A UNITED STATES DEPARTMENT OF COMMERCE PUBLICATION

NOAA Technical Report NMFS CIRC-367

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
October 1972

NOAA TECHNICAL REPORTS

National Marine Fisheries Service, Circulars

The major responsibilities of the National Marine Fisheries Service (NMFS) are to monitor and assess the abundance and geographic distribution of fishery resources, to understand and predict fluctuations in the quantity and distribution of these resources, and to establish levels for optimum use of the resources. NMFS is also charged with the development and implementation of policies for managing national fishing grounds, development and enforcement of domestic fisheries regulations, surveillance of foreign fishing off United States coastal waters, and the development and enforcement of international fishery agreements and policies. NMFS also assists the fishing industry through marketing service and economic analysis programs, and mortgage insurance and vessel construction subsidies. It collects, analyses, and publishes statistics on various phases of the industry.

The NOAA Technical Report NMFS CIRC series continues a series that has been in existence since 1941. The Circulars are technical publications of general interest intended to aid conservation and management. Publications that review in considerable detail and at a high technical level certain broad areas of research appear in this series. Technical papers originating in economics studies and from management investigations appear in the Circular series.

NOAA Technical Reports NMFS CIRC are available free in limited numbers to governmental agencies, both Federal and State. They are also available in exchange for other scientific and technical publications in the marine sciences. Individual copies may be obtained (unless otherwise noted) from NOAA Publications Section, Rockville, Md. 20852. Recent Circulars are:

315. Synopsis of biological data on the chum salmon, *Oncorhynchus keta* (Walbaum) 1792. By Richard G. Bakkala. March 1970, iii + 89 pp., 15 figs., 51 tables.

319. Bureau of Commercial Fisheries Great Lakes Fishery Laboratory, Ann Arbor, Michigan. By Bureau of Commercial Fisheries. March 1970, 8 pp., 7 figs.

330. EASTROPAC Atlas: Vols. 4, 2. Catalog No. I 49.4:330/(vol.) 11 vols. ($4.75 each). Available from the Superintendent of Documents, Washington, D.C. 20402.

331. Guidelines for the processing of hot-smoked chub. By H. L. Seagran, J. T. Graikoski, and J. A. Emerson. January 1970, iv + 23 pp., 8 figs., 2 tables.

332. Pacific hake. (12 articles by 20 authors.) March 1970, iii + 152 pp., 72 figs., 47 tables.

333. Recommended practices for vessel sanitation and fish handling. By Edgar W. Bowman and Alfred Larsen. March 1970, iv + 27 pp., 6 figs.

335. Progress report of the Bureau of Commercial Fisheries Center for Estuarine and Menhaden Research, Pesticide Field Station, Gulf Breeze, Fla., fiscal year 1969. By the Laboratory staff. August 1970, iii + 33 pp., 29 figs., 12 tables.

336. The northern fur seal. By Ralph C. Baker, Ford Wilke, and C. Howard Baltzo. April 1970, iii + 19 pp., 13 figs.

337. Program of Division of Economic Research, Bureau of Commerecial Fisheries, fiscal year 1969. By Division of Economic Research. April 1970, iii + 29 pp., 12 figs., 7 tables.

338. Bureau of Commercial Fisheries Biological Laboratory, Auke Bay, Alaska. By Bureau of Commercial Fisheries. June 1970, 8 pp., 6 figs.

339. Salmon research at Ice Harbor Dam. By Wesley J. Ebel. April 1970, 6 pp., 4 figs.

340. Bureau of Commercial Fisheries Technological Laboratory, Gloucester, Massachusetts. By Bureau of Commercial Fisheries. June 1970, 8 pp., 8 figs.

341. Report of the Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N.C., for the fiscal year ending June 30, 1968. By the Laboratory staff. August 1970, iii + 24 pp., 11 figs., 16 tables.

342. Report of the Bureau of Commercial Fisheries Biological Laboratory, St. Petersburg Beach, Florida, fiscal year 1969. By the Laboratory staff. August 1970, iii + 22 pp., 20 figs., 8 tables.

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.

344. Bureau of Commercial Fisheries Tropical Atlantic Biological Laboratory progress in research 1965-69, Miami, Florida. By Ann Weeks. October 1970, iv + 65 pp., 53 figs.

346. Sportsman's guide to handling, smoking, and preserving Great Lakes coho salmon. By Shearon Dudley, J. T. Graikoski, H. L. Seagran, and Paul M. Earl. September 1970, iii + 28 pp., 15 figs.

347. Synopsis of biological data on Pacific ocean perch, *Sebastodes alutus*. By Richard L. Major and Herbert H. Shippen. December 1970, iii + 38 pp., 31 figs., 11 tables.

Continued on inside back cover.

U.S. DEPARTMENT OF COMMERCE
Peter G. Peterson, Secretary
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator
NATIONAL MARINE FISHERIES SERVICE
Philip M. Roedel, Director

NOAA Technical Report NMFS CIRC-367

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
October 1972

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C., 20402 - Price $1.50.

CONTENTS

Figures

Tables

Engineering Economic Model For Fish Protein Concentration Processes

By

K. K. Almenas,[1] L. C. Durilla,[2] R. C. Ernst,[2]
J. W. Gentry,[1] M. B. Hale,[2] and J. M. Marchello[1]

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.

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

[1] University of Maryland, Department of Chemical Engineering, College Park, MD 20740.
[2] National Marine Fisheries Service, College Park Fishery Products Technology Laboratory, College Park, MD 20740.

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

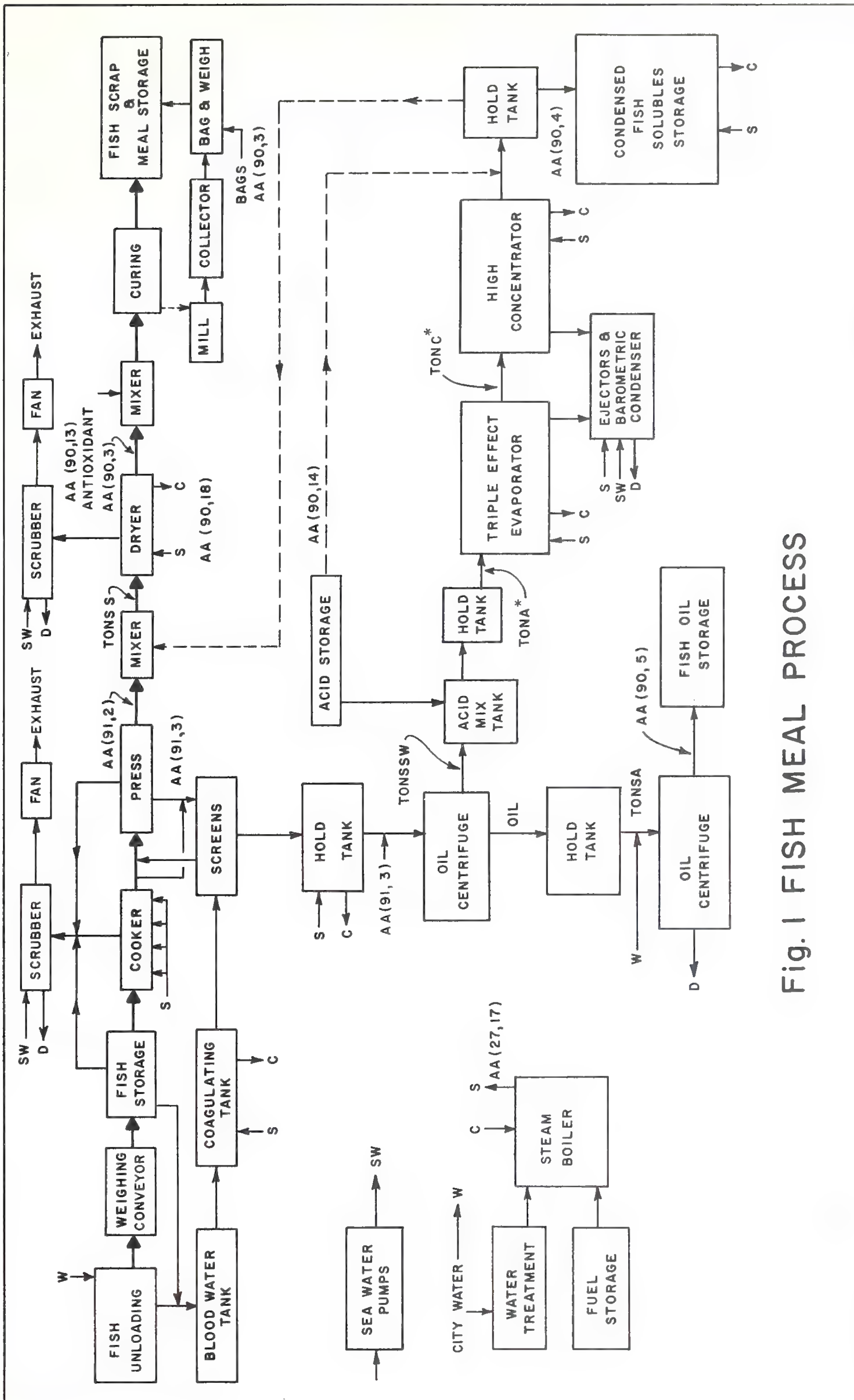


Fig. I FISH MEAL PROCESS

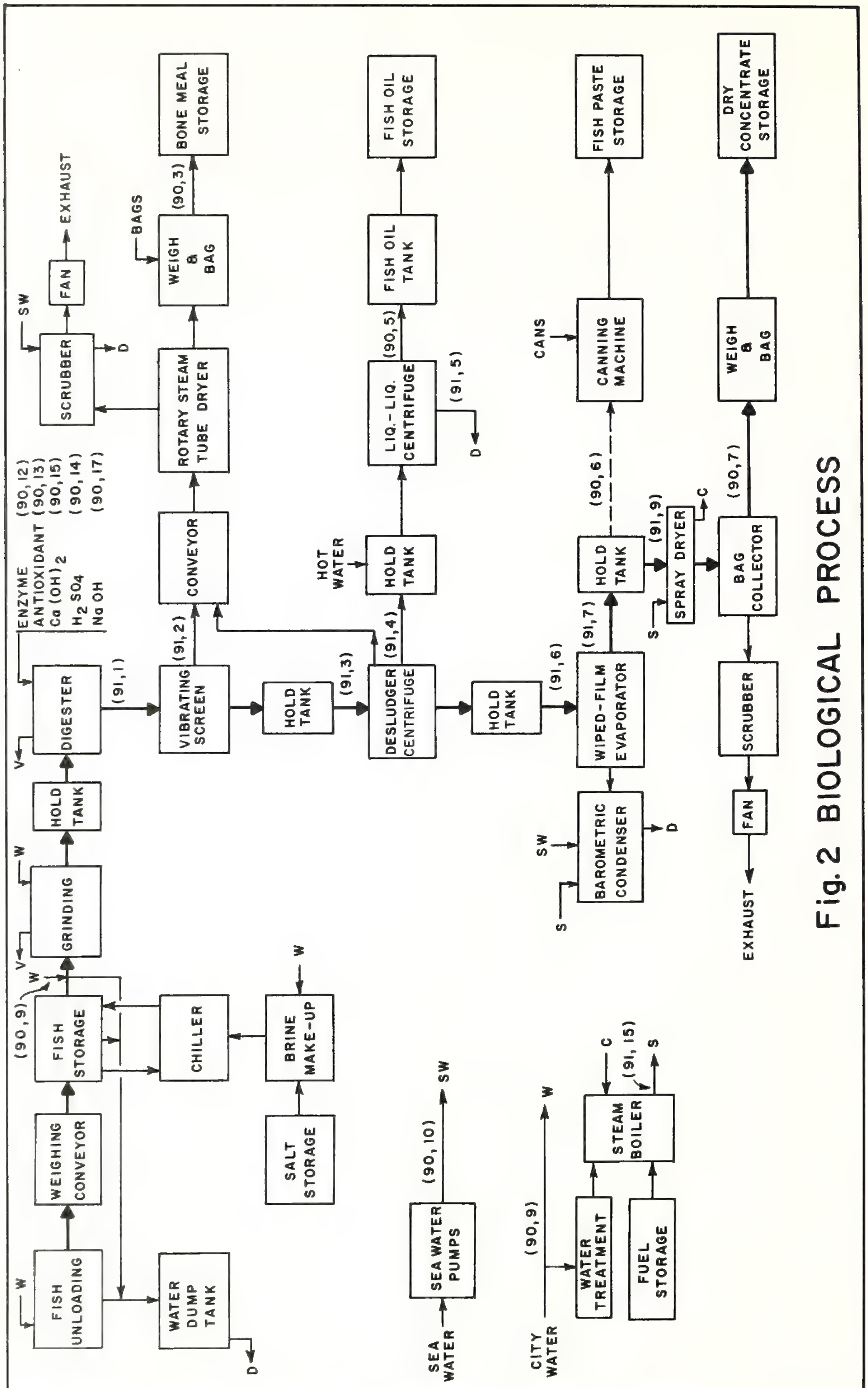


Fig. 2 BIOLOGICAL PROCESS

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-

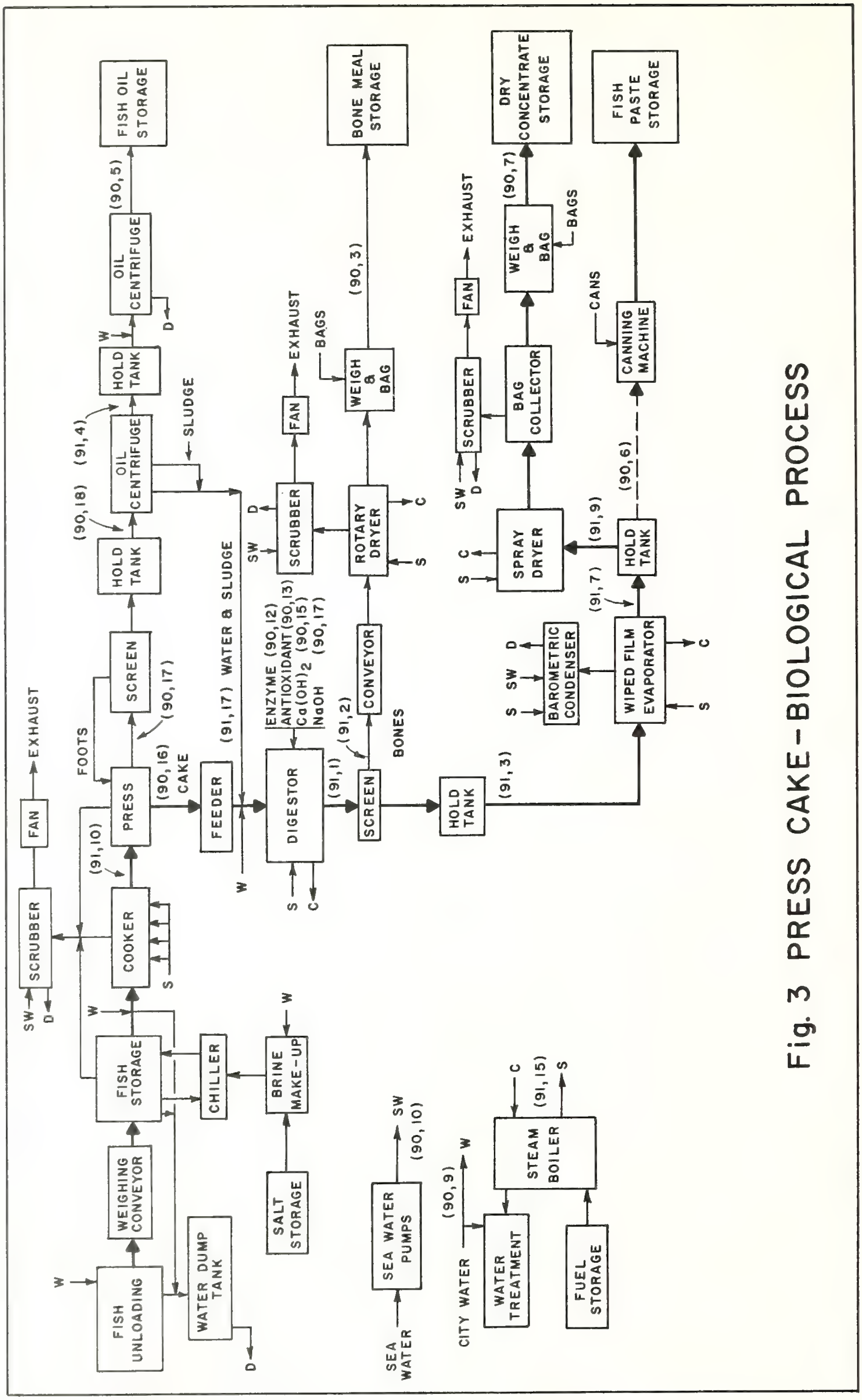


Fig. 3 PRESS CAKE-BIOLOGICAL PROCESS

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

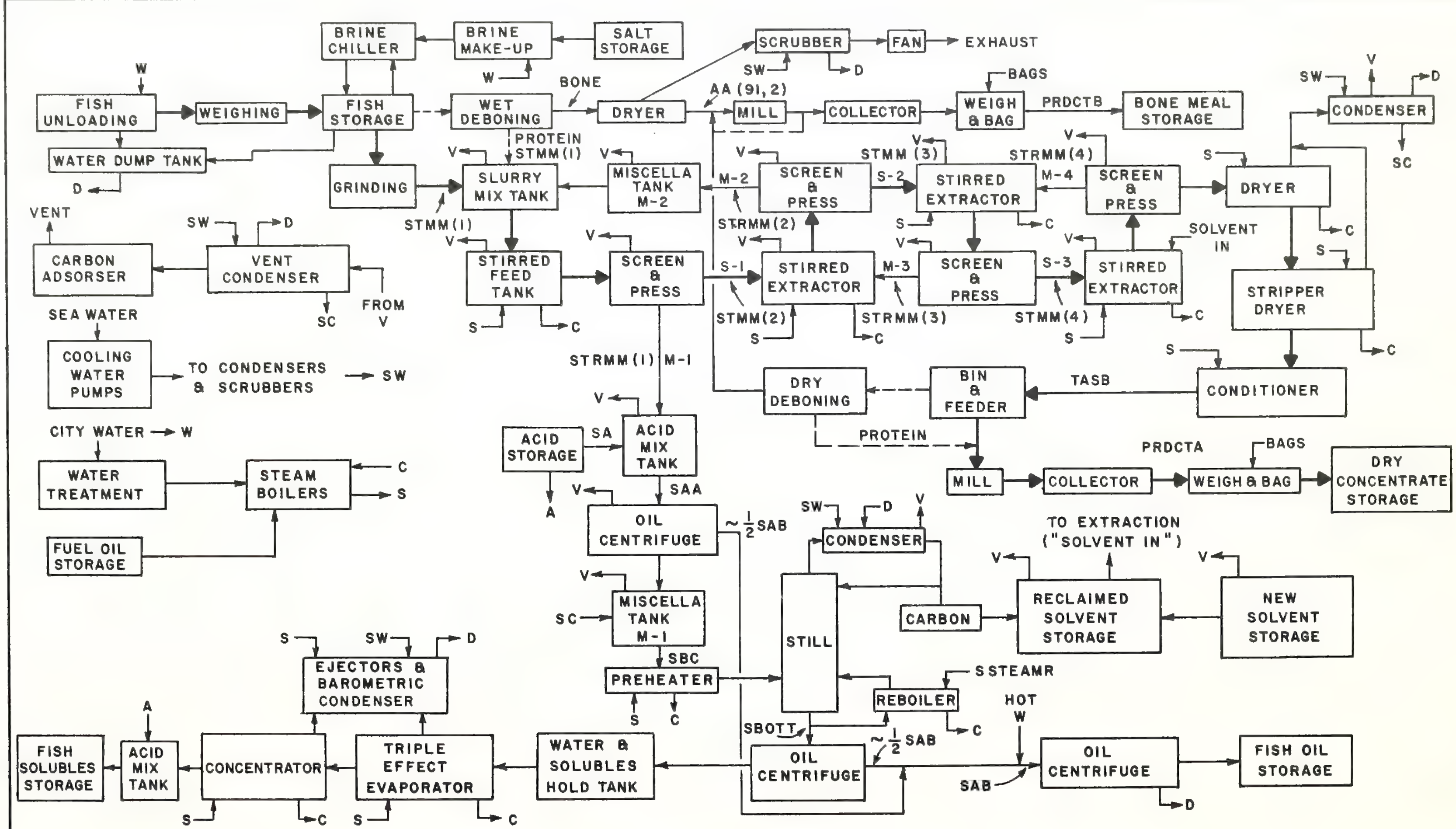


Fig. 4 ISOPROPYL ALCOHOL EXTRACTION PROCESS

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

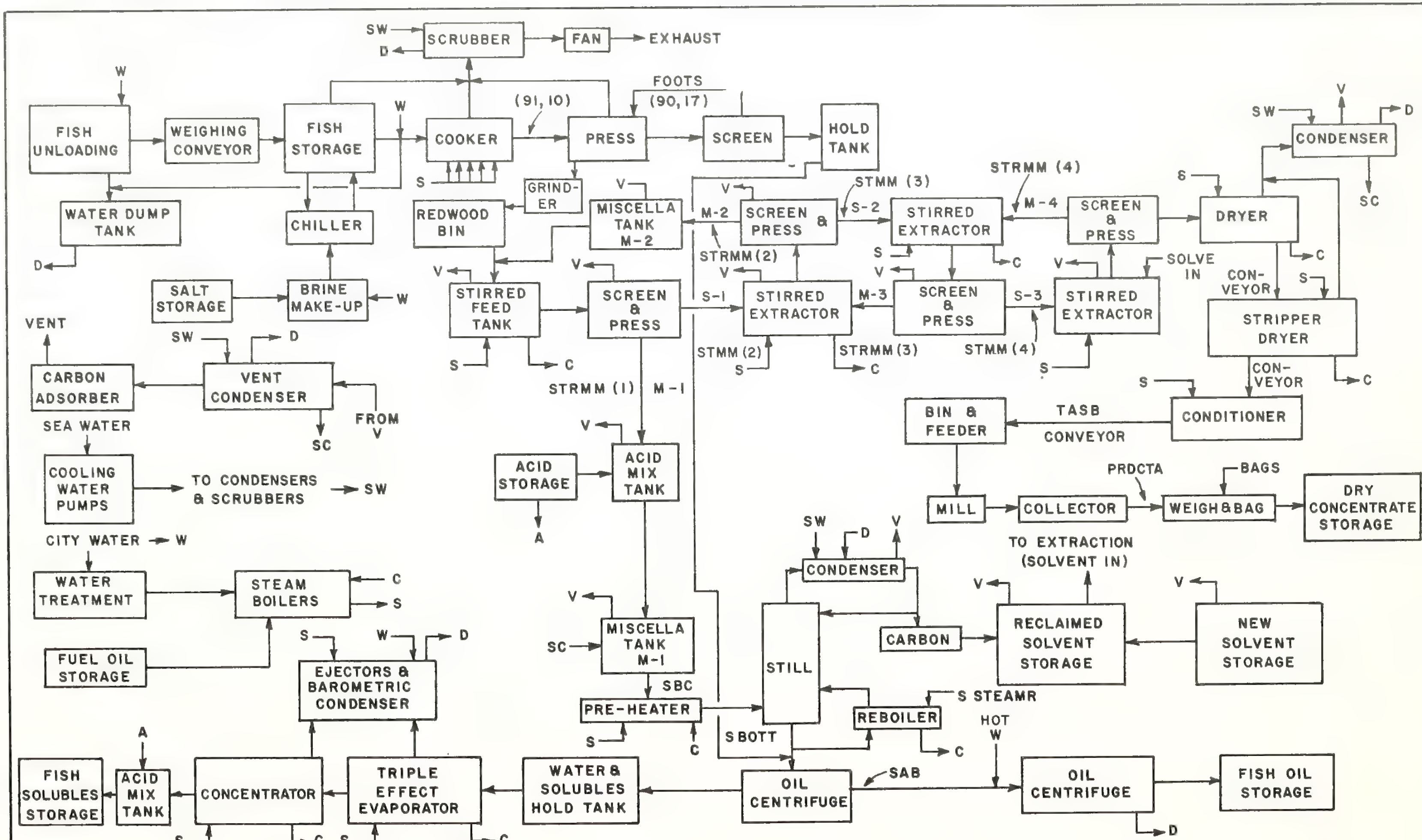
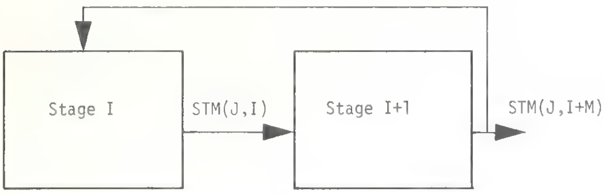


Fig. 5 PRESS CAKE ISOPROPYL ALCOHOL EXTRACTION PROCESS

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.

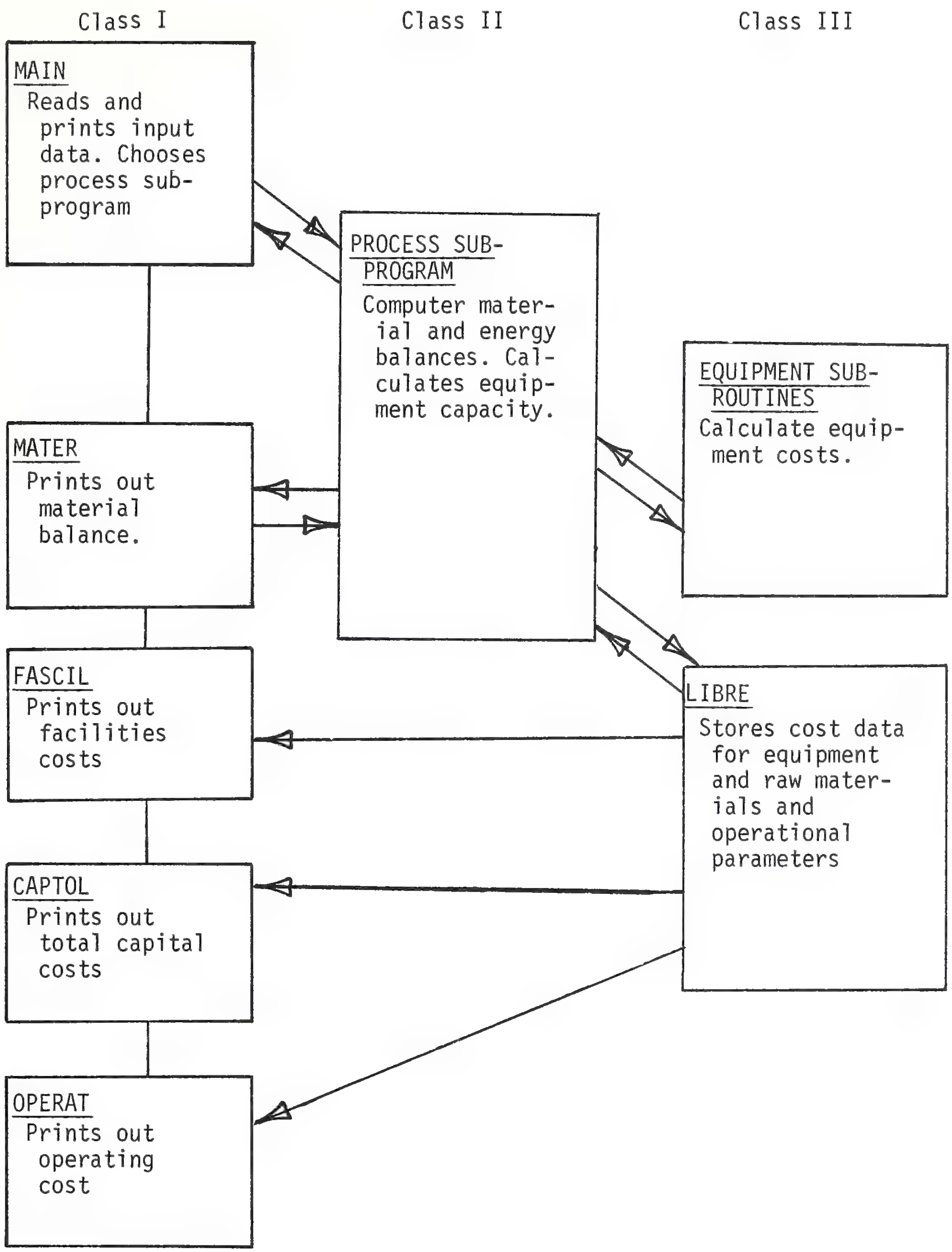
Most of the program changes which will be necessary as cost data change or become more accurately known can be done in LIBRE. This is discussed in more detail in Appendix A.

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 $8(\text{ton-days}/50)^{1/2}$ 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 0_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

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

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 manhours. 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.

B. References

1. Gaden, E. L., Jr., "World Protein Resources," Chem. Engr. Progress, 65, (9), September, 1969.
2. Roels, O. A., "Marine Protein," Chem. Engr. Progress, 65, (9), 27, September, 1969.
3. Klumpar, I. V., "Process Predesign by Computer," Chem. Engr., 76, 114, September 22, 1969.
4. Drayer, D. E., "How to Computerize Plant Cost Estimations," Petro/Chem. Engineer, 42, 39, May, 1970.
5. "Economic Indicators," Chem. Engr., 77, 250, May 4, 1970.
6. Guthrie, K. M., "Capital Cost Estiamting," Chem. Engr., 76, 115, March 24, 1969.
7. Drew, J. W., and Ginder, A. F., "How to Estimate the Cost of Pilot-Plant Equipment, Chem. Engr., 77, 100, February 9, 1970.
8. Dryden, C. E., and Furlow, R. H., "Chemical Engineering Costs," Ohio State University, Columbus, 1966.
9. Mills, H. E., "Costs of Process Equipment," Chem. Engr., 71, 133, March 16, 1964.
10. Clerk, Jackson, "Multiplying Factors Give Installed Costs of Process Equipment," Chem. Engr., 70, 182, February 18, 1962.
11. Miller, C. A., "New Cost Factors," Chem. Engr., 72, 226, September 13, 1965.
12. "Centrifuges Exemplify Chem. Show Trends," Chem. & Engr. News, 56, December 15, 1969.
13. Ambler, C. M., "How to Select the Optimum Centrifuge," Chem. Engr., 76, 96, October 20, 1969.
14. "Guide to Solids Handling," Deskbook Issue, Chem. Engr., 76, October 13, 1969.
15. Drayer, D. E., "How to Estimate Plant Cost-Capacity Relationship," Petro/Chem. Engineer, 42, 10, May, 1970.
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.

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    LIBRE
    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 IY        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  )
00301     1021    FORMAT(/8X45H SOLUBLE FISH SOLIDS RECYCLED TO MIXER  IY=2 )
```

Table I.--Continued.

```
00302    65*   1022  FORMAT(/8X45H SOLUBLE FISH SOLIDS REMOVED AS PRODUCT TY=1 )
00303    66*    1023  FORMAT(/8X26H OPERATING DAYS PER YEAR =,F8.0)
00304    67*    1030  FORMAT(//8X18H FISH COMPOSITION  )
00305    68*    1031  FORMAT(/13X11H OIL        =,F6.2,8H PERCENT)
00306    69*    1032  FORMAT( 13X11H PROTEIN  =,F6.2,8H  ''-''  )
00307    70*    1033  FORMAT( 13X11H ASH        =,F6.2,8H  ''-'' )
00310    71*    1034  FORMAT( 13X11H WATER      =,F6.2,8H  ''-'' )
00311    72*          IPTION(5)=IV
00312    73*          IF(IX.EQ.1)  PRINT 1040
00315    74*          IF(IX.EQ.2)  PRINT 1041
00320    75*          IF(IZ .EQ. 1) CALL FPCXX1(TONS)
00322    76*          IF(IZ.EQ.2) CALL XXIPA(TONS)
00324    77*          IF(IZ .EQ. 3) CALL BIOLOG(TONS)
00326    78*          IF(IZ .EQ. 4) CALL PRESCK(TONS)
00330    79*          IF(IZ.EQ.7)  CALL  PRSIPA(TONS)
00332    80*          CALL FASCIL(TONS)
00333    81*          CALL CAPTOL(TONS)
00334    82*          CALL  OPERAT(TONS)
00335    83*          GO TO 2
00336    84*   999   STOP
00337    85*          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    BELT
    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          COX60H   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   163*        SUMHP=SUMHP+HP
00364   164*        AA(40,17)=(AA(90,3)+AA(90,13)/2000.)*2000./8.33*15.
00365   165*        IA(40,1)=0
00366   166*        CALL STORAG
00366   167*  C PUMP TO CURING
00367   168*        IA(66,1)=0
00370   169*        AA(66,17)=AA(40,17)*30./(15.*16.*60.)
00371   170*        CALL PMPCNT
00372   171*        HP=.001*AA(66,17)
00373   172*        SUMHP=SUMHP+HP
00374   173*         AA(18,17)= 1.30 * TONST/16.
00375   174*         CALL HAMMER
00376   175*         AA(72,17) = 18.
00377   176*         CALL SCALE
00400   177*        IA(75,1)=0.0
00401   178*        IA(75,2)=0.0
00402   179*        AA(75,17)=AA(90,3)*20./(60.*16.)
00403   180*         CALL BAGGMA
00404   181*         AA(75,17) = AA(75,17)*60*16
00405   182*         HP=XNUM*20.
00406   183*         SUMHP=SUMHP    +  (.001*HP)
00407   184*         AA(54,17)=HP
00407   185*  C
00407   186*  C   FISH OIL STREAM
00407   187*  C
00410   188*        AA(40,17)=AA(91,3)*2000./(16.*8.33)*1.
00411   189*        IA(40,1)=0
00412   190*        CALL STORAG
00413   191*        AA(66,17)=AA(40,17)*30./60.
00414   192*        CALL PMPCNT
00415   193*        CALL PMPCNT
00416   194*        HP=.001*AA(66,17)
00417   195*        SUMHP=SUMHP+HP
00420   196*        SUMHP=SUMHP+HP
00421   197*         DO  11  I=1,NUM
00424   198*         AA(54,17)=20.
00425   199*     11  CALL  CNTFGE
00427   200*         TONSA= TONSA* Z3*1.1
00430   201*         HP= .025*TONSA
00431   202*         AA(52,17)= HP
00432   203*        N1=(HP/20.)  +1.
00433   204*        HP=20*N1
00434   205*         SUMHP= SUMHP+ HP
00435   206*         AA(52,17)=20.
00436   207*         DO  12  I=1,N1
00441   208*     12   CALL  SHARP
00443   209*         TONSA=TONS*3.0*.8*.13*2000./8.33
00444   210*         TONSA=TONSA*Z1*Z3/(.8*.13)
00445   211*         Z7= 1.-Z3
00446   212*         IA(40,1)=2
00447   213*        AA(40,17)=TONSA*7./3.
00450   214*         AA(40,18)=1.0
00451   215*         CALL STORAG
00452   216*         IA(66,1)=0
00453   217*        AA(66,17)=TONSA*30./(3.*16.*60.)
00454   218*         SUMHP=  SUMHP +(AA(66,17)*.001)
00455   219*         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.

```
      AA(33,17) = TONA / 20.
      CALL EVPHOR
      CALL EVPHOR
      CALL EVPHOR
      TONC =  TONA*.06/(.87*.3)
      TONC=TONC*Z6*.87/(Z7*.06)
C PUMP TO CONCENTRATOR
      AA(66,17)=TONC*2000.*30./(8.33*60.)
      IA(66,1)=0
      CALL PMPCNT
      HP=.001*AA(66,17)
      SUMHP=SUMHP+HP
      AA(33,17)=TONC/25.
       CALL EVPHOR
      AA(90,4)=TONS*Z1*Z6*2.*1.
      AA(40,17)=AA(90,4)*2000./(8.33*16.)*1.
      IA(40,1)=0
      CALL STORAG
      AA(66,17)=30.*AA(40,17)/60.
      CALL PMPCNT
      CALL PMPCNT
      HP=.001*AA(66,17)
      SUMHP=SUMHP+HP
      SUMHP=SUMHP+HP
      IF(IPTION(1).EQ.2) GO TO 51
C
C CONDENSED FISH SOLUBLES STORAGE (15 DAYS)
C
      AA(40,17)=AA(90,4)*2000./8.33*15.
      IA(40,1)=0
      CALL STORAG
   51 CONTINUE
C
C   SUMMATION OF STEAM, WATER, AND ELECTRICITY
C
       AA(27,18)= 150.
       AA(27,17)= TONS*2.*2000./(3.*16.)
C
C BOILER WATER TREATMENT
C
      COST(5)=1.000
      COST(1)=COST(5)
      PRINT 4242,COST(1),COST(5)
 4242  FORMAT(/25H BOILER WATER TREATMENT  , 10X ,15H                ,10H
     1           ,F10.3,30X,F10.3)
      COSTA(1)=COSTA(1)+COST(1)
      COSTA(5)=COSTA(5)+COST(5)
C
C FUEL OIL STORAGE
C
      IA(40,1)=2
      AA(40,17)=TONS*6000./387.*15.
      CALL STORAG
      AA(66,17)=30.*AA(40,17)/(15.*60.)
      CALL PMPCNT
      HP=.001*AA(66,17)
      SUMHP=SUMHP+HP
```

Table I.-- Continued.

```
00620   334*          CALL BOILER
00621   335*          XLOOPS=  9 + NA +NB
00622   336*          TOND=TONA/2.4 -TONC/2.4 +(TONC*.4)
00623   337*          AA(91,5) = (TONA-TOND)/(0.6*8.33)
00624   338*          AA(90,17)= (TONC*.4)
00625   339*          AA(90,16)= (TONA-TONC)/2.4
00626   340*          AA(66,17)=4*(AA(90,16) +AA(90,17)) +1.5*TONS
00626   341*    C
00626   342*    C SEA WATER PUMPS
00626   343*    C
00627   344*         IA(66,1)=1
00630   345*         IA(66,4)=2
00631   346*         CALL PMPCNT
00632   347*         IA(66,1)=0
00633   348*         IA(66,4)=0
00634   349*          SUMHP= SUMHP +(AA(66,17)*.001*1.5)
00635   350*          COST(1)=XLOOPS *AA(100,1)
00636   351*          COST(5)=COST(1)
00637   352*          COSTA(1)     = COSTA(1)    + COST(1)
00640   353*         COSTA(5)=COSTA(5)      + COST(5)
00641   354*          PRINT 1021 COST(1),COST(5)
00645   355*          AA(8,17) = TONS
00646   356*          CALL CONDEN
00647   357*           COST(1)=AA(100,2)
00650   358*          COST(5)=COST(1)
00651   359*          COSTA(1)=COST(1)         + COSTA(1)
00652   360*          COSTA(5)=COSTA(5) + COST(5)
00653   361*          PRINT 1022, COST(1).COST(5)
00657   362*          AA(72,17)=18.
00660   363*          CALL  SCALE
00661   364*          CALL  SCALE
00662   365*          PRINT 1041,(COSTA(J),J=1,6)
00670   366*     1041 FORMAT(//25H  TOTAL COSTS              ,35X6F10.3)
00671   367*          COSTA(7)=0.02*COSTA(1)
00672   368*          IF(IPTION(1).EQ.2) AA(90,4)=0.
00674   369*     1034 FORMAT(// 40H      TOTAL COST OF FEPC  PLANT          ,F16.3)
00675   370*          PRINT 1010
00677   371*-    1010  FORMAT(1H1)
00700   372*          HP = TONS*0.00124 +13.6
00701   373*          SUMHP = HP + SUMHP
00702   374*          HP = 40*TONS/3.
00703   375*          SUMHP = HP + SUMHP
00704   376*          AA(90,2)= SUMHP* .7457 * 16.
00705   377*          AA(90,1)= TONS* 6000./387.
00706   378*          AA(100,10)=COSTA(5)
00707   379*          IXX =(16.0*(TONS/50.0)**.31) +0.5
00710   380*          PXX =IXX
00711   381*          AA(90,9) =PXX*10.
00712   382*          AA(90,8) =IXX*8.0
00712   383*    C
00712   384*    C  MATERIAL BALANCE INFORMATION PRINTOUT
00712   385*    C
00713   386*          CALL MATER(TONS)
00714   387*          TONS = TONS/16
00715   388*          AA(90,15)= TONS*2000.*.2
00716   389*          PRINT 1060,AA(90,15)
00721   390*     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    SCRFEN
    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     1*          SUBROUTINE PRSIPA(TONS)
00103     2*          COMMON/BLOCK2/ COST(7),COSTA(7)
00104     3*          COMMON/ DATA1 / DATB(8,5)
00105     4*          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00106     5*          COMMON/BLOCK4/ IPTION(10)
00107     6*          DIMENSION  STM(5,9),STRM(5,9),STRMM(9),STMM(9)
00110     7*          DIMENSION  STOP(5) ,SBOT(5)
00111     8*          REAL   MATRL
00111     9*    C
00111    10*    C  NORMALIZATION
00111    11*    C
00112    12*          DO 1 I=1,7
00115    13*          COST(I) = 0.
00116    14*        1 COSTA(I)= 0.
00120    15*          DO 2 I=1,20
00123    16*          AA(90,I)=0.
00124    17*      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)  NORFAC = 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                                              2
00203              CALL SCALE                                             2
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
```

Table I.--Continued.

```
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 SCREWR                                                  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)*DATH(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  VESSEI
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.

```
01000          AA(33,17) = SAQT * 2000. /(HOUR* 25.)
01001          STEAM = STEAM + (HWAT * 2000./HOUR)
01002          CALL  EVPHOR
01003          IA(66,1)=0.
01004          AA(66,17)=30.*SBQQT        *2000./(10.*60.*HOUR)
01005          CALL  PMPCNT
01006          HP=.001*AA(66,17)
01007          SUMHP=SUMHP + HP
01007    C
01007    C   ACID MIX TANK
01007    C
01010          AA(40,17)=SBQQT        *2000./(10.*1.)*.01
01011          IA(40,1)=2
01012          CALL  STORAG
01013          IA(40,1)=0
01013    C
01013    C   STORAGE OF FISH SOLUABLES(15 DAYS)
01013    C
01014          IA(66,1)=0
01015          AA(66,17)=30.*AA(40,17)/(60.*HOUR)
01016          CALL  PMPCNT
01017          HP=.001*AA(66,17)
01020          SUMHP=SUMHP  + HP
01021          IA(40,1)=2
01022          AA(40,17)=SBQQT        *2000./10. *15.
01023          CALL  STORAG
01024          IA(40,1)=0.
01025       52  CONTINUE
01025    C
01025    C  ACID TANK AND  FISH SOLUABLES  STORAGE
01025    C
01025    C
01025    C  DRYING AND CONDITIONING OPERATION(SOLIDS FROM EXTRACTION VESSELS)
01025    C
01026          TASA= STMM(NOREAC+1)/2.
01027          NZ= NOREAC + 1
01030          TASB= STM(1,NZ) + STM(2,NZ) + STM(3,NZ) +(0.05*STM(4,NZ))
01030        1 +  (STM(5,NZ)*1.E-04 * 1.0 )
01031          TASC= STM(4,NZ) * .95
01032          TASD= STM(5,NZ) * .9999
01033          STEAM6 = (TASC + (1.0  * TASD)) *  2000. / HOUR
01034          STEAM=  STEAM + STEAM6
01034    C  DRYER - CONDITIONER
01035          AA(21,17) = 3.8* 16.* TASA/ 24.
01036          IA(21,5)  = 6.
01037          BB(2)     = 0.9
01040          CALL DRYERR                                                    D
01041          BB(2) = 1.0
01042          IA(21,5) = 7
01043          CALL DRYERR                                                    SD
01044          BB(2) =  1.0
01045          IA(21,5) = 7
01046          CALL DRYERR                                                    SD
01047          IA(21,5) = 8
01050          BB(2) = 1.0                                                    C
01051          CALL DRYERR
01052          LOOPS =  LOOPS + 4
```

Tabie 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 STFAM(STIRRED VESSEL 1 )           ,F8.0,7H LB/HR )
01234          YYB=STEAM2
01235          PRINT 1202,YYB
01240    1202  FORMAT(/8X,35H STFAM(STIRRED VESSEL 2 )           ,F8.0,7H LB/HR )
01241          YYC= STEAM3
01242          PRINT 1203,YYC
01245    1203  FORMAT(/8X,35H STFAM(STIRRED VFSSEL 3 )           ,F8.0,7H LB/HR )
01246          YYD= STEAM4
01247          PRINT 1204,YYD
01252    1204  FORMAT(/8X,35H STFAM(STIRRED VESSEL 4 )           ,F8.0,7H LB/HR )
01253          YYE = STEAM9
01254          PRINT 1205,YYF
01257    1205  FORMAT(/8X,35H STFAM(PREHEATER-DISTILLATION)      ,F8.0,7H LB/HR )
01260          YYG= STEAMR
01261          PRINT 1206,YYG
01264    1206  FORMAT(/8X,35H STFAM(REBOILER)                    ,F8.0,7H LB/HR )
01265          YYH = STEAM6
01266          PRINT 1207,YYH
01271    1207  FORMAT(/8X,35H STFAM(ROTARY DPYER  FPC   )        ,F8.0,7H LB/HR )
01272          YYI= STEAMW
01273          PRINT 1208,YYI
01276    1208  FORMAT(/8X,35H STFAM(ROTARY DPYER 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 WATFR                        ,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-07/12-11:34 (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    BELT
     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    WATER
     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    000036 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(T)*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            COX60H    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.)
```

Tabie 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.CAOH 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.

```
1023  FORMAT(/8X26H MISCEIALEOUS STEAM          ,F8.0,7H LB/HR  )
      AA(90,9)=AA(90,9)/8.33
      PRINT 1024 ,AA(90,9)
1024  FORMAT(/8X26H CITY WATER                  ,F8.0,7H GAL/HR )
      AA(90,1) = AA(27,17)*24*0.0112
      AA(90,2)= SUMHP* .7457 * 24.
      AA(90,3) = AA(90,3)*24/2000
      AA(90,5) = AA(90,5)*24/2000
      AA(90,6) = AA(90,6)*24/2000
      AA(90,7) = AA(90,7)*24/2000
      IXX =(14.0*(TONS/50.0)**.31) +0.5
      PXX =IXX
      AA(90,8) =IXX*8.0
      AA(90,9) =AA(90,9)*24
      AA(90,12)=AA(90,12)*24
      AA(90,13)=AA(90,13)*24
      AA(90,15)=AA(90,15)*24
     AA(90,14)=AA(90,14)*24
     AA(90,17)=AA(90,17)*24
      RETURN
      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    BELT
    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                SUBROUTINE XXIPA(TONS)
00101       C
00101       C  ISOPROPYL ALCOHOL EXTRACTION PROCESS
00101       C
00101       C
00103             COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104             COMMON/BLOCK2/ COST(7),COSTA(7)
00105             COMMON/BLOCK4/ IPTION(10)
00106             DIMENSION STM(5,5),STRM(5,5) , STMM(5), STRMM(5)
00107             DIMENSION  STOP(3),SBOT(3)
00110             AA(72,17)=18.
00111              PRDCTB=0.
00112      1113   FORMAT(/ 25H WET DEBONER              ,F10.3,25H  TONS         SST
00112          C         ,6F10.3)
00113             IPTION(2)=IPTION(1)
00114             LOOPS=0
00115             DO 1 I=1,7
```

```
00120         COST(I)=0.0
00121       1 COSTA(I)=0.n
00123         IF(IPTION(1).EQ.2)  PRINT 1120
00126           IF(IPTION(1).EQ.1)  PRINT 1110
00131         DO 2 I= 1,2n
00134         AA (90,I)=0.n
00135       2 AA (91,I)=0.n
00137         DO 10 I =30,33
00142      10 BB(I)=BB(I)*.01
00144        PRINT 2000
00146  2000   FORMAT(1H1//55H DETAILED EQUIPMENT COSTS (ALL COSTS IN 1000.n DOL
00146       CLARS) )
00147        PRINT 3001
00151  3001   FORMAT (//18H    EQUIPMENT TYPE,10X10H  CAPACITY,12X9H MATERIAL,
00151       C60H     BASE    MATERIALS    LABOR    INDIRECT    MODULE      RANGE ,/6
00151       C0X60H    COST        COSTS      COSTS      COSTS      COST        + OR - )
00151  C UNLOADING AND STORAGE OF FISH
00152         TONSA =  TONS*2000./8.33
00153         GALLON=  TONSA/(24.*60.)
00154         GALS  =  1.3* GALLON
00155         SUMHP=0.
00156         IA(65,1) =0.
00157         IA(65,2) =1.n
00160         AA(65,17)= GALS*3n.
00161         NUM = TONS/500 + 1
00162         DO 143 I=1,NUM
00165        SUMHP=SUMHP+(1.*AA(65,17)*.001*1.5)
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.GE.150.) AA(70,18)=48.
00201         AA(70,17)=100.
00202         CALL BELT
00203         HP=  TONS*0.00124 + 13.6
00204         SUMHP=  SUMHP + Hp
00205         AA(40,17)= 30.0* TONS
00206         IA(40,1) = n
00207         IA(40,2) = 2
00210         CALL STORAG
00211         IA(40,2)= 0
00212         AA(85,17)= 0.5* TONS* 3.n
00213         IA(85,1) = 30
00214         CALL REFRIG
00215         IA(7,1) = 1
00215  C
00215  C FISH STORAGE FOR 3 DAYS
00215  C
00216        AA(7,17)=3.*TONS*2000.*1.69/62.4
00217        CALL SILO
00220        COST(1)=1.19
00221        IF(TONS.GE.300) COST(1)=1.88
00223        COST(5)=COST(1)
00224        PRINT 4249, COST(1), COST(5)
00230        COSTA(1)=COSTA(1)+COST(1)
00231        COSTA(5)=COSTA(5)+COST(5)
```

Table I.--Continued.

```
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.

```
C
      TONSA=(TONS*ZA1) + (TONS*BB(32)*ZA2*(1.-ZA3))
      TONSB= TONS-TONSA
      SLMXTK=  875.* TONSB / 50.
C     MIX TANK
      GALS= 875.* TONS/50.
      AA(73,17)=   GALS*.005
      IA(66,1)= 2
      IA(73,5)= 2
      AA(40,17)= GALS
      AA(40,18)= 3.2
      AA(41,12)=3.2
      IA(40,1)= 1
      CALL STORAG
      GAA= STMM(1)*2000./(24.*60.)
     GAA=GAA/8.33
     AA(66,17)=GAA*30.
      IF(GAA.GT.125.) IP= (GAA/125.) + 1
      IF(GAA.LE.125.) IP=1
      DO  40  IQ=1,IP
     HP=(AA(66,17)*.001)
     SUMHP=HP+SUMHP
     CALL PMPCNT
     AA(66,17)=(STMM(1)+STRMM(2))*2000.*30./(24.*60.*8.33)
     SUMHP=.001*AA(66,17)+SUMHP
  40 CALL PMPCNT
      IF (GALS. GT. 10000.)  AA(73,17)=50.
      CALL AGITOR
C
C     REACTOR  VESSELS
C
      AA(51,17)=TONS*60./50.
        IP=(AA(51,17)/144.) +2.
        AA(51,17) =IP
      VES= TONS* 30.
      AA(49,17) = VES
      VESS= TONS*16.
      IR=1
      IF(VES.GT.10000.) IR= (VES/10000.) + 1.
      IRR=1
      IF(VESS.GT.10000.) IRR= (VESS/10000.)+1.
      IF(VES.GT.10000.)   VES = 10000.
      TANK= 800.* TONS/50.
      AA(40,18) = 3.2
      AA(41,18) = 3.2
      AA(40,17) = TANK
      CALL STORAG
      SAG= STRMM(2)*2000./(24.*8.33*60.)
      IP=1
      IF(SAG.GT.1250.) IP =(SAG/1250.) + 1.
        DO 93  IU=1,IP
      XIP = IP
      AA(66,17) = (SAG/XIP)* 24.
     CALL PMPCNT
     CALL PMPCNT
     HP=.001*AA(66,17)
     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.
```

```
      IA(17,5)=1
      CALL SCREWR
      BB(2)=1.
       IA(21,5)=7
       AA(21,17)=AA(21,17)
       CALL DRYERR
       AA(21,17)=AA(21,17)
       IA(21,5)  = 8
       BB(2)=1.0
      CALL DRYERR
      AA(17,18)=6
      AA(17,17)=6
      IA(17,5)=1
      CALL SCREWR
       LOOPS = LOOPS  + 2
       LOOPS = LOOPS + 2
       AA(17,18) = 6.
       AA(17,17) = 20.
       IA(17,5)  = 1
       CALL SCREWR
       ZA7= .96
      IF(IPTION(2).NE.1) ZA7=1.
      ZA8=1.-ZA7
      IF(IPTION(2).NE.1.AND.IPTION(2).NE.2) GO TO 300
       AA(18,17) =(TASB/ 8.)
       CALL HAMMER
       HP = (TASB *2000.*75./(8. * 700.))
       HP = HP/3.
      SUMHP=SUMHP+HP
      IF(IPTION(2).EQ.1) GO TO 44
C      DRY DEBONING OPTION
       PRDCTA=((STM(2,5)*ZA7)    + (STM(3,5)*ZA8))/.95
       PRDCTB=((STM(2,5)*ZA8)    + (STM(3,5)*ZA7))/.95
       AA(75,17)=PRDCTA*2000./(25.*24.*60.)
       CALL  BAGGMA
       XAA=AA(75,17)
       AA(75,17)=PRDCTB*2000./(25.*24.*60.)
       CALL  BAGGMA
       AA(75,17)=AA(75,17) +XAA
       AA(75,17)=AA(75,17)*24.*60.
       GO TO 49
  300 CONTINUE
      AA(18,17)=TASB/8.
      CALL HAMMER
      HP=(TASB*2000.*75./(8.*700.))
      HP=HP/3.
      SUMHP=SUMHP+HP
      PRDCTA=((STM(2,5)+STM(3,5))/.95)
      AA(75,17)=PRDCTA*2000./(25.*24.*60.)
      CALL BAGGMA
      AA(75,17)=AA(75,17)*24.*60.
      GO TO 49
   44 CONTINUE
C  WET DEBONING OPTION
       AA(75,17) =((STM(2,5)*ZA7) + (STM(3,5)*ZA8))/.95
       PRDCTA=AA(75,17)
       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
       SBOT=SBOT(2) + STRM(2,1)
       SBOQT=STRM(2,1)*2.
       HWAT=SBOT-SBOQT
 3006 FORMAT(/50H FISH SOLUABLES ARE MORE THAN 50 PERCENT PROTEIN
       IF(HWAT.GE.0.)  GO TO 51
        PRINT 3006
       AA(90,4)=SBOT
       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.

```
          PRINT 1227,XXD
    1227  FORMAT(/8X,35H TOPS FROM DISTILLATION COLUMN      ,F8.0,7H LB/HR )
          XXE= SBOTT*2000./24.
          PRINT 1228,XXE
    1228  FORMAT(/8X,35H BOTTOMS FROM DISTILLATION COLUMN   ,F8.0,7H LB/HR )
          XXF =(.5*STRM(1,1)*2000./24.)
          PRINT 1229,XXF
    1229  FORMAT(/8X,35H OIL FROM SECOND CENTRIFUGE         ,F8.0,7H LB/HR )
          XXG= AA(90,5)*2000./24.
          PRINT 1230,XXG
    1230  FORMAT(/8X,35H FISH OIL PRODUCT                   ,F8.0,7H LB/HR )
          XXH=AA(90,3)*2000./24.
    1231  FORMAT(/8X,35H FISH PROTEIN CONCENTRATE           ,F8.0,7H LB/HR )
          XXI=AA(90,7)*2000./24.
          PRINT 1232, XXH
          PRINT 1231, XXI
    1232  FORMAT(/8X,35H BONE MEAL CONCENTRATE              ,F8.0,7H LB/HR )
         AA(95,1) =  STRM(1,2) *  2.
         XXJ =  AA(95,1)* 2000./24.
          PRINT 1233, XXJ
    1233  FORMAT(/8X,35H FISH SOLUABLES                     ,F8.0,7H LB/HR )
          IXX=(14.0*(TONS/50.)**.31)  + 0.5
          AA(90,8)=IXX*8
         AA(90,9)=(YYJ+YYK*60.)*24.
          AA(90,13)  =  AA(90,13) + (AA(90,3)+AA(90,7)+AA(90,20)+AA(90,4))
          RETURN
          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           COX60H    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
```

Table I.--Continued.

```
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
```

Tabie I.-- Continued.

```
      AA(90,3)=1.05*SLDS
      AA(91,12)=AA(91,2)-AA(90,3)
C
C BAGGING MACHINE AND HAMMER MILL FOR BONE FEED
C
      AA(75,17)=AA(90,3)*2000./(24.*60.*25.)
      IA(75,2)=0
      IA(75,1)=0
      AA(18,17)=AA(90,3)/24.
      CALL HAMMER
      CALL BAGGMA
      AA(75,5)=AA(75,17)
C
C
C DIGESTED SOLIDS STREAM
C
       AA(91,3) =AA(91,1)-AA(91,2)
       AA(40,17) = AA(91,3)*2000/(8.33*24)
      IA(40,1)=1
       CALL STORAG
       IA(40,1) = 0
C PUMPS BEFORE AND AFTER HOLD TANK
      IA(66,1)=0
      AA(66,17)=AA(40,17)*30./60.
      CALL PMPCNT
      CALL PMPCNT
      SUMHP=SUMHP+2.*.001*AA(66,17)
      AA(91,6)=AA(91,3)
      PROD=(((612./667.)*BB(31))+((89./103.)*(103./500.)*BB(30))+((77./1
     C45.)*BB(32)))*TONS+((20./112.)*(AA(90,12)+AA(90,13)+AA(90,15)+AA(9
     10,17))*(77./145.))
      WATER=AA(91,3)-PROD
       WATEVP =WATER-PROD
       HP=0.01*AA(91,3)*2000./(8.33*24.)
       SUMHP=HP+SUMHP
       AA(91,13)=WATEVP
       AA(31,17)=AA(91,13)*2000./(24.*25)
       CALL EVPFLM
C
C HOLD TANK FOR DIGESTED SOLIDS
C
      AA(91,7)=2.*PROD
      AA(40,17)=AA(91,7)*2000./(8.33*24.)
      IA(40,1)=0
      CALL STORAG
C PUMP AFTER WIPED FILM EVAPORATOR
      AA(66,17)=AA(40,17)*30./60
      IA(66,1)=0
      CALL PMPCNT
      HP=.001*AA(66,17)
      SUMHP=HP+SUMHP
      AA(90,6)=AA(91,7)*BB(42)*.01
C PUMP BEFORE CANNING MACHINE
      AA(66,17)=AA(90,6)*2000.*30./(8.33*24.*60.)
      IF(BB(42).GT.0.0) CALL PMPCNT
      HP=.001*AA(66,17)
      SUMHP=HP+SUMHP
```

Table I.-- Continued.

```
          AA(75,17)=AA(90,6)*2000.0/(8.33*24.0*60.0*5.0)
         IA(75,1)=1.0
         IA(75,2)=2.0
          IF(BB(42) .GT. 0.0) CALL RAGGMA
         AA(75,4)=AA(75,17)
         IA(75,1)=0.0
         IA(75,2)=0.0
          AA(75,4)=AA(75,4)*60.*24.
          AA(91,9)=AA(91,7)-AA(90,6)
         AA(90,7)=AA(91,9)/(2.*.95)
C PUMP BEFORE SPRAY DRYER
         AA(66,17)=AA(90,7)*2000.*30./(8.33*60.*24.)
         IA(66,1)=0
         CALL PMPCNT
         HP=.001*AA(66,17)
         SUMHP=HP+SUMHP
          AA(91,14)=AA(91,9)-AA(90,7 )
          AA(30,17)=AA(91,14)*2000.0/24.0
          CALL EVPSPR
         AA(75,17)=(AA(75,17)+AA(75,5))*60.*24.
          IF(BB(42) .LT. 100) CALL RAGGMA
         AA(75,17)=AA(75,17)*60.*24.
C
C FISH OIL STREAM
C
         AA(40,17)=AA(90,18)*2000/(8.33*24)
          IA(40,1) = 0
         CALL STORAG
C PUMPS AFTER SCREEN AND BEFORE CENTRIFUGE
         AA(66,17)=AA(40,17)*30./60.
         IA(66,1)=0
         CALL PMPCNT
         CALL PMPCNT
         HP=.001*AA(66,17)
         SUMHP=HP+SUMHP
         SUMHP=HP+SUMHP
          AA(91,4) = 1.1*AA(90,5)
          HP = 0.01*AA(90,18)*2000.0/(8.33*24.0)
          SUMHP =HP+SUMHP
          NUM = HP/20. +1
          DO 40 I=1,NUM
         AA(52,17)=20.
   40    CALL SHARP
          AA(40,17) = AA(91,4)*2000/(8.33*24)
         CALL STORAG
C PUMP BEFORE AND AFTER HOLD TANK
         AA(66,17)=AA(40,17)*30./60.
         IA(66,1)=0
         CALL PMPCNT
         CALL PMPCNT
         HP=.001*AA(66,17)
         SUMHP=HP+SUMHP
         SUMHP=HP+SUMHP
          HP = 0.025*AA(91,4)*2000.0/(8.33*24.0)
          SUMHP =HP+SUMHP
          NUM= HP/20. +1
          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)=1.000
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.

```
         PRINT 1050 COST(1),COST(5)
    1050 FORMAT(/ 25H CONTROL INSTRUMENTATION , 10X ,15H                    ,10H
        1         ,F10.3,30X,F10.3)
         AA(8,17) = TONS
         CALL CONDEN
         AA(72,17) = 18.
         CALL SCALE
         CALL SCALE
         CALL SCALE
        CALL SCALE
          COST(1)=AA(100,2)
         COST(5)=COST(1)
         COSTA(1)=COST(1)          + COSTA(1)
         COSTA(5)=COSTA(5) + COST(5)
         PRINT 1051, COST(1),COST(5)
    1051 FORMAT(/ 25H PAYLOADER AND FORK LIFT , 10X ,15H                    ,10H
        1         ,F10.3,30X,F10.3)
         PRINT 1041,(COSTA(J),J=1,6)
    1041 FORMAT(//25H  TOTAL COSTS                 ,35X6F10.3)
         COSTA(7)=0.02*COSTA(1)
         AA(100,10)=COSTA(5)
   C
   C MATERIAL BALLANCE INFORMATION PRINTOUT. ALL STREAMS HERE IN LB/HR
   C
         AA(90,2)= SUMHP* .7457 * 24.
        AA(90,10)=AA(90,10)*2000./(24.*8.33)
        CALL MATER(TONS)
         DO 50 I=1,20
         AA(90,I)=AA(90,I)*2000/24
     50  AA(91,I)=AA(91,I)*2000/24
         FISH=TONS*2000/24
         PRINT 1003,FISH
    1003 FORMAT(/8X26H FISH FED TO COOKERS       ,F8.0,7H LB/HR  )
         PRINT 1004,AA(91,16)
    1004 FORMAT(/8X26H COOKERS STEAM             ,F8.0,7H LB/HR  )
         PRINT 1005,AA(90,16)
    1005 FORMAT(/8X26H PRESS CAKE TO DIGESTERS   ,F8.0,7H LB/HR  )
         PRINT 1006,AA(91,17)
    1006 FORMAT(/8X26H FISH SOL. TO DIGESTERS    ,F8.0,7H LB/HR  )
         PRINT 1007,AA(90,12)
    1007 FORMAT(/8X26H ENZYME TO DIGESTERS       ,F8.2,7H LB/HR  )
         PRINT 1008,AA(90,15)
    1008 FORMAT(/8X26H CAOH TO DIGESTERS         ,F8.2,7H LB/HR  )
        PRINT 1017,AA(90,13)
   1017 FORMAT(/8X26H ANTIOXIDANT TO DIGESTERS ,F8.2,7H LB/HR  )
        PRINT 1033,AA(90,17)
   1033 FORMAT(/8X26H 5N NAOH TO DIGESTERS     ,F8.2,7H LB/HR  )
        PRINT 1009,AA(91,2)
    1009 FORMAT(/8X26H FEED TO ROTARY DRYER      ,F8.0,7H LB/HR  )
         PRINT 1010,AA(91,12)
    1010 FORMAT(/8X26H ROTARY DRYER STEAM        ,F8.0,7H LB/HR  )
         PRINT 1011,AA(90,3)
    1011 FORMAT(/8X26H BONE FEED PRODUCT         ,F8.0,7H  LB/HR  )
         PRINT 1012,AA(91,3)
    1012 FORMAT(/8X26H DIGESTER LIQUOR           ,F8.0,7H LB/HR  )
         PRINT 1013,AA(91,6)
    1013 FORMAT(/8X26H FEED TO FILM EVAPORATOR  ,F8.0,7H LB/HR  )
```

Tabie I.--Continued.

```
01034   445*          PRINT 1014,AA(91,13)
01037   446*    1014  FORMAT(/8X26H FILM EVAPORATOR STEAM     ,F8.0,7H LB/HR  )
01040   447*          COOL =AA(91,13)*4
01041   448*          PRINT 1015,COOL
01044   449*    1015  FORMAT(/8X26H FILM EVAPORATOR COOLING   ,F8.0,7H.GAL/HR )
01045   450*          PRINT 1016,AA(91,7)
01050   451*    1016  FORMAT(/8X26H FISH PASTE                ,F8.0,7H LB/HR  )
01051   452*          AA(90,13)=0.05*AA(91,7)*0.01
01052   453*          PRINT 1018,AA(90,6)
01055   454*    1018  FORMAT(/8X26H PACKAGED AS FISH PASTE    ,F8.0,7H LB/HR )
01056   455*          PRINT 1019,AA(91,9)
01061   456*    1019  FORMAT(/8X26H FEED TO SPRAY EVAPORATOR  ,F8.0,7H LB/HR  )
01062   457*          PRINT 1020,AA(91,14)
01065   458*    1020  FORMAT(/8X26H SPRAY EVAPORATOR STEAM    ,F8.0,7H LB/HR  )
01066   459*          COOL=4*AA(91,14)
01067   460*          PRINT 1021,COOL
01072   461*    1021  FORMAT(/8X26H SPRAY EVAP. COOLING       ,F8.0,7H GAL/HR )
01073   462*          PRINT 1022,AA(90,7 )
01076   463*    1022  FORMAT(/8X26H DRY CONCENTRATE           ,F8.0,7H LB/HR  )
01077   464*          PRINT 1023,AA(90,5)
01102   465*    1023  FORMAT(/8X26H FISH OIL                  ,F8.0,7H LB/HR  )
01103   466*          STEAM=AA(27,17)-AA(91,12)-AA(91,13)-AA(91,14)-AA(91,18)-AA(91,19)
01103   467*        C-AA(91,16)
01104   468*          PRINT 1030,STEAM
01107   469*    1030  FORMAT(/8X26H MISCELANEOUS STEAM        ,F8.0,7H LB/HR  )
01110   470*          AA(90,9)=AA(90,9)/8.33
01111   471*          PRINT 1031,AA(90,9)
01114   472*    1031  FORMAT(/8X26H CITY WATER                ,F8.0,7H GAL/HR )
01115   473*         AA(90,10)=AA(90,10)*24./2000.
01116   474*          PRINT 1032,AA(90,10)
01121   475*    1032  FORMAT(/8X26H PROCESS WATER             ,F8.0,7H GAL/HR )
01122   476*          AA(90,1) = AA(27,17)*24*0.0112
01123   477*          AA(90,2)= SUMHP* .7457 * 24.
01124   478*          AA(90,3) = AA(90,3)*24/2000
01125   479*          AA(90,5) = AA(90,5)*24/2000
01126   480*          AA(90,6) = AA(90,6)*24/2000
01127   481*          AA(90,7) = AA(90,7)*24/2000
01130   482*          IXX =(14.0*(TONS/50.0)**.31) +0.5
01131   483*          PXX =IXX
01132   484*          AA(90,8) =IXX*8.0
01133   485*          AA(90,9) =AA(90,9)*24
01134   486*          AA(90,12)=AA(90,12)*24
01135   487*          AA(90,13)=AA(90,13)*24
01136   488*          AA(90,15)=AA(90,15)*24
01137   489*         AA(90,17)=AA(90,17)*24
01140   490*          RETURN
01141   491*          END

       END OF COMPILATION:        NO  DIAGNOSTICS.
```

Table I.-- Continued.

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

   SUBROUTINE HOPPER     ENTRY POINT 000007*

   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    NI01$
    0010    NI02$
    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               SUBROUTINE HAMMER
00103               COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104               COMMON /BLOCK2/ COST(7),COSTA(7)
00105               IX = 18
00106              IF(AA(18,17).LT.1.) COST(1)=.5
00110              IF(AA(18,17).LT.1.) GO TO 2
00112               COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00113      2       COST(2)=COST(1)*AA(IX,11)
00114               COST(3) = COST(1)*AA(IX,12)
00115               COST(4) = COST(1)*AA(IX,13)
00116               COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00117               COST(6) = COST(5)*AA(IX,15)
00120               DO 1 I=1,6
00123          1    COSTA(I)=COST(I)+COSTA(I)
00125               PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00134       1000    FORMAT(/25H HAMMER MILL             ,F10.3,15H TONS PER HR.  ,10H
00134          C SST      ,6F10.3)
00135               RETURN
00136               END

      END OF COMPILATION:       NO  DIAGNOSTICS.
```

Tabie 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          SUBROUTINE DRYER
00103          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104          COMMON/BLOCK2/ COST(7),COSTA(7)
00105          IX=19
00106     1000 FORMAT(/ 25H DRUM DRYER              ,F10.3,15H SQUARE FEET   ,10H
00106        1  SS      ,6F10.3)
00107          COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00110           COST(1)=COST(1)*.001
00111          COST(2)= COST(1)*AA(IX,11)
00112          COST(3)= COST(1)*AA(IX,12)
00113          COST(4)= COST(1)*AA(IX,13)
00114          COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00115          COST(6)= COST(5)*AA(IX,15)
00116          DO 1 I=1,6
00121        1 COSTA(I)=COST(I)+COSTA(I)
00123          PRINT 1000, AA(IX,17),(COST(J),J=1,6)
00132          RETURN
00133          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 1176       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 T.-- 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    NIO1$
    0010    NIO2$
    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 EVPFRC,EVPFRC
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE EVPFRC    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 EVPFRC
00103      2*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON /BLOCK2/ COST(7),COSTA(7)
00105      4*          IX = 32
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 FORCED CIR. EVAPORATOR  ,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 EVPHOR,EVPHOR
FOR S9A-07/12-11:05 (0,)

   SUBROUTINE EVPHOR     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 EVPHOR
00103                  COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104                  COMMON /BLOCK2/ COST(7),COSTA(7)
00105                  IX = 33
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 VERTICAL EVAPORATOR     ,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 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 1001I     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    NI01$
    0010    NI02$
    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      1*           SUBROUTINE VESSEL
00103      2*           COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104      3*           COMMON/BLOCK2/  COST(7),COSTA(7)
00105      4*           IX=42
00106      5*           IF(IA(42,3).EQ.1) F=AA(42,1)
00110      6*           IF(IA(42,3).EQ.2)  F =AA(42,2)
00112      7*           IF(IA(42,3).EQ.3)  F =AA(42,3)
00114      8*           U= AA(42,18)**1.6*AA(42,19)*0.132
00115      9*           IF(IA(42,2).EQ.1)  COST(1)=.313*U**0.81 *BB(1)
00117     10*           IF(IA(42,2).EQ.2)  COST(2)=.260*U**0.759*BB(I)
00121     11*           IF(IA(42,2).NE.1)  GO TO 3
00123     12*           AA(42,11)= 1.038
00124     13*           AA(42,12)=  .992
00125     14*           AA(42,13)= 1.20
00126     15*           GO TO 4
00127     16*        3  AA(42,11) = 0.645
00130     17*           AA(42,12) = 0.615
00131     18*           AA(42,13) = 0.916
00132     19*        4  CONTINUE
00133     20*           COST(4)= COST(1)* AA(IX,13)
00134     21*           COST(3)= COST(1)* AA(IX,12)
00135     22*           COST(2)= COST(1)* AA(IX,11)
00136     23*           COST(1) =COST(1)*F
```

Table I.--Continued.

```
00137    24*          COST(5)=COST(1)+COST(2)+COST(3)+COST(4)
00140    25*          AA(42,17)=3.14159*.25*AA(42,18)*AA(42,18)*AA(42,19)
00141    26*         COST(7)=0.
00142    27*          COST(6)= COST(1)*AA(IX,15)
00143    28*          DO 1 I=1,7
00146    29*       1  COSTA(I) = COSTA(I) +COST(I)
00150    30*    1000 FORMAT(/ 25H PRESSURE VESSEL          ,F10.3,15H CUBIC FEET    ,10H
00150    31*        1 SS       ,6F10.3)
00151    32*         IF(IA(42,4).EQ.2) GO TO 5
00153    33*          PRINT 1000,  AA(IX,17), (COST(I),I=1,6)
00162    34*      5  PRINT 2000, AA(IX,17),(COST(I),I=1,6)
00171    35*   2000   FORMAT(/25H DIST. COLUMN SHELL       ,F10.3,15H CUBIC FEET    ,10H
00171    36*        1 SS       ,6F10.3)
00172    37*          RETURN
00173    38*          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      1*          SUBROUTINE COLUMN
00103      2*          COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104      3*          COMMON/BLOCK2/  COST(7),COSTA(7)
00105      4*          IX=43
00106      5*     1000 FORMAT(/ 25H DISTILLATION COLUMN     ,F10.3,15H FEET(HIGHT)   ,10H
00106      6*         1 SS        ,6F10.3)
00107      7*          FS=1.0+ (0.4)**((24.-AA(43,18))/6.)
00110      8*          FM=AA(43,1)
00111      9*          FT=0.
00112     10*          IF(AA(43,2).GT.2.)  FT=AA(43,4)
00114     11*          IF(AA(43,2).GT.4.)  FT=AA(43,5)
00116     12*          IF(IA(43,3).EQ.2)    FM=0.
00120     13*          IF(AA(43,17).LE.4.)   AA(43,7)=8.3*(AA(43,20) )
00122     14*          IF(AA(43,17).GE.4.)   AA(43,7)=AA(43,20)*(AA(43,20)+4.3)
00124     15*          COST(1)= (AA(43,17)**AA(43,8))*AA(43,7)*BB(1)*(FS+FT)
00125     16*          COST(1)=COST(1)*.001
00126     17*          COST(2)= COST(1)* AA(IX,11)
00127     18*          COST(3)= COST(1)* AA(IX,12)
00130     19*          COST(4)= COST(1)* AA(IX,13)
00131     20*         COST(7)=0.
00132     21*          COST(1)= COST(1)*(1.+FM)
00133     22*          COST(5)=COST(1)+COST(2)+COST(3)+COST(4)
00134     23*          COST(6)= COST(1)*AA(IX,15)
00135     24*          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               SUBROUTINE GRINDR
00103               COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104               COMMON /BLOCK2/ COST(7),COSTA(7)
00105               IX=50
00106               COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107               COST(1) = COST(1)*AA(50,18)
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 FISH GRINDER            ,F10.3,15H TONS/HR       ,10H
00131             CSST        ,6F10.3)
00132               RETURN
00133               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    NI01$
    0010    NI02$
    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 SHARP
00103     2*         COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104     3*         COMMON/BLOCK2/ COST(7),COSTA(7)
00105     4*         IX=52
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 SHARPLES 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 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    NI01$
    0010    NI02$
    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    BOWL
00103     2*          COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104     3*          COMMON/BLOCK2/ COST(7),COSTA(7)
00105     4*          IX=53
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 SOLID BOWL 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 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    21*          AA(IX,17) = 1000.0*AA(IX,17)
00135    22*          IF(IA(IX,2) .EQ. 1) GO TO 17
00137    23*          IF(IA(IX,1) - 1) 13,14,15
00142    24*     13   PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00151    25*          GO TO 16
00152    26*     14   PRINT 1001,AA(IX,17),(COST(J),J=1,6)
00161    27*          GO TO 16
00162    28*     15   PRINT 1002,AA(IX,17),(COST(J),J=1,6)
00171    29*          GO TO 16
00172    30*     17   PRINT 1003,AA(IX,17),(COST(J),J=1,6)
00201    31*     16   CONTINUE
00202    32*     1000 FORMAT(/25H RECIPROCATING PUMP      ,F10.0,15H GPM TIMES PSI ,10H
00202    33*         C STEEL    ,6F10.3)
00203    34*     1001 FORMAT(/25H RECIPROCATING PUMP      ,F10.0,15H GPM TIMES PSI ,10H
00203    35*         C BRONZE   ,6F10.3)
00204    36*     1002 FORMAT(/25H RECIPROCATING PUMP      ,F10.0,15H GPM TIMES PSI ,10H
00204    37*         C SST      ,6F10.3)
00205    38*     1003 FORMAT(/25H FISH PUMPS              ,F10.0,15H GPM TIMES PSI ,10H
00205    39*         C STEEL    ,6F10.3)
00206    40*          RETURN
00207    41*          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    21*          AA(IX,17) = 1000.0*AA(IX,17)
00135    22*         IF(IA(66,4).EQ.2) GO TO 17
00137    23*          IF(IA(IX,1) - 1) 13,14,15
00142    24*     13   PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00151    25*          GO TO 16
00152    26*      17 PRINT 1003,AA(IX,17),(COST(J),J=1,6)
00161    27*         GO TO 16
00162    28*   1003   FORMAT(/25H SEA WATER PUMPS          ,F10.3,15H GPM TIMES PSI ,10H
00162    29*        1 BRONZE    ,6F10.3)
00163    30*     14   PRINT 1001,AA(IX,17),(COST(J),J=1,6)
00172    31*          GO TO 16
00173    32*     15   PRINT 1002,AA(IX,17),(COST(J),J=1,6)
00202    33*     16   CONTINUE
00203    34*   1000   FORMAT(/25H CENTRIFUGAL PUMP         ,F10.3,15H GPM TIMES PSI ,10H
00203    35*        C STEEL     ,6F10.3)
00204    36*    1001  FORMAT(/25H CENTRIFUGAL PUMP         ,F10.0,15H GPM TIMES PSI ,10H
00204    37*        C BRONZE    ,6F10.3)
00205    38*   1002   FORMAT(/25H CENTRIFUGAL PUMP         ,F10.3,15H GPM TIMES PSI ,10H
00205    39*        C SST       ,6F10.3)
00206    40*          RETURN
00207    41*          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 1002     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     1*          SUBROUTINE HEATEX
00103     2*          COMMON /BLOCK2/ COST(7),COSTA(7)
00104     3*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00105     4*          IX=67
00106     5*          COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107     6*          CAST = COST(1)
00110     7*          IF (IA(67,1) - 1)  10,11,12
00113     8*     10   GO TO 13
00114     9*     11   COST(1) = COST(1)*AA(67,18)
00115    10*          GO TO 13
00116    11*     12   COST(1) = COST(1)*AA(67,19)
00117    12*          GO TO 13
00120    13*     13   COST(2) = COST(1)*AA(IX,11)
00121    14*          COST(3) = CAST*AA(IX,12)
00122    15*          COST(4) = COST(1)*AA(IX,13)
00123    16*          COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00124    17*          COST(6) = COST(5)*AA(IX,15)
00125    18*          DO 1 I=1,6
00130    19*        1 COSTA(I)=COST(I)+COSTA(I)
00130    20*    C MATERIAL FACTORS IA(67,1) = 0,1,2  IMPLIES  SHELL/TUBE =ST/ST,ST/SST
00130    21*    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 SCALF,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 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 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    NI01$
    0010    NI02$
    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             SUBROUTINE BAGGMA
00103             COMMON/BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104             COMMON/BLOCK2/ COST(7),COSTA(7)
00105              IX=75
00106              IF(IA(75,2).EQ.2) AA(75,7)=AA(75,1)
00110             COST(1)= BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00111              COST(1)=COST(1)*.001
00112             COST(2)= COST(1)*AA(IX,11)
00113             COST(3)= COST(1)*AA(IX,12)
00114             COST(4)= COST(1)*AA(IX,13)
00115             COST(5)= COST(1)+COST(2)+COST(3)+COST(4)
00116             COST(6)= COST(5)*AA(IX,15)
00117             DO 1 I=1,6
00122           1 COSTA(I)=COST(I)+COSTA(I)
00124              IF(IA(IX,1) .EQ. 0) PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00134             IF(IA(IX,1).EQ.1)PRINT 1001,AA(IX,17),(COST(J),J=1,6)
00144        1000 FORMAT(/ 25H BAGGING MACHINE         ,F10.3,15H BAGS/MIN      ,10H
00144           1  SS        ,6F10.3)
00145       1001  FORMAT(/ 25H CANNING MACHINE         ,F10.3,15H CANS/MIN      ,10H
00145            CSST        ,6F10.3)
00146             RETURN
00147             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     1*          SUBROUTINE FILTER
00103     2*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104     3*          COMMON /BLOCK2/ COST(7),COSTA(7)
00105     4*          IX= 78
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 ROT. DRUM FILTER        ,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 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    NIO1$
    0010    NIO2$
    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     1*          SUBROUTINE CRANES
00103     2*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104     3*          COMMON /BLOCK2/ COST(7),COSTA(7)
00105     4*          IX= 80
00106     5*          COST(1) = BB(1)*AA(IX,7)*AA(IX,17)**AA(IX,8)
00107     6*          IF (IA(80,1) - 1) 12,11,10
00112     7*     10   COST(1) = COST(1)*AA(IX,19)
00113     8*          GO TO 12
00114     9*     11   COST(1) = COST(1)*AA(IX,18)
00115    10*     12   COST(2) = COST(1)*AA(IX,11)
00116    11*          COST(3) = COST(1)*AA(IX,12)
00117    12*          COST(4) = COST(1)*AA(IX,13)
00120    13*          COST(5) = COST(1) + COST(2) + COST(3) + COST(4)
00121    14*          COST(6) = COST(5)*AA(IX,15)
00122    15*          DO 1 I=1,6
00125    16*        1 COSTA(I)=COST(I)+COSTA(I)
00127    17*          IF (IA(80,1) - 1) 13,14,15
00132    18*     13   PRINT 1000,AA(IX,17),(COST(J),J=1,6)
00141    19*          GO TO 16
00142    20*     14   PRINT 1001,AA(IX,17),(COST(J),J=1,6)
00151    21*          GO TO 16
00152    22*     15   PRINT 1002,AA(IX,17),(COST(J),J=1,6)
```

Table I.--Continued.

```
00161        16    CONTINUE
00162        1000  FORMAT(/25H OVERHEAD CRANE 20FT SPAN,F10.3,15H TONS LIFT     ,10H
00162            C STEEL     ,6F10.3)
00163        1001  FORMAT(/25H OVERHEAD CRANE 30FT SPAN,F10.3,15H TONS LIFT     ,10H
00163            C STEEL     ,6F10.3)
00164        1002  FORMAT(/25H OVERHEAD CRANE 40FT SPAN,F10.3,15H TONS LIFT     ,10H
00164            C STEEL     ,6F10.3)
00165              RETURN
00166              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     1*           SUBROUTINE DRAGMA
00103     2*           COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104     3*           COMMON/BLOCK2/  COST(7),COSTA(7)
00105     4*           IX=81
00106     5*           Q=  AA(IX,7)
00107     6*           IF(AA(81,18).GT.15.)  GO TO 2
00111     7*           AA(81,11)= 0.27
00112     8*           AA(81,12)= 0.42
00113     9*           IF(AA(81 ,18).LE.13.) AA(81,7)=7.
00115    10*           GO TO 3
00116    11*         2 CONTINUE
00117    12*           IF(AA(81,18).LE.20.)  AA(81,7)=10.
00121    13*           IF(AA(81,18).LE.18.)  AA(81,7)=9.
00123    14*           AA(81,11)=0.278
00124    15*           AA(81,12)=0.382
00125    16*         3 CONTINUE
00126    17*      1000 FORMAT(/ 25H DRAG CONVEYER            ,F10.3,15H FEET           ,10H
00126    18*          1 SS        ,6F10.3)
00127    19*           COST(1)=BB(1)*AA(81,7)*AA(81,17)**AA(81,8)
00130    20*           COST(1)=COST(1)*.001
00131    21*           COST(2)= COST(1)* AA(IX,11)
00132    22*           COST(3)= COST(1)* AA(IX,12)
00133    23*           COST(4)= COST(1)* AA(IX,13)
00134    24*           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      1*           SUBROUTINE MATER(TONS)
00103      2*           COMMON/BLOCK1/AA(100,20),IA(100,5),BB(100)
00104      3*           DO 10 I=30,32
00107      4*     10    BB(I)=BB(I)*100.0
00111      5*           PRINT 1050
00113      6*     1050  FORMAT(1H1//20X33H MATERIAL AND ENERGY INFORMATION ,//5X8H GENERA
00113      7*          CL)
00114      8*           PRINT 1051,TONS
00117      9*     1051  FORMAT(/8X26H FISH                      =,F9.3,9H TONS/DAY)
00120     10*           OIL  =TONS*BB(30)*0.01
00121     11*           PROT =TONS*BB(31)*0.01
00122     12*           ASH  =TONS*BB(32)*0.01
00123     13*           PRINT 1052,BB(30),OIL
00127     14*           PRINT 1053,BB(31),PROT
00133     15*           PRINT 1054,BB(32),ASH
00137     16*     1052  FORMAT(/8X10H OF WHICH ,F6.2,12H  PERCENT OR,F8.3,20H   - '' -  IS
00137     17*         C OIL     )
00140     18*     1053  FORMAT( 8X10H          ,F6.2,12H    - ''-  OR,F8.3,20H   - ''-
00140     19*        C PROTEIN)
00141     20*     1054  FORMAT( 8X10H          ,F6.2,12H    - ''-  OR,F8.3,20H   - ''-
00141     21*        C ASH     )
00142     22*           PRINT 1055,AA(27,17)
00145     23*     1055  FORMAT(//8X26H PROCESS STEAM           =,F8.0,7H LB/HR )
00146     24*          WATER=AA(90,10)
00147     25*           PRINT 1056,WATER
00152     26*     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 CAPTOi (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 T 000021 NOCK      0000 R 000020 PAVE      0000 R 000023 WARE


00101      1*          SUBROUTINE FASCIL(TONS)
00103      2*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104      3*          DIMENSION COST(6),COSTT(6)
00105      4*          IZ = BB(91)
00106      5*          PRINT 1000
00110      6*    1000 FORMAT(1H1//14X43H-COST OF FACILITIES AND SITE DEVELOPMENT     )
00111      7*          PRINT 1001
00113      8*    1001  FORMAT(//25X85H   UNIT                    NUMBER     BASE       LA
00113      9*        CBOR      INDIRECT    TOTAL     RANGE    ,/25X85H   COST
00113     10*        C        OF UNITS     COST       COSTS     COSTS      COSTS      + OR - )
00114     11*          DO 1 J=1,6
00117     12*          COST(J)= 0.0
00120     13*     1    COSTT(J) = 0.0
00122     14*         ACRE=.0050*TONS
00123     15*          COST(2) = AA(99,3)*ACRE
00124     16*          COST(5) = COST(2)
00125     17*          COST(6) = COST(5)*AA(99,2)
00126     18*          PRINT 1010,AA(99,3),ACRE ,(COST(J),J=2,6)
```

Table I.-- Continued.

```
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 YMFAL      0000 R  000061 YOIL       0000 R  000057 YPAST
    0000 R  000056 YSOL


00101      1*           SUBROUTINE  OPERAT(TONS)
00101      2*     C SUMMARY OF MATERIAL FLOW STREAMS,UNDER THE INDEX AA(90,I)
00101      3*     C    1=FUEL OIL   2=POWER    3=FISH MEAL   4=FISH SOL. 5= FISH OIL
00101      4*     C    8=MAN HRS    9=CITY WATER
00101      5*     C  13=ANIOXID. 14=SULPH.ACID
00103      6*           COMMON/BLOCK1/  AA(100,20),IA(100,5),BB(100)
00104      7*           DIMENSION CST(20),CSTT(20)
00105      8*           IZ = BB(91)
00106      9*           PRINT 2000
00110     10*      2000 FORMAT(1H1)
00111     11*           PRINT 2001
00113     12*           DO 10 J=1,20
00116     13*           CST(J)=0.0
00117     14*      10   CSTT(J)=0.0
```

Table I.-- Continued.

```
00121   15*          CST(1) = TONS*BB(5)*20.0
00122   16*          PRINT 1001,TONS,CST(1)
00126   17*          CST(2) = AA(90,1)*BB(10)
00127   18*          PRINT 1002,AA(90,1),CST(2)
00133   19*          CST(3) =AA(90,2)*BB(6)*0.01
00134   20*          PRINT 1003,AA(90,2),CST(3)
00140   21*         CST(4)=AA(90,14)*BB(14)
00141   22*          IF(IZ     .EQ. 1) PRINT 1004,AA(90,14),CST(4)
00146   23*         IF(IZ     .EQ. 3) PRINT 1004,AA(90,14),CST(4)
00153   24*         IF(IZ.NE.3.AND.IZ.NE.4) GO TO 4
00155   25*         CST(16)=AA(90,17)*BB(10)
00156   26*         PRINT 3000,AA(90,17),CST(16)
00162   27*       4 CST(15)=AA(90,12)*BB(41)
00163   28*    3000 FORMAT(/25H 5N SODIUM HYDROXIDE     ,F8.0,8H LB      ,5XF8.2)
00164   29*          IF(IZ .EQ. 3) PRINT 1105,AA(90,12),CST(15)
00171   30*          IF(IZ .EQ. 4) PRINT 1105,AA(90,12),CST(15)
00176   31*          CST(14) = AA(90,15)*BB(16)
00177   32*          IF(IZ .EQ. 3) PRINT 1104,AA(90,15),CST(14)
00204   33*          IF(IZ .EQ. 4) PRINT 1104,AA(90,15),CST(14)
00211   34*         IF(IZ .EQ. 3) GO TO 3
00213   35*         IF(IZ .EQ. 4) GO TO 3
00215   36*         CST(5)=AA(90,13)*BB(13)
00216   37*         GO TO 5
00217   38*       3 CST(5)=AA(90,13)*BB(44)
00220   39*       5 CONTINUE
00221   40*         PRINT 1005,AA(90,13),CST(5)
00225   41*         CST(6)=AA(75,17)*BB(15)
00226   42*         PRINT 1006,AA(75,17),CST(6)
00232   43*         CANS=0.0
00233   44*         CANS=AA(75,4)*BB(15)
00234   45*         IF(AA(75,4).GT.0) PRINT 106,AA(75,4),CANS
00241   46*         CST(6)=CST(6)+CANS
00242   47*          CST(7) =AA(90,9)*BB(9)
00243   48*          PRINT 1007,AA(90,9),CST(7)
00247   49*          CST(8) =AA(90,8)*BB(7)
00250   50*          PRINT 1008,AA(90,8),CST(8)
00254   51*          CST(9) =AA(100,10)*BB(8)*0.1/3
00255   52*          PRINT 1009,CST(9)
00260   53*          CST(10) =AA(100,10)/30.
00261   54*          PRINT 1010,CST(10)
00264   55*          CST(11)=CST(8)*0.15
00265   56*          PRINT 1011,CST(11)
00270   57*          CST(12) =CST(10)
00271   58*    6000 FORMAT(25H BOILER WATER TREATMENT  ,21XF8.2,12XF6.2,//)
00272   59*         CAST=3.3
00273   60*         PRINT 6000,CAST
00276   61*          PRINT 1012,CST(12)
00301   62*          CST(13) =CST(8)*0.30
00302   63*          PRINT 1013,CST(13)
00305   64*          IF(IZ.NE.2.AND.IZ.NE.6.AND.IZ.NE.7)  GO TO 60
00307   65*          CST(18)  =AA(90,18)*BB(18)
00310   66*          AA(90,18)=AA(90,18)*2000.
00311   67*          PRINT 1018,AA(90,18),CST(18)
00315   68*          CST(19)  =AA(90,19) * BB(19)
00316   69*          AA(90,19)=AA(90,19)*2000.
00317   70*           PRINT 1019,  AA(90,19),CST(19)
00323   71*      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 =,E12.6,8H 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               ,F8.1,13XF12.6)
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          ,F8.1,13XF12.6)
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   186*         BYPROD=YOIL+YSOL+YMEAL+YPAST
00604   187*         YCOST=YCOST-BYPROD
00605   188*         FPC=(YCOST/YCONC)*100.
00606   189*         PRINT 4007,FPC
00611   190*    4007 FORMAT(/20X,32H FPC COST WITH BY-PRODUCTS        ,F8.1,13H CENTS/POU
00611   191*        CND )
00612   192*     101  RETURN
00613   193*          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     1*          SUBROUTINE LIBRE
00103     2*          COMMON/ DATA1 / DATB(8,5)
00104     3*          COMMON /BLOCK1/ AA(100,20),IA(100,5),BB(100)
00104     4*      C IDENTIFICATION OF DATA STORED IN LIBRARY SUBROUTINE
00104     5*      C
00104     6*      C EQUIPMENT INDEX NUMBERS
00104     7*      C
00104     8*      C        6= CONICAL HOPPER                CALLED BY SUB. HOPPER
00104     9*      C       11= PULVERISER                    CALLED BY SUB. PULVER
00104    10*      C       17= SCREW CONVEYER                CALLED BY SUB. SCREWR
00104    11*      C       18= HAMMER MILL                   CALLED BY SUB. HAMMER
00104    12*      C       19= DRUM DRYER                    CALLED BY SUB. DRYER
00104    13*      C       20= PAN DRYER                     CALLED BY SUB. DRYERP
00104    14*      C       21= ROTARY VACUUM DRYER           CALLED BY SUB. DRYERR
00104    15*      C       27= BOILER                        CALLED BY SUB. BOILER
00104    16*      C       30= SPRAY EVAPORATOR              CALLED BY SUB. EVPSPR
00104    17*      C       31= WIPED FILM EVAPORATOR         CALLED BY SUB. EVPFLM
00104    18*      C       32= FORCED CIRCULATION EVAPORAT.CALLED BY SUB. EVPFRC
00104    19*      C       33= VERTICAL EVAPORATOR           CALLED BY SUB. EVPHOR
00104    20*      C       40= SHOP FAB. STORAGE TANK        CALLED BY SUB. STORAG
00104    21*      C       42  PRESSURE VESSEL               CALLED BY SUB. VESSEL
00104    22*      C       43= DISTILLATION COLUMN           CALLED BY SUB. COLUMN
00104    23*      C       49= JACKETED REACTING VESSEL      CALLED BY SUB. REACTR
00104    24*      C       50= FISH GRINDER                  CALLED BY SUB. GRINDR
00104    25*      C       51= VIBRATING SCREEN              CALLED BY SUB. SCREEN
00104    26*      C       52= SHARPLES CENTRIFUGE           CALLED BY SUB. SHARP
00104    27*      C       53= SOLID BOWL CENTRIFUGE         CALLED BY SUB. BOWL
00104    28*      C       54= V-BASKET CENTRIFUGE           CALLED BY SUB. CNTFGF
00104    29*      C       57= FREE FLOWING SOL. BLENDER     CALLED BY SUB. BLENDR
00104    30*      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 UNIT = 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   145*           AA(31,15) = 0.10
00215   146*    C FORCED CIRCULATION EVAPORATORS  SIZE UNIT= SQ FT  REF GUTHRIE
00216   147*           AA(32,7)=0.6
00217   148*           AA(32,8) = 0.70
00220   149*           AA(32,11) =0.66
00221   150*           AA(32,12) = 0.24
00222   151*           AA(32,13) = 0.42
00223   152*           AA(32,15) = 0.10
00224   153*           AA(32,18) = 2.40
00224   154*    C VERTICAL EVAPORATORS  SIZE UNIT = SQ. FT.  REF. GUTHRIE
00225   155*           AA(33,7) =.12
00226   156*           AA(33,8) = 0.53
00227   157*           AA(33,11) = 0.66
00230   158*           AA(33,12) = 0.24
00231   159*           AA(33,13) = 0.42
00232   160*           AA(33,15) = 0.10
00233   161*           AA(33,18) = 2.40
00233   162*    C STORAGE TANK SIZE AND COST DATA. REF GUTHRIE
00233   163*    C SIZE UNITS 100 GAL CAPACITY . MATRIAL FACTOR INDEX 18 = SST
00234   164*           AA(40,7) = 0.88
00235   165*           AA(40,8) = 0.31
00236   166*           AA(40,11) = 0.20
00237   167*           AA(40,12) = 0.27
00240   168*           AA(40,13) = 0.49
00241   169*           AA(40,15) = 0.10
00242   170*           AA(40,18) = 3.2
00242   171*    C STORAGE TANK FROM 1000 GAL TO 40000 GAL CAPACITY  STEEL + SST  REF GUT
00242   172*    C HRIE. SIZE UNITS 100-DS GAL
00243   173*           AA(41,7) = 0.5
00244   174*           AA(41,8) = 0.35
00245   175*           AA(41,11) = 0.38
00246   176*           AA(41,12) = 0.10
00247   177*           AA(41,13) = 0.49
00250   178*           AA(41,15) = 0.10
00251   179*           AA(41,18) = 3.2
00251   180*    C  PRESSURE VESSEL
00251   181*    C      FOR THE PRESSURE VESSEL(IA(42,3) DETERMINES THE METAL,IA(42,2) = 1
00251   182*    C      IMPLIES VERTICAL CONSTRUCTION(AA(42,18) IS THE DIAMETER,AA(42,19)
00251   183*    C      IS THE HIGHT
00252   184*           AA(42, 1)=  3.67
00253   185*           AA(42, 2)=  2.25
00254   186*           AA(42, 3)=  1.0
00255   187*           AA(42,15)=  .1
00255   188*    C DISTILLATION COLUMN
00255   189*    C     THE METAL,AA(43,20) THE WIDTH,AA(43,18) THE TRAY SEPARATION,
00255   190*    C     AA(43,17) THE HEIGHT
00255   191*    C     DETERMINES THE WIDTH
00256   192*           AA(43, 4)=  0.4
00257   193*           AA(43, 5)=  1.8
00260   194*           AA(43,15)=  .1
00261   195*           AA(43,1)= 1.7
00262   196*           AA(43,8) =1.0
00263   197*           AA(43,11)= .3
00264   198*           AA(43,12)= .4
00265   199*           AA(43,13)= .4
00266   200*           AA(43,15)= .1
00266   201*    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 RECD. 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$/FOR                  1    001165 001524        2    044007 044061
FXP$/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
FRU$
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
NEXP6$/FOR                  1    007252 007325        2    050013 050022
SQRT$/FOR                   1    007326 007366        2    050023 050034
NTOS$/FOR                   1    007367 011022        2    050035 050417
NOSYM$/FOR                  1    011023 011261        2    050420 050431
NERR$/UOM                   1    011262 011742        2    050432 050604
BLOCK4 (COMMON BLOCK)                                      050605 050616
BLOCK2 (COMMON BLOCK)                                      050617 050634
BLOCK1 (COMMON BLOCK)                                      050635 055704
DATA1 (COMMON BLOCK)                                       055705 055754
BLANK$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$COMMON
			4	BLOCK2
DRYERR	1	022055 022361	0	062013 062165
	3	BLOCK2	2	BLANK$COMMON
			4	BLOCK1
DRYERP	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-JUN  12,1971

   TERMINATION TIME:   11:07:11-JUN  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					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 $\$\cdot 10^6$		
Biolog-ical	Fat	1.35	1340	-	1360	900	0.985	36.1	30.
Press Cake-Biolog-ical	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

GPO 985-034

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 anadromous 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.

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.

UNITED STATES
DEPARTMENT OF COMMERCE
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
SCIENTIFIC PUBLICATIONS STAFF
BLDG. 67, NAVAL SUPPORT ACTIVITY
SEATTLE, WASHINGTON 98115

OFFICIAL BUSINESS

U.S.MAIL