20) GO TO 11
00113      8*             IF (IA(85,1) .GT.  1) GO TO 12
00115      9*      11     COST(1) = COST(1)*AA(85,18)
00116     10*             GO TO 13
00117     11*      12     COST(1) = COST(1)*AA(85,13)
00120     12*      13     COST(2) = COST(1)*AA(IX,11)
00121     13*             COST(3) = COST(1)*AA(IX,12)
00122     14*             COST(4) = COST(1)*AA(IX,13)
00123     15*             COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00124     16*             COST(6) = COST(5)*AA(IX,15)
00125     17*             DO 1 I=1,6
00130     18*         1   COSTA(I)=COST(I)+COSTA(I)
00132     19*             PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00141     20*      1000   FORMAT(/25H MECHANICAL REFRIGERAT.   ,F10.3,15H TONS          ,10H
00141     21*          C           ,6F10.3)
00142     22*             RETURN
00143     23*             END
```

Table I.--Continued.

```
END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S MATER,MATER
FOR S9A-07/12-11:06 (0,)

   SUBROUTINE MATER      ENTRY POINT 000113

   STORAGE USED: CODE(1) 000121; DATA(0) 000151; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003     BLOCK1 005050

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004     NPRT$
    0005     NIO2$
    0006     NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001     000002 105G       0000    000005 1050F      0000    000020 1051F      0000    000031 1052F      0000    000045 1053F
    0000     000061 1054F      0000    000075 1055F      0000    000106 1056F      0000    000117 1057F      0000    000130 1058F
    0003 R   000000 AA         0000 R  000003 ASH        0003 R  004704 BB         0000 I  000000 I          0003    003720 IA
    0000     000141 INJP$      0000 R  000001 OIL        0000 R  000002 PROT       0000 R  000004 WATER
```

```
00101                SUBROUTINE MATER(TONS)
00103                COMMON/BLOCK1/AA(100,20),IA(100,5),BB(100)
00104                DO 10 I=30,32
00107         10     BB(I)=BB(I)*100.0
00111                PRINT 1050
00113         1050   FORMAT(1H1//20X33H MATERIAL AND ENERGY INFORMATION ,//5X8H GENERA
00113             CL)
00114                PRINT 1051,TONS
00117         1051   FORMAT(/8X26H FISH                          =,F9.3,9H TONS/DAY)
00120                OIL  =TONS*BB(30)*0.01
00121                PROT =TONS*BB(31)*0.01
00122                ASH  =TONS*BB(32)*0.01
00123                PRINT 1052,BB(30),OIL
00127                PRINT 1053,BB(31),PROT
00133                PRINT 1054,BB(32),ASH
00137         1052   FORMAT(/8X10H OF WHICH ,F6.2,12H  PERCENT OR,F8.3,20H  - '' -  IS
00137             C OIL      )
00140         1053   FORMAT( 8X10H           ,F6.2,12H   - ''-  OR,F8.3,20H  - ''-
00140             C PROTEIN)
00141         1054   FORMAT( 8X10H           ,F6.2,12H   - ''-  OR,F8.3,20H  - ''-
00141             C ASH      )
00142                PRINT 1055,AA(27,17)
00145         1055   FORMAT(//8X26H PROCESS STEAM              =,F8.0,7H LB/HR )
00146               WATER=AA(90,10)
00147                PRINT 1056,WATER
00152         1056   FORMAT(/8X26H PROCESS COOLING WATER    =,F8.0,7H GAL/HR )
```

Table I.--Continued.

```
00153     27*             PRINT 1057,AA(90,2)
00156     28*      1057   FORMAT(/8X26H ELECTRICITY                 ,F8.0,7H KWHR  )
00157     29*             PRINT 1058
00161     30*      1058   FORMAT(///5X23H EQUIPMENT FLOW RATES      )
00162     31*             RETURN
00163     32*             END

     END OF COMPILATION:          NO  DIAGNOSTICS.
```

Table I.--Continued.

```
@FOR,S CAPTOL,CAPTOL
FOR S9A-07/12-11:06 (0,)

   SUBROUTINE CAPTOL     ENTRY POINT 000111

   STORAGE USED: CODE(1) 000113; DATA(0) 000073; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050
    0004    BLOCK2 000016

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005    NPRT$
    0006    NIO2$
    0007    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000003 1001F      0000     000012 1002F      0000     000021 1003F      0000     000030 1004F      0000     000037 1005F
    0000    000046 1020F      0000     000055 2000F      0000     000056 2001F      0003 R 000000 AA         0003     004704 BB
    0004    000000 COST       0004 R 000007 COSTA      0000 R 000001 COSTT      0000 R 000000 COSTTT     0000 R 000002 DOSTT
    0003    003720 IA         0000     000066 INJP$


00101      1*           SUBROUTINE CAPTOL(TONS)
00103      2*           COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104      3*           COMMON/BLOCK2/       COST(7),COSTA(7)
00105      4*      1001 FORMAT(//,25X,20H EQUIPMENT           ,F10.3)
00106      5*      1002 FORMAT(//,25X,20H SPARE PARTS         ,F10.3)
00107      6*      1003 FORMAT(//,25X,20H FACILITIES          ,F10.3)
00110      7*      1004 FORMAT(//,25X,20H ENGINEERING         ,F10.3)
00111      8*      1005 FORMAT(//,25X,20H CONTINGENCIES       ,F10.3,//)
00112      9*      1020 FORMAT(//,25X,20H TOTAL CAPITOL COSTS,F10.3,//)
00113     10*      2000 FORMAT(1H1)
00114     11*      2001 FORMAT(20X,30H SUMMARY OF FIXED COSTS        ,//)
00115     12*           PRINT 2000
00117     13*           PRINT 2001
00121     14*           COSTTT=0.
00122     15*           COSTT=COSTA(5)
00123     16*           PRINT 1001,COSTT
00126     17*           COSTTT=COSTT+COSTTT
00127     18*           COSTT=.02*COSTA(1)
00130     19*           PRINT 1002,COSTT
00133     20*           COSTTT=COSTT+COSTTT
00134     21*           COSTT=AA(100,9)
00135     22*           PRINT 1003,COSTT
00140     23*           COSTTT=COSTT+COSTTT
00141     24*           COSTT=COSTTT*AA(98,1)
00142     25*           PRINT 1004, COSTT
```

Table I.--Continued.

```
00145     26*           COSTTT=COSTT+COSTTT
00146     27*           DOSTT=COSTTT*AA(98,2)
00147     28*           PRINT 1005,DOSTT
00152     29*           COSTTT=DOSTT+COSTTT
00153     30*           AA(100,10)=COSTTT
00154     31*           PRINT 1020,AA(100,10)
00157     32*           RETURN
00160     33*           END

       END OF COMPILATION:          NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S FASCIL,FASCIL
FOR S9A-07/12-11:06 (0,)

   SUBROUTINE FASCIL     ENTRY POINT 000530

   STORAGE USED: CODE(1) 000536; DATA(0) 000365; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004    NPRT$
    0005    NIO2$
    0006    NIO1$
    0007    SQRT
    0010    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000025 1000F     0000     000037 1001F     0000     000077 1010F     0000     000112 1020F     0000     000125 1030F
    0000     000140 1040F     0000     000153 1050F     0000     000161 1060F     0000     000173 1070F     0000     000205 1080F
    0000     000220 1090F     0000     000226 1100F     0000     000240 1110F     0000     000252 1120F     0000     000264 1130F
    0000     000276 1140F     0001     000022 115G      0001     000044 132G      0001     000052 140G      0001     000110 154G
    0001     000123 164G      0001     000155 200G      0000     000325 2000F     0001     000170 210G      0001     000235 227G
    0001     000250 237G      0001     000336 272G      0000     000311 3012F     0001     000351 302G      0001     000442 344G
    0001     000455 354G      0001     000472 366G      0001     000511 401G      0001     000504 90L       0003 R 000000 AA
    0000 R 000016 ACRE       0003 R 004704 BB         0000 R 000024 BUILD      0000 R 000000 COST       0000 R 000006 COSTT
    0000 R 000022 DOCK       0000 R 000017 FENCE      0003   003720 IA         0000   000354 INJP$      0000 I 000014 IZ
    0000 I 000015 J          0000 I 000021 NOCK       0000 R 000020 PAVE       0000 R 000023 WARE

00101                SUBROUTINE FASCIL(TONS)
00103                COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104                DIMENSION COST(6).COSTT(6)
00105                IZ = BB(91)
00106                PRINT 1000
00110          1000 FORMAT(1H1//14X43H-COST OF FACILITIES AND SITE DEVELOPMENT     )
00111                PRINT 1001
00113          1001  FORMAT(//25X85H   UNIT                          NUMBER      BASE        LA
00113              CBOR      INDIRECT     TOTAL      RANGE     ,/25X85H    COST
00113              C         OF UNITS    COST        COSTS       COSTS       COSTS       + OR - )
00114                DO 1 J=1,6
00117                COST(J)= 0.0
00120           1    COSTT(J) = 0.0
00122               ACRE=.0050*TONS
00123                COST(2) = AA(99,3)*ACRE
00124                COST(5) = COST(2)
00125                COST(6) = COST(5)*AA(99,2)
00126                PRINT 1010,AA(99,3),ACRE ,(COST(J),J=2,6)
```

```
00136   1010  FORMAT(/25H LAND                         ,F10.3,15H PER ACRE       ,6F1
00136        C0.3)
00137         DO 10 J =2,6
00142   10    COSTT(J) = COST(J)+COSTT(J)
00144         FENCE = 4*SQRT(ACRE*0.0434)
00145         COST(2) =FENCE*AA(99,4)
00146         COST(3) =COST(2)*AA(99,5)
00147         COST(4) =COST(2)*AA(99,1)
00150         COST(5) =COST(2)+COST(3)+COST(4)
00151         COST(6) = COST(5)*AA(99,2)
00152         COST(1) = COST(5)/FENCE
00153         DO 20      J=2,6
00156   20   COSTT(J)=COST(J)+COSTT(J)
00160         PRINT 1020,COST(1),FENCE,(COST(J),J=2,6)
00170         PAVE =0.333*ACRE*43.56
00171         COST(2) =PAVE*AA(99,6)
00172         COST(3) =COST(2)*AA(99,7)
00173         COST(4) =COST(2)*AA(99,1)
00174         COST(5) =COST(2)+COST(3)+COST(4)
00175         COST(6) = COST(5)*AA(99,2)
00176         COST(1) = COST(5)/PAVE
00177         DO 30 J=2,6
00202   30    COSTT(J) =COST(J) +COSTT(J)
00204         PRINT 1030,COST(1),PAVE,(COST(J),J=2,6)
00214   1020  FORMAT(/25H      FENCING                ,F10.3,15H PER 1000 FT    ,6F1
00214        C0.3)
00215   1030  FORMAT(/25H      PAVING                 ,F10.3,15H PER 1000 SQ.FT,6F1
00215        C0.3)
00216         NOCK = TONS/500.  +1
00217           DOCK = 2.4*NOCK
00220         COST(2)=DOCK*AA(99,8)
00221         COST(3)=COST(2)*AA(99,9)
00222         COST(4)=COST(2)*AA(99,1)
00223         COST(5)=COST(2)+COST(3)+COST(4)
00224         COST(6)=COST(5)*AA(99,2)
00225         COST(1) = COST(5)/DOCK
00226         DO 40 J=2,6
00231   40    COSTT(J) =COST(J)+COSTT(J)
00233         PRINT 1040,COST(1),DOCK,(COST(J),J=2,6)
00243   1040  FORMAT(//25H DOCK FACILITIES         ,F10.3,15H PER 1000 SQ.FT,6F1
00243        C0.3)
00244         PRINT 1050
00246   1050  FORMAT(/25H BULK STORAGE WAREHOUSE    , )
00247         PRINT 1060,AA(99,10)
00252   1060  FORMAT( 25H      ELECTRICAL WIRING      ,F10.3,15H PER 1000SQ.FT   )
00253         PRINT 1070,AA(99,11)
00256   1070  FORMAT( 25H      FIRE PREVENTION EQP.,F10.3,15H PER 1000SQ.FT   )
00257         IF(IZ .EQ. 1) WARE = 0.015*TONS
00261         IF(IZ .GT. 1) WARE = 0.003*TONS
00263         COST(2) =WARE*(AA(99,10)+AA(99,11)+AA(99,12))
00264         COST(3)=COST(2)*AA(99,13)
00265         COST(4)=COST(2)*AA(99,1)
00266         COST(5)=COST(2)+COST(3)+COST(4)
00267         COST(6)=COST(5)*AA(99,2)
00270         COST(1) = COST(5)/WARE
00271         DO 80 J= 2,6
00274   80    COSTT(J) =COST(J)+COSTT(J)
```

Table I.-- Continued.

```
00276          PRINT 1080,COST(1),WARE,(COST(J),J=2,6)
00306    1080  FORMAT(/25H   TOTAL WAREHOUSE        ,F10.3,15H PER 1000 SQ.FT,6F1
00306         C0.3)
00307          PRINT 1090
00311    1090  FORMAT(/25H PROCESS BUILDING         )
00312          PRINT 1100,AA(99,14)
00315          PRINT 1110,AA(99,15)
00320          PRINT 1120,AA(99,16)
00323          PRINT 1130,AA(99,17)
00326    1100  FORMAT(25H     ELECTRICAL WIRING     ,F10.3,15H PER 1000 SQ.FT )
00327    1110  FORMAT(25H     HEATING AND VENTIL.   ,F10.3,15H PER 1000 SQ.FT )
00330    1120  FORMAT(25H     PLUMBING(GENERAL)     ,F10.3,15H PER 1000 SQ.FT )
00331    1130  FORMAT(26H     FIRE PREVENTION EQUIP,F 9.3,15HPER 1000 SQ.FT  )
00332          BUILD =0.013*TONS
00333          IF(BUILD .LE. 2) BUILD = 2.0
00335          COST(2) =AA(99,18)*BUILD
00336          COST(3) =COST(2)*AA(99,19)
00337          COST(4) =COST(2)*AA(99,1)
00340          COST(5) =COST(2)+COST(3)+COST(4)
00341          COST(6) =COST(5)*AA(99,2)
00342          COST(1) = COST(5)/BUILD
00343          DO 140  J=2,6
00346    140   COSTT(J) = COST(J) +COSTT(J)
00350          PRINT 1140,COST(1),BUILD,(COST(J),J=2,6)
00360    1140  FORMAT(/25H   TOTAL BUILDING COSTS   ,F10.3,15H PER 1000 SQ.FT,6F1
00360         C0.3)
00361          IF(IZ .EQ. 1) GO TO 90
00363           COST(1)      =150.
00364          COST(5)=COST(1)
00365          DO 150  J=2,6
00370    150   COSTT(J) = COST(J) +COSTT(J)
00372          PRINT 3012,  COST(1),COST(5)
00376    3012  FORMAT(/45H LABORATORY CONTROL INSTRUMENTATION           ,15X,F10.
00376         C3,20X,F10.3)
00377    90    PRINT 2000,(COSTT(J),J=2,6)
00405    2000  FORMAT(//25H TOTAL FACILITIES        ,35X5F10.3)
00406          AA(100,9)=COSTT(5)
00407          RETURN
00410          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S OPERAT,OPERAT
FOR S9A-07/12-11:06 (3,)

   SUBROUTINE OPERAT    ENTRY POINT 001242

   STORAGE USED: CODE(1) 001253; DATA(0) 000757; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004    NPRT$
    0005    NIO2$
    0006    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000127 1001F     0000     000142 1002F     0000     000155 1003F     0000     000170 1004F     0000     000203 1005F
    0000     000214 1006F     0000     000242 1007F     0000     000255 1008F     0000     000270 1009F     0001     001226 101L
    0000     000300 1010F     0000     000310 1011F     0000     000320 1012F     0000     000330 1013F     0000     000374 1018F
    0000     000407 1019F     0000     000341 1020F     0000     000227 106F      0000     000352 1104F     0000     000363 1105F
    0001     000022 114G      0000     000065 2000F     0000     000422 2001F     0000     000453 2002F     0000     000460 2003F
    0000     000467 2004F     0000     000476 2005F     0000     000505 2006F     0000     000515 2007F     0000     000524 2008F
    0000     000533 2009F     0000     000544 2010F     0000     000554 2011F     0000     000563 2012F     0000     000572 2013F
    0000     000601 2014F     0000     000610 2015F     0000     000110 2020F     0000     000117 2021F     0001     000230 3L
    0000     000066 3000F     0001     000511 330G      0001     000136 4L        0000     000617 4000F     0000     000625 4001F
    0000     000643 4002F     0000     000653 4003F     0000     000663 4005F     0000     000673 4006F     0000     000706 4007F
    0001     000233 5L        0001     000447 60L       0000     000077 6000F     0001     000565 71L       0001     000572 72L
    0001     000572 75L       0001     000572 76L       0003 R   000000 AA        0003 R   004704 BB        0000 R   000064 BYPROD
    0000 R   000052 CANS      0000 R   000053 CAST      0000 R   000000 CST       0000 R   000024 CSTT      0000 R   000063 FPC
    0003     003720 IA        0000     000741 INJP$     0000 I   000050 IZ        0000 I   000051 J         0000 R   000060 YCONC
    0000 R   000054 YCOST     0000 R   000062 YHTM      0000 R   000055 YMEAL     0000 R   000061 YOIL      0000 R   000057 YPAST
    0000 R   000056 YSOL


00101                  SUBROUTINE  OPERAT(TONS)
00101            C SUMMARY OF MATERIAL FLOW STREAMS.UNDER THE INDEX AA(90,I)
00101            C    1=FUEL OIL  2=POWER     3=FISH MEAL  4=FISH SOL. 5= FISH OIL
00101            C    8=MAN HRS   9=CITY WATER
00101            C   13=ANIOXID. 14=SULPH.ACID
00103                  COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104                  DIMENSION CST(20),CSTT(20)
00105                  IZ = BB(91)
00106                  PRINT 2000
00110             2000 FORMAT(1H1)
00111                  PRINT 2001
00113                  DO 10 J=1,20
00116                  CST(J)=0.0
00117               10 CSTT(J)=0.0
```

Table I.--Continued.

```
00276            PRINT 1080,COST(1),WARE,(COST(J),J=2,6)
00306       1080 FORMAT(/25H   TOTAL WAREHOUSE        ,F10.3,15H PER 1000 SQ.FT,6F1
00306          C0.3)
00307            PRINT 1090
00311       1090 FORMAT(/25H PROCESS BUILDING         )
00312            PRINT 1100,AA(99,14)
00315            PRINT 1110,AA(99,15)
00320            PRINT 1120,AA(99,16)
00323            PRINT 1130,AA(99,17)
00326       1100 FORMAT(25H      ELECTRICAL WIRING    ,F10.3,15H PER 1000 SQ.FT )
00327       1110 FORMAT(25H      HEATING AND VENTIL.  ,F10.3,15H PER 1000 SQ.FT )
00330       1120 FORMAT(25H      PLUMBING(GENERAL)    ,F10.3,15H PER 1000 SQ.FT )
00331       1130 FORMAT(26H      FIRE PREVENTION EQUIP,F 9.3,15HPER 1000 SQ.FT  )
00332            BUILD =0.013*TONS
00333            IF(BUILD .LE. 2) BUILD = 2.0
00335            COST(2) =AA(99,18)*BUILD
00336            COST(3) =COST(2)*AA(99,19)
00337            COST(4) =COST(2)*AA(99,1)
00340            COST(5) =COST(2)+COST(3)+COST(4)
00341            COST(6) =COST(5)*AA(99,2)
00342            COST(1) = COST(5)/BUILD
00343            DO 140  J=2,6
00346       140  COSTT(J) = COST(J) +COSTT(J)
00350            PRINT 1140,COST(1),BUILD,(COST(J),J=2,6)
00360       1140 FORMAT(/25H   TOTAL BUILDING COSTS  ,F10.3,15H PER 1000 SQ.FT,6F1
00360          C0.3)
00361            IF(IZ .EQ. 1) GO TO 90
00363             COST(1)       =150.
00364            COST(5)=COST(1)
00365            DO 150  J=2,6
00370       150  COSTT(J) = COST(J) +COSTT(J)
00372            PRINT 3012,  COST(1),COST(5)
00376       3012 FORMAT(/45H LABORATORY CONTROL INSTRUMENTATION           ,15X,F10.
00376          C3,20X,F10.3)
00377       90   PRINT 2000,(COSTT(J),J=2,6)
00405       2000 FORMAT(//25H TOTAL FACILITIES        ,35X5F10.3)
00406            AA(100,9)=COSTT(5)
00407            RETURN
00410            END

      END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S OPERAT,OPERAT
FOR S9A-07/12-11:06 (3,)

   SUBROUTINE OPERAT    ENTRY POINT 001242

   STORAGE USED: CODE(1) 001253; DATA(0) 000757; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    BLOCK1 005050

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004    NPRT$
    0005    NIO2$
    0006    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000     000127 1001F     0000     000142 1002F     0000     000155 1003F     0000     000170 1004F     0000     000203 1005F
    0000     000214 1006F     0000     000242 1007F     0000     000255 1008F     0000     000270 1009F     0001     001226 101L
    0000     000300 1010F     0000     000310 1011F     0000     000320 1012F     0000     000330 1013F     0000     000374 1018F
    0000     000407 1019F     0000     000341 1020F     0000     000227 106F      0000     000352 1104F     0000     000363 1105F
    0001     000022 114G      0000     000065 2000F     0000     000422 2001F     0000     000453 2002F     0000     000460 2003F
    0000     000467 2004F     0000     000476 2005F     0000     000505 2006F     0000     000515 2007F     0000     000524 2008F
    0000     000533 2009F     0000     000544 2010F     0000     000554 2011F     0000     000563 2012F     0000     000572 2013F
    0000     000601 2014F     0000     000610 2015F     0000     000110 2020F     0000     000117 2021F     0001     000230 3L
    0000     000066 3000F     0001     000511 330G      0001     000136 4L        0000     000617 4000F     0000     000625 4001F
    0000     000643 4002F     0000     000653 4003F     0000     000663 4005F     0000     000673 4006F     0000     000706 4007F
    0001     000233 5L        0001     000447 60L       0000     000077 6000F     0001     000565 71L       0001     000572 72L
    0001     000572 75L       0001     000572 76L       0003 R   000000 AA        0003 R   004704 BB        0000 R   000064 BYPROD
    0000 R   000052 CANS      0000 R   000053 CAST      0000 R   000000 CST       0000 R   000024 CSTT      0000 R   000063 FPC
    0003     003720 IA        0000     000741 INJP$     0000 I   000050 IZ        0000 I   000051 J         0000 R   000060 YCONC
    0000 R   000054 YCOST     0000 R   000062 YHTM      0000 R   000055 YMEAL     0000 R   000061 YOIL      0000 R   000057 YPAST
    0000 R   000056 YSOL


00101                 SUBROUTINE  OPERAT(TONS)
00101         C SUMMARY OF MATERIAL FLOW STREAMS.UNDER THE INDEX AA(90,I)
00101         C    1=FUEL OIL  2=POWER    3=FISH MEAL   4=FISH SOL. 5= FISH OIL
00101         C    8=MAN HRS    9=CITY WATER
00101         C   13=ANIOXID. 14=SULPH.ACID
00103                 COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104                 DIMENSION CST(20),CSTT(20)
00105                 IZ = BB(91)
00106                 PRINT 2000
00110          2000   FORMAT(1H1)
00111                 PRINT 2001
00113                 DO 10 J=1,20
00116                 CST(J)=0.0
00117            10   CSTT(J)=0.0
```

Table I.--Continued.

```
00121            CST(1) = TONS*BB(5)*20.0
00122            PRINT 1001,TONS,CST(1)
00126            CST(2) = AA(90,1)*BB(10)
00127            PRINT 1002,AA(90,1),CST(2)
00133            CST(3) =AA(90,2)*BB(6)*0.01
00134            PRINT 1003,AA(90,2),CST(3)
00140          CST(4)=AA(90,14)*BB(14)
00141            IF(IZ     .EQ. 1) PRINT 1004,AA(90,14),CST(4)
00146          IF(IZ     .EQ. 3) PRINT 1004,AA(90,14),CST(4)
00153          IF(IZ.NE.3.AND.IZ.NE.4) GO TO 4
00155          CST(16)=AA(90,17)*BB(10)
00156          PRINT 3000,AA(90,17),CST(16)
00162     4    CST(15)=AA(90,12)*BB(41)
00163  3000    FORMAT(/25H 5N SODIUM HYDROXIDE      ,F8.0,8H LB      ,5XF8.2)
00164            IF(IZ .EQ. 3) PRINT 1105,AA(90,12),CST(15)
00171            IF(IZ .EQ. 4) PRINT 1105,AA(90,12),CST(15)
00176            CST(14) = AA(90,15)*BB(16)
00177            IF(IZ .EQ. 3) PRINT 1104,AA(90,15),CST(14)
00204            IF(IZ .EQ. 4) PRINT 1104,AA(90,15),CST(14)
00211          IF(IZ .EQ. 3) GO TO 3
00213          IF(IZ .EQ. 4) GO TO 3
00215          CST(5)=AA(90,13)*BB(13)
00216          GO TO 5
00217        3 CST(5)=AA(90,13)*BB(44)
00220      5   CONTINUE
00221          PRINT 1005,AA(90,13),CST(5)
00225          CST(6)=AA(75,17)*BB(15)
00226          PRINT 1006,AA(75,17),CST(6)
00232          CANS=0.0
00233          CANS=AA(75,4)*BB(15)
00234          IF(AA(75,4).GT.0) PRINT 106,AA(75,4),CANS
00241          CST(6)=CST(6)+CANS
00242            CST(7) =AA(90,9)*BB(9)
00243            PRINT 1007,AA(90,9),CST(7)
00247            CST(8) =AA(90,8)*BB(7)
00250            PRINT 1008,AA(90,8),CST(8)
00254            CST(9) =AA(100,10)*BB(8)*0.1/3
00255            PRINT 1009,CST(9)
00260            CST(10) =AA(100,10)/30.
00261            PRINT 1010,CST(10)
00264            CST(11)=CST(8)*0.15
00265            PRINT 1011,CST(11)
00270            CST(12) =CST(10)
00271   6000   FORMAT(25H BOILER WATER TREATMENT  ,21XF8.2,12XF6.2,//)
00272          CAST=3.3
00273          PRINT 6000,CAST
00276            PRINT 1012,CST(12)
00301            CST(13) =CST(8)*0.30
00302            PRINT 1013,CST(13)
00305            IF(IZ.NE.2.AND.IZ.NE.6.AND.IZ.NE.7)  GO TO 60
00307            CST(18)  =AA(90,18)*BB(18)
00310            AA(90,18)=AA(90,18)*2000.
00311            PRINT 1018,AA(90,18),CST(18)
00315            CST(19)  =AA(90,19) * BB(19)
00316            AA(90,19)=AA(90,19)*2000.
00317             PRINT 1019,  AA(90,19),CST(19)
00323     60     CONTINUE
```

Table I.--Continued.

```
00324           YCOST =(CST(1)+CST(2)+CST(3)+CST(4)+CST(5)+CST(6)+CST(7))*BB(50)+
00324         C(CST(8)+CST(9)+CST(10)+CST(11)+CST(12)+CST(13))*360.0 +(CST(14) +
00324         C CST(15)+CST(16)+CST(17)+CST(18))*BB(50)
00325           YCOST=(CST(19)*BB(50)) + YCOST
00326          YCOST=YCOST+CAST*BB(50)
00327          DO 20 J=2,20
00332           CST(J) =CST(J-1) + CST(J)
00333    20     CSTT(J) =CSTT(J-1)+CSTT(J)
00335          CST(20)=CST(20)+CAST
00336           PRINT 1020,CST(20)
00341           PRINT 2002
00343           IF(IZ.NE.2.AND.IZ.NE.6)  GO TO 76
00345           IF(IZ.NE.6)  GO TO 71
00347    2020   FORMAT(/15X14H HTM FISH MEAL,F8.3,10H TONS/DAY )
00350          AA(90,20)=AA(90,20)/2000.
00351          PRINT 2020,AA(90,20)
00354           GO TO 75
00355      71   IF(IZ.NE.2)  GO TO 72
00357           GO TO 75
00360      72   CONTINUE
00361      76   CONTINUE
00362      75   CONTINUE
00363           IF(IZ      .EQ. 1) PRINT 2003,AA(90,3)
00367           IF(IZ      .GT. 1) PRINT 2011,AA(90,3)
00373           IF(IZ .EQ. 1) PRINT 2004,AA(90,4)
00377           IF(IZ.GT.2.AND.IZ.LT.6)  PRINT 2012,AA(90,6)
00403           IF(IZ.EQ.7)  PRINT 2004,AA(90,4)
00407          IF(IZ.EQ.2) PRINT 2004,AA(90,4)
00413           IF(IZ .GT. 1) PRINT 2013,AA(90,7)
00417           PRINT 2005,AA(90,5)
00422           YMEAL = AA(90,3)*BB(50)
00423           YSOL  = AA(90,4)*BB(50)
00424           YPAST = AA(90,6)*BB(50)
00425           YCONC = AA(90,7)*BB(50)
00426           YOIL  = AA(90,5)*BB(50)
00427          YHTM=AA(90,20)*BB(50)
00430          IF(IZ.EQ.6)  PRINT 2021,YHTM
00434           IF(IZ      .EQ. 1) PRINT 2006,YMEAL
00440           IF(IZ      .GT. 1) PRINT 2010,YMEAL
00444           IF(IZ .EQ. 1) PRINT 2007,YSOL
00450          IF(IZ.GT.2.AND.IZ.LT.6) PRINT 2014,YPAST
00454          IF(IZ.EQ.2) PRINT 2007,YSOL
00460           IF(IZ.EQ.7)  PRINT 2007,YSOL
00464           IF(IZ .GT. 1) PRINT 2015,YCONC
00470    2021   FORMAT(/15X 14H HTM FISH MEAL,F8.0,11H TONS/YEAR  )
00471           PRINT 2008,YOIL
00474           PRINT 2009,YCOST
00477    1001   FORMAT(/25H FISH                      ,F8.0,8H TONS     ,5XF8.2,12XF6
00477         C.2)
00500    1002   FORMAT(/25H FUEL OIL                  ,F8.0,8H GALLONS,5XF8.2,12XF6
00500         C.2)
00501    1003   FORMAT(/25H ELECTRICITY               ,F8.0,8H KWHR     ,5XF8.2,12XF6
00501         C.2)
00502    1004   FORMAT(/25H SULPHURIC ACID            ,F8.0,8H LB       ,5XF8.2,12XF6
00502         C.2)
00503   1005   FORMAT(/25H ANTIOXIDANT               ,F8.2,8H LB       ,5XF8.2)
00504    1006  FORMAT(/25H PACKAGING                 ,F8.0,8H BAGS     ,5XF8.2,12XF6.
```

Table I.--Continued.

```
00504          C2)
00505     106   FORMAT(/25H PACKAGING                ,F8.0,8H CANS    ,5XF8.2,12XF6.
00505          C2)
00506    1007   FORMAT(/25H CITY WATER               ,F8.0,8H GALLONS.5XF8.2,12XF6
00506          C.2)
00507    1008   FORMAT(/25H LABOR AND SUPERVISION    ,F8.0,8H MAN HR..5XF8.2,12XF6
00507          C.2,//)
00510    1009   FORMAT(/25H DEPRECIATION             ,21XF8.2,12XF6.2)
00511    1010   FORMAT(/25H MAINTENANCE              ,21XF8.2,12XF6.2)
00512    1011   FORMAT(/25H PAYROLL EXTRAS           ,21XF8.2,12XF6.2)
00513    1012   FORMAT(/25H INSURANCE AND TAXES      ,21XF8.2,12XF6.2)
00514    1013   FORMAT(/25H OVERHEAD                 ,21XF8.2,12XF6.2,//)
00515    1020   FORMAT(/25H     TOTAL OPERATING COSTS,21XF8.2,12XF6.2,//)
00516    1104   FORMAT(/25H CALCIUM HYDROXIDE        ,F8.0,8H LB      ,5XF8.2)
00517    1105   FORMAT(/25H ENZYME                   ,F8.0,8H LB      ,5XF8.2)
00520    1018   FORMAT(/25H ISOPROPYL ALCOHOL        ,F8.0,8H POUNDS ,5XF8.2,12XF6
00520          C.2)
00521    1019   FORMAT(/25H PHOSPHORIC ACID          ,F8.0,8H POUNDS ,5XF8.2,12XF6
00521          C.2)
00522    2001   FORMAT( 20X,17H OPERATING COSTS  ,//75H      COST ITEM
00522          CQUANTITY USED   COST IN DOLLARS                          ,/43X30H PER D
00522          CAY                           )
00523    2002   FORMAT(/20X,17H PRODUCTION RATE )
00524    2003   FORMAT(/15X12H FISH MEAL  ,F10.3,10H TONS/DAY )
00525    2004   FORMAT(/15X12H FISH SOL.  ,F10.3,10H TONS/DAY )
00525   C
00526    2005   FORMAT(/15X12H FISH OIL   ,F10.3,10H TONS/DAY )
00527    2006   FORMAT(//15X12H FISH MEAL  ,F10.0,11H TONS/YEAR )
00530    2007   FORMAT(/15X 12H FISH SOL.  ,F10.0,11H TONS/YEAR )
00531    2008   FORMAT(/15X 12H FISH OIL   ,F10.0,11H TONS/YEAR )
00532    2009   FORMAT(/20X24H YEARLY OPERATING COST =,F12.6,8H DOLLARS )
00533   2010   FORMAT(//15X12H BONE MEAL  ,F10.0,11H TONS/YEAR )
00534   2011   FORMAT(/15X12H BONE MEAL  ,F10.3,10H TONS/DAY )
00535    2012   FORMAT(/15X12H FISH PASTE ,F10.3,10H TONS/DAY )
00536    2013   FORMAT(/15X12H DRY CONC.  ,F10.3,10H TONS/DAY )
00537    2014   FORMAT(/15X 12H FISH PASTE ,F10.0,11H TONS/YEAR )
00540    2015   FORMAT(/15X 12H DRY CONC.  ,F10.0,11H TONS/YEAR )
00541           IF(IZ .EQ. 1) GO TO 101
00543          PRINT 4000
00545   4000   FORMAT(/20X,24H PRODUCTION COST OF FPC )
00546          PRINT 4001
00550   4001   FORMAT(74H BY-PRODUCT             PRICE(CENTS/POUND)          TOTAL WO
00550         CRTH(DOLLARS/YEAR) )
00551          YMEAL=YMEAL*2000.*BB(66)/100.
00552          IF(YMEAL.GT.0) PRINT 4002,BB(66),YMEAL
00557   4002   FORMAT(/25H BONE MEAL                ,F8.1,13XE12.6)
00560          YOIL=YOIL*2000.*BB(67)/100.
00561          PRINT 4003,BB(67),YOIL
00565   4003   FORMAT(/25H FISH OIL                 ,F8.1,13XE12.6)
00566          YSOL=YSOL*2000.*BB(68)/100.
00567          IF(IZ.EQ.2.OR.IZ.EQ.7) PRINT 4005,BB(68),YSOL
00574   4005   FORMAT(/25H FISH SOLUBLES            ,F8.1,13XE12.6)
00575          YCONC=YCONC*2000.+.50*YPAST*2000.
00576          FPC=(YCOST/YCONC)*100.
00577          PRINT 4006,FPC
00602   4006   FORMAT(/20X,32H FPC COST WITHOUT BY-PRODUCTS   ,F8.1,13H CENTS/POU
00602         CND )
```

Table I.-- Continued.

```
00603            BYPROD=YOIL+YSOL+YMEAL+YPAST
00604            YCOST=YCOST-BYPROD
00605            FPC=(YCOST/YCONC)*100.
00606            PRINT 4007,FPC
00611      4007  FORMAT(/20X,32H FPC COST WITH BY-PRODUCTS          ,F8.1,13H CENTS/POU
00611           CND )
00612       101   RETURN
00613             END

          END OF COMPILATION:       NO  DIAGNOSTICS.
```

Table I.-- Continued.

```
@FOR,S LIBRE,LIBRE
FOR S9A-07/12-11:06 (1,)

   SUBROUTINE LIBRE      ENTRY POINT 001077

   STORAGE USED: CODE(1) 001106; DATA(0) 000247; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   DATA1  000050
    0004   BLOCK1 005050

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0004 R 000000 AA       0004 R 004704 BB       0003 R 000000 DATB     0004   003720 IA       0000   000230 INJP$


00101            SUBROUTINE LIBRE
00103            COMMON/ DATA1 / DATB(8,5)
00104            COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      C IDENTIFICATION OF DATA STORED IN LIBRARY SUBROUTINE
00104      C
00104      C EQUIPMENT INDEX NUMBERS
00104      C
00104      C        6= CONICAL HOPPER                   CALLED BY SUB. HOPPER
00104      C       11= PULVERISER                       CALLED BY SUB. PULVER
00104      C       17= SCREW CONVEYER                   CALLED BY SUB. SCREWR
00104      C       18= HAMMER MILL                      CALLED BY SUB. HAMMER
00104      C       19= DRUM DRYER                       CALLED BY SUB. DRYER
00104      C       20= PAN DRYER                        CALLED BY SUB. DRYERP
00104      C       21= ROTARY VACUUM DRYER              CALLED BY SUB. DRYERR
00104      C       27= BOILER                           CALLED BY SUB. BOILER
00104      C       30= SPRAY EVAPORATOR                 CALLED BY SUB. EVPSPR
00104      C       31= WIPED FILM EVAPORATOR            CALLED BY SUB. EVPFLM
00104      C       32= FORCED CIRCULATION EVAPORAT.CALLED BY SUB. EVPFRC
00104      C       33= VERTICAL EVAPORATOR              CALLED BY SUB. EVPHOR
00104      C       40= SHOP FAB. STORAGE TANK           CALLED BY SUB. STORAG
00104      C       42  PRESSURE VESSEL                  CALLED BY SUB. VESSEL
00104      C       43= DISTILLATION COLUMN              CALLED BY SUB. COLUMN
00104      C       49= JACKETED REACTING VESSEL         CALLED BY SUB. REACTR
00104      C       50= FISH GRINDER                     CALLED BY SUB. GRINDR
00104      C       51= VIBRATING SCREEN                 CALLED BY SUB. SCREEN
00104      C       52= SHARPLES CENTRIFUGE              CALLED BY SUB. SHARP
00104      C       53= SOLID BOWL CENTRIFUGE            CALLED BY SUB. BOWL
00104      C       54= V-BASKET CENTRIFUGE              CALLED BY SUB. CNTFGE
00104      C       57= FREE FLOWING SOL. BLENDER        CALLED BY SUB. BLENDR
00104      C       65= RECIPROCAL PUMPS                 CALLED BY SUB. PMPREC
```

Table I.--Continued.

```
00104    C       66= CENTRIFUGAL PUMPS              CALLED BY SUB  PMPCNT
00104    C       67= SHELL-TUBE HEAT EXCHANGERS     CALLED BY SUB. HEATEX
00104    C       70= BELT CONVEYER                  CALLED BY SUB. BELT
00104    C       71= BUCKET CONVEYER                CALLED BY SUB. BUCKET
00104    C       72= SCALE                          CALLED BY SUB. SCALE
00104    C       73= AGITATOR-PROPELLAR             CALLED BY SUB. AGITOR
00104    C       74= BALL MIL                       CALLED BY SUB. BALMIL
00104    C       75= BAGGING MACHINE                CALLED BY SUB. BAGGMA
00104    C       78= ROTARY DRUM FILTER             CALLED BY SUB. FILTER
00104    C       80= OVERHEAD CRANE                 CALLED BY SUB. CRANES
00104    C       81= DRAG CONVEYER                  CALLED BY SUB  DRAGMA
00104    C       85= MECHANICA REFRIGERATION        CALLED BY SUB. REFRIG
00104    C       99= FASCILITIES                    CALLED BY SUB. FASCIL
00104    C
00104    C GENERAL IDENTIFICATION OF THE STORED DATA.
00104    C     THE FOLLOWING DATA WILL IN MOST CASES BE STORED UNDER THE IDENTIF-
00104    C     YING INDEX NUMBER FOR EACH IDOM OF EQUIPMENT. VARIATIONS OR ADDI-
00104    C     TIONS TO THIS PATTERN ARE EXPLAINED UNDER THE RESPECTIVE HEADINGS.
00104    C
00104    C       AA(IX,7) = UNIT COST
00104    C       AA(IX,8) = EXPONENT OF COST EQUATION
00104    C       AA(IX,11) = FIELD MATERIALS COST FACTOR
00104    C       AA(IX,12) = DIRECT LABOR COST FACTOR
00104    C       AA(IX,13) = INDIRECT COST FACTOR
00104    C       AA(IX,15) = UNCERTAINTY FACTOR FOR BARE MODULE COST
00104    C
00104    C CONICAL HOPPERS. SIZE UNIT CUBIC FEET. REF GUTHRIE
00105            AA(6,7) = 0.010
00106            AA(6,8) = 0.68
00107            AA(6,11) = 0.04
00110            AA(6,12) = 0.01
00111            AA(6,13) = 0.42
00112            AA(6,15) = 0.10
00113            AA(6,18) = 2.40
00113    C FISH STORAGE
00114            AA(7,7)= 0.9
00115            AA(7,8) = 0.9
00116            AA(7,11)= 0.0
00117            AA(7,12) =0.10
00120            AA(7,13)=.4
00121            AA(7,15)=0.1
00121    C BAROMETRIC CONDENSER AND SCRUBBERS
00122            AA(8,7) = 20.
00123            AA(8,8) = 1.0
00124            AA(8,11) = 0.33
00125            AA(8,12) = 0.33
00126            AA(8,13) = 0.33
00127            AA(8,15)= 0.1
00127    C PULVERIZER
00130            AA(11, 7)=  520.
00131            AA(11, 8)=  .35
00132            AA(11,11)=  .272
00133            AA(11,12)=  .318
00134            AA(11,13)=.4
00135            AA(11,15)=  .1
00135    C SCREW CONVEYER
00136            AA(17, 7)=  1000.0
```

Table I.--Continued.

```
00137          AA(17, 8)=  .9
00140          AA(17,11)=  .272
00141          AA(17,12)=  .318
00142          AA(17,13)=  .4
00143          AA(17,15)=  .1
00143   C HAMMER MILL SIZE + COST DATA. REF GUTHRIE
00143   C SIZE UNIT = TON PER HOUR
00144          AA(18,7) = 0.5
00145          AA(18,8) = 0.85
00146          AA(18,11) = 0.27
00147          AA(18,12) = 0.431
00150          AA(18,13) = 0.44
00151          AA(18,15) = 0.10
00151   C DRUM DRYER
00152          AA(19, 7)=  3000.
00153          AA(19, 8)=  .38
00154          AA(19,11)=  .279
00155          AA(19,12)=  .461
00156          AA(19,13)=  .4
00157          AA(19,15)=  .1
00157   C PAN DRYER
00160          AA(20,7 )=  1900.
00161          AA(20, 8)=  .38
00162          AA(20,11)=  .279
00163          AA(20,12)=  .461
00164          AA(20,13)=  .4
00165          AA(20,15)=  .1
00165   C ROTARY VACUUM  DRYER
00166          AA(21, 7)=  2500.
00167          AA(21, 8)=  .45
00170          AA(21,11)=  .279
00171          AA(21,12)=  .20
00172          AA(21,13)=  .16
00173          AA(21,15)=  .1
00173   C BOILER
00174          AA(27, 7)=  395.5
00175          AA(27, 8)=  .5
00176          AA(27,11)=  .19
00177          AA(27,12)=  .15
00200          AA(27,13)=  .2
00201          AA(27,15)=  .1
00201   C SPRAY EVAPORATOR SIZE UNTT = LB OF WATER EVAP. PER HR
00201   C PRAY AND FILM EVAP.  INCLUDE SCRUBBERS AND BAR. CONDENSRS. BASE
00201   C COST FROM CHEM. ENG. FEB. 9, 1970, OTHER FACTORS EQ. TO EVAP. FROM
00201   C GUTHRIE
00202          AA(30,7) = 0.050
00203          AA(30,8) = 1.0
00204          AA(30,11) = 0.66
00205          AA(30,12) = 0.24
00206          AA(30,13) = 0.42
00207          AA(30,15) = 0.10
00207   C WIPED FILM EVAPORATORS  SIZE UNIT = SQ. FT AREA
00210          AA(31,7)=0.9
00211          AA(31,8) = 0.31
00212          AA(31,11) = 0.66
00213          AA(31,12) = 0.24
00214          AA(31,13) = 0.42
```

Table I.-- Continued.

```
00215        AA(31,15) = 0.10
00215  C FORCED CIRCULATION EVAPORATORS  SIZE UNIT= SQ FT  REF GUTHRIE
00216        AA(32,7)=0.6
00217        AA(32,8) = 0.70
00220        AA(32,11) =0.66
00221        AA(32,12) = 0.24
00222        AA(32,13) = 0.42
00223        AA(32,15) = 0.10
00224        AA(32,18) = 2.40
00224  C VERTICAL EVAPORATORS  SIZE UNIT = SQ. FT.  REF. GUTHRIE
00225        AA(33,7) =.12
00226        AA(33,8) = 0.53
00227        AA(33,11) = 0.66
00230        AA(33,12) = 0.24
00231        AA(33,13) = 0.42
00232        AA(33,15) = 0.10
00233        AA(33,18) = 2.40
00233  C STORAGE TANK SIZE AND COST DATA. REF GUTHRIE
00233  C SIZE UNITS 100 GAL CAPACITY . MATRIAL FACTOR INDEX 18 = SST
00234        AA(40,7) = 0.88
00235        AA(40,8) = 0.31
00236        AA(40,11) = 0.20
00237        AA(40,12) = 0.27
00240        AA(40,13) = 0.49
00241        AA(40,15) = 0.10
00242        AA(40,18) = 3.2
00242  C STORAGE TANK FROM 1000 GAL TO 40000 GAL CAPACITY  STEEL + SST  REF GUT
00242  C HRIE. SIZE UNITS 100-DS GAL
00243        AA(41,7) = 0.5
00244        AA(41,8) = 0.35
00245        AA(41,11) = 0.38
00246        AA(41,12) = 0.10
00247        AA(41,13) = 0.49
00250        AA(41,15) = 0.10
00251        AA(41,18) = 3.2
00251  C  PRESSURE VESSEL
00251  C     FOR THE PRESSURE VESSEL(IA(42,3) DETERMINES THE METAL,IA(42,2) = 1
00251  C     IMPLIES VERTICAL CONSTRUCTION(AA(42,18) IS THE DIAMETER,AA(42,19)
00251  C     IS THE HIGHT
00252        AA(42, 1)=  3.67
00253        AA(42, 2)=  2.25
00254        AA(42, 3)=  1.0
00255        AA(42,15)=  .1
00255  C DISTILLATION COLUMN
00255  C    THE METAL,AA(43,20) THE WIDTH,AA(43,18) THE TRAY SEPARATION,
00255  C    AA(43,17) THE HEIGHT
00255  C    DETERMINES THE WIDTH
00256        AA(43, 4)=  0.4
00257        AA(43, 5)=  1.8
00260        AA(43,15)=  .1
00261        AA(43,1)= 1.7
00262        AA(43,8) =1.0
00263        AA(43,11)= .3
00264        AA(43,12)= .4
00265        AA(43,13)= .4
00266        AA(43,15)= .1
00266  C JACKETED REACTOR VESSEL   UNIT COST 3*TANK COST DATA GUTHRIE. SIZE=GAL
```

Table I.--Continued.

```
00267          AA(49,7) = 0.240
00270          AA(49,8) = 0.35
00271          AA(49,11) = 0.38
00272          AA(49,12)= 0.10
00273          AA(49,13)= 0.49
00274          AA(49,15)= 0.10
00275          AA(49,18)= 3.20
00275   C FISH GRINDER  BASED ON 3 TON/HR UNIT COST OF 18300 DOLLARS. OTHER FAC-
00275   C TORS AS FOR BALL MILL
00276          AA(50,7) = 2.54
00277          AA(50,8) =  0.65
00300          AA(50,11) = 0.54
00301          AA(50,12) = 0.195
00302          AA(50,13) = 0.42
00303          AA(50,15) = 0.10
00304          AA(50,18) = 2.4
00304   C VIBRATING SCREEN FILTERS. SINGLE. SIZE UNIT = SURFACE AREA. REF GUTH.
00305          AA(51,7) = 0.7
00306          AA(51,8) = 0.58
00307          AA(51,11) = 0.27
00310          AA(51,12) = 0.05
00311          AA(51,13) = 0.42
00312          AA(51,15) = 0.10
00313          AA(51,18) = 2.40
00313   C SHARPLES CENTRIFUGE
00314          AA(52,7)=5200.
00315          AA(52, 8)=  .68
00316          AA(52,11)=  .26
00317          AA(52,12)=  .34
00320          AA(52,13)=  .4
00321          AA(52,15)=  .1
00321   C SOLID BOWL CENTRIFUGE
00322          AA(53, 7)=  1900.
00323          AA(53,8)=   .73
00324          AA(53,11)=  .26
00325          AA(53,12)=  .34
00326          AA(53,13)=  .4
00327          AA(53,15)=  .1
00327   C VERTICAL BASKET CENTRIFUGE
00330          AA(54, 7)=  620.
00331          AA(54, 8)=  1.
00332          AA(54,11)=  .26
00333          AA(54,12)=  .194
00334          AA(54,13)=  .4
00335          AA(54,15)=  .1
00335   C FLOWING SOLIDS BLENDER  SIZE UNIT =FT**3/HR  UNIT NORMALIZED TO GIVE
00335   C   A COST OF 15000 FOR 750 FT**3/HR POWERED BY 25 HP MOTOR
00336          AA(57,7) = 0.47
00337          AA(57,8) = 0.52
00340          AA(57,11) =0.48
00341          AA(57,12) =0.13
00342          AA(57,13) = 0.42
00343          AA(57,15) = 0.10
00343   C CENTRIFUGAL AND RECP. PUMPS ARE COST FITED BY A QUADRATIC EQ. IN TERMS
00343   C OF LOG(SIZE). (REF. GUTHRIE)  SIZE UNIT = GPM*PSI. THE EQ IS:
00343   C   LOG(COST)= LOG(UNIT COST) + EXP*LOG(SIZE) + BEXP*LOG(SIZE)**2
00343   C   UNIT COST = AA(IX,7)  EXP = AA(IX,8)   BEXP=AA(IX,9)
```

Table I.-- Continued.

```
00343      C
00343      C  CENTRIFUGAL PUMPS. MATERIAL FACTOR  IA(66,1)=0/1/2 =FE/BRONZE/SST
00343      C  AA(66,18)=BRONZE FACTOR, AA(66,19)= SST FACTOR
00344               AA(66,7) =0.5
00345               AA(66,8) =0.174
00346               AA(66,9) =0.049
00347               AA(66,11) =0.71
00350               AA(66,12) =0.35
00351               AA(66,13) =0.44
00352               AA(66,15) =0.10
00353               AA(66,18) = 1.28
00354               AA(66,19) = 1.93
00354      C  RECIPROCATING PUMPS, SAME AS FO CENTRIFUGAL (REF GUTHRIE)
00355               AA(65,7) = 3.2
00356               AA(65,8) = 0.281
00357               AA(65,9) = 0.0335
00360               AA(65,11) = 0.71
00361               AA(65,12) = 0.70
00362               AA(65,13) = 0.89
00363               AA(65,15) = 0.10
00364               AA(65,18) = 1.25
00365               AA(65,19) = 2.10
00365      C COST AND SIZE VALUES FOR SHELL-TUBE HEAT EXCHANGERS. REF GUTHRIE
00365      C SIZE UNITS ARE SQ. FT OF SURFACE AREA
00366               AA(67,7) = 0.113
00367               AA(67,8) = 0.622
00370               AA(67,11) = 0.714
00371               AA(67,12) = 0.63
00372               AA(67,13) = 0.947
00373               AA(67,15) = 0.17
00373      C MATERIAL FACTORS FOR HEAT EXCHANGERS, SHELL/TUBE. INDEX 18 = ST/SST
00373      C INDEX 19 = SST/SST  REF GUTHRIE
00374               AA(67,18) = 2.25
00375               AA(67,19) = 3.26
00375      C BELT CONVEYER
00376               AA(70, 7)=  540.
00377               AA(70, 8)=  .65
00400               AA(70,11)=  .27
00401               AA(70,12)=  .39
00402               AA(70,13)=  .4
00403               AA(70,15)=  .1
00403      C BUCKET CONVEYER
00404               AA(71, 7)=  220.
00405               AA(71, 8)=  .65
00406               AA(71,11)=  .278
00407               AA(71,12)=   .562
00410               AA(71,13)=  .4
00411               AA(71,15)=  .1
00411      C SCALE
00412               AA(72,20)= 4.0
00413               AA(72,18)=    7.2
00414               AA(72,19)=  8.55
00415               AA(72,11)=0.08
00416               AA(72,13)=0.4
00417               AA(72,15)= 0.1
00417      C AGITATOR
00420               AA(73, 7)=  350.
```

Table I.--Continued.

```
00421         AA(73, 8)=  .5
00422         AA(73,11)=  .276
00423         AA(73,12)=  .344
00424         AA(73,13)=  .4
00425         AA(73,15)=  .1
00425   C BALL MILL COST DATA. MATERIAL FACTOR INDEX=18. SIF TONS/HR REF GUTHRIE
00426         AA(74,7) = 0.55
00427         AA(74,8) = 0.65
00430         AA(74,11) = 0.54
00431         AA(74,12) = 0.195
00432         AA(74,13) = 0.42
00433         AA(74,15) = 0.10
00434         AA(74,18) = 2.4
00434   C BAGGING MACHINE
00435         AA(75,7)=3300.
00436         AA(75,8)=0.8
00437         AA(75,11)=.40
00440         AA(75,12)=0.11
00441         AA(75,13)=  .4
00442         AA(75,15)=.1
00443         AA(75,1)=1000.
00443   C ROTARY DRUM FILTERS. SIZE UNITS SQ.FT. SURFACE REF GUTHRIE
00444         AA(78,7) = 1.40
00445         AA(78,8) = 0.63
00446         AA(78,11) = 0.47
00447         AA(78,12) = 0.13
00450         AA(78,13) = 0.42
00451         AA(78,15) = 0.10
00452         AA(78,18) = 2.4
00452   C OVERHEAD CRANES. IA(80,1)= INDEX FOR SPAN  0=20FT;1=30FT;2=40FT. SPAN
00452   C   UNIT SIZE FACTORS ARE  AA(80,18)=30FT ; AA(80,19)=40FT .SIZE UNIT=TONS
00453         AA(80,7) =1.2
00454         AA(80,8) =0.60
00455         AA(80,11) = 0.46
00456         AA(80,12) = 0.12
00457         AA(80,13) = 0.42
00460         AA(80,15) = 0.10
00461         AA(80,18) = 1.6
00462         AA(80,19) = 2.0
00462   C  DRAG CONVEYER
00463         AA(81,7)=9.
00464         AA(81,8)=.8
00465         AA(81,13)    =.4
00466         AA(81,15)=  .1
00466   C MECANICAL REFRIGERATION. SIZE UNITS= TONS.
00466   C   COOLING TEMP. INDEX = IA(85,1) WHICH SHOULD CONTAIN TEMP. IN DEG F
00466   C   AA(85,18) THEN CONTAINS FACTOR FOR 20  AA(85,19) FOR 0 DEG
00467         AA(85,7) =2.9
00470         AA(85,8) = 0.70
00471         AA(85,11) =0.17
00472         AA(85,12) =0.14
00473         AA(85,13) =0.11
00474         AA(85,15) =0.10
00475         AA(85,18) =1.95
00476         AA(85,19) =2.25
00476   C COST OF FACILITIES  INDEX= 99  DETAIL INDEX IDENTIFIES SEP. IDOMS
00476   C 1= FACILITIES.INDIRECTS 2=FASCILITIES CERTAINTY RANGE 3=COST OF LAND
```

Table I.--Continued.

```
00476   C PER ACRE  4=COST OF FENCE/1000 FT 5=LABOR FACTOR FENCE 6 = COST OF PAV
00476   C MENT/1000 FT**2  7=LABOR FACTOR PAVEMENT  8= COST OF DOCK 9=COST OF CO
00476   C STRUCT LABOR , 10=WAREHOUSE LIGHTING COST/1000FTSQ 11= WAREH. FIRE PRE
00476   C VENTION COST  12= WAREH. BASE SHELL COST 13= CONST. LABOR FACTOR 14=LI
00476   C GHTING 15=HEAT AND VENT. 16= PUMBING 17-FIREPEVENTION 18-BASE 19-LABOR
00477           AA(98,2)=.10
00500           AA(98,1)=0.075
00501           AA(99,1) = 0.34
00502           AA(99,2) = 0.15
00503         AA(99,3)=10.0
00504           AA(99,4) = 1.61
00505           AA(99,5) = 0.32
00506           AA(99,6) = 0.364
00507           AA(99,7) = 1.75
00510           AA(99,8) = 0.65
00511           AA(99,9) = 2.50
00512           AA(99,10) =0.90
00513           AA(99,11) =1.10
00514           AA(99,12) =3.22
00515           AA(99,13) =0.34
00516           AA(99,14) =1.75
00517           AA(99,15) =1.50
00520           AA(99,16) =1.70
00521           AA(99,17) =1.10
00522           AA(99,18) =8.80
00523           AA(99,19) =0.34
00524           AA(99,20)= 15.
00525           AA(100,1)=3.
00526           AA(100,2)=32.
00527           AA(100,3)=  1.125 E-02
00530           AA(100,4)= 5.00
00531           AA(100,7)= 5.0E-05
00532           AA(100,8) = 1.3 E-05
00533           AA(100,9) =  1.E-07
00534           AA(100,11)=.724
00535           AA(100,12) = .074
00536           AA(100,13)=0.1
00537           AA(100,20) = 20.
00537   C THE BB(I) COMMON BLOCK INCLUDES BUILT IN PRICE SCHEDULES.
00537   C  9=CITY WATER 10=FUEL OIL 13=ANTIOXIDANT 14=SULPHURIC ACID 15=FISH MEA
00537   C  L BAGS 16=CAOH 66=PRICE OF BONE MEAL(CENTS/LB) 67=PRICE OF FISH OIL
00537   C  (CENTS/LB) 68=PRICE OF FISH SOLUBLES(CENTS/LB)
00540         BB(9)=.25*.001
00541         BB(10)=.06
00542         BB(13)=4.00
00543         BB(14)=.017
00544           BB(15) = 0.25
00545           BB(16) = 0.01
00546         BB(18)=129.22
00547         BB(66)=3.5
00550         BB(67)=4.0
00551         BB(68)=3.5
00552           BB(19)=45.
00552   C
00552   C DATA FOR ISOPRORYL  EXTRACTION (FRACTION OF STREAM EXTRACED IN STAGE)
00552   C       DATB(STAGE,STREAM)   STREAM INDICES  1-OIL 2-PROTEIN 3-ASH  4-WATER
00552   C       5-ISOPROPYL ALCOHOL
```

Table I.-- Continued.

```
C
      DATB(1,1)=  28./168.
      DATB(2,1)=   8./28.
      DATB(3,1)=   4./8.
      DATB(4,1)=   1./4.
      DATB(5,1)=   1./4.
      DATB(6,1)=   1./4.
      DATB(7,1)=   1./4.
      DATB(8,1)=   1./4.
      DATB(1,2)= 487./605.
      DATB(2,2)=477./487.
      DATB(3,2)= 476./477.
      DATB(4,2)= 471./476.
      DATB(5,2)= 471./476.
      DATB(6,2)= 471./476.
      DATB(7,2)= 471./476.
      DATB(8,2)= 471./476.
      DATB(1,3)= 100./124.
      DATB(2,3)=  98./100.
      DATB(3,3)=  97./98.
      DATB(4,3)=  96./97.
      DATB(5,3)=  96./97.
      DATB(6,3)=  96./97.
      DATB(7,3)=  96./97.
      DATB(8,3)=  96./97.
      DATB(1,4)= (963.+(.123*125.))/ 3276.
      DATB(2,4)=(543.+(.123*161.))/(963.+(.123*125.))
      DATB(3,4)= (324.+(.123*301.))/(543.+(.123*161.))
      DATB(4,4)= (38.+(.123*553.))/(324.+(.123*301.))
      DATB(5,4)= DATB(4,4)
      DATB(6,4)= DATB(5,4)
      DATB(7,4)= DATB(6,4)
      DATB(8,4)= DATB(7,4)
      DATB(1,5)=   125.*.877 / 3276.
      DATB(2,5)=   161./125.
      DATB(3,5)=   301./161.
      DATB(4,5)=   553./301.
      DATB(5,5)=   DATB(4,5)
      DATB(6,5)=   DATB(5,5)
      DATB(7,5)=   DATB(6,5)
      DATB(8,5)=   DATB(7,5)
      RETURN
      END

END OF COMPILATION:       NO  DIAGNOSTICS.
```

Table I.-- Continued.

@MAP
MAP 22B -07/12-11:06

ADDRESS LIMITS 001000 043715 044000 071006
STARTING ADDRESS 043307

WORDS DECIMAL 17870 IBANK 10759 DBANK

SEGMENT MAIN		001000 043715		044000 071006
NSWTC$/FOR	1	001000 001021		
NWBLK$/FOR	1	001022 001164	0	044000 044006
NFTCH$/FOR	1	001165 001524	2	044007 044061
EXP$/FOR	1	001525 001614	2	044062 044102
NTOC$/FOR	1	001615 003174	2	044103 046602
NOS$/FOR	1	003175 004263	2	046603 046673
NTAB$/FOR			2	046674 046732
NERR$D/UOM			0	046733 047000
ERU$				
NTB$/FOR	1	004264 004556	2	047001 047022
UOMSYS (COMMON BLOCK)				047023 047037
H$MONITOR/RALPH	1	004557 006006	2	047040 047677
			4	UOMSYS
NTS$/FOR	1	006007 007132	2	047700 047751
ALOG$/FOR	1	007133 007251	2	047752 050012
NFXP6$/FOR	1	007252 007325	2	050013 050022
SQRT$/FOR	1	007326 007366	2	050023 050034
NTOS$/FOR	1	007367 011022	2	050035 050417
NOSYM$/FOR	1	011023 011261	2	050420 050431
NFRR$/UOM	1	011262 011742	2	050432 050604
BLOCK4 (COMMON BLOCK)				050605 050616
BLOCK2 (COMMON BLOCK)				050617 050634
BLOCK1 (COMMON BLOCK)				050635 055704
DATA1 (COMMON BLOCK)				055705 055754
BLANK$COMMON (COMMON BLOCK)				
LIBRE	1	011743 013050	0	055755 056223
	3	DATA1	2	BLANK$COMMON
			4	BLOCK1
OPERAT	1	013051 014323	0	056224 057202
	3	BLOCK1	2	BLANK$COMMON
FASCIL	1	014324 015061	0	057203 057567
	3	BLOCK1	2	BLANK$COMMON
CAPTOL	1	015062 015174	0	057570 057662
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
MATER	1	015175 015315	0	057663 060033
	3	BLOCK1	2	BLANK$COMMON
REFRIG	1	015316 015442	0	060034 060064

Table I.-- Continued.

	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
DRAGMA	1	015443 015613	0	060065 060135
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
CRANES	1	015614 015761	0	060136 060220
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
FILTER	1	015762 016060	0	060221 060251
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
BAGGMA	1	016061 016212	0	060252 060322
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
BALMIL	1	016213 016311	0	060323 060353
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
AGITOR	1	016312 016411	0	060354 060406
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
SCALE	1	016412 016534	0	060407 060444
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
BUCKET	1	016535 016675	0	060445 060505
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
BELT	1	016676 017025	0	060506 060546
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
HEATEX	1	017026 017216	0	060547 060647
	3	BLOCK2	2	BLANK$COMMON
			4	BLOCK1
PMPCNT	1	017217 017435	0	060650 060756
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
PMPREC	1	017436 017654	0	060757 061065
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
BLENDR	1	017655 017751	0	061066 061116
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
CNTFGE	1	017752 020045	0	061117 061151
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
BOWL	1	020046 020145	0	061152 061204
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
SHARP	1	020146 020245	0	061205 061237
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
SCREEN	1	020246 020344	0	061240 061270
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
GRINDR	1	020345 020443	0	061271 061321
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
REACTR	1	020444 020542	0	061322 061352

Table I.-- Continued.

	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
COLUMN	1	020543 020725	0	061353 061416
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
VESSEL	1	020726 021142	0	061417 061503
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
STORAG	1	021143 021346	0	061504 061607
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
EVPHOR	1	021347 021445	0	061610 061640
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
EVPFRC	1	021446 021544	0	061641 061671
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
EVPFLM	1	021545 021637	0	061672 061721
	3	BLOCK2	2	BLANK$COMMON
			4	BLOCK1
EVPSPR	1	021640 021734	0	061722 061752
	3	BLOCK2	2	BLANK$COMMON
			4	BLOCK1
BOILER	1	021735 022054	0	061753 062012
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
DRYFRR	1	022055 022361	0	062013 062165
	3	BLOCK2	2	BLANK$COMMON
			4	BLOCK1
DRYFRP	1	022362 022461	0	062166 062220
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
DRYER	1	022462 022561	0	062221 062253
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
HAMMER	1	022562 022675	0	062254 062307
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
SCREWR	1	022676 023154	0	062310 062435
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
PULVER	1	023155 023254	0	062436 062470
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
CONDEN	1	023255 023345	0	062471 062521
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
STLO	1	023346 023467	0	062522 062571
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
HOPPER	1	023470 023567	0	062572 062622
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
PRESCK	1	023570 026234	0	062623 063630
	3	BLOCK1	2	BLANK$COMMON
			4	BLOCK2
XXIPA	1	026235 032602	0	063631 065313

Table I.-- Continued.

```
                              3   BLOCK1                  2   BLANK$COMMON
                              5   BLOCK4                  4   BLOCK2
BIOLOG                        1   032603 035152           0   065314 066246
                              3   BLOCK1                  2   BLANK$COMMON
                                                          4   BLOCK2
PRSIPA                        1   035153 040771           0   066247 067656
                              3   BLOCK2                  2   BLANK$COMMON
                              5   BLOCK1                  4   DATA1
                                                          6   BLOCK4
FPCXX1                        1   040772 043306           0   067657 070456
                              3   BLOCK4                  2   BLANK$COMMON
                              5   BLOCK2                  4   BLOCK1
MAIN                          1   043307 043715           0   070457 071006
                              3   BLOCK1                  2   BLANK$COMMON
                              5   BLOCK4                  4   BLOCK2


SYS$*RLIB$. LEVEL  53.29
END OF COLLECTION - TIME 4.470 SECONDS


@FIN


   RUNID:  7053      ACCOUNT: 154-04-105      PROJECT: FISHFISH

      LOAD P0111N 3/0 A             -1 7053

      SERVICE    3/0 P0111N : 7053

   TIME: 00:01:02.380     IN: 54      OUT: 0          PAGES:   137

   MEMORY TIME: 0:02:50.430

   INITIATION  TIME:    11:01:32-JUL 12,1971

   TERMINATION TIME:    11:07:11-JUL 12,1971
```

Table II.—IPA plant cost analysis.

```
IPA PLANT COST ANALYSIS

INPUT DATA

   PLANT SIZE                     =    200.00 TONS/DAY
   MARSHAL/STEVENS INDEX          =     1.135
   COST OF FISH                   =      1.00 CENTS/LB
   ELECTRICITY COSTS              =      1.30 CENTS/KWH
   FUEL COST                      =       .06 DOLLARS/THERM
   LABOR AND SUPV. COSTS          =      4.00 DOLLARS/HR
   DEPRECIATION AND INT. CHARGE   =     15.00 PERCENT

   FISH COMPOSITION

         OIL      =  4.00 PERCENT
         PROTEIN  = 16.00 ''-''
         ASH      =  3.00 ''-''
         WATER    = 77.00 ''-''

OPERATING OPTIONS

   OPERATING DAYS PER YEAR =    200.
```

Table II.-- Continued.

DETAILED EQUIPMENT COSTS (ALL COSTS IN 1000.0 DOLLARS)

EQUIPMENT TYPE	CAPACITY	MATERIAL	BASE COST	MATERIALS COSTS	LABOR COSTS	INDIRECT COSTS	MODULE COST	RANGE + OR -
FISH PUMPS	1301. GPM TIMES PSI	STEEL	3.919	2.783	2.743	3.488	12.934	1.293
BELT CONVEYER	100.000 FEET(LENGTH)		18.796	5.075	7.330	7.518	38.719	3.872
WATER DUMP TANK	6000. GALLONS	STEEL	2.379	.904	.238	1.165	4.686	.469
MECHANICAL REFRIGERAT.	300.000 TONS		347.856	59.136	48.700	38.264	493.956	49.396
REDWOOD STORAGE BIN	32500. CUBIC FEET	REDWOOD	11.747	2.349	1.175	4.699	19.970	1.175
BRINE MAKE-UP+SALT STOR.			1.190				1.190	
CENTRIFUGAL PUMP	71. GPM TIMES PSI	BRONZE	.512	.364	.140	.225	1.241	.124
CENTRIFUGAL PUMP	65.487 GPM TIMES PSI	STEEL	.400	.284	.140	.176	1.000	.100
BUCKET CONVEYER	20.000 FEET(HEIGHT)	SS	1.750	.487	.984	.700	3.920	.392
PULVERIZER	16666.667 POUNDS/HOUR	SS	17.727	4.822	5.637	7.091	35.277	3.528
SHOP FAB. STORAGE TANK	3500. GALLONS	SST	6.303	2.395	6.303	3.088	18.089	1.809
CENTRIFUGAL PUMP	1000.400 GPM TIMES PSI	SST	1.095	.778	.199	.482	2.554	.255
CENTRIFUGAL PUMP	3123.715 GPM TIMES PSI	SST	1.423	1.010	.258	.626	3.317	.332
AGITATOR-PROPELLAR	17.500 HORSEPOWER	SS	1.662	.459	.572	.665	3.357	.336
SHOP FAB. STORAGE TANK	3200. GALLONS	SST	6.108	2.321	6.108	2.993	17.530	1.753
CENTRIFUGAL PUMP	1698.652 GPM TIMES PSI	SST	1.218	.865	.221	.536	2.839	.284
CENTRIFUGAL PUMP	1698.652 GPM TIMES PSI	SST	1.218	.865	.221	.536	2.839	.284
JACKETED REACTOR VESSEL	6000. GALLONS	SST	18.310	6.958	1.831	8.972	36.071	3.607
VIBRATING SCREEN	3.000 SURFACE SQ FT.	SST	3.606	.974	.180	1.515	6.274	.627
AGITATOR-PROPELLAR	30.000 HORSEPOWER	SS	2.176	.601	.748	.870	4.395	.440
CENTRIFUGAL PUMP	733.627 GPM TIMES PSI	SST	1.043	.740	.189	.459	2.431	.243
PULP PRESS	6.000 FEET	STEEL	5.288	1.438	1.682	2.115	10.523	.529
CENTRIFUGAL PUMP	733.627 GPM TIMES PSI	SST	1.043	.740	.189	.459	2.431	.243
JACKETED REACTOR VESSEL	3200. GALLONS	SST	14.694	5.584	1.469	7.200	28.948	2.895
VIBRATING SCREEN	3.000 SURFACE SQ FT.	SST	3.606	.974	.180	1.515	6.274	.627

Table II.--Continued.

AGITATOR-PROPELLAR	30.000	HORSEPOWER	SS	2.176	.601	.748	.870	4.395	.440
PULP PRESS	6.000	FEET	STEEL	5.288	1.438	1.682	2.115	10.523	.529
CENTRIFUGAL PUMP	733.627	GPM TIMES PSI	SST	1.043	.740	.189	.459	2.431	.243
JACKETED REACTOR VESSEL	3200.	GALLONS	SST	14.694	5.584	1.469	7.200	28.948	2.895
VIBRATING SCREEN	3.000	SURFACE SQ FT.	SST	3.606	.974	.180	1.515	6.274	.627
AGITATOR-PROPELLAR	30.000	HORSEPOWER	SS	2.176	.601	.748	.870	4.395	.440
PULP PRESS	6.000	FEET	STEEL	5.288	1.438	1.682	2.115	10.523	.529
CENTRIFUGAL PUMP	733.627	GPM TIMES PSI	SST	1.043	.740	.189	.459	2.431	.243
JACKETED REACTOR VESSEL	3200.	GALLONS	SST	14.694	5.584	1.469	7.200	28.948	2.895
VIBRATING SCREEN	3.000	SURFACE SQ FT.	SST	3.606	.974	.180	1.515	6.274	.627
AGITATOR-PROPELLAR	30.000	HORSEPOWER	SS	2.176	.601	.748	.870	4.395	.440
PULP PRESS	6.000	FEET	STEEL	5.288	1.438	1.682	2.115	10.523	.529
CENTRIFUGAL PUMP	412.565	GPM TIMES PSI	SST	.976	.693	.177	.429	2.275	.227
CENTRIFUGAL PUMP	315.100	GPM TIMES PSI	SST	.956	.679	.173	.421	2.230	.223
CENTRIFUGAL PUMP	297.519	GPM TIMES PSI	SST	.953	.677	.173	.419	2.222	.222
CENTRIFUGAL PUMP	2025.850	GPM TIMES PSI	SST	1.269	.901	.230	.558	2.959	.296
CENTRIFUGAL PUMP	290.051	GPM TIMES PSI	SST	.952	.676	.173	.419	2.219	.222
CENTRIFUGAL PUMP	2008.268	GPM TIMES PSI	SST	1.266	.899	.230	.557	2.952	.295
CENTRIFUGAL PUMP	2000.800	GPM TIMES PSI	SST	1.265	.898	.229	.557	2.950	.295
HEAT EXCHANGER	100.000	SURFACE SQ FT.	ST/ST	2.249	1.606	1.417	2.130	7.403	1.258
DRYER	73.450	AREA(SQ.FEET	SST	50.846	4.926	3.531	2.825	28.936	2.894
STRIPPER DRYER	73.450	AREA(SQ.FEET	SST	62.772	5.473	3.923	3.139	32.151	3.215
SCREW CONVEYER	6.000	FEET	SS	.998	.271	.317	.399	1.985	.100
STRIPPER DRYER	73.450	AREA(SQ.FEET	SST	62.772	5.473	3.923	3.139	32.151	3.215
CONDITIONER	73.450	AREA(SQ.FEET	SST	62.772	5.473	3.923	3.139	32.151	3.215
SCREW CONVEYER	6.000	FEET	SS	.998	.271	.317	.399	1.985	.100
SCREW CONVEYER	20.000	FEET	SS	2.055	.559	.653	.822	4.089	.205
HAMMER MILL	3.727	TONS PER HR.	SST	1.736	.469	.748	.764	3.717	.372
BAGGING MACHINE	1.725	BAGS/MIN	SS	5.795	2.318	.637	2.318	11.068	1.107

Table II.--Continued.

ACID STORAGE TANK	38.	GALLONS	SST	2.367	.473	.200	1.160	4.199	.420
CENTRIFUGAL PUMP	1.506	GPM TIMES PSI	SST	.772	.548	.140	.340	1.800	.180
CENTRIFUGAL PUMP	2711.150	GPM TIMES PSI	STEEL	.709	.503	.248	.312	1.772	.177
SHOP FAB. STORAGE TANK	1301.	GALLONS	STEEL	1.393	.529	4.458	.683	7.063	.706
CENTRIFUGAL PUMP	2711.150	GPM TIMES PSI	STEEL	.709	.503	.248	.312	1.772	.177
DISK TYPE CENTRIFUGE	20.000	HORSEPOWER	SS	14.074	3.659	2.730	5.629	26.092	2.609
DISK TYPE CENTRIFUGE	20.000	HORSEPOWER	SS	14.074	3.659	2.730	5.629	26.092	2.609
DISK TYPE CENTRIFUGE	20.000	HORSEPOWER	SS	14.074	3.659	2.730	5.629	26.092	2.609
CENTRIFUGAL PUMP	43.746	GPM TIMES PSI	STEEL	.400	.284	.140	.176	1.000	.100
SHARPLES CENTRIFUGE	20.000	HORSEPOWER	SS	45.257	11.767	15.387	18.103	90.514	9.051
SHOP FAB. STORAGE TANK	30777.	GALLONS	SST	13.489	5.126	13.489	6.610	38.714	3.871
CENTRIFUGAL PUMP	.427	GPM TIMES PSI	STEEL	.400	.284	.140	.176	1.000	.100
SHOP FAB. STORAGE TANK	5383.	GALLONS	SST	7.327	2.784	7.327	3.590	21.030	2.103
CENTRIFUGAL PUMP	26.913	GPM TIMES PSI	STEEL	.400	.284	.140	.176	1.000	.100
CENTRIFUGAL PUMP	26.913	GPM TIMES PSI	STEEL	.400	.284	.140	.176	1.000	.100
HEAT EXCHANGER	448.365	SURFACE SQ FT.	ST/ST	5.720	4.084	3.603	5.417	18.824	3.200
CENTRIFUGAL PUMP	780.882	GPM TIMES PSI	STEEL	.545	.387	.191	.240	1.363	.136
DISK TYPE CENTRIFUGE	20.000	HORSEPOWER	SS	14.074	3.659	2.730	5.629	26.092	2.609
HEAT EXCHANGER	4283.600	SURFACE SQ FT.	ST/ST	23.283	16.624	14.669	22.049	76.626	13.026
SHOP FAB. STORAGE TANK	4002.	GALLONS	SST	6.605	2.510	6.605	3.237	18.957	1.896
CENTRIFUGAL PUMP	1980.792	GPM TIMES PSI	STEEL	.654	.464	.229	.288	1.635	.163
DIST. COLUMN SHELL	1526.813	CUBIC FEET	SS	65.250	18.455	17.637	21.335	122.677	6.525
DISTILLATION COLUMN	54.000	FEET(HIGHT)	SS	10.605	2.273	3.030	3.030	18.938	1.061
SHOP FAB. STORAGE TANK	14406.	GALLONS	STEEL	3.232	1.228	10.342	1.584	16.385	1.639
CENTRIFUGAL PUMP	.200	GPM TIMES PSI	STEEL	.400	.284	.140	.176	1.000	.100
HEAT EXCHANGER	13374.648	SURFACE SQ FT.	ST/ST	47.272	33.753	29.782	44.767	155.574	26.448
CENTRIFUGAL PUMP	200.000	GPM TIMES PSI	STEEL	.487	.346	.170	.214	1.217	.122
SHOP FAB. STORAGE TANK	1577.	GALLONS	SST	4.768	1.812	4.768	2.336	13.684	1.368
CENTRIFUGAL PUMP	7.884	GPM TIMES PSI	STEEL	.400	.284	.140	.176	1.000	.100

Table II.--Continued.

VERTICAL EVAPORATOR	662.220	SURFACE SQ FT.	SST	10.221	6.746	2.453	4.293	23.713	2.371
VERTICAL EVAPORATOR	662.220	SURFACE SQ FT.	SST	10.221	6.746	2.453	4.293	23.713	2.371
VERTICAL EVAPORATOR	662.220	SURFACE SQ FT.	SST	10.221	6.746	2.453	4.293	23.713	2.371
VERTICAL EVAPORATOR	79.588	SURFACE SQ FT.	SST	3.325	2.195	.798	1.397	7.715	.771
CENTRIFUGAL PUMP	59.691	GPM TIMES PSI	STEEL	.400	.284	.140	.176	1.000	.100
SHOP FAB. STORAGE TANK	29.	GALLONS	STEEL	.678	.136	.183	.332	1.329	.133
CENTRIFUGAL PUMP	.597	GPM TIMES PSI	STEEL	.400	.284	.140	.176	1.000	.100
SHOP FAB. STORAGE TANK	42977.	GALLONS	STEEL	4.738	1.800	15.161	2.322	24.021	2.402
BOILER	62097.921	POUNDS/HOUR	SS	124.585	23.671	18.688	24.917	191.861	19.186
SHOP FAB. STORAGE TANK	19169.	GALLONS	STEEL	3.572	1.357	11.429	1.750	18.108	1.811
CENTRIFUGAL PUMP	.266	GPM TIMES PSI	STEEL	.400	.284	.140	.176	1.000	.100
CONTROL INSTRUMENTATION				87.000				1.000	
PAYLOADER				20.000				20.000	
SCRUBBERS	200.000	TONS PROCESSED	STEEL	4.540	1.498	1.498	1.498	9.034	.454
BOILER WATER TREATMENT				1.000				1.000	
SEA WATER PUMPS	8179.034	GPM TIMES PSI	BRONZE	1.300	.923	.355	.572	3.151	.315
CARBON ADSORBER				2.000				2.000	
VENT CONDENSER	20.000	SURFACE SQ FT.	ST/SST	1.860	1.328	.521	1.761	5.470	.930
SCALE	18.000	TONS	SS	4.540	.363	.000	1.816	6.719	.454
SCALE	18.000	TONS	SS	4.540	.363	.000	1.816	6.719	.454
SCALE	18.000	TONS	SS	4.540	.363	.000	1.816	6.719	.454
SCALE	18.000	TONS	SS	4.540	.363	.000	1.816	6.719	.454
TOTAL COSTS				1400.533	331.836	319.878	359.491	2163.078	221.047

Table II.--Continued.

MATERIAL AND ENERGY INFORMATION

GENERAL

FISH = 200.000 TONS/DAY

OF WHICH	4.00	PERCENT	OR	8.000	- '' -	IS OIL
	16.00	- ''-	OR	32.000	- ''-	PROTEIN
	3.00	- ''-	OR	6.000	- ''-	ASH

PROCESS STEAM = 62098. LB/HR

PROCESS COOLING WATER = 408952. GAL/HR

ELECTRICITY 12214. KWHR

EQUIPMENT FLOW RATES

FISH TO EXTRACTION VESSELS 16667. LB/HR

STEAM(STIRRED VESSEL 1)	140.	LB/HR
STEAM(STIRRED VESSEL 2)	80.	LB/HR
STEAM(STIRRED VESSEL 3)	80.	LB/HR
STEAM(STIRRED VESSEL 4)	80.	LB/HR
STEAM(PREHEATER-DISTILLATION)	4484.	LB/HR
STEAM(REBOILER)	42836.	LB/HR
STEAM(ROTARY DRYER FPC)	2348.	LB/HR
STEAM(ROTARY DRYER BONE MEAL)	0.	LB/HR
COOLING WATER CONDENSER	248392.	GAL/HR
COOLING WATER DISTILLATION COND.	2676.	GAL/MIN
TOTAL STEAM	62098.	LB/HR
TOTAL WATER	3406568.	LB/HR

	STREAM 1	STREAM 2	STREAM 3	STREAM 4	STREAM 5
RAFFINATE OIL	7.951	1.311	.345	.148	.000
RAFFINATE ASH	1.332	.192	.095	.047	.000
RAFFINATE PROTEIN	7.163	.763	.251	.251	.000

Table II.--Continued.

RAFFINATE WATER	152.199	42.859	23.209	13.205	.000
RAFFINATE ALCOHOL	373.368	379.368	381.108	387.842	400.000
EXTRACT OIL	8.000	1.360	.394	.197	.049
EXTRACT ASH	6.000	4.860	4.763	4.715	4.668
EXTRACT PROTEIN	32.000	25.600	25.088	25.088	24.837
EXTRACT WATER	154.000	44.660	25.010	15.006	1.801
EXTRACT ALCOHOL	.000	6.000	7.740	14.474	26.632

FLOW FROM EXTRACTION VESSEL 4	4832. LB/HR
FLOW FROM EXTRACTION VESSEL 1	45168. LB/HR
AQUEOUS STREAM(CENTRIFUGE)	44882. LB/HR
TOPS FROM DISTILLATION COLUMN	31088. LB/HR
BOTTOMS FROM DISTILLATION COLUMN	13009. LB/HR
OIL FROM SECOND CENTRIFUGE	331. LB/HR
FISH OIL PRODUCT	663. LB/HR
BONE MEAL CONCENTRATE	0. LB/HR
FISH PROTEIN CONCENTRATE	2588. LB/HR
FISH SOLUABLES	218. LB/HR

Table II.--Continued.

COST OF FACILITIES AND SITE DEVELOPMENT

	UNIT COST	NUMBER OF UNITS	BASE COST	LABOR COSTS	INDIRECT COSTS	TOTAL COSTS	RANGE + OR -
LAND	10.000 PER ACRE	1.000	10.000	.000	.000	10.000	1.500
FENCING	2.673 PER 1000 FT	.833	1.342	.429	.456	2.227	.334
PAVING	1.125 PER 1000 SQ.FT	14.505	5.280	9.240	1.795	16.315	2.447
DOCK FACILITIES	2.496 PER 1000 SQ.FT	2.400	1.560	3.900	.530	5.990	.899
BULK STORAGE WAREHOUSE							
ELECTRICAL WIRING	.900 PER 1000SQ.FT						
FIRE PREVENTION EQP.	1.100 PER 1000SQ.FT						
TOTAL WAREHOUSE	8.770 PER 1000 SQ.FT	.600	3.132	1.065	1.065	5.262	.789
PROCESS BUILDING							
ELECTRICAL WIRING	1.750 PER 1000 SQ.FT						
HEATING AND VENTIL.	1.500 PER 1000 SQ.FT						
PLUMBING(GENERAL)	1.700 PER 1000 SQ.FT						
FIRE PREVENTION EQUIP	1.100PER 1000 SQ.FT						
TOTAL BUILDING COSTS	14.784 PER 1000 SQ.FT	2.600	22.880	7.779	7.779	38.438	5.766
LABORATORY CONTROL INSTRUMENTATION			150.000			150.000	
TOTAL FACILITIES			67.074	30.193	19.405	228.233	17.501

Table II.--Continued.

SUMMARY OF FIXED COSTS

EQUIPMENT	2163.078
SPARE PARTS	28.011
FACILITIES	228.233
ENGINEERING	181.449
CONTINGENCIES	260.077
TOTAL CAPITOL COSTS	2860.848

Table II.-- Continued.

OPERATING COSTS

COST ITEM	QUANTITY USED		COST IN DOLLARS PER DAY
FISH	200.	TONS	4000.00
FUEL OIL	10645.	GALLONS	638.72
ELECTRICITY	12214.	KWHR	158.78
ANTIOXIDANT	45.38	LB	181.54
PACKAGING	2485.	BAGS	621.16
CITY WATER	9814840.	GALLONS	2453.71
LABOR AND SUPERVISION	176.	MAN HR.	704.00
DEPRECIATION			1430.42
MAINTENANCE			95.36
PAYROLL EXTRAS			105.60
BOILER WATER TREATMENT			3.30
INSURANCE AND TAXES			95.36
OVERHEAD			211.20
ISOPROPYL ALCOHOL	8000.	POUNDS	516.88
PHOSPHORIC ACID	1084.	POUNDS	24.39
TOTAL OPERATING COSTS			11240.43

PRODUCTION RATE

BONE MEAL	.000	TONS/DAY
FISH SOL.	14.326	TONS/DAY
DRY CONC.	31.058	TONS/DAY
FISH OIL	7.951	TONS/DAY
BONE MEAL	0.	TONS/YEAR
FISH SOL.	2865.	TONS/YEAR
DRY CONC.	6212.	TONS/YEAR
FISH OIL	1590.	TONS/YEAR

YEARLY OPERATING COST = .267080+07 DOLLARS

Table II.--Continued.

BY-PRODUCT	PRODUCTION COST OF FPC PRICE(CENTS/POUND)	TOTAL WORTH(DOLLARS/YEAR)
FISH OIL	4.0	.127211+06
FISH SOLUBLES	3.5	.200561+06

FPC COST WITHOUT BY-PRODUCTS 21.5 CENTS/POUND

FPC COST WITH BY-PRODUCTS 18.9 CENTS/POUND

Table III

Cost Data for 50 ton/day Capacity Plants

Plant Type	Fish Type	Capital Costs $\$\cdot 10^6$	Yearly Production Rates and Costs: Bone Meal tons/yr	Fish Paste tons/yr	Dry Con. tons/yr	Fish Oil tons/yr	Operating costs $\$\cdot 10^6$	FPC Cost Disregarding by product ¢/lb	FPC with by product ¢/lb
Biological	Fat	1.35	1340	-	1360	900	0.985	36.1	30.
Press Cake-Biological	Fat	1.41	340	-	1960	950	0.896	22.8	20.3
IPA	Lean	1.58	-	720	1550	400	0.987	31.8	29.1
Press Cake-	Fat	1.57	-	1110	1400	1410	0.879	31.2	25.1
IPA	Lean	1.57	-	1110	1400	400	0.88	31.3	27.4

Table IV

Cost Data for 200 ton/day Capacity Plants

Plant Type	Fish Type	Capital Costs $\$ \cdot 10^6$	Yearly Production Rates and Costs					FPC Cost Disregarding by product ¢/ℓb	FPC with by product ¢/ℓb
			Bone Meal tons/yr	Fish Paste tons/yr	Dry Con. tons/yr	Fish Oil tons/yr	Operating costs $\$ \cdot 10^6$		
Biological	Fat	2.40	5350	-	5450	3600	2.76	25.3	19.2
Press Cake Biological	Fat	2.65	1380	-	7860	3800	2.40	15.3	12.7
IPA	Lean	2.73	-	2860	6210	1590	2.64	21.2	18.6
Press Cake	Fat	2.82	-	4430	5620	4790	2.22	19.8	13.6
IPA	Lean	2.82	-	4430	5620	1600	2.23	19.8	16.0

Table V

Cost Data for 1000 ton/day Capacity Plants

Plant Type	Fish Type	Capital Costs $\$\cdot 10^6$	Yearly Production Rates and Costs					FPC Cost Disregarding by product ¢/ℓb	FPC with by product ¢/ℓb
			Bone Meal tons/yr	Fish Paste tons/yr	Dry Con. tons/yr	Fish Oil tons/yr	Operating costs $\$\cdot 10^6$		
Biological	Fat	7.71	26700	-	27300	1800	11.65	21.4	15.3
Press Cake Biological	Fat	8.01	6900	-	39300	1900	9.70	12.3	9.8
IPA	Lean	7.13	-	14300	31000	7900	10.6	17.1	14.4
Press Cake	Fat	7.023	-	22100	28100	24000	8.41	15.0	8.8
IPA	Lean	7.024	-	22100	28100	8000	8.46	15.0	11.1

Table VI

Cost Data for Fish Meal Plants

Plant Capacity tons/day	Fish Type	Capital Costs $\$ \cdot 10^6$	Yearly Production and Costs		
			Fish Meal tons/yr	Fish Oil tons/yr	Operating costs $\$ \cdot 10^6$
50	Fat	.728	2090	1010	0.687
	Lean	.725	1960	340	0.675
200	Fat	1.12	8400	4030	1.72
	Lean	1.11	7860	1340	1.68
1000	Fat	2.84	41800	20000	6.64
	Lean	2.62	39000	6700	6.36