# AN INQUIRY INTO VARIOUS METHODS OF ALLOCATING COSTS TO JOINT PRODUCTS IN A PETROLEUM REFINERY

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# CHAPTER I

## THE PROBLEM AND ITS SCOPE

### The Problem

The main purpose of this study was to investigate the problems involved in the accounting treatment accorded costs of by-products and joint products, and most especially, the various methods used in assigning costs to these products in the oil refining industry.

This involved a general survey of the present day general theory and practice of accounting for such products, a study of available literature of the field of refinery accounting, and personal investigation of the subject by conferences with accountants in several oil refineries.

### Need for the Study

A great deal of accounting literature, both general and specialized, has been written in the last several years, but that pertaining to the refining of crude petroleum is relatively meager. The average writer of accounting articles does not, as a general rule, have the time and opportunity for a thorough study of the particular problems connected with accounting for costs in refinery operations. Accountants employed in the industry, who are in a position to formulate such articles, often do not have the time or desire to write about the subject, or they find that company officials may be inclined to frown upon such literary offerings as perhaps too revealing of company methods and policies.[1]

It may seem curious that no uniform method of cost accounting,

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[1] Raymond W. McKee, Handbook on Petroleum Accounting, New York, Harper & Brothers, 1938, p 314

particularly with respect to the specific problem touched upon by this limited study, has been actively promoted by the accounting committees of the organized industry, for nearly all other phases of accounting within the industry are fairly uniform. It would seem reasonable to expect a uniform method to be actively promoted in due time,[2] and this feeling is echoed by accountants presently engaged in the industry.

Cost accounting is becoming increasingly specialized, and doubtless many of the progressive accountants in the industry are watching developments that may serve as a key to present and future problems. They are well aware that the oil industry is constantly changing and expanding and that a refinery process considered remarkable today may be scrapped within a short time to make way for a more efficient successor; and they are aware that accounting, as a service function, must keep abreast of developments within the field.[3]

It is important that a company have a good method of accounting. A poor system can offer little beyond a general balance sheet and a general profit and loss statement. Without careful analysis of costs as related to revenues the management lacks the data for cost control and for sales and manufacturing policy decisions. Managerial decisions of several kinds must rest, in the end, upon accurate data as supplied by accountants.

## Scope of the Study

With respect to this particular study, the object of refinery cost accounting might be stated as lending constructive guidance to management through an analytical presentation of costs to be charged against revenues

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[2] Ibid, p 314

[3] Ibid, p 316

and costs to be assigned to inventories.

In assigning costs, the important function of the accountant is to secure an equitable distribution. This point of view is particularly important in the handling of joint or common costs. If any cost factor contributes to the production of two or more products it is a common or joint cost, and should be equitably apportioned. There should be no freeing of one product at the expense of another.[4] Common or joint costs are present to some degree in almost all manufacturing and trading operations, and in certain cases (such as petroleum refining) the problem of allocation becomes acute.[5] It would seem logical to say that allocation in the case of a refinery is of marked importance because it affects both current profits and current inventories by assigning certain costs to cost of sales and certain costs to inventories. This study is limited to that particular problem.

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[4] Accountant's Handbook, 3rd Edition, Edited by W. A. Paton, New York Ronald Press, 1949, pp 137-8

[5] Ibid, p 138

# CHAPTER II

## GENERAL SURVEY OF REFINING COST PROBLEMS

Total refining costs may be approximated with sufficient accuracy by an adequate system of bookkeeping, but the apportionment of these costs among the several products obtained in refining is a difficult task at best, and the results so obtained are always open to question.[6] Ideally, each product should be charged with its share of the costs incurred; its actual share. Practically, no such share can be determined, for there are no separate true costs for the several products obtained from a process, but only total true costs; therefore, the only solution is that of allocation on a basis that is reasonable or is at least an accepted conventional method.[7]

The petroleum industry, through its refining operations, produces gasoline, kerosene, klenzine, distillate, fuel oils, and other products which are referred to as joint products or main and by-products. The products are produced jointly; that is, one cannot be produced without the other or others. By-products and joint products are inevitable joint results of the processing. The only distinction that may be made in regard to joint products and by-products is in their relative values. Two or more products made at the same time from the same material and having somewhat the same value and importance are regarded as joint products. Under the same circumstances of production, a product of less relative value and importance than the other or others produced with it is considered to be a by-product. It is important to note that manufacturers of joint products (such as petroleum refiners) have little control over the relative quantities of the various products jointly produced. The situation is unlike that of a

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[6] Ibid, p 580

[7] Charles Schlatter, Cost Accounting, New York, John Wiley and Sons, 1948, p 652

manufacturer of co-products (such as a manufacturer of cars, trucks, and tractors), who can, at will, vary the quantities of various products without affecting the other or others. In consideration of the problem of a distinction as to joint products and by-products, it is impossible to state categorically just when a product becomes of sufficient value and importance to change its status from that of a by-product to that of a joint or main product. In most industries (and in the refining industry) the choice depends largely upon the company accountants; but naturally the relative sales values are the factors upon which preference as to treatment is usually based.[8]

Specifically, the basic question with respect to refinery operations is the method of allocating cost of crude oil consumed and expenses of processing it to the various products obtained therefrom. It is an acute problem because there are no separate true costs for the various products when they are jointly produced.

It may be well to note at this point that if all the joint products are sold by the end of the period, there is no need to allocate costs. Also, if the quantities of the inventories at the end of the period are in the same ratios of their production, and market prices have not changed during the period, allocations of costs are unnecessary. Only when the quantities of inventories at the end of the period are not in the ratios of production, or when market prices have changed during the period, are allocations for inventory valuations necessary. The latter would be the usual case. It should be clearly understood that, whatever allocations of joint costs are made, the purpose in all cases should be to give reasonable valuations to inventories.[9]

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[8] Ibid, p 649

[9] Ibid, p 652

# CHAPTER III

## A GENERAL DISCUSSION OF REFINERY PROCESSES AND COSTS

Refining is a process, or series of processes, by which the component elements of crude oil are separated and treated to produce salable products. The separation is accomplished principally by the application of heat and pressure and by utilizing the physical or chemical characteristic that these elements possess different vaporization points. To illustrate, if two fluids, A and B, are thoroughly intermingled, it is possible to separate them if the temperature at which each becomes a vapor is separated from that of the other by a few degrees. If A becomes a vapor at 215 degrees and B at 245 degrees, it is obvious that A would distill off at 215 degrees while B would remain in a fluid state until the temperature was raised to 245 degrees.[10]

There are many different processes in petroleum refining; perhaps as many different processes, by name, as there are companies engaged in refining operations. All of the processes are similar as to purpose, irrespective of name, and a discussion of general types would seem to serve our purpose better than a detailed description of processes in different refineries.

Direct Refining is the original distillation or breaking down of crude oil into several products, such as raw gasoline, kerosene stock, untreated stove and fuel oils, distillates, and waste fluids. Some of the products, such as fuel oil, klenzine, and painter's distillate, being of the desired quality, may be immediately placed in inventory ready for sale, while others will require further processing before being of the desired quality.

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[10] McKee, op. cit., p 299

Cracking is a name applied to a subsequent process by which certain of the raw oils are processed, producing fuel oil, which is ready for sale, and raw cracked distillate. After having been subjected to a Distillate Treating Process, the distillate is placed in a process called Re-running, from which raw gasoline is produced. The subsequent processes of Gasoline Treating and Kerosene Treating render those products ready for sale. This arrangement is outlined in the flow chart in Illustration I, which depicts the organizational structure of a California refinery of the 1930's.[11] The series of processes outlined may have undergone many refinements since that time, but the problem of cost allocation remains essentially the same. For example, many refineries add different amounts of chemicals and animal oils to the stocks to be treated. In many cases, the grade of the crude oil to be processed determines the amount of such additions required to produce the desired grade of product. An analysis of the mechanics of present day processes, under various names, would be a study in itself, and does not seem to be necessary inasmuch as the basic problem of cost allocation remains the same in spite of some process refinements.

Refinery costs change as processes change, and are, of course, affected by technological advancements. The prime cost to be considered would be that of the crude oil consumed in process. The general feeling is that such cost should be cost of production or cost of purchase. In practice, crude oil placed in production is priced at its sales value and charged to Direct Refining at that figure. One public accountant has indicated that this may lead to stating crude at production cost plus a producing department profit, which would, he feels, present an inventory problem. This does not, however, principally effect the problem of this study, and will not be treated further.

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[11] Ibid, p 320

The principal processing costs in connection with the refining of crude oil are compiled in expense ledgers for the purpose of obtaining the total cost for each process. These expenses would be in the form of salaries, rentals, heat, light, power, water, repairs and maintenance, supplies, taxes, insurance, car and truck expense, depreciation, royalties, and miscellaneous expenses. Some of these costs would have come from the costs of service departments, whose expenses would be distributed to the processes served on a basis of actual consumption, service rendered, or predetermined standard charging rate. All costs would have been accumulated through the usual recordings of invoices, vouchers, and tickets.

It is obvious at this point that there is no problem of allocation in connection with those processes treating only one product. In such a case, the entire cost of processing would be assignable to the one product.

For the purpose of this study, the foregoing general treatment of costs serves to highlight the allocation problem being approached.

CHAPTER IV

# VARIOUS METHODS OF ALLOCATING JOINT COSTS

Various methods of assigning costs of processes to the joint products obtained therefrom have been used, at least in part, in the past. A brief description of several methods follows.

## The Weighted-Selling-Ratio or Sales Realization Method

Under this method the allocable costs are spread to the several products on the basis of their relative selling values. This factor is obtained by multiplying the quantity produced by the sales value (net) of each product. The ratio of each such amount to all such amounts in total then gives the percentage of the total cost to be assigned to a particular product. It is usual, in practice, to use the average of the past three months to arrive at the net sales value of the products in order to remove temporary market fluctuations. It may be immediately noted that this method affords the same rate of gross profit on all products.[12]

## Unit Quantity Method

As far as the writer can determine, this method is not in use at the present time. It involves the dividing of the total costs, crude oil and processing expense, by the total quantity of all products produced, and thus arriving at a uniform cost per unit (gallon), regardless of type of product. This method is regarded as deceptive, for it is evident that under normal conditions some products will then show a disproportionate gain or loss upon sale, while other products will absorb the difference. It is an inescapable fact that crude oil is purchased with product content in mind--that crude oil with a high gasoline content commands a higher price than does crude oil

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[12] Ibid, p 316

with a low gasoline content. This method would disregard that matter in allocation of a uniform cost per unit.[13]

By-Product or Single Product Method

This method has been rather widely used in the past. It involves, in its usual application, the assumption that gasoline is the only main product and that all other products are by-products. This would lead to an assignment of market values to the by-products and the crediting of such values in total against the total costs, leaving the balance as the stated cost of gasoline. The by-products would realize no gain or loss upon sale while the entire profit would be reported in relation to the single main product.[14] The general feeling is that this method dates back to the time when kerosene, and then gasoline, was the sole product of much value to the refiner. The method is still in use in at least one major refinery.

The Standard-Cost-of-Sales Method

This method has at least the attribute of simplicity. It would be used when it would not be necessary to know the exact gross profit for a period, and when an estimate of inventory valuations would be sufficient. It is based on the formula that the opening inventory, plus expenses of manufacture and the cost of crude consumed, less cost of sales for the period, will equal the ending inventory. Instead of actual cost of sales, however, standard pre-determined costs are used to arrive at cost of sales, and profits and inventories reported accordingly. Periodically, the inventory is adjusted by adding to such inventory (as listed by the standard) the standard cost

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13 Ibid, pp 316-7

14 Ibid, p 317

of sales and comparing this total with the total of the opening inventory plus actual costs of producing. The percentage of excess or deficiency is then applied to the ending inventory and cost of sales to adjust them to actual.[15] It is obvious that the results of this method would be only as close as the original standard, and it does not, in reality, offer a method of allocation except in total. An allocation method would still have to be developed to supply the standard.

Barrel-Gravity Method

This method, in all probability, was proposed with the idea in mind that costs should bear a direct relationship to product content, it being felt that crude oil to be processed was purchased on the strength of its product content. In application, the method involves the multiplication of the percentage of yield of each product by its specific gravity, thus obtaining a factor whose relation to all such factors determines the amount of the total costs to be assigned to that particular product.[16] This method, it was felt, could be used for the pricing of crude oil, and other methods used to assign the process costs. It is not currently in use, insofar as this writer has been able to determine.

Heat-Unit Method

This method, though relatively unknown, has been used by at least one major company in the past. The method involves the assigning of costs to the various products in proportion to the units of heat required to cause the passing off of the various products, as related to the total units of the entire process. It may be applied by multiplying the heat units required

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[15] Ibid, pp 317-8

[16] Ibid, p 319

for one product times the quantity of that product recovered to obtain a factor, whose relation to the total of such factors would determine the amount of cost allocated to that particular product. This method is not currently in use, insofar as this writer has been able to determine.

There have doubtless been many variations of the above basic methods in the past. This writer has noted that all of the present-day refineries visited use either the Single-Product Method, the Weighted-Selling-Ratio Method, or the Joint-Cost Method (which is a refinement of the two methods).

# CHAPTER V

## ILLUSTRATIVE PROBLEMS IN ALLOCATION BY VARIOUS METHODS AND THE EFFECT ON INVENTORY VALUATIONS AND GROSS PROFIT REPORTED

Illustration A

This illustration is based on figures presented by Mr. McKee in his book, which were taken from the actual operation of a California refinery.[17] Mr. McKee has outlined only one method. In this illustration, the effects of three methods will be compared. The methods presented are Weighted-Selling-Ratio, By-Product, and Unit-Quantity. They were selected because this writer believes they were the methods having widest use in the past. The illustration will be confined to the Direct Refining process because it presents the primary problem in allocation.

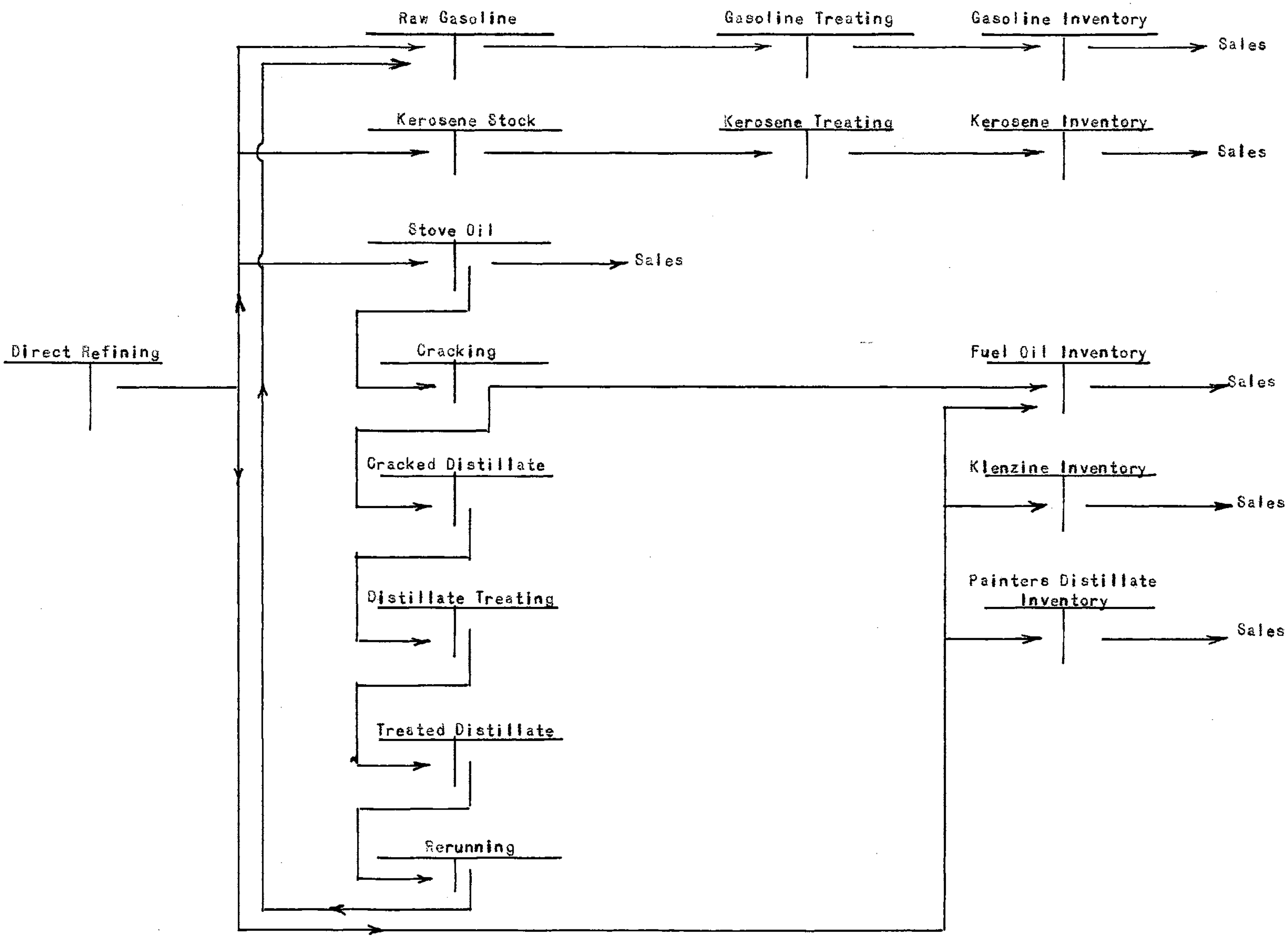
The costs with which the problem is concerned are as follows:

| | |
|---|---|
| Cost of Crude Oil Consumed (2,144,043 gallons, priced as previously indicated*) | $66,777.42 |

*In some cases, raw gasoline of low grade is returned to direct refining, in which case it is priced at last periods cost value.

17 Ibid, pp 319-333

ILLUSTRATION I




FLOW CHART FOR ILLUSTRATION A

The Processing Costs of Direct Refining were as follows:

| | | |
|---|---|---|
| Labor | $ 1,266.25 | |
| Fuel Used | 958.88 | |
| Chemicals, Supplies | 62.50 | |
| Repairs | 23.06 | |
| Service Dept. and General Expense | 1,986.46 | |
| TOTAL | | $ 4,297.15 |
| Total Cost of Crude Oil and Processing | | $71,074.57 |

Products produced were as follows:

| | | |
|---|---|---|
| Raw Gasoline | 681,010 | gallons |
| Fuel Oil | 969,573 | " |
| Stove Oil | 197,064 | " |
| Kerosene Stock | 176,129 | " |
| Klenzine | 43,287 | " |
| Painter's Distillate | 64,287 | " |
| TOTAL | 2,131,350 | |
| Process Loss | 12,693 | |
| TOTAL | 2,144,043 | |

It may be noted that the process loss is disregarded in assigning costs under all methods. It is compiled, as a record, for engineering purposes, principally to indicate the percentage of loss in each process.

A-1 Allocation by Weighted-Selling-Ratio Method:

The first step under this method is to find the average realized value for the various products produced. The procedure is to compute realized value at the market prices, then subtract transportation and other expenses of marketing –– net back to the refinery being the result. The average of three months is ordinarily used in order to avoid temporary fluctuations in market prices.

By this method the realized values would be as follows:

| | | | |
|---|---|---|---|
| Finished Gasoline | $0.12253 | per | gal. |
| Fuel Oil | .01948 | " | " |
| Stove Oil | .03177 | " | " |
| Kerosene, Finished | .07691 | " | " |
| Klenzine | .10937 | " | " |
| Painter's Distillate | .08640 | " | " |

In order to reduce the values per unit of Finished Gasoline and Kerosene to Raw Gasoline and Kerosene Stock, the costs of Treating these two products, as determined in the preceding period (assuming no changes in the treating processes), are subtracted. If costs of treating during the preceding period were .00179 for gasoline and .00508 for kerosene (per gallon), their realized values in an untreated state would be .11748 for gasoline and .07183 for kerosene, per gallon. The other products are in a state in which they are readily marketable without further processing, so that such computations are not necessary in regard thereto. If they require further processing, a like procedure would be followed.

To distribute the costs under this method, the procedure is as follows:

| Product | Gallon Quantity | Per Gallon Realized Value | Equivalent Market Value | Percent of Total Values | Allocated Cost | Per Unit Cost |
|---|---|---|---|---|---|---|
| Raw Gas | 681,010 | .11748 | $80,005.05 | 62.46 | $44,393.18 | $0.0651872 |
| Fuel Oil | 969,573 | .01948 | 18,887.28 | 14.74 | 10,476.39 | .01080515 |
| Stove Oil | 197,064 | .03177 | 6,260.72 | 4.89 | 3,475.55 | .0176366 |
| Kero Stock | 176,129 | .07183 | 12,651.35 | 9.88 | 7,022.17 | .03986947 |
| Klenzine | 43,287 | .10937 | 4,734.30 | 3.70 | 2,629.76 | .0607517 |
| Distillate | 64,287 | .08640 | 5,554.40 | 4.33 | 3,077.52 | .0478717 |
| | 2,131,350 | | $138,093.10 | 100.00 | $71,074.57 | |

A-2 Allocation by the Unit-Quantity Method:

As mentioned earlier, this method assigns costs on a basis of per unit recovery, regardless of relative values.

The computations under this method would then be as follows:

| Products | Gallons Produced | Per Cent of Total | Share of Cost Allocated | Unit Cost |
|---|---|---|---|---|
| Raw Gas | 681,010 | 31.95 | $22,708.33 | .03334 |
| Fuel Oil | 969,573 | 45.49 | 32,331.80 | .03334 |
| Stove Oil | 197,064 | 9.25 | 6,574.40 | .03334 |
| Kero Stock | 176,129 | 8.26 | 5,870.76 | .03334 |
| Klenzine | 43,287 | 2.03 | 1,442.82 | .03334 |
| Distillate | 64,287 | 3.02 | 2,146.46 | .03334 |
| | 2,131,350 | 100.00 | $71,074.57 | |

A-3 Allocation by the By-Product Method:

This method, as mentioned earlier, assigns costs on the assumption that there is one or more main products, and that the others are merely by-products to be sold at no gain.

In this particular illustration gasoline has been chosen as the only main product, which is the method currently in use in one large refinery.

The computations under this method would then be as follows:

| Product | Gallon Quantity | Realized Values | Equivalent Mkt. Values | Allocated Costs | Unit Costs |
|---|---|---|---|---|---|
| Raw Gas | 681,010 | $0.11748 | $80,005.05 | $22,986.52 | .03375 |
| Fuel Oil | 969,573 | .01948 | 18,887.28 | 18,887.28 | .01948 |
| Stove Oil | 197,064 | .03177 | 6,260.72 | 6,260.72 | .03177 |
| Kero Stock | 176,129 | .07183 | 12,651.35 | 12,651.35 | .07183 |
| Klenzine | 43,287 | .10937 | 4,734.30 | 4,734.30 | .10937 |
| Distillate | 64,287 | .08640 | 5,554.40 | 5,554.40 | .08640 |

The following summary illustrates the difference in unit costs as determined by the various methods:

| Product | Weighted Selling-Ratio * | Unit Quantity | By-Product |
|---|---|---|---|
| Raw Gas | .0652 | .03334 | .03375 |
| Fuel Oil | .0108 | .03334 | .01948 |
| Stove Oil | .0176 | .03334 | .03177 |
| Kero Stock | .0399 | .03334 | .07183 |
| Klenzine | .0608 | .0334 | .10937 |
| Distillate | .0479 | .03334 | .08640 |

* Rounded at fourth place.

As mentioned earlier, whatever allocations of costs for joint products are made, the effect should be to give reasonable valuations to inventories. To follow this illustration, let us assume sales of the various products at their realizable values in a raw state and thereby note the different effects on Inventories, Cost of Sales, and Gross Profit reported.

Assumption 1 - Sales in uniform ratio for all products:

Assume that 90% of all products were sold. The computations would be as follows:

(a) Weighted-Selling-Ratio Method:

| Product | Quantity Sold | Quantity Inventory | Inventory Priced | Cost of Sales | Gross Profit Reported |
|---|---|---|---|---|---|
| Gasoline | 612,909 | 68,101 | $4,439.31 | $39.953.87 | $32,050.68 |
| Fuel Oil | 872,616 | 96,957 | 1,047.63 | 9,428.76 | 7,569.80 |
| Stove Oil | 177,358 | 19,706 | 347.55 | 3,128.00 | 2,506.65 |
| Kerosene | 158,517 | 17,612 | 702.21 | 6,319.96 | 5,066.26 |
| Klenzine | 38,959 | 4,328 | 262.97 | 2,366.79 | 1,894.08 |
| Distillate | 57,859 | 6,428 | 207.75 | 2,769.77 | 2,229.19 |
| | | | $7,107.42 | $63,967.15 | $51,316.76 |

(b) Unit-Quantity Method:

| Product | Quantity Sold | Quantity Inventory | Inventory Priced | Cost of Sales | Gross Profit Reported |
|---|---|---|---|---|---|
| Gasoline | As In (a) | | $2,270.83 | $20,437.50 | $51,567.05 |
| Fuel Oil | " | | 3,233.18 | 29,098.62 | 12,100.06* |
| Stove Oil | " | | 657.44 | 5,916.96 | 282.31* |
| Kerosene | " | | 587.07 | 5,283.69 | 6,102.53 |
| Klenzine | " | | 144.28 | 1,298.54 | 2,962.33 |
| Distillate | " | | 214.64 | 1,931.82 | 3,067.14 |
| | | | $7,107.44 | $63,967.13 | $51,316.78 |

* Indicates Loss

(c) By-Product Method:

| Product | Quantity Sold | Quantity Inventory | Inventory Priced | Cost of Sales | Gross Profit Reported |
|---|---|---|---|---|---|
| Gasoline | As in (a) | | $2,298.65 | $20,687.87 | $51,316.78 |
| Fuel Oil | " | | 1,888.72 | 16,998.56 | None |
| Stove Oil | " | | 626.07 | 5,634.65 | None |
| Kerosene | " | | 1,265.13 | 11,386.22 | None |
| Klenzine | " | | 473.43 | 4,260.87 | None |
| Distillate | " | | 555.44 | 4,998.96 | None |
| | | | $7,107.44 | $63,967.13 | $51,316.78 |

As mentioned earlier, in any case in which a uniform sales ratio takes place, the total ending inventory will be the same irrespective of method used. In the foregoing illustration, 90% of all products produced were sold, and, while individual inventories were different in all cases, the total inventory remained the same.

Assumption 2 - Sales not in a uniform ratio for all products:

Let us assume that 50% of the gasoline produced is sold, 90% of the kerosene and klenzine produced is sold, and that all of the other products produced are sold. The computations under each method would be as follows:

(a) Weighted-Selling-Ratio Method:

| Product | Quantity Sold | Quantity Inventory | Inventory Priced | Cost of Sales | Gross Profit Reported |
|---|---|---|---|---|---|
| Gasoline | 340,505 | 340,505 | $22,196.59 | $22,196.59 | $17,805.93 |
| Fuel Oil | 969,573 | None | None | 10,476.39 | 8,410.89 |
| Stove Oil | 197,064 | None | None | 3,475.55 | 2,785.17 |
| Kerosene | 158,517 | 17,612 | 702.21 | 6,319.96 | 5,066.26 |
| Klenzine | 38,959 | 4,328 | 262.97 | 2,366.79 | 1,894.08 |
| Distillate | 64,287 | None | None | 3,077.52 | 2,476.88 |
| | | | $23,161.77 | $47,912.80 | $38,439.21 |

(b) Unit-Quantity Method:

| Product | Quantity Sold | Quantity Inventory | Inventory Priced | Cost of Sales | Gross Profit Reported |
|---|---|---|---|---|---|
| Gasoline | As In (a) | | $11,354.17 | $11,354.17 | $28,648.35 |
| Fuel Oil | " | | None | 32,331.80 | 13,444.52* |
| Stove Oil | " | | None | 6,574.40 | 313.68* |
| Kerosene | " | | 587.07 | 5,283.69 | 6,102.53 |
| Klenzine | " | | 144.28 | 1,298.54 | 2,962.33 |
| Distillate | " | | None | 2,146.46 | 3,407.94 |
| | | | $12,085.51 | $58,989.06 | $27,362.95 |

* Indicates loss.

(c) By-Product Method:

| Product | Quantity Sold | Quantity Inventory | Inventory Priced | Cost of Sales | Gross Profit Reported |
|---|---|---|---|---|---|
| Gasoline | As In (a) | | $11,493.26 | $11,493.26 | $28,509.26 |
| Fuel Oil | " | | None | 18,887.28 | None |
| Stove Oil | " | | None | 6,260.72 | None |
| Kerosene | " | | 1,265.13 | 11,386.22 | None |
| Klenzine | " | | 473.43 | 4,260.87 | None |
| Distillate | " | | None | 5,554.40 | None |
| | | | $13,231.82 | $57,842.75 | $28,509.26 |

Assuming no changes in sales prices, the inventory would sell for $41,741.09 as a unit. This would produce a constant rate of return if the Weighted-Selling-Ratio Method had been used. It would produce a varied rate of return if either of the other methods had been used. In this illustration, the amounts of the differences are large, and this serves to emphasize the importance of method of allocation with respect to inventories and gross profits reported. Such a large variance as between methods would not be found under ordinary circumstances, for in the long run a company's production and sales will be in a fairly even ratio. That is to say, a company would not continue for a long period to produce far in excess of sales, or vice versa. It may be noted that any method employed continuously would consistently report inventories in one fashion. This does not insure, however, that any method used would consistently report acceptable inventory valuations.

To press this point further, let's assume sales of all of the gasoline, kerosene, klenzine, and distillate produced; and sales of 90% of the fuel oil and stove oil produced. Computations would be as follows:

(a) Weighted-Selling-Ratio Method:

| | |
|---|---|
| Sales | $125,578.30 |
| Cost of Sales | 60,679.43 |
| Ending Inventory Priced | 1,395.14 |
| Sales Value of Ending Inventory | 2,514.80 |

(b) Unit-Quantity Method:

| | |
|---|---|
| Sales | $125,578.30 |
| Cost of Sales | 67,183.95 |
| Ending Inventory Priced | 3,890.62 |
| Sales Value of Ending Inventory | 2,514.80 |

(c) By-Product Method:

| | |
|---|---|
| Sales | $125,578.30 |
| Cost of Sales | 68,559.78 |
| Ending Inventory Priced | 2,514.79 |
| Sales Value of Ending Inventory | 2,514.80 |

Note:

(a) A uniform rate is realized on sales and anticipated on inventory.

(b) The ending inventory is priced originally in excess of its market value, and hence would require adjustment.

(c) No profit is anticipated in inventory reported.

It may be noted then that under both the Unit-Quantity Method and the By-Product Method there would be a tendency for inventory valuations to vacillate, since sales would in all probability not hold the same exact ratios from period to period. According to the products left on hand, the inventory might approximate current market price one month, be considerably less than current market price in another month, and be, prior to adjustment, in excess of market price in still another month (in case of the use of the Unit-Quantity Method only). The principal point, then, is that with respect to inventory valuations, the Weighted-Selling-Ratio Method will continually report such valuations in relation to market values, affording, under normal conditions, at least a consistent valuation.

Illustration B

At this point it might be well to add an illustration of the application of the barrel-gravity method. This illustration is taken from Mr. Finlay's article, in which actual operating figures were used.[18] See illustration No. II for a flow chart of the processes. Costs were as follows:

---

[18] Wm. B. Finlay, "Oil Refinery Cost Methods", Pathfinder Service Bulletin, Chas. R. Hadley Co., Los Angeles, No. 86, Feb. 1936, pp 6-7

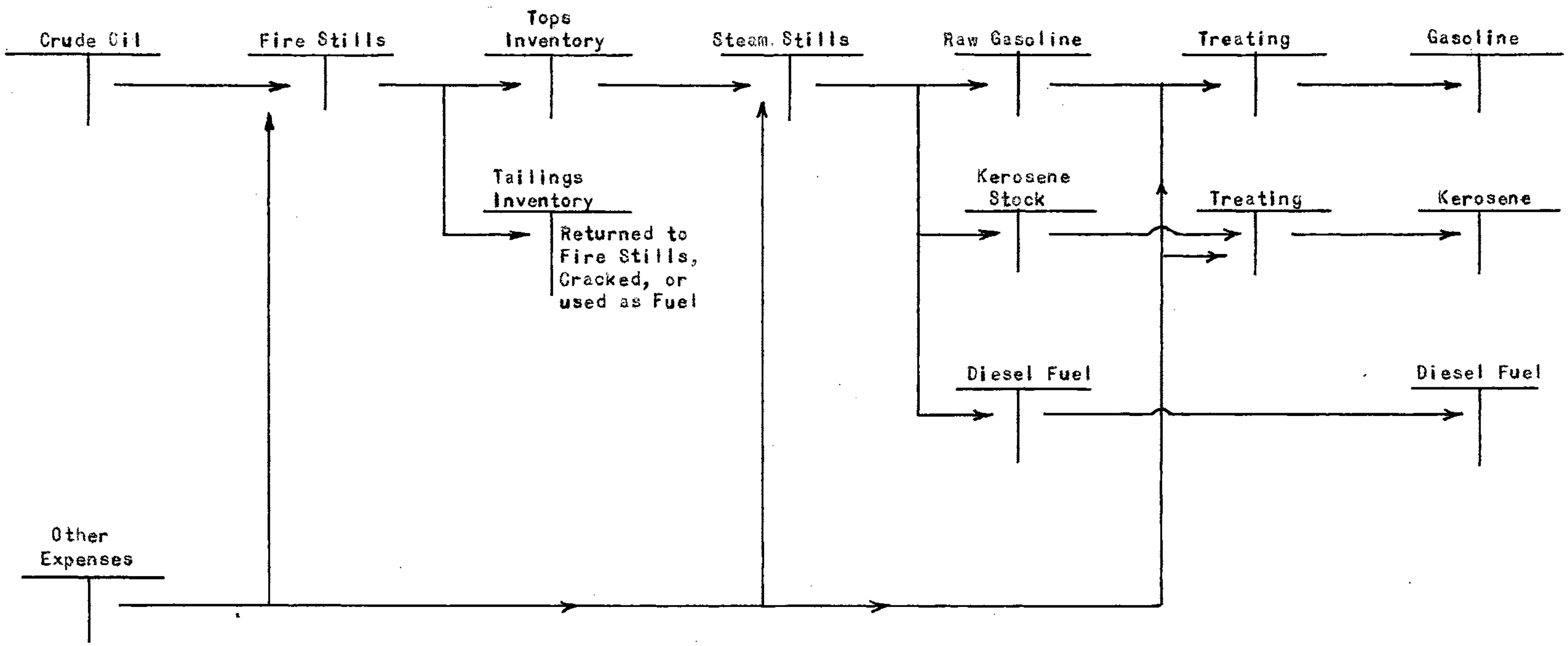
(a) For Fire Stills:

| | | |
|---|---|---|
| 1,600,000 bbls crude oil at average cost of $1.40 bbl | | $2,240,000.00 |
| Other Costs: | | |
| | Direct labor and distribution of refinery expense | 69,000.00 |
| | Fuel oil burned, 18,500 bbls @ cost during previous period, if produced | 25,000.00 |
| | Superintendance and general overhead | 26,000.00 |
| | Total Fire Stills Cost | $2,360,000.00 |
| Recovered: | | |
| | 1,300,000 bbls tailings, or heavier weight residuum (priced at crude oil price of $1.40 bbl) | $1,820,000.00 |
| | 300,000 bbls tops or lighter weight element | 540,000.00 |
| | Total Distributed | $2,360,000.00 |

(b) For Steam Stills

| | | |
|---|---|---|
| Costs: | | |
| | 40,000 bbls of tops @ $1.80 | $ 72,000.00 |
| | Overhead and other expenses | 13,000.00 |
| | Total | $ 85,000.00 |

ILLUSTRATION II




FLOW CHART FOR ILLUSTRATION B

Distribution by Barrel-Gravity Method:

| Products Recovered | Gravity | | Barrels | Barrels Gravity | % of Total | Cost Allocated |
|---|---|---|---|---|---|---|
| Gasoline | 62 | x | 28,000 | 1,736,000 | 80.07 | $57,650.40 |
| Kero Stock | 42 | x | 8,000 | 336,000 | 15.50 | 11,160.00 |
| Diesel | 32 | x | 3,000 | 96,000 | 4.43 | 3,189.60 |
| | | | 39,000 | 2,168,000 | 100.00 | $72,000.00 |

Crude Cost is then distributed on a barrel-gravity basis. The overhead and other expenses are distributed on a barrel-yield basis as follows:

| Barrels Produced | Product Obtained | % of Total | Cost Allocated | Total Cost (Crude & Expenses) |
|---|---|---|---|---|
| 28,000 | Gasoline | 71.79 | $9,332.70 | $66,983.10 |
| 8,000 | Kero Stock | 20.52 | 2,667.60 | 13,827.60 |
| 3,000 | Diesel | 7.69 | 999.70 | 4,189.30 |
| 39,000 | | 100.00 | $13,000.00 | $85,000.00 |
| 1,000 | Loss in Process | | | |
| 40,000 | | | | |

The illustration could be continued for all of the processes depicted in Illustration II, but the foregoing fully covers the method of allocation under consideration.

Illustration C

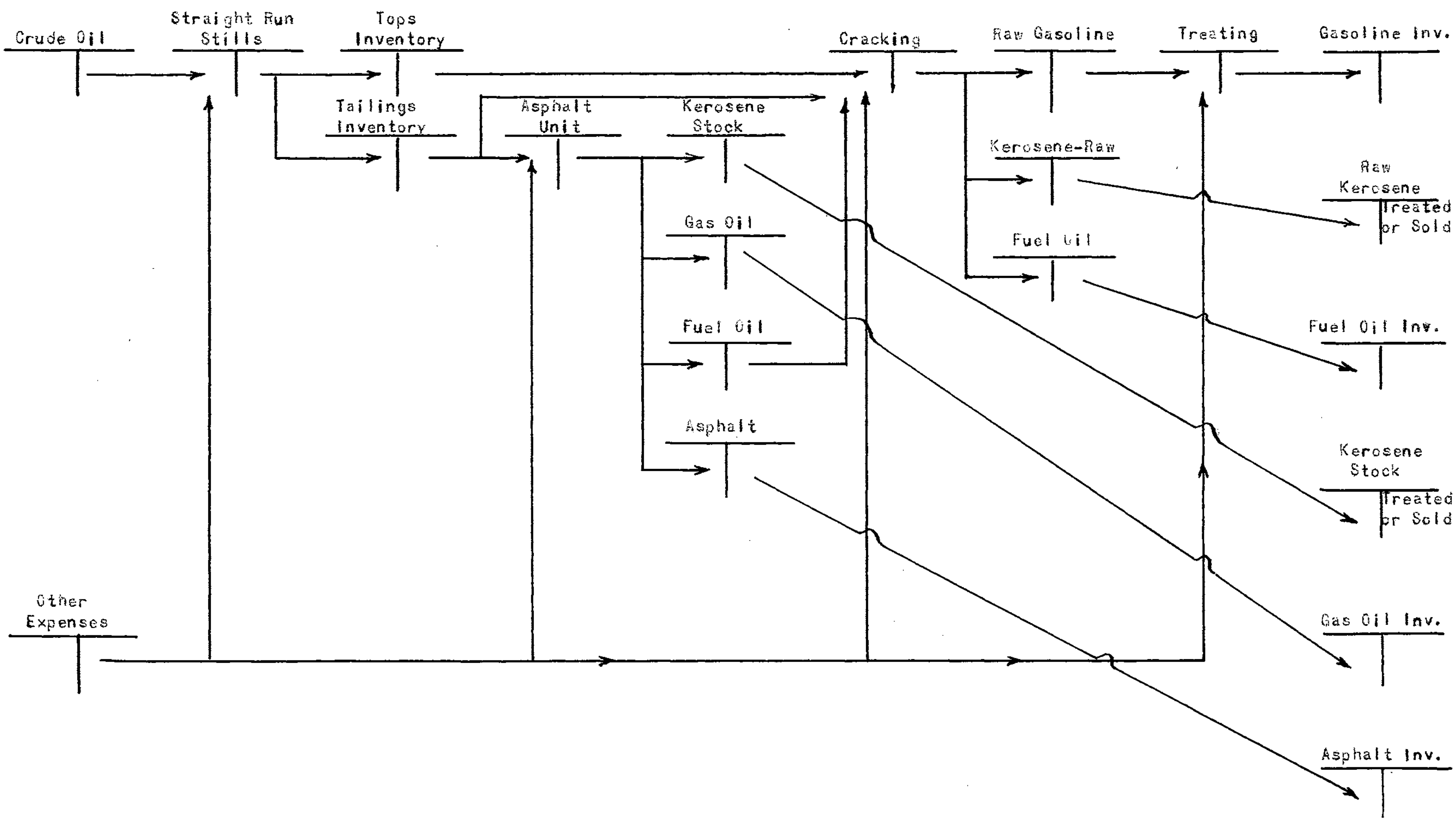
The following computations illustrate the Weighted-Selling-Ratio Method in use in a different type plant.[19] Please note the flow chart prepared as Illustration III.

---

19 *Ibid*, p 7

| Description | Gallonage (1) | Average Net Back Value (2) | Factor (1 x 2) | % of Total | Amount | Cents Cost per Gallon |
|---|---|---|---|---|---|---|
| Process No. 1: | | | | | | |
| Charge: | | | | | | |
| Crude Oil | 10,250,000 | | | | $250,000.00 | 2.44¢ |
| Process Costs | | | | | 50,000.00 | .49¢ |
| Total Costs and Average per Gallon | | | | | $300,000.00 | 2.93¢ |
| Produced: | | | | | | |
| Tops | 2,500,000 | $ .09 | $225,000.00 | .4237 | $127,110.00 | 5.08¢ |
| Trailings | 7,650,000 | .04 | 306,000.00 | .5763 | 172,890.00 | 2.25¢ |
| Loss | 100,000 | | | | | |
| | 10,250,000 | | $531,000.00 | 1.000 | $300,000.00 | |
| Process 1 (a): | | | | | | |
| Charge: | | | | | | |
| Tailings | 500,000 | | | | $ 11,300.00 | 2.26¢ |
| Process Costs | | | | | 250,000 | .05¢ |
| | | | | | $ 11,550.00 | 2.31¢ |
| Produced: | | | | | | |
| Kero Distillate | 100,000 | $.075 | $7,500.00 | .3228 | $ 3,728.34 | 3.78¢ |
| Gas Oil | 90,000 | .05 | 4,500.00 | .1937 | 2,237.24 | 2.48¢ |
| Fuel Oil | 225,000 | .035 | 7,875.00 | .3389 | 3,914.30 | 1.74¢ |
| Asphalt | 84,000 | .04 | 3,360.00 | .1446 | 1,670.12 | 1.98¢ |
| Loss | 1,000 | | | | | |
| | 500,000 | | $23,235.00 | 1.000 | $11,550.00 | |

ILLUSTRATION III




FLOW CHART FOR ILLUSTRATION C

| Description | Gallonage (1) | Average Net Back Value (2) | Factor (1 x 2) | % of Total | Amount | Cents Cost per Gallon |
|---|---|---|---|---|---|---|
| Process 2: | | | | | | |
| Charge | | | | | | |
| Tops | 2,000,000 | | | | $101,600.00 | 5.08¢ |
| Fuel Oil | 200,000 | | | | 3,480.00 | 1.74¢ |
| Tailings | 2,000,000 | | | | 45,200.00 | 2.26¢ |
| | 4,200,000 | | | | $150,280.00 | |
| Process Costs | | | | | 120,000.00 | 2.86¢ |
| Total Costs and Average per Gallon | | | | | $270,280.00 | 6.44¢ |
| Produced: | | | | | | |
| Gasoline, Raw | 2,500,000 | .095 | $237,500.00 | .7504 | $202,818.11 | 8.11¢ |
| Kerosene, Raw | 500,000 | .0775 | 38,750.00 | .1224 | 33,082.27 | 6.62¢ |
| Fuel Oil | 1,150,000 | .035 | 40,250.00 | .1272 | 34,379.62 | 2.99¢ |
| Loss | 50,000 | | | | | |
| | 4,200,000 | | $316,500.00 | 1.000 | $270,280.00 | |
| Process 2 (a) | | | | | | |
| Charge: | | | | | | |
| Gasoline, Raw | 2,000,000 | | | | $162,200.00 | 8.11¢ |
| Process Costs | | | | | 15,000.00 | .75¢ |
| Total Costs and Average per Gallon | | | | | $177,200.00 | 8.86¢ |
| Produced: | | | | | | |
| Gasoline | 1,995,000 | .105 | $209,475.00 | 1.000 | $177,200.00 | 8.89¢ |
| Loss | 5,000 | | | | | |
| | 2,000,000 | | $209,475.00 | 1.000 | $177,200.00 | |

The foregoing columnar computations would afford period by period comparisons as to average costs per gallon and processing costs.

# CHAPTER VI

## AN ILLUSTRATION OF THE METHOD CURRENTLY IN USE IN AN OKLAHOMA REFINERY

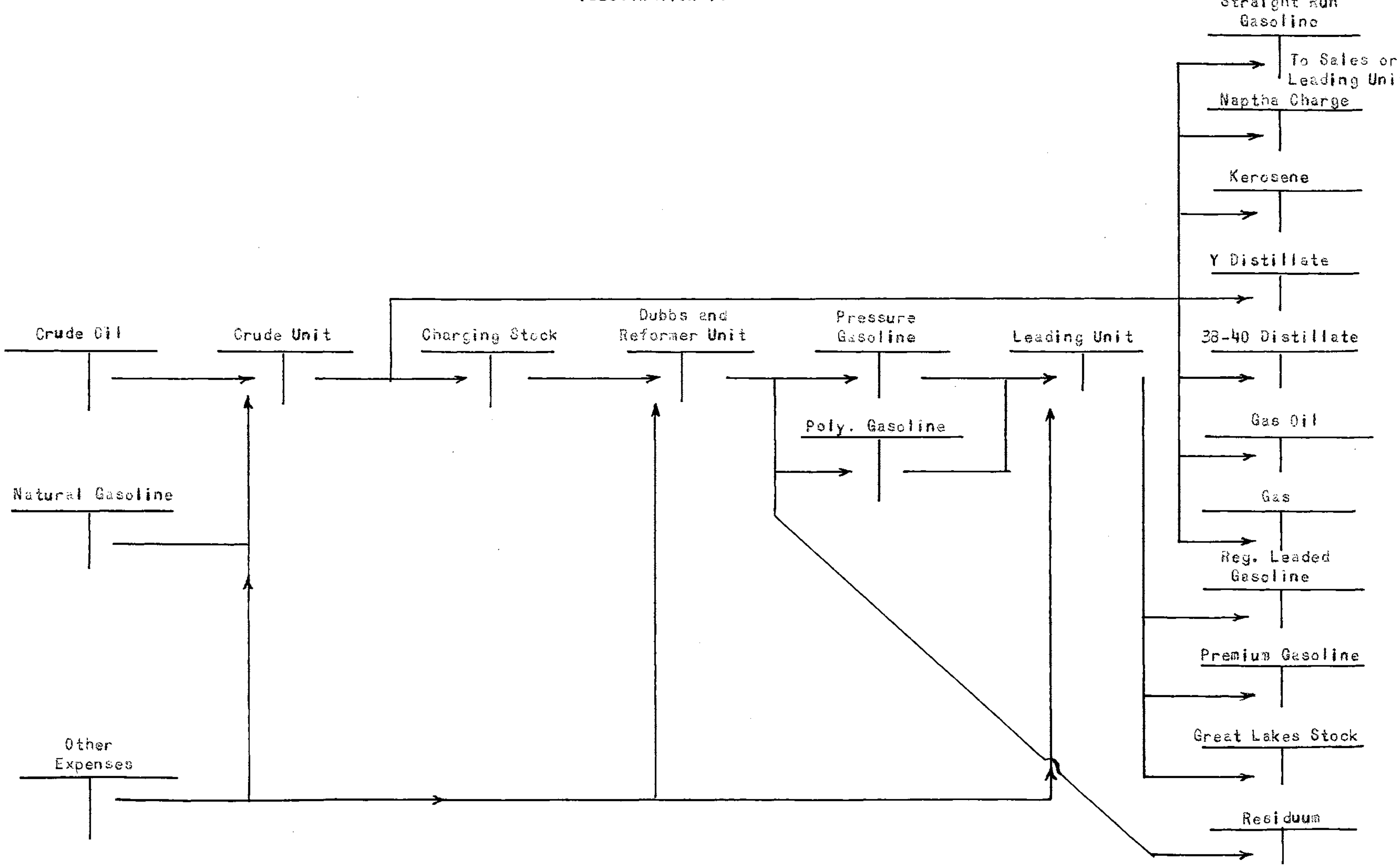
This method of allocation, a refinement of the Weighted-Selling-Ratio method, is in use at the present time in an Oklahoma refinery. The flow chart in Illustration IV depicts the processes in use. The exhibits shown here are actual operational figures given this writer to help outline the method in relation to current costs.

Exhibit 1 -- Recap of Sales for Period

| Product | Gallons | Value | Unit Value or Average Selling Price |
|---|---|---|---|
| 400 EPUSM Gasoline | 4,274 | $ 421.10 | .09852597 |
| Kerosene | 89,537 | 8,282.04 | .09249852 |
| Y. Distillate | 2,541,046 | 226,402.16 | .0890980171 |
| 38-40 Distillate | 310,214 | 27,868.64 | .08983632 |
| Gas Oil | 181,982 | 13,369.92 | .07346836 |
| Charging Stock | 1,047,410 | 53,713.00 | .051281733 |
| Residuum | 1,919,402 | 83,010.64 | .043248178 |
| Reg. Leaded Gasoline | 2,323,633 | 239,844.21 | .1032194886 |
| Premium Gasoline | 92,454 | 10,734.24 | .1161036 |
| | 8,509,952 | $663,645.95 | |

The above sales include general sales and interdepartmental transfers.

ILLUSTRATION IV




FLOW CHART TO ILLUSTRATE CURRENT PROCESSES. SEE CHAPTER VI

Exhibit 2 — Summary of Refining Expenses

| Expense | Departments | | | |
|---|---|---|---|---|
| | Crude Unit | Dubbs Unit | Leading Unit | Total |
| Net Salaries | $8,566.22 | $11,161.63 | $ 750.00 | $20,397.85 |
| Rentals | 30.00 | 20.00 | | 50.00 |
| Heat | 1,341.56 | 10.20 | | 1,351.76 |
| Power | 1,066.05 | 1,302.95 | | 2,369.00 |
| Water | 589.22 | 720.29 | | 1,309.51 |
| Repairs & Maintenance | 3,949.29 | 2,729.97 | 4.37 | 6,683.63 |
| Supplies | 442.55 | 365.92 | 98.71 | 907.18 |
| Miscellaneous | 270.45 | 180.55 | | 451.00 |
| Fed. Old Age Ins. | 134.49 | 167.72 | 11.25 | 313.46 |
| Unemployment Taxes | 53.80 | 67.08 | 4.50 | 125.38 |
| General Taxes | 627.25 | 754.17 | 303.83 | 1,685.25 |
| Pensions - Employees | 471.45 | 549.12 | 42.00 | 1,062.57 |
| Ins. and Bond Prem. | 551.90 | 512.15 | 180.49 | 1,244.54 |
| Car & Truck Expense | 63.16 | 41.92 | | 105.08 |
| Depreciation | 3,655.37 | 3,655.37 | 1,026.57 | 10,592.11 |
| Treating Materials | 835.01 | 1,760.02 | | 2,595.03 |
| Sales & Use Taxes | 1.19 | .79 | | 1.98 |
| Royalties | 1,323.49 | 2,019.39 | | 3,342.88 |
| Total | $24,872.51 | $28,293.98 | $2,421.72 | $55,588.21 |

The above are the processing expenses which were compiled in expense ledgers and distributed to the processes. Method of distribution was similar to that discussed earlier.

The cost of crude oil consumed was determined by reference to an inventory and purchases record, which afforded the following information:

| Crude Oil: | Barrels | Price |
|---|---|---|
| Opening Inventory | 58,668.55 | $165,677.64 |
| Purchases | 175,492.93 | 488,157.33 |
| Less Pipe Line Losses | 1,633.94 | ------- |
| Less Runs | 196,183.07 | 551,639.40 |
| Ending Inventory | 36,344.47 | $102,195.57 |
| Average Cost | 2.811860349 | |

Please note that the above computations are only a part of the total inventory record. The remainder of the record has been omitted for the sake of brevity.

Exhibit 3 - Cost Statement or Analysis of Manufacturing Cost

(a) Crude Unit

| Product | (1) Production % | (2) % Products Produced | (3) Average Selling Price | (4) Factor (2 x 3) | (5) Cost of Crude Oil Charged | (6) Manufact. Expense Charged |
|---|---|---|---|---|---|---|
| 400 EPUSM Gasoline | 10.625 | 10.797699 | .09852597 | 10.638533 | $ 78,241.99 | $ 3,420.68 |
| Naptha Charge | 20.931 | 21.270207 | .09852597 | 20.956678 | 154,127.58 | 6,738.35 |
| Kerosene | 1.087 | 1.104281 | .09249852 | 1.021444 | 7,530.29 | 328.43 |
| Y. Distillate | 11.456 | 11.641897 | .08909802 | 10.372700 | 76,286.86 | 3,335.21 |
| 38-40 Distillate | 3.400 | 3.455279 | .08983682 | 3.104113 | 22,829.45 | 998.09 |
| Gas Oil | 4.531 | 4.640762 | .07346836 | 3.383043 | 24,880.87 | 1,087.77 |
| | | | | 49.476516 | 363,897.04 | 15,908.53 |
| Fuel Oil or Charging Stock | 46.374 | 47,125875 | | | 187,742.36 | 8,207.55 |
| Losses & Gas | 1.596 | | | | | |
| | 100.000 | 100.000 | | | $551,639.40 | $24,116.08 |

| (7) Treating Expense Charged | (8) Production Quantity | (9) Production Cost | (10) Beginning Inventory Quantity | (11) Beginning Inventory Cost | (12) Total Quantity | (13) Total Cost | (14) Unit Cost |
|---|---|---|---|---|---|---|---|
| 491.45 | 875,496 | $ 82,154.12 | 346,889 | $ 32,301.30 | 1,222,385 | $114,455.42 | .0936328734 |
| | 1,724,625 | 160,865.93 | 173,966 | 16,143.99 | 1,898,591 | 177,099.92 | .0932322548 |
| | 89,537 | 7,858.72 | | | 89,537 | 7,858.72 | .0877706423 |
| 264.98 | 943,945 | 79,887.05 | 3,460,281 | 276,524.84 | 4,404,226 | 356,411.89 | .0809249775 |
| | 280,160 | 23,827.54 | 92,019 | 7,483.20 | 372,179 | 31,310.74 | .0841281748 |
| | 373,362 | 25,968.64 | 201,858 | 13,224.01 | 575,220 | 39,192.65 | .0681350613 |
| | 3,821,047 | 195,949.91 | | | 3,821,047 | 195,949.91 | .051281733 |
| 756.43 | 8,108,172 | $576,511.91 | 4,275,013 | $345,677.34 | 12,333,185 | $922,189.25 | |

Remarks pertaining to (a):

The production percentages (column 1) are determined by reference to a processing report, which is a record of the quantity movements of products within the processes. Column 2 is the production percentage with Gas and Losses distributed to the various products. Column 3 is a listing of average selling prices for the various products (see Exhibit 1). Column 4 presents the factors obtained by multiplying production percentage times average selling price. Columns 5, 6 and 7 are the distributions of crude oil and manufacturing costs. Charging Stock, which is usually transferred to the Dubbs Unit for cracking, is assigned costs equal to its sales value. This cost is divided between crude oil and manufacturing by multiplying the production percentage for Charging Stock times its sales value to arrive at a factor whose relation to the total of all factors (column 4) determines the amount of the total manufacturing expense (treating included) to be assigned to that product. This value is then subtracted from the total sales value for the product to arrive at the amount chargeable against crude oil cost. Treating expenses that may be identified with a particular product are assigned thereto, and the remaining costs, for crude oil and manufacturing expenses, are then apportioned to the products other than Charging Stock on the basis of their relative factors. Production is combined with beginning inventories to arrive at unit costs. This method of allocation could be classified as a variation of the Weighted-Selling-Ratio Method, with by-product treatment for one product.

(b) - Dubbs and Reformer Unit

Analysis of Manufacturing Expense

| Product | (1) Cost of Stocks Charged | (2) Manufacturing Expense Allocated | (3) Treating Expense | (4) Production Quantity | (5) Production Cost |
|---|---|---|---|---|---|
| Pressure & Poly Gas | $230,429.17 | $22,195.14 | $1,657.63 | 2,764,362 | $254,281.94 |
| Residuum | 46,108.42 | 4,441.21 | | 1,066,338 | 50,549.63 |
| Gas & Loss | ------ | ------ | ------ | ------ | ------ |
| Totals | $276,537.59 | $26,636.35 | $1,657.63 | 3,830,700 | $304,831.57 |

| (6) Beginning Inventory Quantity | (7) Beginning Inventory Cost | (8) Total Quantity | (9) Total Cost | (10) Unit Cost |
|---|---|---|---|---|
| 204,895 | $19,449.34 | 2,969,257 | $273,731.28 | .0921884767 |
| 1,857,823 | 75,915.01 | 2,924,161 | 126.464.64 | .043248178 |
| ------ | ------ | ------ | ------ | ------ |
| 2,062,718 | $95,364.35 | 5,893,418 | $400,195.92 | |

Remarks pertaining to (b):

The costs of the stocks charged are allocated, in the case of this unit, on the assumption that residuum is a by-product. Residuum is assigned its market value, this divided between crude and manufacturing expenses, in the same fashion as for charging stock in (a), and the balance of the crude and manufacturing expenses assigned to Pressure and Poly Gasoline, the assumed main product. The treating costs noted above are set forth separately as assignable to the gasoline product. The balance of the computations with respect to production and beginning inventory have the same purpose as in (a).

(C) - Leading Unit

## ANALYSIS OF MANUFACTURING EXPENSE

| Production Record: | Gallons | Value | T. E. Lead Lbs. | T. E. Lead Value | Reg. Leaded Gaso. Gallons | Reg. Leaded Gaso. Value | Premium Gasoline Gallons | Premium Gasoline Value | Unleaded Gasoline Gallons | Unleaded Gasoline Value | Great Lakes Stock Gallons | Great Lakes Stock Value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Beginning Inventory | 2,556,032 | $243,680.37 | --- | --- | 301,768 | $30,217.45 | 65,395 | $6,756.95 | 2,188,869 | $206,705.97 | --- | --- |
| Purchases | | 15,494.24 | 4,097,900 | $15,494.24 | | | | | | | | |
| Lead Losses | | 1,798.19 | 475,585 | 1,798.19 | | | | | | | | |
| Natural from Crude Unit | 37,759 | 3,492.02 | --- | --- | 7,204 | 666.24 | 2,233 | 206.51 | 28,322 | 2,619.27 | --- | --- |
| USM from Crude Unit | 880,360 | 82,430.64 | --- | --- | 81,595 | 7,639.97 | --- | ---- | 798,765 | 74,790.67 | --- | --- |
| Pressure & Poly from Dubbs Unit | 2,845,249 | 262,299.17 | --- | --- | 204,544 | 18,856.60 | 92,164 | 8,496.46 | 2,548,541 | 234,946.11 | --- | --- |
| Transfers | | | | | | | | | 1,999,927 | 187,344.92 | 1,999,927 | $187,344.97 |
| Lead Used | | | 3,209,851 | 12,136.51 | | 1,692.01 | | 578.50 | | | | 9,866.00 |
| Manufacturing Expense | | 2,421.72 | | | | 188.77 | | 60.74 | | 2,172.21 | | |
| Losses | 9,326 | | | | 6,775 | | 2,285 | | 266 | | | |
| Total | 6,310,074 | $608,019.97 | 412,464 | $ 1,559.54 | 588,336 | $59,261.04 | 157,507 | $16,099.16 | 3,564,304 | $333,889.31 | 1,999,927 | $197,210.92 |
| Sales and Transfers: | | | | | | | | | | | | |
| Inter-Deptl. | 2,055,928 | 202,868.98 | | | 44,373 | 4,469.54 | 11,628 | 1,188.52 | | | 1,999,927 | 197,210.92 |
| General Sales | 360,159 | 36,397.66 | | | 279,333 | 28,136.24 | 80,826 | 8,261.42 | | | | |
| Total Sales | 2,316,087 | $239,266.64 | | | 323,706 | $32,605.78 | 92,454 | $9,449.94 | | | 1,999,927 | $197,210.92 |
| Ending Inventory | 3,893,987 | $363,753.33 | 412,464 | $ 1,559.54 | 264,630 | $26,655.26 | 65,053 | $6,649.22 | 3,564,304 | $333,889.31 | 0 | 0 |
| Unit Cost | | | .378102125 | | .1007265236 | | .1022123461 | | .0936758790 | | .0986090592 | |

Remarks pertaining to (c):

The products handled in Leading are those produced and transferred from the other units, their cost having previously been determined with the exception of Tetra Ethyl lead. The applications of lead to the various products are from specific records kept for that purpose. The manufacturing expense of this unit is applied on a basis of gallons blended.

For the purposes of this study, a further elaboration of the foregoing illustration is not considered necessary; and for that reason no attempt has been made to illustrate or include in this study the mass of detail incidental to the collection and summarization of the inventories and costs presented. The main point of interest is that the system of allocation used in the illustration contains elements of more than one method. It is felt that such would be the case in nearly all modern refineries producing a wide variety of products. In all refineries visited, with the exception of the one company using the Single-Product Method, such was the case.

# CHAPTER VII

## SUMMARY AND CONCLUSIONS

The foregoing study indicates that the object of allocation of joint costs is to give reasonable valuations to inventories. Simply assigning total costs does not afford any measure of guidance to management. Evaluation of any product or process must be in regard to its worth as compared with its cost, reasonably determined. Since joint products do not have separate true costs, but only total true costs for all joint products, allocation must be undertaken on a reasonable, or at least conventional, basis. In the foregoing illustrations and discussions various methods of allocation were described and compared, with the illustrations aimed at depicting the different effects of the various methods as applied to certain production and sales figures. Accepting the close tie that exists between costs, revenues, and inventories, it would seem that any method of cost assignment that would report different rates of revenue under different ratios of sales for products that have arisen from common costs could not be expected to report inventory valuations that would be consistently acceptable for statement purposes. The only method that does afford consistency under all normal circumstances (which would include varying sales ratios) is the Weighted-Selling-Ratio Method. In justification of the use of this method, it may be stated that, in the absence of unusual situations affecting market prices, it is more highly regarded by current writers than any other method; is in use in nearly all present day refineries; and is the customary, if not standard, method of cost finding in the industry. The only semblance of an objection to this method has been noted: Some companies prefer to regard certain residuums having very little value as by-products, and would then advocate the use of the Weighted-Selling-Ratio Method with by-product treatment for the above mentioned residuums. It is of interest that, of the companies visited, only one was using a method other than the Weighted-Selling-Ratio or a refinement thereof; and that company indicated that it intends to change to the Weighted-Selling-Ratio Method as soon as practicable.

Some objections to the other methods may be summarized as follows:

(a) The Unit-Quantity Method does not permit costs to follow to the products (i.e., a higher price is paid for crude oil with a high gasoline content than for crude oil with a low gasoline content), and would report losses on some products while others absorbed the difference.

(b) The Single-Product Method is a carry-over from the time when gasoline was the only product of much value being produced. Such is not considered to be the case at the present time.

(c) All of the methods other than Weighted-Selling-Ratio would tend to cause inventory valuations to fluctuate, in relation to market values, from period to period as the ratios of sales for the various products changed.

Three of the methods mentioned were given brief treatment because, as mentioned earlier, they were not widely used and are not currently in use insofar as this writer was able to determine.

In conclusion, it is felt that in the absence of separate true costs upon which assignment to products may be made, consistency of reporting would indicate as desirable an allocation bearing a consistent relationship to market values.

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THESIS TITLE: An Inquiry into Various Methods of Allocating Costs to Joint Products in a Petroleum Refinery.

NAME OF AUTHOR: Paul R. Keene

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