THE COSTS TO THE PETROLEUM INDUSTRY ASSOCIATED WITH MMT REMOVAL AND GRADE SPLIT CHANGES OF MOTOR GASOLINES

IP-15
July 1984

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BY

Monenco Engineers and Constructors Inc.

FOR

Environmental Protection Service
Environment Canada

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ABSTRACT

This report details an investigation into the impact, on the Canadian refining industry in 1990, of the elimination of MMT antiknock additives in the unleaded grades of motor gasoline, and a change in gasoline grade split. A series of computerized process simulations was carried out covering refineries in the Atlantic, Quebec, Ontario, and Western Regions. For each of these regions, a composite refinery approach was used in which active refineries in the region were represented by a single entity whose major process unit capacities equalled the sum of the reported installed capacities in that region.

Estimated capital and operating costs for each region are presented as well as an overview of the current state of alternative fuels and blending processes.

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EXECUTIVE SUMMARY

The objective of this study was to estimate the additional capital investment and operating costs that would be incurred by the petroleum refining industry if MMT antiknock additive were withdrawn from use and the percentage of gasoline sales as leaded fuel were reduced from 30% to 10%. These changes are intended to reflect the maximum impact which adoption of U.S. 1981 auto emission standards could have on the refining industry.

The study was carried out using product demands, crude availabilities and product specifications as determined for 1990 by studies previously conducted for the Federal government by Hycarb Engineering. The only significant changes from the Hycarb study were the limiting of lead content in leaded gasoline to 0.29gm/litre maximum and adjustment of MMT use and gasoline grade splits to suit the situation being investigated.

Costs were determined for four separate cases as identified below:

(1) CGSB Octanes, 70/30 UL/L, with MMT.
(2) CGSB Octanes, 90/10 UL/L, without MMT.
(3) Market Octanes, 70/30 UL/L, with MMT.
(4) Market Octanes, 90/10 UL/L, without MMT.

Since current market octanes are considerably higher than minimum octane levels specified by the Canadian General Standards Board (CGSB), it was deemed important to investigate costs at these two extremes.

The petroleum refining industry was analyzed on a regional basis using a refinery simulator. A single refinery for each region having refinery capacity equal to the total refinery capacity in the regions (Atlantic, Quebec, Ontario, Western) was used to determine the refining modifications required (if any) for each case. It was assumed that all refineries currently in operation would continue to be in operation in 1990 with the exception of Texaco's Edmonton refinery for which closure in late 1984 has been announced. The approach adopted was to maximize utilization of existing equipment until such time that it could no longer meet requirements. Then new facilities (either isomerization or high severity reforming) could be chosen and the operation with the new facility was adjusted to minimize crude oil consumption. The severity of existing catalytic reformers was limited to 100 RON and reported capacities were discounted to allow operation at this severity.

Once the additional total new octane generating facilities for each region and each case had been determined, using the refinery simulator, each refinery in each region was reviewed to determine the appropriate allocation of new facilities to permit each refinery to produce specification product. The capital cost of new facilities was estimated using information from process licensors and Monenco experience. A 30% allowance was added to cover off-site costs. No account was taken of opportunities which may exist to revamp existing equipment, eliminate certain low octane components from the gasoline pool or purchase high octane blending components. These factors could, of course, reduce the capital cost of some cases but may increase operating costs.

Operating costs for each case were developed using available cost information for utilities, catalysts, chemicals, gasoline additives, maintenance, taxes, insurance, operating labour, crude oil, etc.

In 1984 dollars, the total incremental cost associated with MMT removal and grade split changes from 70/30 unleaded/leaded to 90/10 is estimated as follows. Costs given in this summary are total erected costs. An additional 30% has been added to capital costs contained in the body of this report to obtain a total erected cost.

	CGSB Octanes	Market Octanes
Capital Cost $M	305	494
Annual Operating Cost $M . . . . (excluding taxes and capital charges)	26	42

The capital costs are scope costs with an accuracy of +/- 30%. No attempt has been made to analyze the impact that the required investment might have on the viability of certain refineries. Rather sufficient funds have been included to provide facilities to permit all existing refineries to manufacture specification product.

In the CGSB octane case, 10 of the 23 existing refineries required addition of isomerization facilities. In the market octanes case all 23 refineries required addition of isomerization facilities. In no case were facilities other than those associated with isomerization required. The increased crude oil required as a result of MMT removal and reduction of leaded gasoline sales was minimal with facilities provided and varied from 0.35% using CGSB octane to 0.22% using market octanes. The costs associated with this additional crude are included in the operating costs provided.

After completing the cases identified above four additional cases were studied to separate the cost of MMT removal and grade split changes. The four separate cases are identified below:

(1) CGSB octanes 70/30 UL/L without MMT
(2) CGSB octanes 90/10 UL/L with MMT
(3) Market octanes 70/30 UL/L without MMT
(4) Market octanes 90/10 UL/L with MMT

In 1984 dollars, the total incremental cost associated with MMT removal and grade split changes is estimated as follows. Costs given in this summary are total erected costs. An additional 30% has been added to capital costs contained in the body of this report to obtain a total erected cost.

	CGSB Octanes		MARKET Octanes	
	70/30 UL/L Without MMT	90/10 UL/L With MMT	70/30 UL/L Without MMT	90/10 UL/L With MMT
Capital cost $M	164	0	112	68
Operating cost $M (excluding taxes and capital charges)	8	11	12	19

In the CGSB octane 70/30 UL/L without MMT case 5 of the 23 existing refineries required addition of isomerization facilities. In the CGSB octane 90/10 UL/L with MMT case none of the 23 existing refineries required addition of isomerization facilities. In the market octane 70/30 UL/L without MMT case 9 of the 23 existing refineries required addition of isomerization facilities. In the market octane 90/10 UL/L with MMT case 7 of the 23 existing refineries required addition of isomerization facilities.

In no case were facilities other than those associated with isomerization required. The increased crude oil required as a result of MMT removal or reduction of leaded gasoline sales was minimal with facilities provided and varied from .25% using CGSB octanes to .33% using market octanes.

The costs associated with this additional crude are included in the operating cost provided.

1.0 INTRODUCTION

This report, prepared for Environment Canada, presents the results of a study into the costs to the petroleum refining Market arising from the removal of all MMT antiknock additives from unleaded grades of motor gasoline and a change in gasoline grade split by 1990.

Statistics on product demand, installed capacities of the major process units in the various refineries and typical composition of crude supplies were taken from Hycarb Engineering's report (Reference 14) which was supplied for the purposes of the study. For simplicity, the same general approach as used in the previous studies was adopted; that of dividing Canada into four regional areas and representing each by a single composite refinery which embodied the total installed capacity of the main processing units in each region.

In consultation with the client (EPS), (RON + MON)/2 was selected as the octane rating to be met at two levels. The first level termed "Market" octanes, matches that reported by Petroleum Association for the conservation of the Canadian environment (PACE.) A somewhat lower level selected by the client is referred to in the report as "CGSB" (Canadian General Standards Board) octanes. These octane specifications, as well as allowable concentrations for TEL and MMT additives to be used in the study, were established for each region (Table 1-1).

Using a computer model which simulates the general refinery scheme shown in Figure 2-1, base cases were first developed for the four regions. These represent the refinery conditions in each region with the given level of antiknock additives still in the gasoline. Leaded regular grade gasoline was taken to be 30% of the motor gasoline demand.

Comparative cases to determine the effect of eliminating MMT in the unleaded gasoline were then run using the same crude blend and, with one exception, the same product demand slate which was used in the corresponding base cases. In the zero MMT cases, while the total motor gasoline demands in each region were kept the same as the base cases, the proportion of leaded regular grade was reduced to 10% of the gasoline pool on the assumption that lead tolerant cars would not be produced for sale in Canada. Processing severities were adjusted and new octane improvement processes added as required until the octane levels of the gasoline produced were restored to those in the base cases.

Estimated capital and operating cost differentials are presented for each case.

The costs developed in the basic study are those required to meet the target octane levels. In the MMT free cases, no allowance was made for the loss of blending flexibility to avoid octane give away.

At the conclusion of the main study four additional cases were studied (using the same methodology as main report) and operating and capital costs identified. The octane specifications, as well as allowable concentrations for TEL and MMT additives used for these additional cases are presented in Table 8-1.

Simulation results, and operating and capital costs for these additional cases are presented separately in Section 8 of this report.

The base case used in the additional cases was that used for establishing incremental operating and capital cost for the main study.

TABLE 1 - 1

SUMMARY OF MOTOR GASOLINE

OCTANE SPECIFICATIONS & ANTIKNOCK ADDITIVE CONCENTRATIONS

	Government Octanes		Industry Octanes	
	Base	Case 1	Base	Case 1
Lead Concentration (Leaded Pool) Gms of Pb/L	0.29	0.29	0.29	0.29
MMT Concentration (Unleaded Pool) Mg of Mn/L	18.0	0	18.0	0
Gasoline Grade Split (Unleaded/Leaded)	70/30	90/10	70/30	90/10
Octane Specification (R+M/2)Min (Leaded/Unleaded Reg/Unleaded Prem)				
Atlantic	87/87/90	87/87/90	89.8/89/91.8	89.8/89/91.8
Quebec	87/87/90	87/87/90	89.8/89/91.8	89.8/89/91.8
Ontario	87/87/90	87/87/90	89.8/89/91.8	89.8/89/91.8
Western	85/85/88	85/85/88	88.3/88.3/90.8	88.3/88.3/90.8

2.0 METHODOLOGY

INTRODUCTION

This section discusses how the computer model was derived and used to simulate the various refinery processes necessary to produce products meeting the product slate and octane requirements.

The basis for the model is first described, followed by a description of the actual process involved in developing the simulated cases.

The section then continues with an account of the parameters used. Tables are included covering crude feedstocks, and product demands, as well as refinery operating parameters and product specifications.

The section concludes with an examination of the limitations of the modelling technique and how adjustments were made to ensure that results were not adversely affected by these limitations.

2.1 Description and Application of Computer Model

Owing to significant differences in the crude oil diets used by refineries, it was decided to divide Canada into four distinct regions namely Western, Ontario, Quebec and Atlantic. Figure 2-3 defines these regions geographically.

The computer model simulated the general refinery process unit configuration shown in Figure 2-1. Refinery operations in the four major regions of Canada were represented by single composite refineries representing each region. The capacity of each process unit in the regional composite refinery was taken to equal the sum of the 1990 installed capacities of all similar units within that region as shown in Hycarb Engineering's report (Reference 14).

The computer model simulates each unit in the refinery and calculates overall material balance and product properties but does not incorporate economic data. In preparing study cases, the model was solved iteratively by user interaction. In effect, the optimizing procedure usually performed by a sub-routine algorithm was done manually.

The optimizing criteria applied for each case study were:-

a) Maximum utilization of existing process units.
b) Minimum crude oil consumption.

Incremental crude oil consumption is disadvantageous to Canada both economically and politically and thus was considered to be the prime factor in the determination of the optimal solution.

A systematic approach was used to develop each case. The steps followed are illustrated in Figure 2-2 and summarized below:

1. Data gathering. Each case study required a definition of feedstock diets, slates, and unit capacities for each region. These are shown in Tables 2-1 to 2-12.

2. Execution of the crude blending routine (blocks 1-3 in Figure 2-2). This computer routine breaks down the individual crude feedstocks into pseudocomponents and blends them in the specified proportions.

3. Execution of material balance routine (blocks 4-10 in Figure 2-2). Sufficient data to satisfy the material balance was entered, such as product slates, feed rates to units, TBP cut points and operating severities for the individual units etc. The program then executes to produce estimated yields from the process.

4. Inspection of material balance results (block 11 in Figure 2-2. The results are reviewed against the following constraints:

    a) unit capacities (Tables 2-9 to 2-12);

    b) limitations in operating variables such as cut points and unit turndowns (Table 2-13).

    If these constraints are not satisfied, step 3 is repeated with modified input data.

5. Execution of product quality routine (blocks 12 and 13). Additional data (including gasoline lead concentration) is entered and product qualities are then computed.

6. Inspection of product qualities (block 14). The calculated product qualities are reviewed against the product specifications listed in Table 2-14. If the specifications are not satisfied, the program is returned to either step 3 or 5 as desired for adjustment.

7. Review of optimizing criteria. If a solution is found to satisfy all the constraints, it is then reviewed to ensure that it is satisfactory in terms of the optimizing criteria previously mentioned. In general, cases were repeated until one or more discrepancies between a variable and its constraints were eliminated.

In this manner eight Base Cases were developed for each region, using 1.24 cc of TEL/IG (equivalent to Ø.29 grams of lead/litre) in leaded regular gasoline and 18 milligrams of MMT/litre in unleaded regular and unleaded premium grades. The eight base cases were made up of four (one in each region) aimed at 199Ø Market target levels, as developed by PACE and four at the slightly lower CGSB octane levels. For all the base cases the leaded regular grade was set at 3Ø% of total motor gasoline.

Alternates to each base case were then developed using 1.24 cc of TEL/IG in leaded regular gasoline and Ø MMT in unleaded gasoline. Product slates and target octane numbers were unchanged except that the volume of leaded regular grade was reduced to 1Ø% of the total pool. The unleaded premium was left the same and the unleaded regular increased to maintain total volume. The following table shows the 199Ø targets.

TARGET OCTANE LEVELS - (RON + MON)/2

ALL REGIONS

	Leaded Regular	Unleaded Regular	Unleaded Premium
Market	89.0	89.0	91.8
CGSB	87.0	87.0	90.0

In keeping with the two optimization criteria, each case was first run using existing equipment and adjusting Reformer severity up to 100 RON if necessary, to balance the gasoline pool octane requirements. The isomerization unit during this stage was 100% by-passed.

If the octanes could not be met with existing equipment once through isomerization of the C5 - 170DEG.F LSR was added. The conversion losses with isomerization are less than those for reforming. A minimum crude run was then obtained by operating the isomerization unit at full capacity and adjusting Reformer severity to balance the octane requirements. At the higher Market octane levels, Reformer severity could only be reduced to that required to blend the unleaded premium. At this point, if the pool octane was still too high, the isomerization unit by-pass was increased until balance was obtained.

Total isomerization was added in those cases where once through isomerization and 100 RON Reformate would not meet requirements. The approach to total isomerization was the same as that previously described for once through isomerization.

Isomerization was selected in preference to adding new higher severity reforming capacity (>100RON), because, when compared with reforming it offers very little loss in yield which results in significantly lower crude runs for the equivalent amount of octane improvement.

2.2 Basic Parameters

Crude Diets (Tables 2-1 to 2-4)

The 1990 feedstock diets for each region were developed from types shown to be available in Hycarb Engineering's report (Reference 14). For simplification, the qualities of the mix for each region were blended from the light and heavy crude types already built into the program file. Frontier crude was assumed to be equivalent to Venezuelan Light.

Since the computer model does not include simulation of residual reduction processes such as visbreaking or coking, sufficient extra syncrude quality stock was added to the mix to produce an acceptable Heavy Fuel Oil viscosity. Provision of residual reduction processes was considered to be outside the scope of the study.

The individual crudes listed in Tables 2-1 to 2-4 are actually blends of several crudes from different fields. The specific assays used to represent each blend are summarized in Table 2-15. Assays for the domestic crudes were taken from in-house reference files while assays for the imported crudes were taken from the Oil and Gas Journal (Reference 4 and 5).

Product Slates (Tables 2-5 to 2-8)

Product demands as set out in Hycarb Engineering's report (Reference 14) were used as 1990 production figures for each region. Refinery output is reported for total gasoline rather than for each grade. The production of leaded regular grade was taken to be 30% of total gasoline in all cases using MMT and 10% of total in those cases with MMT removed.

Refinery Configurations (Tables 2-9 to 2-12)

Capacities for the major processing units installed in each refinery as of the end of 1983 were obtained from Hycarb Engineering's report (Reference 14). Reforming capacities are down rated to reflect the assessed capacities at 98 RON.

Refinery Operating Parameters (Table 2-13)

These constraints were based on in-house experience and reference files pertaining to refinery design and operation.

Production Specifications (Table 2-14)

The number of product types was minimized and their specifications were derived using an average of the specifications for the range of grades of products within a particular broad category.

The specifications published by the Canadian CGSB Standards Board were supplemented by additional data on product quality attained in practice and appropriate target levels which were available from both in-house references and the major refiners themselves.

Process Yields

Catalytic reformer, catalytic cracker and isomerization yields were taken from "Petroleum Refining Technology and Economics" (Reference 3). In general these correlations are based on feedstock gravity and appropriate characterization factors derived from the crude assay data.

The following assumptions were made regarding process unit types and appropriate data was incorporated into the computer model.

Catalytic Reformer	-	Mono-metallic platinum catalyst semi-regenerative unit.
Catalytic Cracker	-	FCC unit using zeolite catalyst and heavy vacuum gas-oil feedstock.
Alkylation	-	HF catalyst using C3/C4 olefinic feedstock plus i-C4.
Isomerization	-	LSR (C5- 170 DEG. F) feedstock both once through and total recycle.

For the HF Alkylation Unit, iso-butane requirements were taken to be 1.24 volumes per volume of olefin, with iso-butane being imported as required to react all olefins allocated to alkylation.

It was assumed that the gas plant in each composite refinery had the capability to recover 95% iso-butane for alkylation and total C4's for blending as required from all sources (crude tower overhead, catalytic Reforming, Catalytic cracking).

For the Distillate Desulphurization Units, hydrogen consumption estimates were taken from Hydrocarbon Processing (August, 1980). The consumptions used for the various streams are as follows:

Naphtha/LSR	:	30 SCF/bbl
Kerosene	:	200 SCF/bbl
Light Gas Oil and Light Cycle Oil	:	700 SCF/bbl

Operating Costs (Table 2 - 17)

The 1984 costs for feedstocks and products were obtained from Energy Mines & Resources (E.M.R.) and from current publications.

Utility costs were developed from discussions with suppliers and in-house information.

Energy Penalty

The definition of the energy penalty incurred in manufacturing gasoline in any one of the study cases, as compared with the base case, was derived as follows.

1. Energy penalty (as a percentage) equals the differential operating energy requirement times 100 divided by the energy content of the base case crude oil consumption.

2. Differential operating energy requirement equals the study case operating energy requirement minus the base case operating energy requirement.

Expressed in terms of a mathematical equation, this definition reduces to the following:

$$\text{Energy Penalty} \quad \frac{Es - Eb \times 100}{Hb}$$

where Es = operating energy requirement of study case,

Eb = operating energy requirement of base case,

Hb = energy content of crude oil used in base case.

If all three are expressed in BTU/calendar day (CD), then

$$Hb = \text{Imp. gallons used/CD} \times \text{HHV (BTU/Imp. gallon)}$$

and $$HHV = [18320 + 40 \, (\,API - 10)] \times 10 \times S.G.$$

Table 2-18, which lists the unit energy requirement for process unit operations, was applied in the calculations. This data was derived from a literature search and a representative number assigned to each process unit considered.

Energy equivalents of utilities which were applied are listed below:

Electricity	10000	BTU/KW
Steam	1300	BTU/LB
Fuel		HHV *
Heavy Fuel Oil (#6)		HHV calculated for each case by formula
Crude Oil		HHV calculated for each region by formula (e.g. BTU/I.G. for Quebec)

* N.B.: The basis for FOE of Fuel Gas Product in the computer model is 6.35×10^{6} BTU/BBL.

Product Quality Estimate

A pseudocomponent approach was used to estimate the properties of distillates, turbo fuels and heavy fuel oil. In this approach the true boiling point curve for each crude was subdivided into pseudocomponents of 20 degrees F boiling range. Each of these was assigned a specific gravity, mid-boiling point and sulphur content as specified by the crude assay. Using procedures provided in the API Data Book (Reference 6), the pseudocomponent composition of each product was used to estimate ASTM distillations, specific gravities and characterization factors. These in turn were used to estimate product qualities such as viscosity, flash point, and pour point, based on various published and in-house correlations. In particular, the diesel cetane index was estimated using the ASTM calculation procedure (Reference 7). The pseudocomponent approach was not used for estimating gasoline properties. Table 2-16 summarizes the RVP and RON used for each gasoline component. The RON values shown are in line with recently published figures (Reference 8). Octane blending, including the effect of lead additives, was based on a method by Eastman (Reference 9). RVP's for each gasoline grade were obtained by blending on a molar basis.

2.3 Assumptions And Limitations

In any empirical study the limitations of the parameters and methods used must be recognized and appropriate steps taken to eliminate, or at least mitigate, their effect on the results. In this study the typical refinery model (Figure 2.1) does not contain all the processing units found in individual refineries, nor does it contain as much processing and blending flexibility. To compensate for these factors a number of assumptions were made, as discussed in this section.

In reviewing the results of the study, it must be remembered that the effects of most, if not all, of these assumptions tend to cancel out when going from the base cases with MMT to the alternate cases without MMT. Therefore, the shortfall of processing to meet the selected unleaded motor gasoline octane targets is considered to be realistic.

Composite Refinery

The composite refinery approach assumes that all the refineries in each region are operating identically at constant conditions throughout the year. In reality, individual refineries may deviate significantly from the composite model in terms of processing schemes, process yields, feedstock and product slates. The operation of a refinery may also change considerably as a result of changed feedstock or seasonal changes in product demand. The following assumptions related to the crude unit are of particular significance.

(a) The cut point between LSR (light straight run) and Reformer feed was taken at 17Ø FVT. This leaves benzene and cyclohexane in the Reformer feed while yielding a C5 - 17Ø F cut for isomerization which contains the low octane C6 components. It was assumed that existing fractionation equipment was not adequate to provide sufficient separation between the LSR and Reformer feed to realize the optimum selectivity from both processes. Allowance has been made for new naptha splitters as part of the cost of the isomerization units.

(b) The model assumes only one light gas oil sidestream. Many refineries produce light and heavy atmospheric gas oil streams, which would enhance blending flexibility in the distillate pool.

The target kerosene EP was taken at 56Ø FVT to suit stove oil distillation limits and the LGO end point was set at 66Ø FVT as a suitable average for diesel quality.

For heavy vacuum gas oil, 1050 FVT end point was taken to be a suitable average between that required for asphalt operation and that for maximum yield. Since heavy vacuum gas oil includes heavy atmospheric gas oil, a 25-30% reduction in vacuum unit feed can be used to determine the required vacuum distillation capacity.

Other Processes

Hydrocracking

Hydrocracking and catalytic cracking capacity were added and the hydrocracker feed run through the catalytic cracker. Thus the hydrocracking yields and product quality are assumed to be identical to those from catalytic cracking. To this end the LCO shown being blended to diesel may be considered to be from the hydrocracker(s). It is also assumed that the pool octane from the cat gasoline plus the additional polymer or alkylate in the cat cracker from the hydrocracker feed is equivalent to the product from catalytic reformed heavy hydrocrackate plus the light naphtha from the hydrocracker.

Coking and Visbreaking

These processes are not represented. The effect of these processes was simulated by adding enough syncrude or additional syncrude into the crude mix to produce an HFO of suitable viscosity. In effect the syncrude represents the net overhead products from residual reduction.

Aromatics

In Quebec the quantity of aromatics in total aromatics, naphtha specialties and naphtha to petrochemical feed is assumed to be equivalent to reformate and is deducted from the reformate produced. In Ontario the naphtha specialties including aromatics are approximately of reformate quality and are also deducted from reformate yield. In the Western region there is not enough extraneous naphtha product to balance the aromatic requirement. In order to compensate for the extraction of the quantity of aromatics required for petrochemicals and also for the higher octanes required on the West coast, the target octanes for motor gasoline in the Western region were left at the same level as the Eastern regions rather than at the normal lower level for the Prairies.

Asphalt

All asphalt was assumed to be produced as residuum from the vacuum tower. No adjustment was made for cutback quantities, etc. due to lack of information.

Product Specifications

The following assumptions were made relating to the product specifications.

a) Due to the lack of published production figures, different product grades of light fuel oil, diesel fuel and heavy fuel oil were not considered. The specifications given in Table 2-14 are representative of the several grades of these products.

b) Not all of the specifications stipulated by the CGSB of Canada for each product could be considered due to unavailability of adequate quality estimation correlations. However, some additional specifications taken from in-house refinery planning data were included in the list of specifications.

Catalytic Reforming Capacity

Certain assumptions were necessary relating to the throughput/severity capacity of existing reformers, as discussed below.

In respect of the 1983 installed reformer capacity, it should be appreciated that most of the reformer units in Canada are old, semi-regenerative types. The required clear octane levels of the gasoline pools during the past ten years have risen steadily due to the gradual introduction of unleaded grades and the trend to reduce the lead additive usage in gasoline. Reformer severities in 1983, expressed in terms of RON, generally ranged from 95 to 98. The trend of increasing proportions of unleaded grades in the total gasoline pools has meant that existing reformer units are being "stretched" to operate at ever increasing severities.

There are several methods to "stretch" or modify a catalytic reforming unit. Some refiners have replaced the mono-metallic catalyst with an expensive bi-metallic catalyst and, in consequence, have gained the advantages of increased catalyst

life and improved reformate yields while retaining high operating pressures. A few refiners have performed major modifications to existing units to convert them to cyclic regeneration types. These modifications allow the units to operate at severities of around 100 RON or higher. Operation of unmodified existing units at higher severities would induce both capacity and mechanical constraints on the systems and also significantly reduce catalyst life.
alistic basis for the study, the reforming capacity of the various regions was rated as follows.

Region	Installed Capacity BPCD Semi-Regen.	Installed Capacity BPCD Cyclic	Rated Capacity BPCD 98 RON	Rated Capacity BPCD 100 RON
Atlantic	39,000	8,200	37,400	30,100
Quebec	85,500	0	77,000	57,700
Ontario	106,100	15,900	111,400	87,500
Western (Prair.)	62,300	20,800	76,800	62,800
Western (B.C.)	23,300	0	17,500	13,100
Western (Total)	85,600	20,800	94,300	75,900

None of the existing units was considered capable of 103 RON severity and entirely new units would have to be built to reach this level.

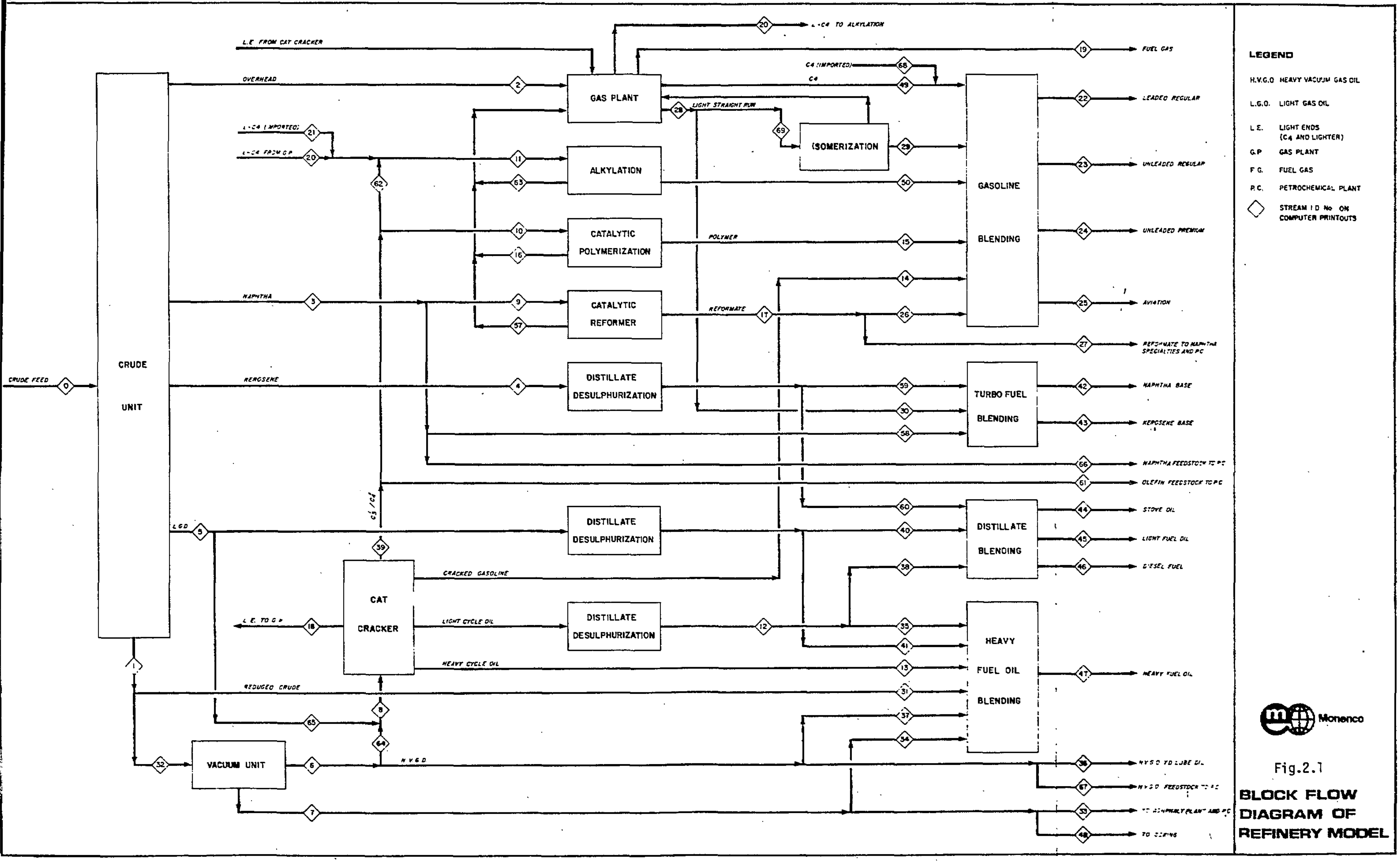
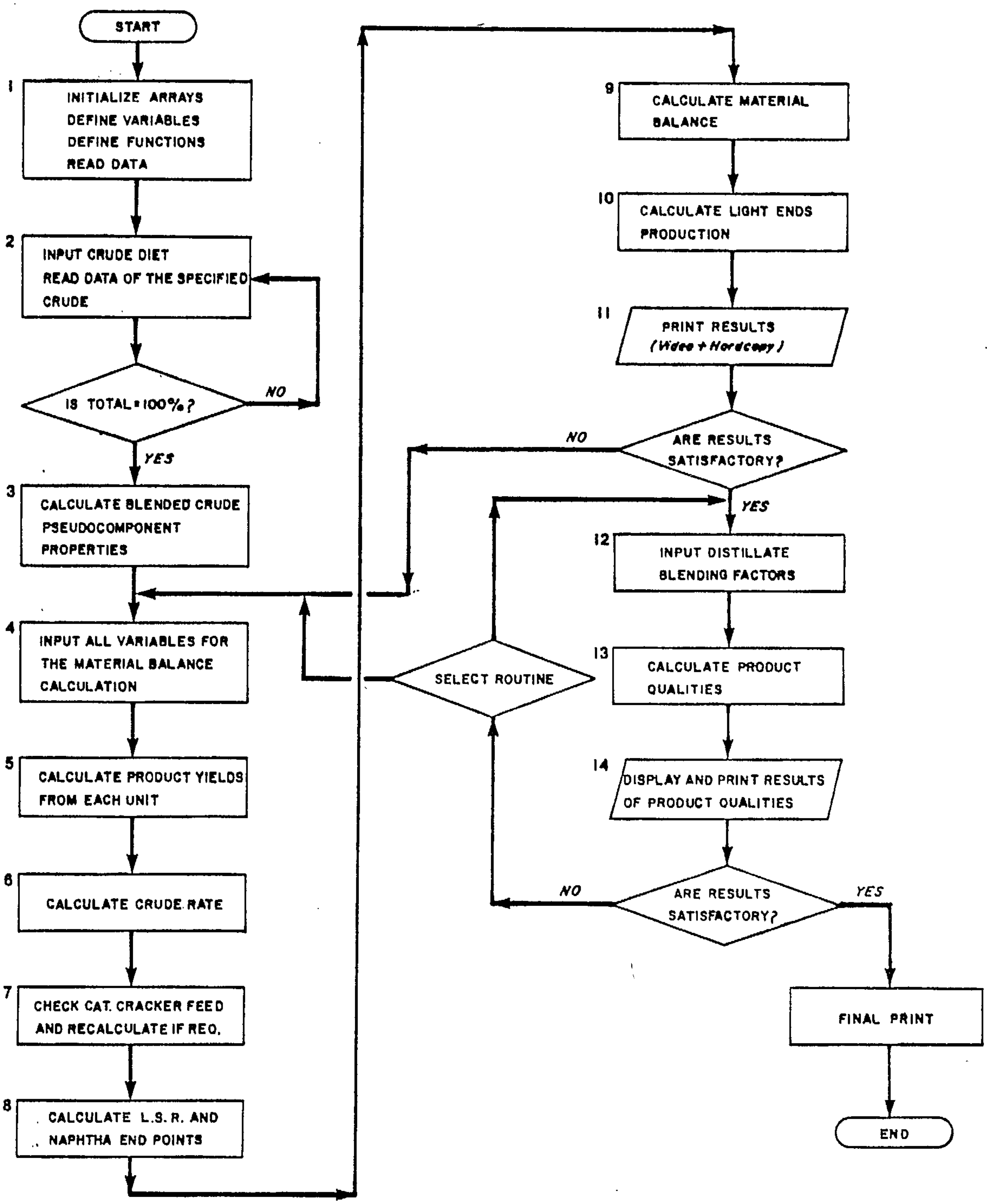
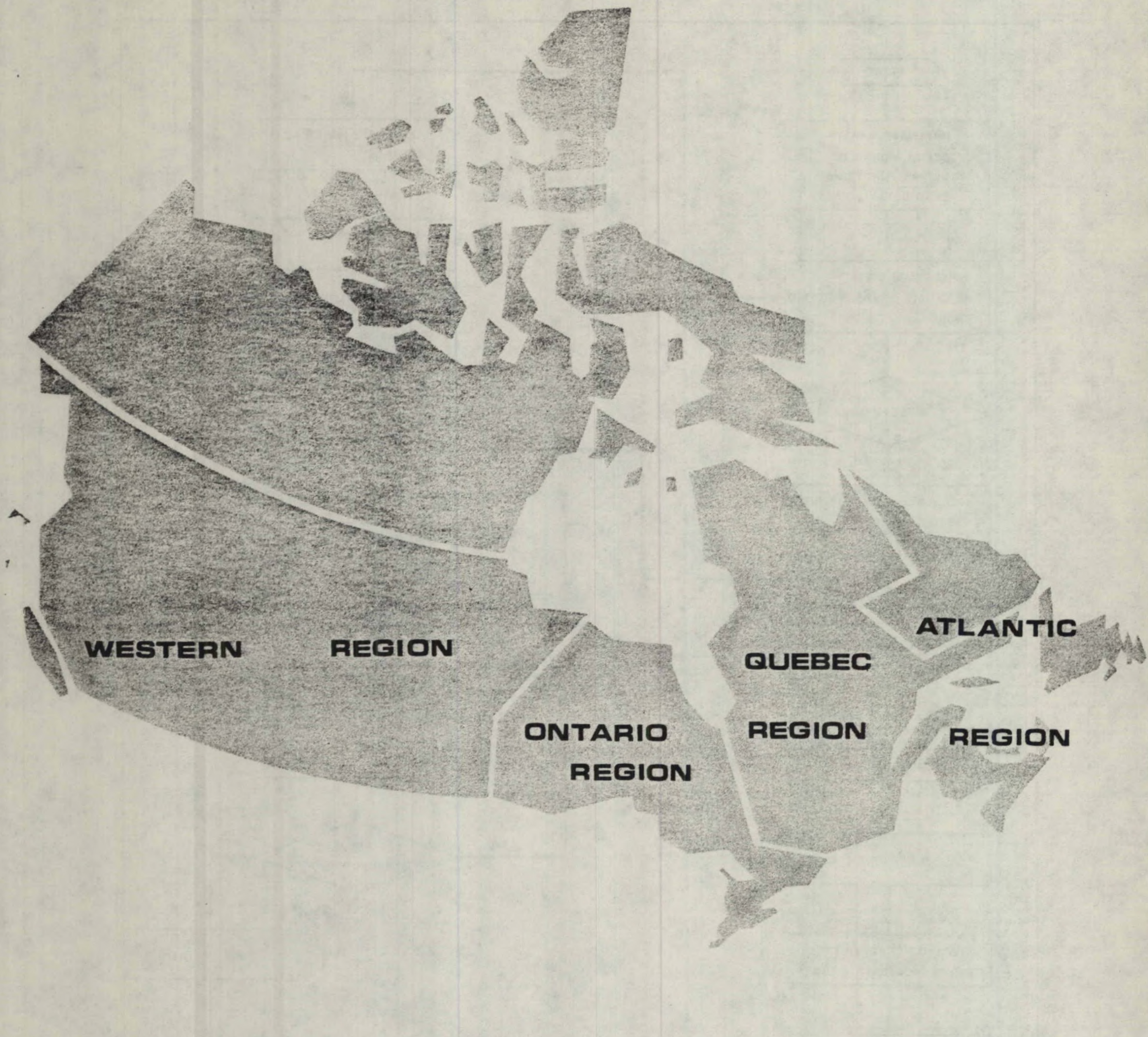


Fig.2.1

BLOCK FLOW DIAGRAM OF REFINERY MODEL



FLOWCHART FOR REFINERY SIMULATION FIG. 2-2



DEFINITION OF REGIONS IN CANADA Figure 2·3

TABLE 2-1

ATLANTIC REGION

CRUDE DIET 1990

	LV%
Frontier	33.0
Venezuelan	7.0
Arabian Light	30.6
Mexican Light	9.9
North Sea	4.5
Syncrude	15.0
TOTAL	100.0

Average Blend

Gravity,DEG. API	31.6
Sulphur, Wt. %	1.2

TABLE 2-2

QUEBEC REGION

CRUDE DIET 1990

	LV%
Frontier	16.8
Venezuelan Heavy	11.65
Arabian Heavy	6.95
Mexican Heavy	11.65
Canadian Heavy	27.3
Syncrude	16.3
Condensate	9.4
TOTAL	100.0

Average Blend

Gravity, DEG. API	28.5
Sulphur Wt. %	1.81

TABLE 2-3

ONTARIO REGION

CRUDE DIET 1990

	LV%
Canadian Light	49.0
Canadian Heavy	9.2
Syncrude	30.8
Condensate	11.0
TOTAL	100.0

Average Blend

Gravity, DEG. API	36.8
Sulphur, Wt.%	0.48

TABLE 2-4

WESTERN REGION

CRUDE DIET 1990

	LV %
Canadian Light	65.1
Syncrude	31.5
Condensate	3.4
TOTAL	100.0

Average Blend

Gravity, DEG.API	36.1
Sulphur, Wt. %	0.31

TABLE 2-5

ATLANTIC REGION

TOTAL PRODUCT SLATE FOR 1990

	Base Cases		Alternate Cases	
	(70/30 Split)		(90/10 Split)	
	BPCD	LV%	BPCD	LV%
Liquid Petroleum Gases	3,019	2.27	3,019	2.27
Leaded Regular Gasoline	12,580*	9.46	4,195**	3.16
Unleaded Regular Gasoline	26,418	19.87	34,803	26.18
Unleaded Premium Gasoline	2,956	2.22	2,956	2.22
Aviation Gasoline	0	0	0	0
Naphtha Specialties	0	0	0	0
Olefin Petrochemical Feed	0	0	0	0
Naphtha Petrochemical Feed	1,348	1.01	1,348	1.01
Jet Fuel B	1,761	1.32	1,761	1.32
Jet Fuel A	4,403	3.31	4,403	3.31
Stove Oil	2,390	1.80	2,390	1.80
Diesel Fuel	27,991	21.07	27,991	21.07
Light Fuel Oil (#2)	26,607	20.02	26,607	20.02
Heavy Fuel Oil (#6)	13,901	10.46	13,901	10.46
Lube Oil	63	.05	63	.05
Asphalt	9,498	7.14	9,498	7.14
Total Product	132,935	100.00	132,935	100.00

* 30% of Gasoline
** 10% of Gasoline

TABLE 2-6

QUEBEC REGION

TOTAL PRODUCT SLATE FOR 1990

	Base Cases		Alternate Cases	
	(70/30 Split)		(90/10 Split)	
Product	BPCD	LV%	BPCD	LV%
Liquid Petroleum Gases	4,780	1.83	4,780	1.83
Leaded Regular Gasoline	26,456*	10.10	8,820**	3.37
Unleaded Regular Gasoline	53,805	20.55	71,441	27.28
Unleaded Premium Gasoline	7,925	3.03	7,925	3.03
Aviation Gasoline	698	.27	698	.27
Naphtha Specialties	10,630	4.06	10,630	4.06
Olefin Petrochemical Feed	0	0	0	0
Naphtha Petrochemical Feed	6,919	2.64	6,919	2.64
Jet Fuel B	3,585	1.37	3,585	1.37
Jet Fuel A	11,133	4.25	11,133	4.25
Stove Oil	1,384	.53	1,384	.53
Diesel Fuel	36,545	13.96	36,545	13.96
Light Fuel Oil (#2)	20,505	7.83	20,505	7.83
Heavy Fuel Oil (#6)	55,901	21.34	55,901	21.34
Lube Oil and Gas Oils	6,101	2.33	6,101	2.33
Asphalt	15,473	5.91	15,473	5.91
Total Product	261,840	100.00	261,841	100.00

* 30% of Gasoline
** 10% of Gasoline

TABLE 2-7

ONTARIO REGION

TOTAL PRODUCT SLATE FOR 1990

	Base Cases (70/30 Split)		Alternate Cases (90/10 Split)	
	BPCD	LV%	BPCD	LV%
Liquid Petroleum Gases	3,711	.87	3,711	.87
Leaded Regular Gasoline	51,175*	1Os2.00	17,058**	
Unleaded Regular Gasoline	104,062	24.40	138,179	32.40
Unleaded Premium Gasoline	15,348	3.60	15,348	3.60
Aviation Gasoline	126	.03	126	.03
Naphtha Specialties	22,581	5.29	22,581	5.29
Olefin Petrochemical Feed	0	0	0	0
Naphtha Petrochemical Feed	15,285	3.58	15,285	3.58
Jet Fuel B	4,277	1.00	4,277	1.00
Jet Fuel A	19,625	4.60	19,625	4.60
Stove Oil	2,264	.53	2,264	.53
Diesel Fuel	81,959	19.23	81,959	19.23
Light Fuel Oil (#2)	38,243	8.97	38,243	8.97
Heavy Fuel Oil (#6)	33,274	7.80	33,274	7.80
Lube Oil and Gas Oils	26,167	6.14	26,167	6.14
Asphalt	8,366	1.96	8,366	1.96
Total Product	426,463	100.00	426,463	100.00

* 30% of Gasoline
** 10% of Gasoline

TABLE 2-8

WESTERN REGION

TOTAL PRODUCT SLATE FOR 1990

	Base Cases		Alternate Cases	
	(70/30 Split)		(90/10 Split)	
	BPCD	LV%	BPCD	LV%
Liquid Petroleum Gases	12,706	2.62	12,706	2.62
Leaded Regular Gasoline	60,195*	12.43	20,065**	4.14
Unleaded Regular Gasoline	126,555	26.13	166,685	34.42
Unleaded Premium Gasoline	13,901	2.87	13,901	2.87
Aviation Gasoline	2,579	.53	2,579	.53
Naphtha Specialties	6,982	1.44	6,982	1.44
Olefin Petrochemical Feed	0	0	0	0
Naphtha Petrochemical Feed	377	.08	377	.08
Jet Fuel B	20,883	4.31	20,883	4.31
Jet Fuel A	17,109	3.53	17,109	3.53
Stove Oil	5,913	1.22	5,913	1.22
Diesel Fuel	157,816	32.59	157,816	32.59
Light Fuel Oil (#2)	13,398	2.77	13,398	2.77
Heavy Fuel Oil (#6)	24,342	5.03	24,342	5.03
Lube Oil and Gas Oils	5,472	1.13	5,472	1.13
Asphalt	16,065	3.32	16,065	3.32
Total Product	484,293	100.00	484,293	100.00

* 30% of Gasoline
** 10% of Gasoline

TABLE 2-9

ATLANTIC REGION

INSTALLED REFINERY PROCESS UNIT CAPACITIES

UNIT TYPE		BPCD
Crude Distillation		340,000
Vacuum Distillation		109,000
Catalytic Reforming, Installed		47,200
	98 RON rated	37,400
	100 RON rated	30,100
Catalytic Cracking		76,700*
Distillate Desulphurization		94,300
Polymerization		4,400 (Product)
Alkylation		0
Isomerization C-5/C-6		0

*Includes 30,200 BPCD Hydrocracking

TABLE 2-10

QUEBEC REGION

INSTALLED REFINERY PROCESS UNIT CAPACITIES

UNIT TYPE		BPCD
Crude Distillation		422,000
Vacuum Distillation		176,000
Catalytic Reforming, Installed		85,500
	98 RON rated	77,000
	100 RON rated	57,700
Catalytic Cracking		119,000*
Distillate Desulphurization		72,300
Polymerization		8,200 (Product)
Alkylation		2,500 (Product)
Isomerization C-5/C-6		0

*Includes 28,300 BPCD Hydrocracking

TABLE 2-11

ONTARIO REGION

INSTALLED REFINERY PROCESS UNIT CAPACITIES

UNIT TYPE		BPCD
Crude Distillation		530,000
Vacuum Distillation		178,000
Catalytic Reforming, Installed		122,000
	98 RON rated	111,400
	100 RON rated	87,500
Catalytic Cracking		152,000*
Distillate Desulphurization		72,300
Polymerization		0
Alkylation		20,800 (Product)
Isomerization C-5/C-6		0

* Includes 37,100 BPCD Hydrocracking

TABLE 2-12

WESTERN REGION

INSTALLED REFINERY PROCESS UNIT CAPACITIES

UNIT TYPE	BPCD
Crude Distillation	615,000
Vacuum Distillation	177,000
Catalytic Reforming, Installed	106,400
98 RON rated	94,300
100 RON rated	75,900
Catalytic Cracking	189,000*
Distillate Desulphurization	178,000
Polymerization	6,300 (Product)
Alkylation	25,200 (Product)
Isomerization C-5/C-6	0

* Includes 32,700 BPCD of Hydrocracking

TABLE 2-13

REFINERY OPERATING CONSTRAINTS

LSR	End Point	170Deg.FVT	
Naphtha	End Point	400Deg.FVT	
Kerosene	End Point	560Deg.FVT	
LGO	End Point	660Deg.FVT	
HVGO	End Point	1050Deg.FVT	
Naphtha in Jet B	ASTM 90%	470Deg.F	(max.)
Naphtha in Jet A	Pour Point	- 50Deg.F	(max.)
LSR in Jet B	RVP	2-3	(max.)
LCO	End Point	650Deg.FVT	(max.)
Cat Cracker Conversion		50-80 Wt.%	
Reformer Severity			
--Existing Equipment		100 RON	
--New Equipment		103 RON	

TABLE 2-14

GENERAL PRODUCT SPECIFICATIONS 1990

		Market	Gov't.
Leaded Regular Gasoline			
Octane No.	(RON+MON/2	89.8	87.0
Lead Content	gms Pb/l	0.29	
RVP	PSIA	7.0 - 12.5	
Unleaded Regular Gasoline			
Octane No.	(RON+MON)/2	89.0	87.0
RVP	PSIA	7.0-12.5	
MMT Content	mg of Mn/l	18	
Unleaded Premium Gasoline			
Octane No.	(RON+MON)/2	91.8	90.0
RVP	PSIA	7.0 - 12.5	
MMT Content	mg of Mn/l	18	
Aviation Gasoline			
Octane No.	RON	93.0	
RVP	PSIA	10.0	
Turbo Fuel Jet B (Naphtha Base)			
Specific Gravity		0.750 - 0.801	
ASTM Distillation %	20/50/90, Deg.F	290/370/470 (max.)	
RVP	PSIA	2 - 3	
Sulphur	Wt.%	0.4 (max.)	
Turbo Fuel Jet A (Kerosene Base)			
Specific Gravity		0.774 - 0.839	
Pour Point Deg. F		- 50 (max.)	
ASTM Distillation 10%	Deg.F	400 (max.)	
Flash Point	Deg. F	90 (min.)	
Sulphur	Wt.%	0.2 (max.)	

GENERAL PRODUCT SPECIFICATIONS 1990 (cont'd)

Diesel Fuel

Pour Point	Deg. F	-10	(max.)
Specific Gravity		.816 - 0.855	
ASTM Distillation %	10/50/90 Deg.F	.460/520/625	(max.)
Flash Point	Deg. F	105	(min.)
Cetane Index		45	(min.)
Viscosity @ 100Deg.F	CS	1.85 - 3.95	
Sulphur	Wt.%	0.4	(max.)

Stove Oil

Pour Point	Deg. F	-40	(max.)
Specific Gravity		0.784 - 0.840	
ASTM Distillation %	10/50/90 Deg.F	420/450/520	(max.)
Flash Point	Deg. F	120	(min.)
Viscosity @ 100Deg.F	CS	1.25	(min.)
Sulphur	Wt.%	0.2	(max.)

Light Fuel Oil (#2)

Pour Point	Deg. F	0	(max.)
Specific Gravity		0.820 - 0.887	
ASTM Distillation %	10/50/90 Deg.F	460/530/675	(max.)
Flash Point	Deg. F	105	(min.)
Viscosity @ 100Deg. F	CS	1.75 - 4.25	
Sulphur	Wt.%	0.5	(max.)

Heavy Fuel Oil

Sulphur	Wt.%	3.5	(max.)
Viscosity @ 122Deg.F	CS	92 - 638	

TABLE 2-15

SUMMARY OF CRUDE ANALYSES

Source/Type	Gravity Deg.API	WT% S	Specific Assays Used
Domestic			
Light	38.9	.44	IPL Blend #1/#2
Heavy	25.1	2.39	Bow Bell
Synthetic	27.7	.08	Syncrude Synthetic
Condensate	69.7	.06	Rimbey
Frontier	30.4	1.26	(Note 1)
Imported			
Venezuelan Light	30.4	1.26	Ceuta
Venezuelan Heavy	16.8	2.40	Bachaquero
Arabian Light	34.4	1.70	Arabian Light
Arabian Heavy	28.2	2.84	Arabian Heavy
Mexican Light	32.9	1.5	Isthmus
Mexican Heavy	22.0	3.3	Maya
North Sea	35.1	0.41	North Sea

Note 1:

Assumed to be of the same quality as Venezuelan Light.

TABLE 2-16

GASOLINE COMPONENT PROPERTIES

	RVP	RON	Sensitivity (RON-MON)	
Reformate	5.Ø	a	Ø.1(RON)+1	Ø
Alkylate	8.5	93.Ø	2.2	Ø
Polymer	4.5	96.5	14.Ø	Ø
Crackate	4.5	b	Ø.Ø75(RON)+4.25	f
Light Straight Run(LSR)	c	c	c	c
Isomerate	e	d	e	e
C-4	55.Ø	93.Ø	2-Ø	Ø

Notes:
- a. Specified for each case
- b. Varies between 91.5 and 94.4 depending on conversion.
- c. Estimated from crude assay data
- d. RON of LSR +13.Ø for once-thru. 9Ø RON and 87 MON for total isomerization.
- e. Same as for LSR
- f. Estimated from cat feed sulphur content.

TABLE 2-17

REGIONAL FEEDSTOCK, PRODUCT

AND UTILITY PRICES FOR 1984

Item	Unit	Atlantic	Quebec	Ontario	Western	Source of Information
Electricity	cents/KW	4.53	2.58	2.8	2.15	Ont.-Hydro and MECo *
Crude Oil	$/bbl	35.43	35.97	36.28	35.53	EMR
HFO	$/bbl	26.11	26.87	27.57	25.23	EMR
i-C4	$/bbl	---	---	30.21	28.62	EMR
Lead Additives	cents /cc.TEL	0.47	0.47	0.47	0.47	Ethyl Can.
MMT Additives	cents /g Mg	6.37	6.37	6.37	6.37	Ethyl Can.

* Escalated.

TABLE 2-18

PROCESS UNIT ENERGY REQUIREMENT

Total Isomerization	Unit Energy Requirement 10^3 BTU/bbl Feed
Crude	95
Vacuum	60
Cracker	100
Poly	500
Alkyl	500
Reformer	290 @ 90 RON 365 @ 100 RON
Naphtha Hydrotreater	90
Isomerization	100
Total Isomerization	200
Gas Plant	600
Aromatics Extraction	130

TABLE 2-19

SUMMARY OF MOTOR GASOLINE

OCTANE QUALITY FOR SIMULATIONS

			-------OCTANE NUMBER (R+M)/2------		
REGION	CASE		Leaded Regular	Unleaded Regular	Unleaded Premium
Atlantic	Market		89.8	89.0	91.8
	CGSB	87	87	90	
Quebec	Market		89.8	89.0	91.8
	CGSB	87	87	90	
Ontario	Market		89.8	89.0	91.8
	CGSB	87	87	90	
Western *	Market		88.3	88.3	90.8
	CGSB	85	85	88	

* Actual simulation values used were the same as other regions to compensate for octane barrels equivalent of aromatics removed from gasoline for petrochemicals. (See Section 2.3)

TABLE 2-20

OPERATING REFINERIES

Atlantic

Irving	Saint John	
Imperial	Dartmouth	
Texaco	Halifax	

Quebec

Gulf	Montreal East	
Petro-Canada	Pointe-aux-Trembles	
Shell	Montreal East	
Ultramar	St-Romuald	

Ontario

Imperial	Sarnia	
Petro-Canada	Oakville	
Shell	Corunna	
Suncor	Sarnia	
Texaco	Nanticoke	
Petrosar	Corunna	(petrochemical refinery)
Gulf	Clarkson	(limited use)

Western

Chevron	Burnaby	
Gulf	Port Moody	
Husky	Prince George	
Imperial	Ioco	
Petro-Canada	Taylor	
Shell	Burnaby	
Imperial	Norman Wells	
Co-Op	Regina	
Gulf	Edmonton	
Imperial	Edmonton	
Shell	Bowden	
Shell	Scotford	
Turbo	Balzac	
Gulf	Moose Jaw	(asphalt refinery)
Husky	Lloydminster	(asphalt refinery)

Reference: Hycarb Engineering (14)

3.0 DISCUSSION OF CASE SIMULATIONS

INTRODUCTION

The previous section examined the basis and technique used to arrive at a simulation of the capabilities and potential of the Canadian refining Market. This section contains a discussion of the results of the various cases which were developed and details the optimizing processes used to arrive at an acceptable 1990 product slate. For each region, the optimizing process was carried out to determine the type and extent of modifications necessary to meet the demand, in order to provide a basis for the costs developed in the following section. The results are presented in tabular form with a commentary on adjustment to feedstocks, additional processes used and their relation to the existing capability of regional plants.

3.1 Base Case

To provide a basis for determining the petroleum refining Market's capital investment, operating costs and energy efficiency of removing MMT from motor gasolines, two base cases using MMT in unleaded gasolines were run for each region; one case using "Market" targets and the other using the "CGSB" targets.

The same octanes were used in all regions. The normal downrating in Western Canada was not applied in order to compensate for extracted aromatics, which were estimated to be equivalent to two octane numbers.

TEL addition to Leaded Regular Grade was taken as 0.29 grams of lead equivalent/litre and MMT addition to the unleaded grades 18 milligrams/litre manganese equivalent.

Atlantic Region

Initial runs for the Atlantic region, using available crude types, would not meet viscosity levels on the Heavy Fuel Oil. This indicates a need for some form of bottoms reduction, a simulation not available in the model. In order to simulate the effect of residual reduction, an amount of syncrude quality material was added to the crude blend to produce an acceptable HFO.

Crude types also indicated more paraffins than those from Western Canadian sources, requiring that the end point and initial Boiling Point of the stove oil be lowered in order to meet the pour point.

Market octanes could not be met with the reformer at 100 RON. Therefore, once through isomerization was added, reducing reformer severity to 98 RON. There is no alkylation capacity in the Atlantic region, which results in higher research octane (RON) requirements in order to meet the specifications. CGSB octanes were quite readily met with reforming severity at 94 RON.

Crude runs and feed rates to secondary units in both cases were well within rated capacities shown in Table 2-9.

Quebec Region

The residual situation in the Quebec area was the reverse of that in the Atlantic. A proportionally higher HFO requirement, coupled with syncrude in the crude blend, resulted in an HFO viscosity below specification. All imported crudes were adjusted to heavy types and domestic heavy was increased at the expense of domestic light and syncrude until satisfactory HFO quality was produced.

The pour points of straight run stocks improved and the end point on the Heavy Straight Run naphtha was increased to maximize reformer feed.

Once through isomerization was required to meet Market octane levels. Balance was reached with isomerization of 8Ø% of the C5-17ØDEG,F. LSR material and reformer severity at 96 RON. CGSB octanes were met with existing equipment and a reformer severity of 9Ø RON.

Feed rates to both primary and secondary units were well within the rated capacities shown in Table 2-1Ø.

Ontario Region

Additional syncrude was added to the crude blend to simulate residual upgrading and produce an HFO with an acceptable viscosity. Additional condensate was also added to the feed to compensate for the amount deducted from petrochemical feed.

The pour point of straight run stocks improved and the end point on the kerosene cut was raised to 56Ø DEG.F as limited by the 9Ø% point on the Stove Oil specification.

Market octanes could not be met with 1ØØ RON reformer severity. While sizeable amounts of C3/C4 olefins are produced surplus to the capacity of existing alkylation unit , this surplus was taken to be equivalent to refinery olefins diverted to petrochemical feed. Therefore alkylate production was limited essentially to installed capacity. Gasoline octanes were balanced with isomerization of 45% of the C5-17Ø DEG.F LSR and a reformer severity of 96.5.

CGSB octanes were met with existing processing and a reformer severity of 93.3.

With the exception of alkylation, as previously explained, crude runs and secondary unit feed rates were well within the rated capacity shown in Table 2-11.

Western Region

Once more additional syncrude was added to the crude blend to simulate residual reducing processing and produce an HFO of acceptable viscosity.

Both Market and CGSB octane requirements were met with existing equipment at reformer severities of 96.5 RON and 90 RON respectively, the octane requirement being adjusted upward to compensate for the aromatics extracted from the reformate for petrochemicals.

As in the other regions the various feed rates to the process units were well within the rated capacities for the region, as shown in Table 2-12.

3.2 MMT Free Cases

To determine the relative increase in processing severity, or additional processing required, if MMT were not used in the unleaded gasoline, alternate cases for each base case were run. These used the same crude blend, product specifications including octane levels, and the same product slate with one exception. The volume of Leaded Regular gasoline was reduced from 30% to 10% of the pool. The volume of Unleaded Premium grade was left the same and the Unleaded Regular increased to maintain the same total volume.

The allowable level of TEL addition to the Leaded Regular grade was the same as that used in the base cases.

Atlantic Region

Market octane levels could not be met with once through isomerization and 100 RON reformer severity. When total normals recycle was added, octane balance was reached with total isomerization of 85% of the LSR and 98 RON reformer severity. All of the octane barrels required to replace the MMT were produced by the isomerate. This is reflected in the crude rate, which is essentially the same as that in the base case and well within rated capacities.

CGSB octanes could also no longer be met with existing equipment. Once through isomerization was added and at isomerization of 100% of the LSR and 96 RON reformer severity, octane requirements were met.

Quebec Region

Once through isomerization and 100 RON reformate were unable to meet Market octane requirements. The pool octane balance was reached with total isomerization of 100% of the C5-170 DEG.F LSR and a reformer severity of 97 RON. Crude run was increased marginally to make up for the increased severity at the reformer but the feed rates to all units were still well within rated capacities.

Installed equipment did not meet the CGSB octane levels either and once through isomerization was required. Octane blending was balanced by isomerizing 70% of the LSR and 96 RON Reformer severity.

Ontario Region

In the base case, Market gasoline octane requirements were met with once through isomerization of only 45% of the LSR and a Reformer severity of 96.5 RON. The shortfall of octane barrels can be made up by once through isomerization of 100% of the LSR and increasing reformer severity to 98.0 RON. The additional crude run was relatively small (<1%) and rated process unit capacities were quite adequate.

Once through isomerization had to be added to achieve the CGSB octane levels. The gasoline pool was balanced with once through isomerization of 80% of the LSR and a reformer severity of 96 RON.

Western Region

Once through isomerization had to be added to meet Market octanes. Gasoline pool octane requirements were met with once through isomerization of 90% of the LSR and a Reformer severity of 96.5 RON. The additional crude required was marginal and other process unit capacities were well within rated values.

The CGSB octane requirements were met solely by raising reformer severity from 90 to 92.8 RON and no new equipment was required.

3.3 Energy Penalties

Tables 3-1 to 3-5 summarize the effects on crude throughput and energy penalty for the four regions that result from the increased process severity required to replace the octane barrels provided by MMT in the base cases.

The results to a large extent reflect the difference in losses between catalytic reforming and isomerization to obtain octane barrels. In going from 90 to 100 RON severity, the yield of C5 + reformate reduces from 85 to 76% of feed. The recovery of isomerate on the other hand, ranges from 98.4% for once through operation to 98% for total recycle.

The eight comparisons shown in the tables reflect various combinations of isomerization and reforming severity.

In the Atlantic region, the Market octanes in the MMT free cases were met solely by going to total recycle isomerization and holding reformer severity constant. This results in only a nominal change in crude run. The energy penalty is small and largely attributable to the new isomerization units.

The CGSB case in the Western region illustrates the effect of increased reformer severity alone while that of the CGSB case in Ontario region shows the combined effect of increased reformer severity and the addition of once through isomerization.

In general, the elimination of MMT from the unleaded grades of gasoline results in higher crude runs and higher energy penalties. The magnitude of these increases depends upon the severity of processing used. The combination of processing which results in the greatest yield loss to produce a given amount of octane barrels shows the greatest increase in crude run coupled with greatest energy penalty.

TABLE 3-1

SUMMARY OF RESULTS

ATLANTIC REGION

Case	Reformer Severity	C-5/C-6 Isomerization	Crude Oil Rate BPCD	Crude Rate Increase %	iC-4 Imported	Fuel Gas BPCD (FOE)	Energy Penalty %
Market:							
BASE	98	ONCE THRU (100%)	136,386	---	0	6,207	---
CASE (No MMT)	98	TOTAL (85%)	136,370	-0.012	0	6,184	0.042
CGSB:							
BASE	94	NONE	135,547	---	0	5,300	---
CASE (NO MMT)	96	ONCE THRU (100%)	135,946	0.294	0	5,751	0.225

TABLE 3-2

SUMMARY OF RESULTS

QUEBEC REGION

Case	Reformer Severity	C-5/C-6 Isomerization	Crude Oil Rate BPCD	Crude Rate Increase %	iC-4 Imported	Fuel Gas BPCD (FOE)	Energy Penalty %
Market:							
BASE	96	ONCE THRU (80%)	276,710	---	0	17,792	---
CASE (No MMT)	97	TOTAL (100%	277,389	0.245	0	18,470	0.212
CGSB:							
BASE	90	NONE	274,571	---	0	15,378	---
CASE (NO MMT)	92	ONCE THRU (70%)	276,121	0.565	0	16,794	0.255

TABLE 3-3

SUMMARY OF RESULTS

ONTARIO REGION

Case	Reformer Severity	C-5/C-6 Isomerization	Crude Oil Rate BPCD	Crude Rate Increase %	iC-4 Imported	Fuel Gas BPCD (FOE)	Energy Penalty %
Market:							
BASE	96.5	ONCE THRU (45%)	447,197	---	3050	28,046	---
CASE (No MMT)	98	ONCE THRU (100%)	449,052	0.415	2656	30,018	0.263
CGSB:							
BASE	93.3	NONE	444,470	---	3471	24,945	---
CASE (NO MMT)	95	ONCE THRU (70%)	446,231	0.396	3064	27,019	0.318

TABLE 3-4

SUMMARY OF RESULTS

WESTERN REGION

Case	Reformer Severity	C-5/C-6 Isomerization	Crude Oil Rate BPCD	Crude Rate Increase %	iC-4 Imported	Fuel Gas BPCD (FOE)	Energy Penalty %
Market:							
BASE	96.5	NONE	494,602	---	1613	25,185	---
CASE (No MMT)	98	ONCE THRU (90%)	495,008	0.082	1448	25,741	0.210
CGSB:							
BASE	90	NONE	491,056	---	1853	19,499	---
CASE (NO MMT)	92.8	NONE	492,068	0.206	1722	21,369	0.114

SIMULATION RESULTS

TABLE 3-5

BASE :-18 mg/l MMT 70/30 Split

REGION:-ATLANTIC- CGSB

CASE1:-0 MMT 90/10 Split

PROCESS UNIT	CASE-1 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	135946	135547	399	95	37.905
VACUUM DISTILLATION	61844	61662	182	60	10.92
CATALYTIC CRACKER	43730	43600	130	100	13
CATALYTIC POLYMERIZATION	3554	3501	53	500	26.5
HF ALKYLATION	0	0	0	500	0
CATALYTIC REFORMER (SEVERITY)	9650 96	9600 94	50	335 (CASE) 320 (BASE)	160.75
HYDROTREATER NAPTHA	9650	9600	50	90	4.5
ISOMERISATION	6279 (ONCE THRU')	0 (ONCE THRU')	6279	100 (CASE) 100 (BASE)	627.9
HDS-LSR	6279	0	6279	90	565.11
GAS PLANT	14586	14044	542	600	325.2
FUEL GAS (FOE)	5751	5300	451	TOTAL	1771.79
HFO PRODUCTION	13901	13901	0		
IMPORTED I-C4	0	0	0		

SIMULATION RESULTS

TABLE 3-6

BASE :-18 mg/l MMT 70/30 Split

REGION:-QUEBEC - CGSB

CASE1:-0 MMT 90/10 Split

PROCESS UNIT	CASE-1 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	276121	274571	1550	95	147.25
VACUUM DISTILLATION	133790	133039	751	60	45.06
CATALYTIC CRACKER	88525	88965	-440	100	-44
CATALYTIC POLYMERIZATION	7434	7037	397	500	198.5
HF ALKYLATION	1900	2431	-531	500	-265.5
CATALYTIC REFORMER (SEVERITY)	33000 92	32600 90	400	305 (CASE) 290 (BASE)	611
HYDROTREATER NAPTHA	33000	32600	400	90	36
ISOMERISATION	12790 (ONCE THRU')	0 (ONCE THRU')	12790	100 (CASE) 100 (BASE)	1279
HDS-LSR	12790	0	12790	90	1151.1
GAS PLANT	36246	34632	1614	600	968.4
FUEL GAS (FOE)	16794	15378	1416	TOTAL	4126.8
HFO PRODUCTION	55901	55901	0		
IMPORTED I-C4	0	0	0		

SIMULATION RESULTS

TABLE 3-7

BASE :-18 mg/1 MMT 70/30 Split

REGION:-ONTARIO - CGSB

CASE1:-0 MMT 90/10 Split

PROCESS UNIT	CASE-1 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	446231	444470	1761	95	167.295
VACUUM DISTILLATION	154141	153533	608	60	36.48
CATALYTIC CRACKER	126425	125790	635	100	63.5
CATALYTIC POLYMERIZATION	0	0	0	500	0
HF ALKYLATION	20736	20736	0	500	0
CATALYTIC REFORMER (SEVERITY)	61750 95	61250 93.3	500	327.5 (CASE) 314.75 (BASE)	944.688
HYDROTREATER NAPTHA	61750	61250	500	90	45
ISOMERISATION	28392 (ONCE THRU')	0 (ONCE THRU')	28392	100 (CASE) 100 (BASE)	2839.2
HDS-LSR	28392	0	28392	90	2555.28
GAS PLANT	52654	50311	2343	600	1405.8
FUEL GAS (FOE)	27019	24945	2074	TOTAL	8057.24
HFO PRODUCTION	33274	33274	0		
IMPORTED I-C4	3064	3471	-407		

SIMULATION RESULTS

TABLE 3-8

BASE :-18 mg/l MMT 70/30 Split

REGION:-WESTERN - CGSB

CASEI:-0 MMT 90/10 Split

PROCESS UNIT	CASE-1 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	492068	491056	1012	95	96.14
VACUUM DISTILLATION	173674	173317	357	60	21.42
CATALYTIC CRACKER	141235	140639	596	100	59.6
CATALYTIC POLYMERIZATION	6115	6115	0	500	0
HF ALKYLATION	20581	20422	159	500	79.5
CATALYTIC REFORMER (SEVERITY)	71500 92.8	71000 90	500	311 (CASE) 290 (BASE)	1646.5
HYDROTREATER NAPTHA	71500	71000	500	90	45
ISOMERISATION	0 (ONCE THRU')	0 (ONCE THRU')	0	100 (CASE) 100 (BASE)	0
HDS-LSR	0	0	0	90	0
GAS PLANT	60934	58845	2089	600	1253.4
FUEL GAS (FOE)	21369	19499	1870	TOTAL	3201.56
HFO PRODUCTION	24342	24342	0		
IMPORTED I-C4	1722	1853	-131		

SIMULATION RESULTS

TABLE 3-9

BASE :-18 mg/l MMT 70/30 Split

REGION:-ATLANTIC - MARKET

CASE1:-0 MMT 90/10 Split

PROCESS UNIT	CASE-1 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	136370	136386	-16	95	-1.52
VACUUM DISTILLATION	62037	62044	-7	60	-.42
CATALYTIC CRACKER	43865	43870	-5	100	-.5
CATALYTIC POLYMERIZATION	3735	3735	0	500	0
HF ALKYLATION	0	0	0	500	0
CATALYTIC REFORMER (SEVERITY)	8900 98	8900 98	0	350 (CASE) 350 (BASE)	0
HYDROTREATER NAPTHA	8900	8900	0	90	0
ISOMERISATION	5357 (TOTAL)	6314 (ONCE THRU')	-957	200 (CASE) 100 (BASE)	440
HDS-LSR	5357	6314	-957	90	-86.13
GAS PLANT	15305	15329	-24	600	-14.4
FUEL GAS (FOE)	6184	6207	-23	TOTAL	337.03
HFO PRODUCTION	13901	13901	0		
IMPORTED I-C4	0	0	0		

SIMULATION RESULTS

TABLE 3-10

BASE :-18 mg/l MMT 70/30 Split

REGION:-QUEBEC - MARKET

CASE1:-0 MMT 90/10 Split

PROCESS UNIT	CASE-1 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	277389	276710	679	95	64.505
VACUUM DISTILLATION	134404	134075	329	60	19.74
CATALYTIC CRACKER	90960	90720	240	100	24
CATALYTIC POLYMERIZATION	7484	7404	80	500	40
HF ALKYLATION	2149	2155	-6	500	-3
CATALYTIC REFORMER (SEVERITY)	32900 97	32800 96	100	342.5 (CASE) 335 (BASE)	280.25
HYDROTREATER NAPTHA	32900	32800	100	90	9
ISOMERISATION	18443 (TOTAL)	14740 (ONCE THRU')	3703	200 (CASE) 100 (BASE)	2214.6
HDS-LSR	18443	14740	3703	90	333.27
GAS PLANT	38171	37368	803	600	481.8
FUEL GAS (FOE)	18470	17792	678	TOTAL	3464.17
HFO PRODUCTION	55901	55901	0		
IMPORTED I-C4	0	0	0		

SIMULATION RESULTS

TABLE 3-11

BASE :-18 mg/l MMT 70/30 Split

REGION:-ONTARIO - MARKET

CASE1:-0 MMT 90/10 Split

PROCESS UNIT	CASE-1 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	449052	447197	1855	95	176.225
VACUUM DISTILLATION	155116	154475	641	60	38.46
CATALYTIC CRACKER	128775	126770	2005	100	200.5
CATALYTIC POLYMERIZATION	0	0	0	500	0
HF ALKYLATION	20811	20807	4	500	2
CATALYTIC REFORMER (SEVERITY)	62500 98	62500 96.5	0	350 (CASE) 338.75 (BASE)	703.125
HYDROTREATER NAPTHA	62500	62500	0	90	0
ISOMERISATION	40667 (ONCE THRU')	18212 (ONCE THRU')	22455	100 (CASE) 100 (BASE)	2245.5
HDS-LSR	40667	18212	22455	90	2020.95
GAS PLANT	55968	53752	2216	600	1329.6
FUEL GAS (FOE)	30018	28046	1972	TOTAL	6716.36
HFO PRODUCTION	33274	33274	0		
IMPORTED I-C4	2656	3050	-394		

SIMULATION RESULTS

TABLE 3-12

BASE :-18 mg/l MMT 70/30 Split

REGION:-WESTERN - MARKET

CASE1:-0 MMT 90/10 Split

PROCESS UNIT	CASE-1 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	495008	494602	406	95	38.57
VACUUM DISTILLATION	174712	174568	144	60	8.64
CATALYTIC CRACKER	143600	143173	427	100	42.7
CATALYTIC POLYMERIZATION	6116	6116	0	500	0
HF ALKYLATION	21218	21102	116	500	58
CATALYTIC REFORMER (SEVERITY)	72200 96.5	72200 96.5	0	338.75 (CASE) 338.75 (BASE)	0
HYDROTREATER NAPTHA	72200	72200	0	90	0
ISOMERISATION	27959 (ONCE THRU')	0 (ONCE THRU')	27959	100 (CASE) 100 (BASE)	2795.9
HDS-LSR	27959	0	27959	90	2516.31
GAS PLANT	66031	65248	783	600	469.8
FUEL GAS (FOE)	25741	25185	556	TOTAL	5929.92
HFO PRODUCTION	24342	24342	0		
IMPORTED I-C4	1448	1613	-165		

TABLE 3 - 13

TYPICAL CALCULATION OF ENERGY PENALTY

ATLANTIC REGION - Market

Base Crude Consumed	= 136 386 BPCD.
	= 4.77×10^{6} IG/CD
Crude Gravity	= 31.64^{o} API = .8674 SG
HHV of Crude Oil	= [18320 + 40(31.64-10)]X10X.8674
	= 166 407 BTU/IG
Energy Content of Base Crude Consumed	= $4.77 \times 10^{6} \times 166{,}407$
	= $793\ 761 \times 10^{6}$ BTU/CD
Additional Energy Required	= 337.03×10^{6} BTU/CD
Energy Penalty	= $\dfrac{337.03 \times 10^{6} \times 100}{793\ 761 \times 10^{6}}$ TYPICAL
	= 0.042%

4.0 COSTS

INTRODUCTION

This section describes the methodology and rationale used to develop the operating and capital cost estimates pertaining to the cases developed in the previous sections of this report.

The validity date of all costs in this Section is the first quarter of 1984. The capital costs developed can be classified as order of magnitude estimates which are normally considered to have a plus or minus 30% accuracy and are reported in 1984 Canadian dollars.

The initial part of this Section essentially defines the terms and limitations on which the costing exercise was based.

4.1 CAPITAL COSTS

4.1.1 SIZING OF NEW UNITS

For the purposes of capital cost estimation, the single regional refinery approach would result in large units which, in practice, would understate the actual capital costs involved.

For cost estimation purposes, the new regional processing units were sized to suit the individual refineries in direct proportion to each refinery's installed crude capacity. In cases where required isomerization capacity was significantly less than 100%, it was assumed that not all refineries in that region would add new isomerization units. In these cases, new processing was allocated to selected refineries to supply the capacity required. Capacity was then distributed among the selected refineries in direct proportion to each refinery's installed crude capacity.

The capital cost for once through and total isomerization units was built up from the following components.

	Once Through Isomerization	Total Isomerization
(1)	Feed Fractionation	Feed Fractionation
(2)	Feed Hydrotreating	Feed Hydrotreating
(3)	*Isom. Unit (Reactor Section)	Isom. Unit (Reactor Section)
(4)		Normals extraction (Molecular Sieve Section)

* Includes feed driers, make-up gas driers, tail gas neutralization, and flare facilities.

Feed fractionation consists of a naptha splitter sized to handle full cut naptha from crude distillation.

Feed hydrotreating was sized at 100% of actual required isomerization capacity. This capacity was uprated to reflect conversion from BPCD to BPSD by application of a service factor of 95%.

The reactor section of the isomerization unit was sized at 120% of available isomerization feed to allow for recycle to extinction of the normals recovered in the sieve section. In cases where once through isomerization only was required, this additional capacity represents pre-investment for the later addition of a sieve section.

The sieve sections of the isomerization units were also sized at 120% of available isomerization feed, to handle recycle.

Reactor section and molecular sieve section capacities were uprated to reflect conversion from BPCD to BPSD by application of service factor of 95%.

Table 4-1 shows the regional requirement of new processing units.

Tables 4-2 to 4-5 show the allocation of individual units within the regions.

Increased inventory costs have been interpreted as extra crude oil storage, necessarily induced by the incremental crude oil throughput. Based on an assumed strategic requirement of 30 days storage, this translates to a "one of" extra crude oil cost.

The possibilities of upgrading existing units, to higher capacities have not been addressed in this report. It is also feasible that individual refineries may elect to upgrade their facilities using other types of process units or may utilize existing equipment. Savings exceeding 50% on capital costs could be achieved on isomerization units by converting existing redundant reformers. However, such discussion as to the capital cost expenditures and planning of individual refineries is beyond the scope of this study.

4.1.2 Basis of Estimate

Capital cost data was derived during the course of the study primarily from major licensors (UOP & BP) of the proprietary technology, to ensure that latest data was applied. This information was supplemented as required with refinery planning and experience data obtained from an in-house cost library.

Pertinent cost estimating data was compiled and a representative average cost curve developed for varying processing capacities of the five basic types of units covered. Representative capacity versus cost data is shown on Table 4-6.

The scope of the estimate includes all direct material and labour, indirect field costs and labour benefits which are associated with the erection of battery limits process equipment including the following specific equipment categories and services:

(a) <u>Battery Limits Process Equipment</u>

Heaters
Vessel and internals
Heat exchange equipment
Pumps
Drivers
Compressors

(b) <u>Battery Limits Process Materials</u>

Piping
Instruments
Electrical
Insulation
Structural steelwork
Fireproofing

(c) <u>Battery Limits Industrial Buildings</u>

Compressor shelter
Control house

(d) <u>Battery Limits Civil</u>

Paving and concrete work

(e) Battery Limits Auxiliary Facilities

Catalyst handling equipment
Catalyst initial fill

(f) Battery Limits Construction Services

Sundry construction equipment
Temporary field office, warehouse, changehouse
Field testing
Expendable tools
Clerical costs associated with construction
Final cleaning
Miscellaneous field costs
Fringe benefits

(g) Battery Limits Engineering Costs

An allowance for design engineering and contractor's fees, overheads and expenses has been added to the total material and labour estimate in order to reach an overall erected cost estimate for the battery limits plant. This allowance is intended to cover the following charges.

Basic process and engineering design
 specifications and drawings (Schedule A package)
Detailed engineering
Construction tools and equipment rental
Contractor's field and home office expenses
Erection supervision
Contractor's fees

(h) Other Costs

In addition an allowance of 30% of the battery limit capital cost was made for additions or extensions to utility systems and offsites.

EXCLUSIONS

Items not included in the estimated capital costs are as follows:

- Cost of land, site preparation and soil investigation
- Piling or any unusual foundation requirement
- Docks, marine terminals or jetties
- Access roads to site
- Home office administrative building
- Employee housing, barracks, canteens, etc.
- Overtime pay during construction
- Royalties on licensed processes
- Owner's expenses in developing project
- Local, provincial, federal taxes or fees
- Items concerned with export shipment
- Operating capital and investment in goods
- Escalation on material and labour
- Contingencies
- Cost of start-up including testing, manpower, utilities, operations manuals and training programs
- Spare parts, special tools or maintenance equipment
- Chemicals and raw materials
- Customer codes
- Special pollution or noise control facilities
- Special communication or computer systems

ESTIMATE STRUCTURE

The total capital investment cost is given per refinery location. The estimate structure of each refinery location comprises:

A. ON SITE CAPITAL COSTS

Isomerization

1.1 Fractionation
1.2 Hydrotreater
-- Catalyst
1.3 Once-Through Isomerization
-- Catalyst
1.4 Total Isomerization
-- Catalyst

Total Isomerization Cost

TOTAL ON SITE CAPITAL COST

B. TOTAL OFFSITE CAPITAL COST (30%)

TOTAL INVESTMENT COST

Pricing Basis

The cost versus capacity relationship derived is represented by:

$$\text{Capital Cost} = \left[\frac{\text{capacity in study case}}{\text{capacity in reference}}\right]^{Y} \times (\text{Reference Cost})$$

where the exponent "y" is the scale factor.

It was necessary to make some adjustment to the methodology as it applies to low capacity process units. For each process unit a range of capacities was established, based on the characteristic cost versus capacity relationship. All plants that fell below the lower boundary of this range were costed at this point.

Capital Cost Summaries

The summary tables (Tables 4-8 to 4-9) report the estimated capital investment cost by region and overall. Additionally, a complete breakdown of costs pertaining to individual refineries is provided (Tables 4-10 to 4-32). Refinery locations are purposely coded as it is outside the scope of this study to make recommendations pertaining to individual refineries.

Credits (Cost Data)

UOP Process Division, Des Plaines, Illinois
BP International Ltd., England

TABLE 4-1

SUMMARY OF REQUIRED NEW UNIT CAPACITY

CASE	ISOMERIZATION UNIT					
	BPCD FRESH FEED	BPSD (FOR COST ESIMATION)				TYPE OF ISOM UNIT
		FRACTIO-NATION	HYDRO-TREATING	REACTOR SEC'T	SIEVE SEC'T	
CGSB OCTANES						
ATLANTIC-BASE	-	-	-	-	-	-
ATLANTIC-CASE1	6313	19,999	6645	7976	-	ONCE THRU
QUEBEC-BASE	-	-	-	-	-	-
QUEBEC-CASE1	12947	42,010	13628	16354	-	ONCE THRU
ONTARIO-BASE	-	-	-	-	-	-
ONTARIO-CASE1	32209	102,966	33904	40685	-	ONCE THRU
WESTERN-BASE	-	-	-	-	-	-
WESTERN-CASE1	-	-	-	-	-	-
MARKET OCTANES						
ATLANTIC-BASE	6313	18,991	6645	7976	-	ONCE THRU
ATLANTIC-CASE1	6313	18,977	6645	7976	7976	TOTAL ISOM
QUEBEC-BASE	14739	48,632	15515	18618	-	ONCE THRU
QUEBEC-CASE1	18445	58,020	19416	23299	23299	TOTAL ISOM
ONTARIO-BASE	18213	57,503	19171	23006	-	ONCE THRU
ONTARIO-CASE1	40666	130,303	42806	51367	-	ONCE THRU
WESTERN-BASE	-	-	-	-	-	-
WESTERN-CASE1	27957	126,867	29428	35315	-	ONCE THRU

TABLE 4-2

DETAILED SUMMARY OF REQUIRED NEW UNIT CAPACITIES

CGSB OCTANES - BASE

ISOMERIZATION UNIT

Refinery #	Req'd Iso. Capacity	Full Cut Naptha	Isom. Feed	Hydrotreater	Reactor Section	Sieve Section	Isom. Type
	FRESH FEED BPCD	-FRACTIONATION- BPSD	BPSD	BPSD	BPSD	BPSD	
Atlantic	----	----	----	----	----	--	----
1	----	----	----	----	----	--	----
2	----	----	----	----	----	--	----
3	----	----	----	----	----	--	----
Total (Atlantic)	----	----	----	----	----	--	----
Quebec							
1	----	----	----	----	----	--	----
2	----	----	----	----	----	--	----
3	----	----	----	----	----	--	----
4	----	----	----	----	----	--	----
Total (Quebec)	----	----	----	----	----	--	----
Ontario							
1	----	----	----	----	----	--	----
2	----	----	----	----	----	--	----
3	----	----	----	----	----	--	----
4	----	----	----	----	----	--	----
5	----	----	----	----	----	--	----
Total (Ontario)							
Western							
1	----	----	----	----	----	--	----
2	----	----	----	----	----	--	----
3	----	----	----	----	----	--	----
4	----	----	----	----	----	--	----
5	----	----	----	----	----	--	----
6	----	----	----	----	----	--	----
7	----	----	----	----	----	--	----
8	----	----	----	----	----	--	----
9	----	----	----	----	----	--	----
10	----	----	----	----	----	--	----
11	----	----	----	----	----	--	----
Total (Western)	----	----	----	----	----	--	----

TABLE 4-3

DETAILED SUMMARY OF REQUIRED NEW UNIT CAPACITIES

CGSB OCTANES - CASE1

ISOMERIZATION UNIT

Refinery #	Req'd Iso. Capacity	Full Cut Naptha	Isom. Feed	Hydrotreater	Reactor Section	Sieve Section	Isom. Type
	FRESH FEED BPCD	-FRACTIONATION- BPSD	BPSD	BPSD	BPSD	BPSD	
Atlantic							
1	4,419	13,999	4,652	4,652	5,583	--	Once Thru
2	1,515	4,808	1,595	1,595	1,914	--	Once Thru
3	379	1,200	398	398	479	--	Once Thru
Total (Atlantic)	6,313	19,999	6,645	6,645	7,976	--	Once Thru
Quebec							
1	2,848	9,242	2,998	2,998	3,609	--	Once Thru
2	4,402	14.283	4,634	4,634	5,549	--	Once Thru
3	5,697	18,485	5,996	5,996	7,196	--	Once Thru
4		----	----	----	----	--	----
Total (Quebec)	12,947	42,010	13,628	13,628	16,354	--	Once Thru
Ontario							
1	10,951	35,008	11,527	11,527	13,800	--	Once Thru
2	7,086	22,653	7,459	7,459	8,791	--	Once Thru
3	6,442	20,593	6,781	6,781	8,178	--	Once Thru
4	7,730	24,712	8,137	8,137	9,916	--	Once Thru
5	----	----	----	----	----	--	----
Total (Ontario)	32,209	102,966	33,904	33,904	40,685	--	Once Thru
Western							
1	----	----	----	----	----	--	----
2	----	----	----	----	----	--	----
3	----	----	----	----	----	--	----
4	----	----	----	----	----	--	----
5	----	----	----	----	----	--	----
6	----	----	----	----	----	--	----
7	----	----	----	----	----	--	----
8	----	----	----	----	----	--	----
9	----	----	----	----	----	--	----
10	----	----	----	----	----	--	----
11	----	----	----	----	----	--	----
Total (Western)	----	----	----	----	----	--	----

TABLE 4-4

DETAILED SUMMARY OF REQUIRED NEW UNIT CAPACITIES

MARKET OCTANES - BASE

ISOMERIZATION UNIT

Refinery #	Req'd Iso. Capacity	Full Cut Naptha	Isom. Feed	Hydrotreater	Reactor Section	Sieve Section	Isom. Type
	FRESH FEED BPCD	-FRACTIONATION- BPSD	BPSD	BPSD	BPSD	BPSD	
Atlantic							
1	4,419	13,294	4,652	4,652	5,583	--	Once Thru
2	1,515	4,558	1,595	1,595	1,914	--	Once Thru
3	379	1,139	398	398	479	--	Once Thru
Total (Atlantic)	6,313	18,991	6,645	6,645	7,976	--	Once Thru
Quebec							
1	-	-	-	-	-	--	-
2	4,274	14,103	4,499	4,499	5,456	--	Once Thru
3	5,601	18,480	5,896	5,896	7,082	--	Once Thru
4	4,864	16,049	5,120	5,120	6,080	--	Once Thru
Total (Quebec)	14,739	48,632	15,515	15,515	18,618	--	Once Thru
Ontario							
1	11,110	35,077	11,694	11,694	14,053	--	Once Thru
2	7,103	22,426	7,477	7,477	8,953	--	Once Thru
3	----	----	----	----	----	--	----
4	----	----	----	----	----	--	----
5	----	----	----	----	----	--	----
Total (Ontario)	18,213	57,503	19,171	19,171	23,006	--	Once Thru
Western							
1	----	----	----	----	----	--	----
2	----	----	----	----	----	--	----
3	----	----	----	----	----	--	----
4	----	----	----	----	----	--	----
5	----	----	----	----	----	--	----
6	----	----	----	----	----	--	----
7	----	----	----	----	----	--	----
8	----	----	----	----	----	--	----
9	----	----	----	----	----	--	----
10	----	----	----	----	----	--	----
11	----	----	----	----	----	--	----
Total (Western)	----	----	----	----	----	--	----

TABLE 4-5

DETAILED SUMMARY OF REQUIRED NEW UNIT CAPACITIES

MARKET OCTANES - CASE1

ISOMERIZATION UNIT

Refinery #	Req'd Iso. Capacity	Full Cut Naptha	Isom. Feed	Hydrotreater	Reactor Section	Sieve Section	Isom. Type
	FRESH FEED BPCD	-FRACTIONATION- BPSD	BPSD	BPSD	BPSD	BPSD	
Atlantic							
1	4,419	13,284	4,652	4,652	5,583	5,583	TOTAL
2	1,515	4,555	1,595	1,595	1,914	1,914	TOTAL
3	379	1,138	398	398	479	479	TOTAL
Total (Atlantic)	6,313	18,977	6,645	6,645	7,976	7,976	TOTAL
Quebec							
1	3,706	11,657	3,901	3,901	4,681	4,681	TOTAL
2	4,274	13,587	4,499	4,499	5,456	5,456	TOTAL
3	5,601	17,636	5,896	5,896	7,082	7,082	TOTAL
4	4,864	15,140	5,120	5,120	6,080	6,080	TOTAL
Total (Quebec)	18,445	58,020	19,416	19,416	23,299	23,299	TOTAL
Ontario							
1	11,110	35,649	11,694	11,694	14,053	--	ONCE THRU
2	7,103	22,711	7,477	7,477	8,953	--	ONCE THRU
3	6,511	20,628	6,854	6,854	8,132	--	ONCE THRU
4	7,859	25,012	8,272	8,272	9,860	--	ONCE THRU
5	8,083	26,303	8,509	8,509	10,369	--	ONCE THRU
Total (Ontario)	40,666	130,303	42,806	42,806	51,367	--	ONCE THRU
Western							
1	1,705	7,739	1,795	1,795	2,154	--	ONCE THRU
2	1,817	8,246	1,913	1,913	2,296	--	ONCE THRU
3	447	2,030	471	471	565	--	ONCE THRU
4	1,985	9,007	2,089	2,089	2,507	--	ONCE THRU
5	895	4,060	942	942	1,130	--	ONCE THRU
6	1,062	4,821	1,118	1,118	1,342	--	ONCE THRU
7	2,069	9,388	2,178	2,178	2,613	--	ONCE THRU
8	5,955	27,023	6,268	6,268	7,522	--	ONCE THRU
9	8,303	37,679	8,740	8,740	10,489	--	ONCE THRU
10	2,320	10,530	2,442	2,442	2,931	--	ONCE THRU
11	1,397	6,344	1,472	1,472	1,766	--	ONCE THRU
Total (Western)	27,957	126,867	29,428	29,428	35,315	--	ONCE THRU

TABLE 4-6

CAPACITY VS ONSITE COST

BPSD VS $MM

	1200	3000	5000	10000	15000
Fractionation	0.74	1.34	1.88	2.95	3.84
Hydrotreating	1.75	3.17	4.42	6.94	9.03
- Catalyst	.02	0.057	0.095	.19	0.29
Once Thru Isomerization	3.50	6.35	8.85	13.88	18.07
- Catalyst	.25	0.624	1.04	2.08	3.12
Total Isomerization	8.37	15.19	21.17	33.22	43.24
- Catalyst	.44	1.1	1.84	3.68	5.52
Aromatics Extraction	4.31	7.82	10.91	17.12	22.27

TABLE 4-7

SUMMARY OF ESTIMATES

CGSB OCTANES

($ MM)

	Isomerization					
	Fractio-nation	Hydro-treating	Isom Unit	Offsites	Crude Inventory	Total Capital Cost
ATL-BASE	-	-	-	-	-	-
ATL-CASE	3.42	8.21	19.56	8.78	Ø.43	4Ø.4Ø
ATL-DIF$	3.42	8.21	19.56	8.78	Ø.43	4Ø.4Ø
QUE-BASE	-	-	-	-	-	-
QUE-CASE	5.26	12.61	31.24	13.63	1.67	64.41
QUE-DIF$	5.26	12.61	31.24	13.63	1.67	64.41
ONT-BASE	-	-	-	-	-	-
ONT-CASE	1Ø.55	25.44	64.35	27.37	1.92	129.63
ONT-DIF$	1Ø.55	25.44	64.35	27.37	1.92	129.63
WES-BASE	-	-	-	-	-	-
WES-CASE	-	-	-	-	1.Ø8	1.Ø8
WES-DIF$	-	-	-	-	1.Ø8	1.Ø8
CANADA-BASE	-	-	-	-	-	-
CANADA-CASE	19.23	46.26	115.15	49.78	5.1	235.52
CANADA-DIF$	19.23	46.26	115.15	49.78	5.1	235.52

TABLE 4-8

SUMMARY OF ESTIMATES

MARKET OCTANES

($ MM)

	Isomerization					
	Fractio-nation	Hydro-treating	Isom Unit	Offsites	Crude Inventory	Total Capital Cost
ATL-BASE	3.42	8.21	19.56	8.78	-	39.97
ATL-CASE	3.42	8.21	45.64	16.19	-	73.46
ATL-DIF$	-	-	26.Ø8	7.41	-	33.49
QUE-BASE	5.77	13.84	34.38	14.93	-	68.92
QUE-CASE	7.36	17.67	1Ø3.84	35.89	Ø.73	165.49
QUE-DIF$	1.59	3.83	69.46	2Ø.96	Ø.73	96.57
ONT-BASE	5.7	13.78	35.25	14.71	-	69.44
ONT-CASE	13.26	32.Ø3	81.Ø4	34.46	2.Ø2	162.81
ONT-DIF$	7.56	18.25	45.79	19.75	2.Ø2	93.37
WES-BASE	-	-	-	-	-	-
WES-CASE	13.24	31.8Ø	76.77	34.13	Ø.4	156.34
WES-DIF$	13.24	31.8Ø	76.77	34.13	Ø.4	156.34
CANADA-BASE	14.89	35.83	89.19	38.42	-	178.33
CANADA-CASE	37.28	89.71	3Ø7.29	12Ø.67	3.15	558.1
CANADA-DIF$	22.39	53.88	218.1Ø	82.25	3.15	379.77

TABLE 4-9

SUMMARY OF INVESTMENT COSTS

($ MM)

REGION: CANADA

REGION	CGSB OCTANES BASE	CGSB OCTANES CASE1	MARKET OCTANES BASE	MARKET OCTANES CASE1
ATLANTIC	-	40.40	39.97	73.46
QUEBEC	-	64.41	68.92	165.49
ONTARIO	-	129.63	69.44	162.81
WESTERN	-	1.08	-	156.34
TOTAL CANADA	-	235.52	178.33	558.1

TABLE 4-10

ESTIMATE DETAIL

($ MM)

REGION: Atlantic — Refinery #1

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	1.79	1.79	1.79
1.2 Hydrotreater	-	4.22	4.22	4.22
--Catalyst	-	.09	.09	0.09
1.3 Once Thru Isom.(reactor sect.)	-	9.51	9.51	--
--Catalyst	-	1.16	1.16	--
1.4 Total Isom. (reactor&sieve sect.	-	--	--	22.74
--Catalyst	-	--	--	2.05
Total Onsite Capital Cost:		16.77	16.77	30.89
2. Total Offsite Capital Cost (30%)		4.66	4.66	8.63
TOTAL INVESTMENT		21.42	21.42	39.52

TABLE 4-11

ESTIMATE DETAIL

($ MM)

REGION: ATLANTIC

REFINERY #2

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	.89	.89	0.89
1.2 Hydrotreater	-	2.10	2.10	2.10
--Catalyst	-	.03	.03	.03
1.3 Once Thru Isom.(reactor sect.)	-	4.74	4.74	--
--Catalyst	-	.40	.40	--
1.4 Total Isom. (reactor&sieve sec.)	-	--	--	11.34
--Catalyst	-	--	--	.7
Total Onsite Capital Cost:	-	8.17	8.17	15.07
2. Total Offsite Capital Cost (30%)	-	2.32	2.32	4.3
TOTAL INVESTMENT	-	10.49	10.49	19.38

TABLE 4-12

ESTIMATE DETAIL

($ MM)

REGION: ATLANTIC REFINERY #3

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	Ø.74	Ø.74	Ø.74
1.2 Hydrotreater	-	1.75	1.75	1.75
--Catalyst	-	Ø.Ø2	Ø.Ø2	Ø.Ø2
1.3 Once Thru Isom.(reactor sect.)	-	3.5Ø	3.5Ø	--
--Catalyst	-	.25	.25	--
1.4 Total Isom. (reactor&sieve sec.)	-	--	--	8.37
--Catalyst	-	--	--	.44
Total Onsite Capital Cost:	-	6.26	6.26	11.33
2. Total Offsite Capital Cost (3Ø%)	-	1.8Ø	1.8Ø	3.26
TOTAL INVESTMENT	-	8.Ø6	8.Ø6	14.59

TABLE 4-13

ESTIMATE DETAIL

($ MM)

REGION: QUEBEC

REFINERY #1

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	1.35	--	1.59
1.2 Hydrotreater	-	3.17	--	3.76
--Catalyst	-	.06	--	0.07
1.3 Once Thru Isom.(reactor sect.)	-	7.16	--	--
--Catalyst	-	.75	--	--
1.4 Total Isom. (reactor&sieve sec.)	-	--	--	20.28
--Catalyst	-	--	--	1.72
Total Onsite Capital Cost:	-	12.49	--	27.43
2. Total Offsite Capital Cost (30%)	-	3.5	--	7.69
TOTAL INVESTMENT	-	15.99	--	35.13

TABLE 4-14

ESTIMATE DETAIL

($ MM)

REGION: QUEBEC

REFINERY # 2

	CGSB Octanes		Market Octanes	
	Base	Casel	Base	Casel
1. Isomerization				
1.1 Fractionation	-	1.79	1.76	1.76
1.2 Hydrotreater	-	4.21	4.13	4.13
--Catalyst	-	.Ø9	.Ø9	Ø.Ø9
1.3 Once Thru Isom.(reactor sect.)	-	9.47	9.37	--
--Catalyst	-	1.15	1.13	--
1.4 Total Isom. (reactor&sieve sec.)	-	--	--	22.41
--Catalyst	-	--	--	2.Ø1
Total Onsite Capital Cost:	-	16.71	16.47	3Ø.38
2. Total Offsite Capital Cost (3Ø%)	-	4.64	4.57	8.49
TOTAL INVESTMENT	-	21.35	21.Ø4	38.87

TABLE 4-15

ESTIMATE DETAIL

($ MM)

REGION: QUEBEC

REFINERY #3

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	2.12	2.1	2.1
1.2 Hydrotreater	-	4.97	4.92	4.92
--Catalyst	-	.11	.11	.11
1.3 Once Thru Isom.(reactor sect.)	-	11.21	11.10	--
--Catalyst	-	1.50	1.47	--
1.4 Total Isom. (reactor&sieve sec.)	-	--	--	28.27
--Catalyst	-	--	--	2.87
Total Onsite Capital Cost:	-	19.91	19.7	38.26
2. Total Offsite Capital Cost (30%)	-	5.49	5.43	10.58
TOTAL INVESTMENT	-	25.4	25.13	48.84

TABLE 4-16

ESTIMATE DETAIL

($ MM)

REGION: QUEBEC

REFINERY #4

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	--	1.91	1.91
1.2 Hydrotreater	-	--	4.49	4.49
--Catalyst	-	--	.10	.10
1.3 Once Thru Isom. (reactor sect.)	-	--	10.05	--
--Catalyst	-	--	1.26	--
1.4 Total Isom. (reactor&sieve sec.)	-	--	--	24.04
--Catalyst	-	--	--	2.24
Total Onsite Capital Cost:	-	--	17.81	32.77
2. Total Offsite Capital Cost (30%)	-	--	4.93	9.13
TOTAL INVESTMENT	-	--	22,74	41.90

TABLE 4-17

ESTIMATE DETAIL

($ MM)

REGION: ONTARIO | REFINERY #1

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	3.23	3.26	3.26
1.2 Hydrotreater	-	7.61	7.68	7.68
--Catalyst	-	.22	.22	.22
1.3 Once Thru Isom.(reactor sect.)	-	17.12	17.32	17.32
--Catalyst	-	2.87	3.15	2.92
1.4 Total Isom. (reactor&sieve sec.)	-	--	--	--
--Catalyst	-	--	--	--
Total Onsite Capital Cost:	-	31.05	31.41	31.41
2. Total Offsite Capital Cost (30%)	-	8.39	8.48	8.48
TOTAL INVESTMENT	-	39.44	39.89	39.89

TABLE 4-18

ESTIMATE DETAIL

($ MM)

REGION: ONTARIO

REFINERY #2

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	2.44	2.44	2.44
1.2 Hydrotreater	-	5.73	5.74	5.74
--Catalyst	-	.14	.14	.14
1.3 Once Thru Isom.(reactor sect.)	-	12.77	12.92	12.92
--Catalyst	-	1.83	1.86	1.86
1.4 Total Isom. (reactor&sieve sec.)	-	--	--	--
--Catalyst	-	--	-	--
Total Onsite Capital Cost:	-	22.92	23.11	23.11
2. Total Offsite Capital Cost (30%)	-	6.28	6.33	6.33
TOTAL INVESTMENT	-	29.19	29.44	29.44

TABLE 4-19

ESTIMATE DETAIL

($ MM)

REGION: ONTARIO

REFINERY # 3

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	2.29	--	2.3
1.2 Hydrotreater	-	5.39	--	5.43
--Catalyst	-	.13	--	.13
1.3 Once Thru Isom.(reactor sect.)	-	12.19	--	12.14
--Catalyst	-	1.70	--	1.69
1.4 Total Isom. (reactor&sieve sec.)	-	--	--	--
--Catalyst	-	--	--	--
Total Onsite Capital Cost:	-	21.7	--	21.6-9
2. Total Offsite Capital Cost (30%)	-	5.96	--	5.9-6
TOTAL INVESTMENT	-	27.65	--	27.6-5

TABLE 4-2Ø

ESTIMATE DETAIL

($ MM)

REGION: ONTARIO

REFINERY # 4

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	2.59	--	2,6
1.2 Hydrotreater	-	6.Ø7	--	6.13
--Catalyst	-	.15	--	.16
1.3 Once Thru Isom. (reactor sect.)	-	13.81	--	13.76
--Catalyst	-	2.Ø6	--	2.Ø5
1.4 Total Isom. (reactor&sieve sec.)	-	--	--	--
--Catalyst	-	--	--	--
Total Onsite Capital Cost:	-	24.67	--	24.71
2. Total Offsite Capital Cost (3Ø%)	-	6.74	--	6.75
TOTAL INVESTMENT	-	31.41	--	31.46

TABLE 4-21

ESTIMATE DETAIL

($ MM)

REGION: ONTARIO

REFINERY #5

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	-	--	2.66
1.2 Hydrotreater	-	-	--	6.24
--Catalyst	-	-	--	Ø.16
1.3 Once Thru Isom.(reactor sect.)	-	-	--	14.22
--Catalyst	-	-	--	2.16
1.4 Total Isom. (reactor&sieve sec.)	-	-	--	--
--Catalyst	-	-	--	--
Total Onsite Capital Cost:	-	-	--	25.44
2. Total Offsite Capital Cost (3Ø%)	-	-	--	6.94
TOTAL INVESTMENT	-	-	--	32.37

TABLE 4-22

ESTIMATE DETAIL

($ MM)

REGION: WESTERN

REFINERY # 1

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	-	-	0.96
1.2 Hydrotreater	-	-	-	2.27
--Catalyst	-	-	-	0.03
1.3 Once Thru Isom.(reactor sect.)	-	-	-	5.12
--Catalyst	-	-	-	.45
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	--
--Catalyst	-	-	-	--
Total Onsite Capital Cost:	-	-	-	8.84
2. Total Offsite Capital Cost (30%)	-	-	-	2.51
TOTAL INVESTMENT	-	-	-	11.35

TABLE 4-23

ESTIMATE DETAIL

($ MM)

REGION: WESTERN — REFINERY # 2

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	-	-	1.Ø
1.2 Hydrotreater	-	-	-	2.37
--Catalyst	-	-	-	.Ø4
1.3 Once Thru Isom.(reactor sect.)	-	-	-	5.34
--Catalyst	-	-	-	.48
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	--
--Catalyst	-	-	-	--
Total Onsite Capital Cost:	-	-	-	9.22
2. Total Offsite Capital Cost (3Ø%)	-	-	-	2.61
TOTAL INVESTMENT	-	-	-	11.84

TABLE 4-24

ESTIMATE DETAIL

($ MM)

REGION: WESTERN REFINERY # 3

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	-	-	.74
1.2 Hydrotreater	-	-	-	1.75
--Catalyst	-	-	-	.02
1.3 Once Thru Isom. (reactor sect.)	-	-	-	3.50
--Catalyst	-	-	-	.25
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	--
--Catalyst	-	-	-	--
Total Onsite Capital Cost:	-	-	-	6.26
2. Total Offsite Capital Cost (30%)	-	-	-	1.80
TOTAL INVESTMENT	-	-	-	8.06

TABLE 4-25

ESTIMATE DETAIL

($ MM)

REGION: WESTERN | REFINERY # 4

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	-	-	1.07
1.2 Hydrotreater	-	-	-	2.51
--Catalyst	-	-	-	.04
1.3 Once Thru Isom.(reactor sect.)	-	-	-	5.65
--Catalyst	-	-	-	.52
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	--
--Catalyst	-	-	-	--
Total Onsite Capital Cost:	-	-	-	9.79
2. Total Offsite Capital Cost (30%)	-	-	-	2.77
TOTAL INVESTMENT	-	-	-	12.55

TABLE 4-26

ESTIMATE DETAIL

($ MM)

REGION: WESTERN

REFINERY # 5

	CGSB Octanes		Market Octanes	
	Base	Casel	Base	Casel
1. Isomerization				
1.1 Fractionation	-	-	-	Ø.74
1.2 Hydrotreater	-	-	-	1.75
--Catalyst	-	-	-	.Ø2
1.3 Once Thru Isom.(reactor sect.)	-	-	-	3.5Ø
--Catalyst	-	-	-	.25
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	--
--Catalyst	-	-	-	--
Total Onsite Capital Cost:	-	-	-	6.26
2. Total Offsite Capital Cost (3Ø%)	-	-	-	1.8Ø
TOTAL INVESTMENT	-	-	-	8.Ø6

TABLE 4-27

ESTIMATE DETAIL

($ MM)

REGION: WESTERN

REFINERY # 6

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	-	-	Ø.74
1.2 Hydrotreater	-	-	-	1.75
--Catalyst	-	-	-	Ø.Ø2
1.3 Once Thru Isom.(reactor sect.)	-	-	-	3.76
--Catalyst	-	-	-	Ø.28
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	--
--Catalyst	-	-	-	--
Total Onsite Capital Cost:	-	-	-	6.56
2. Total Offsite Capital Cost (3Ø%)	-	-	-	1.88
TOTAL INVESTMENT	-	-	-	8.43

TABLE 4-28

ESTIMATE DETAIL

($ MM)

REGION: WESTERN

REFINERY #7

	CGSB Octanes		Market Octanes	
	Base	Casel	Base	Casel
1. Isomerization				
1.1 Fractionation	-	-	-	1.1
1.2 Hydrotreater	-	-	-	2.58
--Catalyst	-	-	-	Ø.Ø4
1.3 Once Thru Isom. (reactor sect.)	-	-	-	5.8Ø
--Catalyst	-	-	-	Ø.54
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	1Ø.Ø6
2. Total Offsite Capital Cost (3Ø%)	-	-	-	2.84
TOTAL INVESTMENT	-	-	-	12.9Ø

TABLE 4-29

ESTIMATE DETAIL

($ MM)

REGION: WESTERN

REFINERY #8

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	-	-	2.18
1.2 Hydrotreater	-	-	-	5.12
--Catalyst	-	-	-	.12
1.3 Once Thru Isom.(reactor sect.)	-	-	-	11.54
--Catalyst	-	-	-	1.56
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	20.52
2. Total Offsite Capital Cost (30%)	-	-	-	5.65
TOTAL INVESTMENT	-	-	-	26.17

TABLE 4-3Ø

ESTIMATE DETAIL

($ MM)

REGION: WESTERN

REFINERY #9

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	-	-	2.7
1.2 Hydrotreater	-	-	-	6.35
--Catalyst	-	-	-	.17
1.3 Once Thru Isom.(reactor sect.)	-	-	-	14.32
--Catalyst	-	-	-	2.18
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	25.72
2. Total Offsite Capital Cost (3Ø%)	-	-	-	7.Ø1
TOTAL INVESTMENT	-	-	-	32.74

TABLE 4-31

ESTIMATE DETAIL

($ MM)

REGION: WESTERN

REFINERY #10

	CGSB Octanes		Market Octanes	
	Base	Casel	Base	Casel
1. Isomerization				
1.1 Fractionation	-	-	-	1.17
1.2 Hydrotreater	-	-	-	2.77
--Catalyst	-	-	-	.05
1.3 Once Thru Isom.(reactor sect.)	-	-	-	6.25
--Catalyst	-	-	-	.61
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	10.86
2. Total Offsite Capital Cost (30%)	-	-	-	3.06
TOTAL INVESTMENT	-	-	-	13.93

TABLE 4-32

ESTIMATE DETAIL

($ MM)

REGION: WESTERN

REFINERY #11

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
1. Isomerization				
1.1 Fractionation	-	-	-	Ø.84
1.2 Hydrotreater	-	-	-	2.ØØ
--Catalyst	-	-	-	.Ø3
1.3 Once Thru Isom. (reactor sect.)	-	-	-	4.5Ø
--Catalyst .37	-	-	-	-
1.4 Total Isom. (reactor&sieve sec.)	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	7.74
2. Total Offsite Capital Cost (3Ø%)	-	-	-	2.2Ø
TOTAL INVESTMENT	-	-	-	9.94

4.2 Operating Costs

4.2.1 Basis of Estimate

Variations in refinery operating costs for removing MMT have been calculated for each region. These costs have been derived from an analysis of nine basic categories, namely:

- Power
- Fuel and Steam
- Additional Crude Oil
- Imported i-C-4
- Credit for extra HFO production
- Catalyst replacement
- Wages for extra refinery personnel
- Credit for reduced lead additive consumption
- Credit for reduced MMT consumption

Table 2-17 lists the pertinent data developed for regional feedstock product and utility costs.

Fuel and Steam Costs

All fuel used for processing requirements is assumed to be supplied primarily by the fuel gas generated within the refinery and supplemented by heavy fuel oil if necessary. However, for calculation and evaluation purposes, the price of an equivalent quantity of HFO is credited.

Catalyst Replacement Costs

The catalyst replacement cost calculations are based on the capacities of the additional units. The cost is taken to be one-third of the initial catalyst charge spread over one-and-one-half years.

Extra Refinery Personnel

For each refinery, the following additional personnel are considered necessary to operate the additional units irrespective of their capacities.

Isomerization Unit	No./Shift	No. Per Day
(once through unit)		
Process Operators	1	4-1/2
Support Staff		1 (equivalent)
-- laboratory technician		
-- utility operator		
-- maintenance staff		
-- clerk		
-- process engineer		
TOTAL		5-1/2

Isomerization Unit (Total ISOM Unit)	No./Shift	No. Per Day
Process Operators	2	9
Support Staff		2 (equivalent)
-- laboratory technician		
-- utility operator		
-- maintenance staff		
-- clerk		
-- process engineer		
TOTAL		11

Aromatics Extraction	No./Shift	No. Per Day
Process Operators	1	4-1/2
Support Staff		1 (equivalent)
-- laboratory technician		
-- utility operator		
-- maintenance staff		
-- clerk		
-- process engineer		
TOTAL		5-1/2

Process Operators

The process operators are responsible for the day to day operation and control of the process units and they will be stationed in the process control room.

Support Staff

The following support staff are deemed necessary on a part time basis.

Category	Function
Laboratory Technician	To conduct routine sample analysis to ensure product quality.
Utility Operator	Responsible for adequate supply of utilities such as water, steam, chemicals, etc.
Maintenance Staff	Responsible for repair to mechanical, electrical and instrumentation equipment on a daily basis.
Clerk	Supplement the office staff and perform routine administrative and clerical duties.
Process Engineer	Responsible for overseeing and coordinating the units on a daily basis. (S)he would monitor process plant operation, conduct test runs and write technical reports suggesting optimum operating modes.

The qualifications needed for these personnel are summarized below.

Personnel Category	Qualifications
Process Operator	High School Education plus practical engineering apprenticeship.
Utility Operator	High School education plus practical engineering apprenticeship.
Maintenance Engineer	Graduate Engineer.
Maintenance Operator	High School education plus practical engineering apprenticeship.
Laboratory Technician	High School education plus chemistry bent
Clerk	High School education
Process Engineer	Degree in chemical engineering

The process operators would be on shift work whereas all other personnel on the list would operate on a daily basis. The average remuneration for each personnel classification has not been subdivided due to lack of readily available data. Statscan publish an average figure relating to process type operators and it is considered fairly representative of the average remuneration applicable to the general classification mentioned above. For study purposes a figure of $20.00 per hour was used to cover wages and payroll burden.

Note that it takes the equivalent of 4-1/2 men on the payroll for each shift job.

The control and operation of the new process units is assumed to be integrated and they would be physically located in one area of the refinery. The personnel requirements are considered to remain the same with the addition of isomerization, or aromatics extraction units, for the purposes of the study.

The total process incremental operating cost variations were calculated for each case and all results are reported in Table 4-33 to 4-46. These figures exclude any capital depreciation. Table 4-46 summarizes the overall incremental operating costs to produce MMT FREE gasoline (90/10 split gasoline).

TABLE 4 - 33

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ATLANTIC

BASE: CGSB OCTANES (18Mg/L Mn 70/30 SPLIT)

CASE1: CGSB OCTANES (0 MMT 90/10 SPLIT)

1.	POWER COST	1377.43
2.	FUEL & STEAM COSTS	-2642.47
3.	COST OF ADDITIONAL CRUDE	14137
4.	COST OF IMPORTED i-C4	-
5.	CREDIT FOR EXTRA HFO PROD'N	-
6.	CATALYSTS REPLACEMENTS COSTS*	1109
7.	WAGES*	2640
8.	CREDIT FOR LEAD ADDITIVES	-1709
9.	CREDIT FOR MMT	-4815
	TOTAL $/CD	10096.96
	TOTAL $MM/YR	3.69

* BASED ON THE FOLLOWING

3 ISOMERIZATION UNITS (ONCE THROUGH) ADDITIONAL TO BASE CASE

TABLE 4 - 34

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: QUEBEC

BASE: CGSB OCTANES (18 Mg/L Mn 70/30 SPLIT)

CASE1: CGSB OCTANES (0 MMT 90/10 SPLIT)

1.	POWER COST	1541.92
2.	FUEL & STEAM COSTS	-16619.8
3.	COST OF ADDITIONAL CRUDE	55754
4.	COST OF IMPORTED i-C4	-
5.	CREDIT FOR EXTRA HFO PROD'N	-
6.	CATALYSTS REPLACEMENTS COSTS*	2230
7.	WAGES*	2640
8.	CREDIT FOR LEAD ADDITIVES	-3594
9.	CREDIT FOR MMT	-9807
	TOTAL $/CD	32145.12
	TOTAL $MM/YR	11.73

* BASED ON THE FOLLOWING

3 ISOMERIZATION UNITS (ONCE THROUGH) ADDITIONAL TO BASE CASE

TABLE 4 - 35

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ONTARIO

BASE: CGSB OCTANES (18 Mg/L Mn 70/30 SPLIT)

CASE1: CGSB OCTANES (0 MMT 90/10 SPLIT)

1.	POWER COST	3863.17
2.	FUEL & STEAM COSTS	-13395.6
3.	COST OF ADDITIONAL CRUDE	63889
4.	COST OF IMPORTED i-C4	-12295
5.	CREDIT FOR EXTRA HFO PROD'N	-
6.	CATALYSTS REPLACEMENTS COSTS*	5551
7.	WAGES*	3520
8.	CREDIT FOR LEAD ADDITIVES	-6953
9.	CREDIT FOR MMT	-18968
	TOTAL $/CD	25211.57
	TOTAL $MM/YR	9.20

* BASED ON THE FOLLOWING

4 ISOMERIZATION UNITS (ONCE THROUGH) ADDITIONAL TO BASE CASE

TABLE 4 - 36

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: WESTERN

BASE: CGSB OCTANES (18 Mg/L Mn 70/30 SPLIT)

CASE1: CGSB OCTANES (0 MMT 90/10 SPLIT)

1.	POWER COST	263.02
2.	FUEL & STEAM COSTS	-34945.6
3.	COST OF ADDITIONAL CRUDE	35956
4.	COST OF IMPORTED i-C4	-3749
5.	CREDIT FOR EXTRA HFO PROD'N	-
6.	CATALYSTS REPLACEMENTS COSTS*	-
7.	WAGES*	-
8.	CREDIT FOR LEAD ADDITIVES	-8179
9.	CREDIT FOR MMT	-23068
	TOTAL $/CD	-33722.58
	TOTAL $MM/YR	-12.31

* BASED ON THE FOLLOWING

0 ISOMERIZATION UNITS (ONCE THROUGH) ADDITIONAL TO BASE CASE

TABLE 4 - 37

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ATLANTIC

BASE: MARKET OCTANES (18 MG/L Mn 70/30 SPLIT)

CASE1: MARKET OCTANES (0 MMT 90/10 SPLIT)

1.	POWER COST	233.71
2.	FUEL & STEAM COSTS	1955.1
3.	COST OF ADDITIONAL CRUDE	-567
4.	COST OF IMPORTED i-C4	-
5.	CREDIT FOR EXTRA HFO PROD'N	-
6.	CATALYSTS REPLACEMENTS COSTS*	780
7.	WAGES*	2640
8.	CREDIT FOR LEAD ADDITIVES	-1709
9.	CREDIT FOR MMT	-4815
	TOTAL $/CD	-1482.19
	TOTAL $MM/YR	-0.54

* BASED ON THE FOLLOWING

3 ISOMERIZATION UNITS (SIEVE SECTION ONLY) ADDITIONAL TO BASE CASE

TABLE 4 - 38

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: QUEBEC

CASE: Market OCTANES (18 MG/L Mn 70/30 SPLIT)

BASE: Market OCTANES (0 MMT 90/10 SPLIT)

1.	POWER COST	1108.55
2.	FUEL & STEAM COSTS	4440.3
3.	COST OF ADDITIONAL CRUDE	24424
4.	COST OF IMPORTED i-C4	-
5.	CREDIT FOR EXTRA HFO PROD'N	-
6.	CATALYSTS REPLACEMENTS COSTS*	2907
7.	WAGES*	4400
8.	CREDIT FOR LEAD ADDITIVES	-3594
9.	CREDIT FOR MMT	-9807
	TOTAL $/CD	23878.85
	TOTAL $MM/YR	8.72

* BASED ON THE FOLLOWING

1 + 3 ISOMERIZATION UNITS (1 TOTAL ISOMERIZATION UNIT) ADDITIONAL TO BASE CASE
(3 SIEVE SECTIONS) ADDITIONAL TO BASE CASE
ADDITIONAL TO BASE CASE

TABLE 4 - 39

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ONTARIO

BASE: MARKET OCTANES (18 Mg/L Mn 70/30 SPLIT)

CASE1: MARKET OCTANES (0 MMT 90/10 SPLIT)

1.	POWER COST	4058.47
2.	FUEL & STEAM COSTS	11103.4
3.	COST OF ADDITIONAL CRUDE	67299
4.	COST OF IMPORTED i-C4	-11903
5.	CREDIT FOR EXTRA HFO PROD'N	-
6.	CATALYSTS REPLACEMENTS COSTS*	3870
7.	WAGES*	2640
8.	CREDIT FOR LEAD ADDITIVES	-6953
9.	CREDIT FOR MMT	-18968
	TOTAL $/CD	52026.87
	TOTAL $MM/YR	18.99

* BASED ON THE FOLLOWING

3 ISOMERIZATION UNITS (ONCE THROUGH) ADDITIONAL TO BASE CASE

TABLE 4 - 40

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: WESTERN

BASE: MARKET OCTANES (18 Mg/L Mn 70/30 SPLIT)

CASE1: MARKET OCTANES (0 MMT 90/10 SPLIT)

1.	POWER COST	2756.68
2.	FUEL & STEAM COSTS	-17769
3.	COST OF ADDITIONAL CRUDE	14425
4.	COST OF IMPORTED i-C4	-4722
5.	CREDIT FOR EXTRA HFO PROD'N	--
6.	CATALYSTS REPLACEMENTS COSTS*	4820
7.	WAGES*	9680
8.	CREDIT FOR LEAD ADDITIVES	-8179
9.	CREDIT FOR MMT	-23068
	TOTAL $/CD	-22056.32
	TOTAL $MM/YR	-8.05

* BASED ON THE FOLLOWING

11 ISOMERIZATION UNITS (ONCE THROUGH) ADDITIONAL TO BASE CASE

TABLE 4-41

ANNUAL OPERATING COST

REGION: ATLANTIC

CAPITAL EQUIPMENT COST - $ MM/YR	CGSB Octanes Base	CGSB Octanes Case1	Market Octanes Base	Market Octanes Case1
Isomerization Units	-	31.19	31.19	57.27
Offsites	-	8.78	8.78	16.19
Crude Inventory	-	0.43	-	-
Total	-	40.40	39.97	73.46

ANNUAL OPERATING COST $ MM/YR

	CGSB Octanes Base	CGSB Octanes Case1	Market Octanes Base	Market Octanes Case1
Capital Charges (25%)	-	10.10	9.993	18.365
Insurance (0.5%)	-	0.202	0.200	0.367
Local Taxes (1.0%)	-	0.404	0.398	0.734
Maintenance (5.5%	-	2.222	2.198	4.041
Process Operating Cost (Incremental Total)	-	3.69	-	-0.54
Total	-	16.618	12.788	22.966
Incremental Annual Operating Cost (Case1 - BASE)	16.618		10.178	

TABLE 4-42

ANNUAL OPERATING COST

REGION: QUEBEC

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
CAPITAL EQUIPMENT COST - $ MM/YR				
Isomerization Units	-	49.1	53.99	128.87
Offsites	-	13.63	14.93	35.89
Crude Inventory	-	1.67	-	Ø.73
Total	-	64.41	68.92	165.49

ANNUAL OPERATING COST $ MM/YR

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
Capital Charges (25%)	-	16.1Ø3	17.23	41.373
Insurance (Ø.5%)	-	Ø.322	Ø.345	Ø.827
Local Taxes (1.Ø%)	-	Ø.6441	Ø.689	1.655
Maintenance (5.5%	-	3.543	3.791	9.1Ø2
Process Operating Cost (Incremental Total)	-	11.73	-	8.72
Total	-	32.342	22.Ø55	61.677
Incremental Annual Operating Cost (Case1 - BASE)	32.342		39.622	

TABLE 4-43

ANNUAL OPERATING COST

REGION: ONTARIO

	CGSB Octanes		Market Octanes	
	Base	Casel	Base	Casel
CAPITAL EQUIPMENT COST - $ MM/YR				
Isomerization Units	-	1ØØ.34	54.73	126.33
Offsites	-	27.37	14.71	34.46
Crude Inventory	-	1.92	-	2.Ø2
Total	-	129.63	69.44	162.81

ANNUAL OPERATING COST $ MM/YR

	CGSB Octanes		Market Octanes	
	Base	Casel	Base	Casel
Capital Charges (25%)	-	32.4Ø8	17.36	4Ø.7
Insurance (Ø.5%)	-	Ø.648	Ø.347	Ø.814
Local Taxes (1.Ø%)	-	1.296	Ø.694	1.628
Maintenance (5.5%	-	7.13Ø	3.819	8.955
Process Operating Cost (Incremental Total)	-	9.2	-	18.99
Total	-	5Ø.682	22.22	71.Ø87
Incremental Annual Operating Cost (Casel - BASE)	5Ø.682		48.867	

TABLE 4-44

ANNUAL OPERATING COST

REGION: WESTERN

	CGSB Octanes		Market Octanes	
	Base	Casel	Base	Casel
CAPITAL EQUIPMENT COST - $ MM/YR				
Isomerization Units	-	-	-	121.81
Offsites	-	-	-	34.13
Crude Inventory	-	1.Ø8	-	Ø.4
Total	-	1.Ø8	-	156.34

ANNUAL OPERATING COST $ MM/YR

	CGSB Octanes		Market Octanes	
	Base	Casel	Base	Casel
Capital Charges (25%)	-	Ø.27	-	39.Ø85
Insurance (Ø.5%)	-	Ø.ØØ5	-	Ø.7817
Local Taxes (1.Ø%)	-	Ø.Ø11	-	1.5634
Maintenance (5.5%	-	Ø.Ø59	-	8.599
Process Operating Cost (Incremental Total)	-	-12.31	-	-8.Ø5
Total	-	-11.965	-	41.979
Incremental Annual Operating Cost (Casel - BASE)	-11.965		41.979	

TABLE 4-45

ANNUAL OPERATING COST

REGION: CANADA

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
CAPITAL EQUIPMENT COST - $ MM/YR				
Isomerization Units	-	180.64	139.91	434.28
Offsites	-	49.78	38.42	120.67
Crude Inventory	-	5.1	-	3.15
Total	-	235.52	178.33	558.1

ANNUAL OPERATING COST $ MM/YR

	CGSB Octanes		Market Octanes	
	Base	Case1	Base	Case1
Capital Charges (25%)	-	58.88	44.583	139.525
Insurance (0.5%)	-	1.178	0.892	2.791
Local Taxes (1.0%)	-	2.3552	1.783	5.581
Maintenance (5.5%	-	12.955	9.808	30.695
Process Operating Cost (Incremental Total)	-	12.31	-	19.12
Total	-	87.678	57.066	197.712
Incremental Annual Operating Cost (Case1 - BASE)	87.678		140.646	

TABLE 4-46

SUMMARY OF ANNUAL INCREMENTAL OPERATING COSTS

(CASE - BASE)

REGION: CANADA

REGION	CGSB OCTANES MM $/YR	MARKET OCTANES MM $/YR
ATLANTIC	16.618	10.178
QUEBEC	32.342	39.622
ONTARIO	50.682	48.867
WESTERN	-11.965	41.979
CANADA	87.678	140.646

5.Ø OVERVIEW OF ALTERNATE ANTI-KNOCK BLENDING COMPONENTS

INTRODUCTION

This section presents a general overview of the various alternate anti-knock blending components, and processes that may be adopted to meet environmental legislation, that would eliminate or restrict the use of MMT and lead additives in motor gasoline.

5.1 Alternate High Octane Blending Components

Over the past decade there has been increasing interest in the use of certain alcohols and ethers as blending components in gasolines. In certain countries dependent on foreign crude, for example Brazil, the addition of these components to extend gasoline supplies has reduced the amount of imported crude needed to make motor gasoline. In other areas, notably in the U.S., legislation has been passed or is being contemplated for ecological reasons, which will eliminate or severely restrict the amount of TEL and/or MMT in gasoline. Blending components are therefore being used by some suppliers in preference to increased process severity to maintain the octane quality of gasoline.

The four most widely used compounds at the present time are methanol, ethanol, MTBE (methyl tertiary butyl ether) and TBA (Tertiary butyl alcohol). Table 5-1 shows comparable octane blending values for these materials and the octane improvements that may be expected from the addition of 5% of each in a 92 RON clear gasoline. The quantities currently being used are, for the most part, greater than this figure. By comparison 16.5 mg Mn/litre of MMT would raise the Research octane number 1.7 units.

The large volumetric increase of blending additive required to achieve a certain octane improvement will make transportation a significant, if not the controlling, factor in any assessment of the economics of producing and using these compounds in gasoline. The most attractive economic solution would be to have production at the refinery site or to be within a refining complex where transportation costs would be at a minimum.

The following brief review examines the various additives.

Methyl Alcohol - (Methanol)

Methanol in motor gasoline blends has experienced performance problems associated with vapour lock, rough idling, layer separation with inherent water, corrosion and engine wear. Atlantic Richfield Co. is now using and marketing a blend of 50:50, methanol: tertiary butyl alcohol (TBA) under the trade name Oxinol. This is claimed to reduce the problems associated with straight methanol to an acceptable level.

Pure methanol is reported to be cleaner burning and more energy efficient than either gasoline or ethanol. While most of the current methanol supply is derived from natural gas, it can be produced from coal, wood, refuse, bio-mass, or almost any carbonaceous material using available technology. Long term fleet tests using cars modified to burn pure methanol are being carried out in the U.S. as part of a program to develop a market for methanol from non petroleum sources.

Mobil Oil has developed a catalytic process named MTG which converts methanol to a mixed hydrocarbon product in the gasoline range. Considerable energy savings are possible in the production of methanol since this process can tolerate 15% water in the alcohol. A small (100 B/D) test plant has been operating satisfactorily in West Germany since December 1982 and a 14,000 B/D plant is currently under construction in New Zealand using methanol from natural gas. Completion is scheduled for 1985.

Ethyl Alcohol (Ethanol)

Ethanol derived from fermentation of grain is currently being marketed as Gasohol (10% in gasoline) in the U.S. The most ambitious current national program for the use of ethanol in motor fuels is in Brazil, where blends of up to 20% have been used. The raw material is sugar cane. Future planned developments include the production of vehicles to use straight alcohol with a 1985 goal of 5 million cars, or about two thirds of the cars on the road.

Much of the cost of ethanol is in the energy required for distillation (which varies between 28 - 43%) of the energy content of the final alcohol product. Studies have indicated that, in the Mobil process, the cost of converting ethanol to gasoline is less than the distillation costs, since the alcohol need only be concentrated to 85%. There is no indication, however, of development of this process for ethanol.

Methyl Tertiary Butyl Ether - (MTBE)

Methyl tertiary butyl either blends into motor gasoline with none of the disadvantages of either methanol or, to a lesser extent, ethanol. MTBE is produced by the combination of isobutylene and methanol over a catalyst. A number of patented processes are offered for this conversion.

The limiting component to rapid development of this compound is the supply of isobutylene. A number of plants have been built in the past few years, the largest of which obtain their isobutylene from large ethylene steam cracking plants.

In the refinery, isobutylene is in the B-B cut from fluid catalytic cracking. In most refineries this isobutylene is currently being converted into alkylate or polymer gasoline. Application of the process in Canadian refineries would have to compete for feedstock with existing upgrading processes.

Tertiary Butyl Alcohol - (TBA)

Tertiary butyl alcohol is a co-product from the manufacture of propylene oxide. A gasoline grade is being marketed by the Oxirane Corporation of Houston and is used in both the U.S. and Europe largely as the 50:50 mixture with methanol. The mixture of the two appears to solve most of the problems associated with the separate use of the light and heavy alcohols.

5.2 Processing Severity and Selectivity

As pointed out in the previous section, the use of purchased high octane blending components will be influenced largely by transportation costs. For refineries located some distance from major refining petrochemical complexes, changes to processing severity or selectivity may be the only economical means by which the octane barrels required to fulfill unleaded gasoline requirements can be met.

Table 5.2 lists representative octane numbers for typical refinery gasoline base stocks as well as those components from more selective processing. Table 5.3 shows the installed capacities of the downstream gasoline producing processing units reported for fully integrated Canadian fuel product refineries in 1983.

It must be noted that catalytic reforming is the main octane improvement process. The majority of Canadian reformers are cited as being semi-regenerative types and therefore acceptable run length will limit severity. Alkylation and polymerization capacities are sized to use the olefins available from cracking operations.

The difficulty of making blend corrections, particularly with the premium grade, is not immediately apparent from examination of the octanes of components available to make the blends. With TEL and MMT, only a small volume of additive is needed to give a 0.5 RON improvement. In an existing refinery with 100 RON as the highest available octane number, correcting an 80,000 barrel initial blend from 96 RON to 96.5 RON would require the addition of approximately 11,000 bbl of 100 RON component. For comparison purposes this same amount of correction would be obtained with only about 2,000 bbl of a 115 RON component. This would suggest that, for optimum use of the blending stocks, it may be necessary to add process equipment and storage to extract and segregate the mixed aromatic fractions from the reformate as a controlling blending component.

Catalytic reforming is used primarily to process the crude cut that contains all the hydrocarbons with 7,8 and 9 carbon atoms in their molecular structure. Lighter materials require higher severities to effect appreciable change, while heavier materials generally lead to more coke formation and deactivation of catalyst.

Despite the fact that reformer feed contains a broad spectrum of individual compounds, some flexibility exists in the choice of operating conditions to adjust severity and run length to optimize yield and octane number for a given feed. The development of bi-metallic catalysts has led to operation at lower pressures, which tends to increase yields and aromatics production. Conversion of the present semi-regenerative units to low pressure cyclic or fully regenerative units would increase the octane barrels produced.

Gasoline pool octane could also be improved by increasing reformer capacity to upgrade the heavy naphthas from catalytic cracking and thermal cracking. Pretreatment of these naphthas to reduce the nitrogen and sulphur to acceptable levels for reforming may be required.

Octane improvement in the gasoline pool can also be realized by diverting low octane components, primarily the normal paraffins, to other products. For example the raffinate from the extraction of the aromatics from a relatively low severity reformate might be used in blending gasoline-type jet fuel instead of straight run heavy naphtha. In some areas there may be a market for these naphthas as feed to steam reformers.

A number of proven processes or combinations of processes are available to improve the octane levels of the lower boiling components.

Once through catalytic isomerization of the C5/C6 light straight run naphtha will increase the RON by about 13 numbers. Separation and recycle to extinction of the normal paraffins will yield 90-91 RON clear. Apart from the improvement in gasoline pool octane this product has an additional advantage. When blended with reformate or alkylate, which are higher boiling materials, it is capable of providing a more uniform octane over the entire boiling range of the finished gasoline.

Other combinations of processes have been proposed aimed at selective use of the propylene-butylene feed stocks currently being processed in alkylation and polymerization units to make higher octane blending stocks.

The 93-94 RON octane rating of the alkylate made from mixed C3/C4 feed is several numbers lower than that made from the B-B cut alone. IFP propose that the propylenes be converted separately to gasoline grade isohexenes with a RON of 97. The product from alkylation of the C4 feed alone would have a RON of 96.

In a similar fashion, in respect of the alkylate product (96 RON) from mixed butylenes the octane number of the alkylate from isobutylene is lower than that produced from the N-butylenes. Isobutylene can be converted to methyl tertiary butyl ether, or MTBE. A combination MTBE-alkylation unit has been suggested to pass the C4 feed through the MTBE process for selective removal of the isobutylene, followed by alkylation of the normal butylene. The MTBE has an octane blending value of 117 and the alkylate from butenes alone is reported to be 99+ RON.

In conclusion a number of processing alternatives do exist to enable the refiner to meet the estimated octane numbers of lead free gasolines. However, in addition to the improvement required in the gasoline pool clear octane, it will probably be necessary to extract and segregate high octane components to provide adequate control during blending.

Therefore, the process scheme best suited to each refinery will require detailed study of the many alternatives available.

TABLE 5-1

BLENDING VALUES OF HIGH OCTANE COMPONENTS

	Research Octane No. (RON)	Motor Octane No. (MON)	Sensitivity (RON + MON)/2
Methanol	112	92	102
Ethanol	110	90	100
MTBE	117	101	109
TBA	109	97	103
Premium Gasoline	96	84	90

Increase in Octane for 5% Addition of High Octane Component Base Octane 92.7/83.7.

	RON	MON
Methanol	0.9	0.29
Ethanol	0.8	0.17
MTBE	1.16	0.84
TBA	0.78	0.63

TABLE 5-2

TYPICAL GASOLINE BASE STOCK OCTANE NUMBERS

Basic Processes	RON	MON	(RON+MON)/2
Light Straight Run	68-73	66-71	67-72
Light FCC Gasoline	94	80	87
FCC Gasoline	92	79	85.5
Lt. Hydrocrackate	80.9	78.7	79.8
Thermally Cracked	77	69	73
Heavy FCC Gasoline	90	78	84
Octane Improvement			
Reformate 100	100	88.4	94.2
Reformate 94	94	83.8	88.9
C4 Alkylate	96	94	95
C3/C4 Alkylate	93	90.8	91.9
C3/C4 Polymer	96.5	82.5	89.5
Selective Processes			
C5	92.3	89.7	91.0
C5/C6 Isomerate (1-Pass)	83.2	81.4	82.3
C5/C6 Isomerate (Total Recycle)	90.7		
Dimersol Isohexenes	97	82	89.5
Toluene	115	97	106
Premium Unleaded (1990)	96.5		
Regular Unleaded (1990)	93.1		

TABLE 5.3

CANADIAN CONVERSION UNIT CAPACITIES - 1983 BPCD (1)

	Catalytic Cracking	Cat. Hydro-Cracking	Thermal Cracking (2)	Catalytic Reforming	Alkylation	Polymerization	C5/C6 Isomerization
Atlantic	47,600	29,700	18,000	46,950	-	4,410	-
Quebec	94,100	27,900	27,500	78,700	4,425	4,030	-
Ontario	138,800	19,200	22,200	137,650	24,500	3,800	-
Western	157,000	-	15,800	91,250	26,900	5,450	-
	437,500	76,800	83,500	354,550	55,825	17,690	-

(1) O & G Journal December 26, 1983

(2) Includes Coking

6.0 CONCLUSIONS

Reducing or eliminating MMT antiknock additive from unleaded motor gasoline and changing grade split, will for most refiners require more severe operation of existing as well as the addition of new octane improvement facilities with attendant costs and energy penalties.

The overall incremental cost to the oil refining Market in 1990 for the two octane levels studied is as follows:-

(1st quarter 1984 Dollars)

	CGSB Octanes	Market Octanes
Capital Cost ($)	235,520,000	379,770,000
Annual Operating Cost ($/YR) (including costs of capital)	87,678,000	140,646,000

As expected, the Market octanes being the higher result in the greatest increase in cost.

The study constraints were maximum use of existing equipment and minimum crude oil consumption. In arriving at the above costs priority was first given to maximum use of existing equipment. If existing equipment could not meet octane requirements and additional equipment was shown to be needed, then the new combination of processes was operated for minimum crude consumption.

It is recognized, therefore, that more definitive evaluation of the individual refineries may show some reduction in capital investment at the expense of increased crude oil requirements and energy penalties.

Since no allowance was made in the simulation for any octane giveaway due to reduced blending flexibility in the absence of MMT additive, these costs, from a study standpoint, may be considered to be the minimum that will be required. To maintain control of blending, the refineries may have to carry larger inventories of the higher octane components, run catalytic reforming at maximum severity or add additional selective processing to separate a blending component of significantly higher octane than those used in the study. All of these carry additional costs and processing penalties over those presented. An overview of processing severity and selectivity is given in Section 5.2.

A complete assessment of all the various possibilities would have to be carried out to determine the optimum solution for any particular location.

The regional breakdown of the incremental capital and operating costs are shown in Table 6-1. No constant pattern of investment emerges, probably because the new investment is entirely for C5/C6 isomerization units and the size of the units in a region are influenced by the volume of isomerization feed in crude as well as the amount of crude run.

The Western region, however, is of particular interest. The area contains 11 refineries made up of several large refineries in the Prairie provinces and a number of smaller refineries on the West Coast and in the interior of British Columbia.

While allowance was made for the higher octane requirements in the B.C. market area, the greater processing capabilities of the larger more modern refineries in the prairies may have overshadowed the real effect that withdrawal of MMT would have on smaller, older refineries in British Columbia. The study showed that Market octane levels could not be met on an MMT free leaded gasolines with existing processing equipment and most refiners will have to add once through isomerization units to maintain quality.

Since capital investment and operating costs per barrel are substantially higher for small units, the economic viability of some of the small refineries may be in jeopardy.

TABLE 6-1

REGIONAL INCREMENTAL CAPITAL AND OPERATING COST SUMMARY

	ATLANTIC	QUEBEC	ONTARIO	WESTERN	TOTAL
CRUDE RUN BPCD	136,400	276,700	447,200	494,600	1,354,900
NO. OF REFINERIES	3	4	5	11	23
AVERAGE BPD	45,500	69,200	89,400	45,000	58,900
CGSB OCTANES					
CAPITAL COST ($000)	40,400	64,410	129,630	1,080	235,520
$/BPD	296	233	290	2	174
ANNUAL OPERATING COST ($000)	16,618	32,342	50,684	(11,965)	87,678
$/BPD	121	117	113	(24)	65
MARKET OCTANES					
CAPITAL COST ($000)	33,490	96,570	93,370	156,340	379,770
$/BPD	245	349	209	316	280
ANNUAL OPERATING COSTS ($000)	10,178	39,622	48,867	41,979	140,646
$/BPD	75	143	109	85	104

7.0 LITERATURE REFERENCES

The following reference literature was used during the study:-

Ref. 1 Petroleum Refinery Engineering, W. L. Nelson Fourth Edition.

Ref. 2 Guide To Refinery Operating Costs, W. L. Nelson Third Edition.

Ref. 3 Petroleum Refining. Technology and Economics, Gary and Handwerk.

Ref. 4 Oil And Gas Journal, April 15, 1963.

Ref. 5 A Guide To World Export Crudes, published by Oil and Gas Journal, 1976.

Ref. 6 Technical Data Book - Petroleum, Refining, American Petroleum Institute, Second Edition, 1970.

Ref. 7 ASTM STANDARDS - Classification of Diesel Fuel Oils (D975-537), Appendix II: Calculated Cetane Index.

Ref. 8 Hoffman, H. L., Hydrocarbon Processing, February, 1980.

Ref. 9 Eastman, Industrial and Engineering Chemistry, 1941.

Ref. 10 Lukenback, E. C., Chemical Engineering Progress, February, 1979.

Ref. 11 Magee, J.S., R. E. Ritter and L. Rheaume, Hydrocarbon Processing, September, 1979.

Ref. 12 Adams, F.H. and A.P. Krueding, "Gasoline Production", Presented at the UOP Technology Conference, 1973.

Ref. 13 "Polygas Spells Relief From Alkylation Ills." Chemical Engineering, June 16, 1980.

Ref. 14 Fuels for Railway and Marine Diesels Prepared for the Transportation Development Centre. Prepared by Hycarb Engineering December 1983.

15 World Refining Report, Oil & Gas Journal December 1983.

16 An Antiknock for Unleaded Gasoline, Economic, Energy, & Environmental aspects G.H. Unzelman 1975.

17 Octane Improvement economics antiknocks and alternatives. G.H. Unzelman, G.W. Michalski 1979.

18 Now MTBE From Butane Hydrocarbon Processing October 1980.

19 Toluene's Role As Gasoline Octane improver will not change much O&G Journal May 28, 1979.

20 A Fixed Bed Process For The Conversion Of Methanol-To-Gasoline. NPRA Annual Meeting 1980.

21 Gasoline From An Alchol Feed, Chemical Engineering April 21, 1980.

22 Mobil's Methanol-To-Gasoline Process will make Its World Debut. Chemical Engineering (C) October 5, 1981.

23 Fermentation Alchol Better to Convert to Fuel. Hydrocarbon Processing August 1982.

24 Glowing Results for West German Methanol-To-Gasoline Test. Chemical Engineering June 27, 1983.

25 Modern Gasoline Economics. Hydrocarbon Processing, December 1982.

26 Olefin Processes Aid Gasoline. Hydrocarbon Processing, September 1981.

27 Better Use Of Butenes For High-Octane Gasoline Hydrocarbon Processing April 1980.

28 Gasoline Pool: What It Needs. Hydrocarbon Processing May 1975.

29 What Affects Cat Reformer Yield. Hydrocarbon Processing January 1976.

30 Low-Pressure Reforming UPS Yields. O&G Journal August 26, 1974.

31 Production of Aromatic Hydrocarbons by Pressure Rheniforming, NPRA Annual Meeting 1976.

32 The Next Octane Increment: Where From And At What Cost? API-44th Refining Mid-year meeting 1979.

33 Octane Improvement Economics - Antiknocks and Alternatives NPRA Annual Meeting 1979.

34 As Antiknock for Unleaded Gasoline - Economic Energy, and Environmental Aspects, WGPOA meeting October 1975.

35 The MMT Outlook - 1977 G.H. Unzelman ET AL.

36 Alchol Use In Motor Fuels Ends Steady Climb O&G Journal November 14, 1983.

37 Methanol: What Role In Energy Future? Hydrocarbon Processing November 1983.

38 Methanol Blends To Be Tested In 150 Automobiles Chemical engineering, March 21, 1983.

39 Guarded Prognosis For Alchol Fuel Chemical Engineering, November 29, 1982.

40 TBA Aids Methanol/Fuel Mix, Hydrocarbon Processing, May 1982.

41 Value of Oxygenates in Blending, Octane Improvements For Motor Gasoline - O&G Journal June 1, 1981.

42 Octane Boosters Compete For Gasoline Pool Chemical Engineering October 23, 1978.

8.0 ADDITIONAL STUDY CASES

INTRODUCTION

At the conclusion of the main study four additional cases were studied (using the same methodology as main report) and operating and capital costs identified. The octane specifications, as well as allowable concentration for TEL and MMT additives used for these additional cases, are presented in Table 8-1.

Simulation results, and operating and capital costs for these additional cases are presented separately in this section of the report.

The base case used in the additional cases was that used for establishing incremental operating and capital cost for the main study.

TABLE 8 - 1

SUMMARY OF MOTOR GASOLINE

OCTANE SPECIFICATIONS & ANTIKNOCK ADDITIVE CONCENTRATIONS

	SGSB Octanes		Market Octanes	
	Case 2	Case 3	Case 2	Case 3
Lead Concentration (Leaded Pool) Gms of Pb/L	Ø.29	Ø.29	Ø.29	Ø.29
MMT Concentration (Unleaded Pool) Mg of Mn/L	Ø	18	Ø	18
Gasoline Grade Split (Unleaded/Leaded)	7Ø/3Ø	9Ø/1Ø	7Ø/3Ø	9Ø/1Ø
Octane Specification (R+M/2)Min (Leaded/Unleaded Reg/Unleaded Prem)				
Atlantic	87/87/9Ø	87/87/9Ø	89.8/89/91.8	89.8/89/91.8
Quebec	87/87/9Ø	87/87/9Ø	89.8/89/91.8	89.8/89/91.8
Ontario	87/87/9Ø	87/87/9Ø	89.8/89/91.8	89.8/89/91.8
Western	85/85/88	85/85/88	88.3/88.3/9Ø.8	88.3/88.3/9Ø.8

TABLE 8 - 2

SUMMARY OF RESULTS

ATLANTIC REGION

Case	Reformer Severity	C-5/C-6 Isomerization	Crude Oil Rate BPCD	Crude Rate Increase %	iC-4 Imported	Fuel Gas BPCD (FOE)	Energy Penalty %
Market:							
CASE 2	98	TOTAL (75%)	136360	-.02	0	6169	.017
CASE 3	98	TOTAL (53%)	136338	-.04	0	6136	-.037
CGSB:							
CASE 2	95.5	ONCE THRU (54%)	135803	.19	0	5611	.098
CASE 3	94	NONE	135568	.01	0	5322	.006

TABLE 8 - 3

SUMMARY OF RESULTS

QUEBEC REGION

Case	Reformer Severity	C-5/C-6 Isomerization	Crude Oil Rate BPCD	Crude Rate Increase %	iC-4 Imported	Fuel Gas BPCD (FOE)	Energy Penalty %
Market:							
CASE 2	97.3	TOTAL 70%	278021	.47	0	18953	.125
CASE 3	97	TOTAL 57.5	277281	.21	0	18299	.096
CGSB:							
CASE 2	92	ONCE THRU (44)	276108	.56	0	16732	.156
CASE 3	92	NONE	276175	.58	0	16692	.084

TABLE 8 - 4

SUMMARY OF RESULTS

ONTARIO REGION

Case	Reformer Severity	C-5/C-6 Isomerization	Crude Oil Rate BPCD	Crude Rate Increase %	iC-4 Imported	Fuel Gas BPCD (FOE)	Energy Penalty %
Market:							
CASE 2	98	ONCE THRU 74%	448883	.38	2739	29824	.177
CASE 3	96.5	ONCE THRU 60%	447354	.04	2951	28292	.048
CGSB:							
CASE 2	94.5	ONCE THRU 40%	445538	.24	3222	26265	.186
CASE 3	94	NONE	445085	.14	3338	25740	.036

TABLE 8 - 5

SUMMARY OF RESULTS

WESTERN REGION

Case	Reformer Severity	C-5/C-6 Isomerization	Crude Oil Rate BPCD	Crude Rate Increase %	iC-4 Imported	Fuel Gas BPCD (FOE)	Energy Penalty %
Market:							
CASE 2	99	NONE	496124	.31	1489	27381	.112
CASE 3	96.5	NONE	494746	.03	1523	25149	-.009
CGSB:							
CASE 2	91.8	NONE	491523	.10	1805	20473	.064
CASE 3	90.5	NONE	491214	.03	1798	19636	.018

SIMULATION RESULTS

TABLE 8-6

BASE :-18 mg/l MMT 70/30 Split

REGION:-ATLANTIC - CGSB

CASE-2:-0 mg/l MMT 70/30 Split

PROCESS / UNIT	CASE-2 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	135803	135547	256	95	24.32
VACUUM DISTILLATION	61779	61662	117	60	7.02
CATALYTIC CRACKER	44033	43600	433	100	43.3
CATALYTIC POLYMERIZATION	2689	3501	-812	500	-406
HF ALKYLATION	0	0	0	500	0
CATALYTIC REFORMER (SEVERITY)	9650 95.5	9600 94	50	331.25 (CASE) 320 (BASE)	124.563
HYDROTREATER NAPTHA	9650	9600	50	90	4.5
ISOMERISATION	3594 (ONCE THRU)	0	3594	100 (CASE) 100 (BASE)	359.4
HDS-LSR	3594	0	3594	90	323.46
GAS PLANT	14536	14044	492	600	295.2
FUEL GAS (FOE)	5601	5300	301	TOTAL	775.763
HFO PRODUCTION	13901	13901	0		
IMPORTED I-C4	0	0	0		

SIMULATION RESULTS

TABLE 8-7

BASE :-18 mg/l MMT 70/30 Split

REGION:-ATLANTIC - CGSB

CASE-3:-18 mg/l MMT 90/10 Split

PROCESS UNIT	CASE-3 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	135568	135547	21	95	1.995
VACUUM DISTILLATION	61672	61662	10	60	.6
CATALYTIC CRACKER	43605	43600	5	100	.5
CATALYTIC POLYMERIZATION	3508	3501	7	500	3.5
HF ALKYLATION	0	0	0	500	0
CATALYTIC REFORMER (SEVERITY)	9650 94	9600 94	50	320 (CASE) 320 (BASE)	16
HYDROTREATER NAPTHA	9650	9600	50	90	4.5
ISOMERISATION	0	0	0	100 (CASE) 100 (BASE)	0
HDS-LSR	0	0	0	90	0
GAS PLANT	14081	14044	37	600	22.2
FUEL GAS (FOE)	5322	5300	22	TOTAL	49.295
HFO PRODUCTION	13901	13901	0		
IMPORTED I-C4	0	0	0		

SIMULATION RESULTS

TABLE 8-8

BASE :-18 mg/l MMT 70/30 Split

REGION:-ATLANTIC - INDUSTRY

CASE-2:-0 MMT 70/30 Split

PROCESS UNIT	CASE-2 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	276108	274571	1537	95	146.015
VACUUM DISTILLATION	133783	133039	744	60	44.64
CATALYTIC CRACKER	88520	88965	-445	100	-44.5
CATALYTIC POLYMERIZATION	7032	7037	-5	500	-2.5
HF ALKYLATION	2461	2431	30	500	15
CATALYTIC REFORMER (SEVERITY)	32600 92	32600 92	0	305 (CASE) 305 (BASE)	0
HYDROTREATER NAPTHA	32600	32600	0	90	0
ISOMERISATION	8056 (ONCE THRU)	0	8056	100 (CASE) 100 (BASE)	805.6
HDS-LSR	8056	0	8056	90	725.04
GAS PLANT	36021	34632	1389	600	833.4
FUEL GAS (FOE)	16732	15378	1354	TOTAL	2522.70
HFO PRODUCTION	55901	155901	-100000		
IMPORTED I-C4	0	0	0		

SIMULATION RESULTS

TABLE 8-9

BASE :-18 mg/l MMT 70/30 Split

REGION:-QUEBEC - CGSB

CASE-3:-18 mg/l MMT 90/10 Split

PROCESS UNIT	CASE-3 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	276175	274571	1604	95	152.38
VACUUM DISTILLATION	133816	133039	777	60	46.62
CATALYTIC CRACKER	88445	88965	-520	100	-52
CATALYTIC POLYMERIZATION	7434	7037	397	500	198.5
HF ALKYLATION	1636	2431	-795	500	-397.5
CATALYTIC REFORMER (SEVERITY)	33000 92	32600 90	400	305 (CASE) 290 (BASE)	611
HYDROTREATER NAPTHA	33000	32600	400	90	36
ISOMERISATION	0	0	0	100 (CASE) 100 (BASE)	0
HDS-LSR	0	0	0	90	0
GAS PLANT	35893	34632	1261	600	756.6
FUEL GAS (FOE)	16692	15378	1314	TOTAL	1351.6
HFO PRODUCTION	55901	55901	0		
IMPORTED I-C4	0	0	0		

SIMULATION RESULTS

TABLE 8-10

BASE :-18 mg/l MMT 70/30 Split

REGION:-ONTARIO - CGSB

CASE-2:-0 mg/l MMT 70/30 Split

PROCESS UNIT	CASE-2 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	445538	444470	1068	95	101.46
VACUUM DISTILLATION	153902	153533	369	60	22.14
CATALYTIC CRACKER	126500	125790	710	100	71
CATALYTIC POLYMERIZATION	0	0	0	500	0
HF ALKYLATION	20737	20736	1	500	.5
CATALYTIC REFORMER (SEVERITY)	61250 94.5	61250 93.3	0	323.75 (CASE) 314.75 (BASE)	551.25
HYDROTREATER NAPTHA	61250	61250	0	90	0
ISOMERISATION	16232 (ONCE THRU)	0	16232	100 (CASE) 100 (BASE)	1623.2
HDS-LSR	16232	0	16232	90	1460.88
GAS PLANT	51780	50311	1469	600	881.4
FUEL GAS (FOE)	26265	24945	1320	TOTAL	4711.83
HFO PRODUCTION	33274	33274	0		
IMPORTED I-C4	3222	3471	-249		

SIMULATION RESULTS

TABLE 8-11

BASE :-18 mg/l MMT 70/30 Split

REGION:-ONTARIO - CGSB

CASE-3:-18 mg/l MMT 90/10 Split

PROCESS UNIT	CASE-3 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	445085	444470	615	95	58.425
VACUUM DISTILLATION	153746	153533	213	60	12.78
CATALYTIC CRACKER	126837	125790	1047	100	104.7
CATALYTIC POLYMERIZATION	0	0	0	500	0
HF ALKYLATION	20738	20736	2	500	1
CATALYTIC REFORMER (SEVERITY)	61000 94	61250 93.3	-250	320 (CASE) 314.75 (BASE)	241.563
HYDROTREATER NAPTHA	61000	61250	-250	90	-22.5
ISOMERISATION	0	0	0	100 (CASE) 100 (BASE)	0
HDS-LSR	0	0	0	90	0
GAS PLANT	51186	50311	875	600	525
FUEL GAS (FOE)	25740	24945	795	TOTAL	920.968
HFO PRODUCTION	33274	33274	0		
IMPORTED I-C4	3338	3471	-133		

SIMULATION RESULTS

TABLE 8-12

BASE :-18 mg/l MMT 70/30 Split

REGION:-WESTERN - CGSB

CASE-2:-0 mg/l MMT 70/30 Split

PROCESS UNIT	CASE-2 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	491523	491056	467	95	44.365
VACUUM DISTILLATION	173482	173317	165	60	9.9
CATALYTIC CRACKER	141145	140639	506	100	50.6
CATALYTIC POLYMERIZATION	6115	6115	0	500	0
HF ALKYLATION	20558	20422	136	500	68
CATALYTIC REFORMER (SEVERITY)	71000 91.8	71000 90	0	303.5 (CASE) 290 (BASE)	958.5
HYDROTREATER NAPTHA	71000	71000	0	90	0
ISOMERISATION	0	0	0	100 (CASE) 100 (BASE)	0
HDS-LSR	0	0	0	90	0
GAS PLANT	59959	58845	1114	600	668.4
FUEL GAS (FOE)	20473	19499	974	TOTAL	1799.77
HFO PRODUCTION	24342	24342	0		
IMPORTED I-C4	1805	1853	-48		

SIMULATION RESULTS

TABLE 8-13

BASE :-18 mg/l MMT 70/30 Split

REGION:-WESTERN- CGSB

CASE-3:-18 mg/l MMT 90/10 Split

PROCESS UNIT	CASE-3 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)		ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	491214	491056	158		95	15.01
VACUUM DISTILLATION	173372	173317	55		60	3.3
CATALYTIC CRACKER	140400	140639	-239		100	-23.9
CATALYTIC POLYMERIZATION	6114	6115	-1		500	-.5
HF ALKYLATION	20354	20422	-68		500	-34
CATALYTIC REFORMER (SEVERITY)	71500 90.5	71000 90	500	293.75 (CASE)	290 (BASE)	413.125
HYDROTREATER NAPTHA	71500	71000	500		90	45
ISOMERISATION	0	0	0	100 (CASE)	100 (BASE)	0
HDS-LSR	0	0	0		90	0
GAS PLANT	58972	58845	127		600	76.2
FUEL GAS (FOE)	19636	19499	137		TOTAL	494.235
HFO PRODUCTION	24342	24342	0			
IMPORTED I-C4	1798	1853	-55			

SIMULATION RESULTS

TABLE 8-14

BASE :-18 mg/l MMT 70/30 Split

REGION:-ATLANTIC - MARKET

CASE-2:-0 mg/l MMT 70/30 Split

PROCESS UNIT	CASE-2 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	136360	136386	-26	95	-2.47
VACUUM DISTILLATION	62032	62044	-12	60	-.72
CATALYTIC CRACKER	43865	43870	-5	100	-.5
CATALYTIC POLYMERIZATION	3736	3735	1	500	.5
HF ALKYLATION	0	0	0	500	0
CATALYTIC REFORMER (SEVERITY)	8880 98	8900 98	-20	350 (CASE) 350 (BASE)	-7
HYDROTREATER NAPTHA	8880	8900	-20	90	-1.8
ISOMERISATION	4727 (TOTAL)	6314 (ONCE THRU')	-1587	200 (CASE) 100 (BASE)	314
HDS-LSR	4727	6314	-1587	90	-142.83
GAS PLANT	15292	15329	-37	600	-22.2
FUEL GAS (FOE)	6169	6207	-38	TOTAL	136.98
HFO PRODUCTION	13901	13901	0		
IMPORTED I-C4	0	0	0		

SIMULATION RESULTS

TABLE 8-15

BASE :-18 mg/l MMT 70/30 Split

REGION:-ATLANTIC - MARKET

CASE-3:-18 mg/l MMT 90/10 Split

PROCESS UNIT	CASE-3 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	136338	136386	-48	95	-4.56
VACUUM DISTILLATION	62022	62044	-22	60	-1.32
CATALYTIC CRACKER	43855	43870	-15	100	-1.5
CATALYTIC POLYMERIZATION	3733	3735	-2	500	-1
HF ALKYLATION	0	0	0	500	0
CATALYTIC REFORMER (SEVERITY)	8900 98	8900 98	0	350 (CASE) 350 (BASE)	0
HYDROTREATER NAPTHA	8900	8900	0	90	0
ISOMERISATION	3295 (TOTAL)	6314 (ONCE THRU')	-3019	200 (CASE) 100 (BASE)	27.6
HDS-LSR	3295	6314	-3019	90	-271.71
GAS PLANT	15254	15329	-75	600	-45
FUEL GAS (FOE)	6136	6207	-71	TOTAL	-297.49
HFO PRODUCTION	13901	13901	0		
IMPORTED I-C4	0	0	0		

SIMULATION RESULTS

TABLE 8-16

BASE :-18 mg/l MMT 70/30 Split

REGION:-QUEBEC - MARKET

CASE-2:-0 MMT 70/30 Split

PROCESS UNIT	CASE-2 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)		ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	278021	276710	1311		95	124.545
VACUUM DISTILLATION	134710	134075	635		60	38.1
CATALYTIC CRACKER	91181	90720	461		100	46.1
CATALYTIC POLYMERIZATION	7644	7404	240		500	120
HF ALKYLATION	1580	2155	-575		500	-287.5
CATALYTIC REFORMER (SEVERITY)	33000 97.3	32800 96	200	344.75 (CASE)	335 (BASE)	388.75
HYDROTREATER NAPTHA	33000	32800	200		90	18
ISOMERISATION	13027 (TOTAL)	14740 (ONCE THRU')	-1713	200 (CASE)	100 (BASE)	1131.4
HDS-LSR	13027	14740	-1713		90	-154.17
GAS PLANT	38393	37368	1025		600	615
FUEL GAS (FOE)	18953	17792	1161		TOTAL	2040.23
HFO PRODUCTION	55901	55901	0			
IMPORTED I-C4	0	0	0			

SIMULATION RESULTS

TABLE 8-17

BASE :-18 mg/l MMT 70/30 Split

REGION:-QUEBEC - MARKET

CASE-3:-18 mg/l MMT 90/10 Split

PROCESS UNIT	CASE-3 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)		ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	277281	276710	571		95	54.245
VACUUM DISTILLATION	134352	134075	277		60	16.62
CATALYTIC CRACKER	90920	90720	200		100	20
CATALYTIC POLYMERIZATION	7484	7404	80		500	40
HF ALKYLATION	2124	2155	-31		500	-15.5
CATALYTIC REFORMER (SEVERITY)	32900 97	32800 96	100	342.5 (CASE)	335 (BASE)	280.25
HYDROTREATER NAPTHA	32900	32800	100		90	9
ISOMERISATION	12398 (TOTAL)	14740 (ONCE THRU')	-2342	200 (CASE)	100 (BASE)	1005.6
HDS-LSR	12398	14740	-2342		90	-210.78
GAS PLANT	37975	37368	607		600	364.2
FUEL GAS (FOE)	18299	17792	507		TOTAL	1563.64
HFO PRODUCTION	55901	55901	0			
IMPORTED I-C4	0	0	0			

SIMULATION RESULTS

TABLE 8-18

BASE :-18 mg/l MMT 70/30 Split

REGION:-ONTARIO - MARKET

CASE-2:-0 mg/l MMT 70/30 Split

PROCESS UNIT	CASE-2 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	448883	447197	1686	95	160.17
VACUUM DISTILLATION	155057	154475	582	60	34.92
CATALYTIC CRACKER	128713	126770	1943	100	194.3
CATALYTIC POLYMERIZATION	0	0	0	500	0
HF ALKYLATION	20810	20807	3	500	1.5
CATALYTIC REFORMER (SEVERITY)	62500 98	62500 96.5	0	350 (CASE) 338.75 (BASE)	703.125
HYDROTREATER NAPTHA	62500	62500	0	90	0
ISOMERISATION	30008 (ONCE THRU)	18212 (ONCE THRU)	11796	100 (CASE) 100 (BASE)	1179.6
HDS-LSR	30008	18212	11796	90	1061.64
GAS PLANT	55715	53752	1963	600	1177.8
FUEL GAS (FOE)	29824	28046	1778	TOTAL	4513.06
HFO PRODUCTION	33274	33274	0		
IMPORTED I-C4	2739	3050	-311		

SIMULATION RESULTS

TABLE 8-19

BASE :-18 mg/l MMT 70/30 Split

REGION:-ONTARIO - MARKET

CASE-3:-18 mg/l MMT 90/10 Split

PROCESS UNIT	CASE-3 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	447354	447197	157	95	14.915
VACUUM DISTILLATION	154529	154475	54	60	3.24
CATALYTIC CRACKER	127825	126770	1055	100	105.5
CATALYTIC POLYMERIZATION	0	0	0	500	0
HF ALKYLATION	20811	20807	4	500	2
CATALYTIC REFORMER (SEVERITY)	62000 96.5	62500 96.5	-500	338.75 (CASE) 338.75 (BASE)	-169.38
HYDROTREATER NAPTHA	62000	62500	-500	90	-45
ISOMERISATION	24167 (ONCE THRU)	18212 (ONCE THRU')	5955	100 (CASE) 100 (BASE)	595.5
HDS-LSR	24167	18212	5955	90	535.95
GAS PLANT	54058	53752	306	600	183.6
FUEL GAS (FOE)	28292	28046	246	TOTAL	1226.33
HFO PRODUCTION	33274	33274	0		
IMPORTED I-C4	2951	3050	-99		

SIMULATION RESULTS

TABLE 8-20

BASE :-18 mg/l MMT 70/30 Split

REGION:-WESTERN - MARKET

CASE-2:-0 mg/l MMT 70/30 Split

PROCESS UNIT	CASE-2 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	496124	494602	1522	95	144.59
VACUUM DISTILLATION	175106	174568	538	60	32.28
CATALYTIC CRACKER	149880	143173	6707	100	670.7
CATALYTIC POLYMERIZATION	6123	6116	7	500	3.5
HF ALKYLATION	21428	21102	326	500	163
CATALYTIC REFORMER (SEVERITY)	70750 99	72200 96.5	-1450	357.5 (CASE) 338.75 (BASE)	835.375
HYDROTREATER NAPTHA	70750	72200	-1450	90	-130.5
ISOMERISATION	0	0	0	100 (CASE) 100 (BASE)	0
HDS-LSR	0	0	0	90	0
GAS PLANT	67647	65248	2399	600	1439.4
FUEL GAS (FOE)	27381	25185	2196	TOTAL	3158.35
HFO PRODUCTION	24342	24342	0		
IMPORTED I-C4	1489	1613	-124		

SIMULATION RESULTS

TABLE 8-21

BASE :-18 mg/l MMT 70/30 Split

REGION:-WESTERN - MARKET

CASE-3:-18 mg/l MMT 90/10 Split

PROCESS UNIT	CASE-3 (BPCD)	BASE (BPCD) REQUIRED	INCREMENT (BPCD)	UNIT ENERGY REQUIREMENT (10^3 BTU/BBL)	ADDN ENERGY REQUIREMENT (10^6 BTU/CD)
CRUDE DISTILLATION	494746	494602	144	95	13.68
VACUUM DISTILLATION	174619	174568	51	60	3.06
CATALYTIC CRACKER	142480	143173	-693	100	-69.3
CATALYTIC POLYMERIZATION	6115	6116	-1	500	-.5
HF ALKYLATION	20899	21102	-203	500	-101.5
CATALYTIC REFORMER (SEVERITY)	72200 96.5	72200 96.5	0	338.75 (CASE) 338.75 (BASE)	0
HYDROTREATER NAPTHA	72200	72200	0	90	0
ISOMERISATION	0	0	0	100 (CASE) 100 (BASE)	0
HDS-LSR	0	0	0	90	0
GAS PLANT	65080	65248	-168	600	-100.8
FUEL GAS (FOE)	25149	25185	-36	TOTAL	-255.36
HFO PRODUCTION	24342	24342	0		
IMPORTED I-C4	1523	1613	-90		

TABLE 8 - 22

SUMMARY OF REQUIRED NEW UNIT CAPACITY

CASE	ISOMERIZATION UNIT					
	BPCD FRESH FEED	BPSD (FOR COST ESIMATION)				TYPE OF ISOM UNIT
		FRACTIO-NATION	HYDRO-TREATING	REACTOR SEC'T	SIEVE SEC'T	
CGSB OCTANES						
ATLANTIC-CASE 2	3388	10824	3566	4280	---	ONCE THRU
ATLANTIC-CASE 3	---	---	---	---	---	--- ---
QUEBEC-CASE 2	8056	25437	8589	10307	---	ONCE THRU
QUEBEC-CASE 3	---	---	---	---	---	--- ---
ONTARIO-CASE 2	16232	51541	17086	20504	---	ONCE THRU
ONTARIO-CASE 3	---	---	---	---	---	--- ---
WESTERN-CASE 2	---	---	---	---	---	--- ---
WESTERN-CASE 3	---	---	---	---	---	--- ---
MARKET OCTANES						
ATLANTIC-CASE 2	4728	14218	4977	5972	5972	TOTAL ISOM
ATLANTIC-CASE 3	3295	9950	3468	4163	4163	TOTAL ISOM
QUEBEC-CASE 2	13027	40810	13713	16455	16455	TOTAL ISOM
QUEBEC-CASE 3	10562	33316	11118	13341	13341	TOTAL ISOM
ONTARIO-CASE 2	30008	96335	31587	37904	---	ONCE THRU
ONTARIO-CASE 3	24243	77621	25519	30623	---	ONCE THRU
WESTERN-CASE 2	---	---	---	---	---	--- ---
WESTERN-CASE 3	---	---	---	---	---	--- ---

TABLE 8 - 23

DETAILED SUMMARY OF REQUIRED NEW UNIT CAPACITIES

CGSB OCTANES - CASE 2

ISOMERIZATION UNIT

Refinery #	Req'd Iso. Capacity	Full Cut Naphtha	Isom. Feed	Hydrotreater	Reactor Section	Sieve Section	Isom. Type
		-FRACTIONATION-					
	BPCD	BPSD	BPSD	BPSD	BPSD	BPSD	
Atlantic							
1	3388	10824	3566	3566	4280	----	ONCE THRU
2	----	----	----	----	----	----	---- ----
3	----	----	----	----	----	----	---- ----
Total (Atlantic)	3388	10824	3566	3566	4280	----	ONCE THRU
Quebec							
1	2691	8394	2834	2834	3401	----	ONCE THRU
2	----	----	----	----	----	----	---- ----
3	5469	17043	5755	5755	6906	----	ONCE THRU
4	----	----	----	----	----	----	---- ----
Total (Quebec)	8160	25437	8589	8589	10307	----	ONCE THRU
Ontario							
1	----	----	----	----	----	----	---- ----
2	----	----	----	----	----	----	---- ----
3	----	----	----	----	----	----	---- ----
4	7954	25255	8372	8372	10047	----	ONCE THRU
5	8278	26286	8714	8714	10457	----	ONCE THRU
Total (Ontario)	16232	51541	17086	17086	20504	----	ONCE THRU
Western							
1	----	----	----	----	----	----	---- ----
2	----	----	----	----	----	----	---- ----
3	----	----	----	----	----	----	---- ----
4	----	----	----	----	----	----	---- ----
5	----	----	----	----	----	----	---- ----
6	----	----	----	----	----	----	---- ----
7	----	----	----	----	----	----	---- ----
8	----	----	----	----	----	----	---- ----
9	----	----	----	----	----	----	---- ----
10	----	----	----	----	----	----	---- ----
11	----	----	----	----	----	----	---- ----
Total (Western)	----	----	----	----	----	----	---- ----

TABLE 8 - 24

DETAILED SUMMARY OF REQUIRED NEW UNIT CAPACITIES

CGSB OCTANES - CASE 3

ISOMERIZATION UNIT

Refinery #	Req'd Iso. Capacity	Full Cut Naphtha	Isom. Feed	Hydrotreater	Reactor Section	Sieve Section	Isom. Type
		-FRACTIONATION-					
	BPCD	BPSD	BPSD	BPSD	BPSD	BPSD	
Atlantic							
1	----	----	----	----	----	----	----
2	----	----	----	----	----	----	----
3	----	----	----	----	----	----	----
Total (Atlantic)	----	----	----	----	----	----	----
Quebec							
1	----	----	----	----	----	----	----
2	----	----	----	----	----	----	----
3	----	----	----	----	----	----	----
4	----	----	----	----	----	----	----
Total (Quebec)	----	----	----	----	----	----	----
Ontario							
1	----	----	----	----	----	----	----
2	----	----	----	----	----	----	----
3	----	----	----	----	----	----	----
4	----	----	----	----	----	----	----
5	----	----	----	----	----	----	----
Total (Ontario)	----	----	----	----	----	----	----
Western							
1	----	----	----	----	----	----	----
2	----	----	----	----	----	----	----
3	----	----	----	----	----	----	----
4	----	----	----	----	----	----	----
5	----	----	----	----	----	----	----
6	----	----	----	----	----	----	----
7	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----
11	----	----	----	----	----	----	----
Total (Western)	----	----	----	----	----	----	----

TABLE 8 - 25

DETAILED SUMMARY OF REQUIRED NEW UNIT CAPACITIES

MARKET OCTANES - CASE 2

ISOMERIZATION UNIT

Refinery #	Req'd Iso. Capacity	Full Cut Naphtha	Isom. Feed	Hydrotreater	Reactor Section	Sieve Section	Isom. Type
		-FRACTIONATION-					
	BPCD	BPSD	BPSD	BPSD	BPSD	BPSD	
Atlantic							
1	4350	13081	4579	4579	5494	5494	TOTAL ISOM
2	----	----	----	----	----	----	---- ----
3	378	1137	398	398	478	478	TOTAL ISOM
Total (Atlantic)	4728	14218	4977	4977	5972	5972	TOTAL ISOM
Quebec							
1	2866	8978	3017	3017	3620	3620	TOTAL ISOM
2	4429	13875	4662	4662	5595	5595	TOTAL ISOM
3	5732	17956	6034	6034	7240	7240	TOTAL ISOM
4	----	----	----	----	----	----	----
Total (Quebec)	13027	40810	13713	13713	16455	16455	TOTAL ISOM
Ontario							
1	----	----	----	----	----	----	----
2	7202	23120	7581	7581	9097	----	ONCE THRU
3	6602	21194	6949	6949	8339	----	ONCE THRU
4	7802	25047	8213	8213	9855	----	ONCE THRU
5	8402	26974	8844	8844	10613	----	ONCE THRU
Total (Ontario)	30008	96335	31587	31587	37904	----	ONCE THRU
Western							
1	----	----	----	----	----	----	----
2	----	----	----	----	----	----	----
3	----	----	----	----	----	----	----
4	----	----	----	----	----	----	----
5	----	----	----	----	----	----	----
6	----	----	----	----	----	----	----
7	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----
11	----	----	----	----	----	----	----
Total (Western)	----	----	----	----	----	----	----

TABLE 8 - 26

DETAILED SUMMARY OF REQUIRED NEW UNIT CAPACITIES

MARKET OCTANES - CASE 3

ISOMERIZATION UNIT

Refinery #	Req'd Iso. Capacity	Full Cut Naphtha	Isom. Feed	Hydrotreater	Reactor Section	Sieve Section	Isom. Type
		-FRACTIONATION-					
	BPCD	BPSD	BPSD	BPSD	BPSD	BPSD	
Atlantic							
1	3031	9154	3191	3191	3830	3830	TOTAL ISOM
2	----	----	----	----	----	----	----
3	264	796	277	277	333	333	TOTAL ISOM
Total (Atlantic)	3295	9950	3468	3468	4163	4163	TOTAL ISOM
Quebec							
1	----	----	----	----	----	----	----
2	----	----	----	----	----	----	----
3	5703	17991	6004	6004	7204	7204	TOTAL ISOM
4	4859	15325	5114	5114	6137	6137	TOTAL ISOM
Total (Quebec)	10562	33316	11118	11118	13341	13341	TOTAL ISOM
Ontario							
1	11152	35706	11739	11739	14087	----	ONCE THRU
2	6788	21734	7145	7145	8574	----	ONCE THRU
3	6303	20181	6635	6635	7962	----	ONCE THRU
4	----	----	----	----	----	----	----
5	----	----	----	----	----	----	----
Total (Ontario)	24243	77621	25519	25519	30623	----	ONCE THRU
Western							
1	----	----	----	----	----	----	----
2	----	----	----	----	----	----	----
3	----	----	----	----	----	----	----
4	----	----	----	----	----	----	----
5	----	----	----	----	----	----	----
6	----	----	----	----	----	----	----
7	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----
11	----	----	----	----	----	----	----
Total (Western)	----	----	----	----	----	----	----

TABLE 8 - 27

SUMMARY OF ESTIMATES

CGSB OCTANES CASE 2

($ MM)

	Isomerization					
	Fractio-nation	Hydro-treating	Isom Unit	Offsites	Crude Inventory	Total Capital Cost
ATL-BASE	-	-	-	-	-	-
ATL-CASE 2	1.51	3.62	8.89	3.92	Ø.27	18.21
ATL-DIF$	1.51	3.62	8.89	3.92	Ø.27	18.21
QUE-BASE	-	-	-	-	-	-
QUE-CASE 2	3.36	8.Ø6	19.96	8.72	1.66	41.76
QUE-DIF$	3.36	8.Ø6	19.96	8.72	1.66	41.76
ONT-BASE	-	-	-	-	-	-
ONT-CASE 2	5.33	12.85	32.5Ø	13.82	1.16	65.66
ONT-DIF$	5.33	12.85	32.5Ø	13.82	1.16	65.66
WES-BASE	-	-	-	-	-	-
WES-CASE 2	-	-	-	-	Ø.5	Ø.5
WES-DIF$	-	-	-	-	Ø.5	Ø.5
CANADA-BASE	-	-	-	-	-	-
CANADA-CASE 2	1Ø.2	24.53	61.35	26.46	1.78	126.13
CANADA-DIF$	1Ø.2	24.53	61.35	26.46	1.78	126.13

TABLE 8 - 28

SUMMARY OF ESTIMATES

CGSB OCTANES CASE 3

($ MM)

	Isomerization Fractio-nation	Isomerization Hydro-treating	Isomerization Isom Unit	Offsites	Crude Inventory	Total Capital Cost
ATL-BASE	-	-	-	-	-	-
ATL-CASE 3	-	-	-	-	Ø.Ø2	Ø.Ø2
ATL-DIF$	-	-	-	-	Ø.Ø2	Ø.Ø2
QUE-BASE	-	-	-	-	-	-
QUE-CASE 3	-	-	-	-	1.73	1.73
QUE-DIF$	-	-	-	-	1.73	1.73
ONT-BASE	-	-	-	-	-	-
ONT-CASE 3	-	-	-	-	Ø.67	Ø.67
ONT-DIF$	-	-	-	-	Ø.67	Ø.67
WES-BASE	-	-	-	-	-	-
WES-CASE 3	-	-	-	-	Ø.17	Ø.17
WES-DIF$	-	-	-	-	Ø.17	Ø.17
CANADA-BASE	-	-	-	-	-	-
CANADA-CASE 3	-	-	-	-	2.59	2.59
CANADA-DIF$	-	-	-	-	2.59	2.59

TABLE 8 - 29

SUMMARY OF ESTIMATES

MARKET OCTANES CASE 2

($ MM)

	Isomerization Fractio-nation	Isomerization Hydro-treating	Isomerization Isom Unit	Offsites	Crude Inventory	Total Capital Cost
ATL-BASE	3.42	8.21	19.56	8.78	-	39.97
ATL-CASE 2	2.52	6.03	33.37	11.80	-0.03	53.69
ATL-DIF$	-0.9	-2.18	13.81	3.02	-0.03	23.72
QUE-BASE	5.77	13.84	34.38	14.93	-	68.92
QUE-CASE 2	5.27	12.65	72.92	25.36	1.41	117.61
QUE-DIF$	-0.50	-1.19	38.54	10.43	1.41	48.69
ONT-BASE	5.7	13.78	35.25	14.71	-	69.44
ONT-CASE 2	7.39	17.79	44.83	19.17	1.84	91.02
ONT-DIF$	1.69	4.01	9.58	4.46	1.84	21.58
WES-BASE	-	-	-	-	-	-
WES-CASE 2	-	-	-	-	1.62	1.62
WES-DIF$	-	-	-	-	1.62	1.62
CANADA-BASE	14.89	35.83	89.19	38.42	-	178.33
CANADA-CASE 2	15.18	36.47	151.09	56.33	3.31	263.91
CANADA-DIF$	0.29	0.64	71.90	17.91	3.31	85.58

TABLE 8 - 3Ø

SUMMARY OF ESTIMATES

MARKET OCTANES CASE 3

($ MM)

	Isomerization					
	Fractio-nation	Hydro-treating	Isom Unit	Offsites	Crude Inventory	Total Capital Cost
ATL-BASE	3.42	8.21	19.56	8.78	-	39.97
ATL-CASE 3	2.15	5.13	28.Ø2	1Ø.Ø2	Ø.Ø5	45.37
ATL-DIF$	-1.27	-3.Ø8	8.46	1.24	Ø.Ø5	15.4Ø
QUE-BASE	5.77	13.84	34.38	14.93	-	68.92
QUE-CASE 3	4.Ø3	9.68	55.94	19.35	Ø.62	89.62
QUE-DIF$	-1.74	-4.16	21.56	4.42	Ø.62	2Ø.Ø7
ONT-BASE	5.7	13.78	35.25	14.71	-	69.44
ONT-CASE 3	7.9	19.Ø7	48.27	2Ø.51	Ø.17	95.92
ONT-DIF$	2.2	5.29	13.Ø2	5.8	Ø.17	26.48
WES-BASE	-	-	-	-	-	-
WES-CASE 3	-	-	-	-	Ø.15	Ø.15
WES-DIF$	-	-	-	-	Ø.15	Ø.15
CANADA-BASE	14.89	35.83	89.19	38.42	-	178.33
CANADA-CASE 3	14.Ø8	33.88	132.23	49.88	Ø.84	231.Ø6
CANADA-DIF$	-Ø.81	-1.95	43.Ø4	11.46	Ø.84	52.73

TABLE 8 - 31

SUMMARY OF INVESTMENT COSTS

($ MM)

REGION: CANADA

REGION	CGSB OCTANES CASE 2	CGSB OCTANES CASE 3	MARKET OCTANES CASE 2	MARKET OCTANES CASE 3
ATLANTIC	18.21	Ø.Ø2	53.69	45.37
QUEBEC	41.76	1.73	117.61	89.62
ONTARIO	65.66	Ø.67	91.Ø2	95.92
WESTERN	Ø.5Ø	Ø.17	1.62	Ø.15
TOTAL CANADA	126.13	2.59	263.94	231.Ø6

TABLE 8 - 32

ESTIMATE DETAIL

($ MM)

REGION: Atlantic

Refinery #1

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	1.51	-	1.78	1.40
1.2 Hydrotreater	3.55	-	4.17	3.30
--Catalyst	0.07	-	0.09	0.06
1.3 Once Thru Isom.(reactor sect.)	8.00	-	-	-
--Catalyst	0.89	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	22.51	17.80
--Catalyst	-	-	2.02	1.41
Total Onsite Capital Cost:	14.01	-	30.57	23.98
2. Total Offsite Capital Cost (30%)	3.92	-	8.54	6.75
TOTAL INVESTMENT	17.93	-	39.10	30.73

TABLE 8 - 33

ESTIMATE DETAIL

($ MM)

REGION: Atlantic | Refinery #2

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (30%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 34

ESTIMATE DETAIL

($ MM)

REGION: Atlantic | Refinery #3

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	Ø.74	Ø.74
1.2 Hydrotreater	-	-	1.75	1.75
--Catalyst	-	-	Ø.Ø2	Ø.Ø2
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	8.37	8.37
--Catalyst	-	-	Ø.44	Ø.44
Total Onsite Capital Cost:	-	-	11.33	11.33
2. Total Offsite Capital Cost (3Ø%)	-	-	3.26	3.26
TOTAL INVESTMENT	-	-	14.59	14.59

TABLE 8 - 35

ESTIMATE DETAIL

($ MM)

REGION: Quebec

Refinery #1

		CGSB Octanes		Market Octanes	
		CASE 2	CASE 3	CASE 2	CASE 3
1.	Isomerization				
1.1	Fractionation	1.30	-	1.35	-
1.2	Hydrotreater	3.06	-	3.18	-
	--Catalyst	0.05	-	0.06	-
1.3	Once Thru Isom.(reactor sect.)	6.89	-	-	-
	--Catalyst	0.71	-	-	-
1.4	Total Isom. (reactor&sieve sect.	-	-	17.16	-
	--Catalyst	-	-	1.39	-
	Total Onsite Capital Cost:	12.01	-	23.09	-
2.	Total Offsite Capital Cost (30%)	3.37	-	6.51	-
	TOTAL INVESTMENT	15.38	-	29.60	-

TABLE 8 - 36

ESTIMATE DETAIL

($ MM)

REGION: Quebec

Refinery #2

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	1.80	-
1.2 Hydrotreater	-	-	4.22	-
--Catalyst	-	-	0.09	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	22.78	-
--Catalyst	-	-	2.06	-
Total Onsite Capital Cost:	-	-	30.94	-
2. Total Offsite Capital Cost (30%)	-	-	8.64	-
TOTAL INVESTMENT	-	-	39.58	-

TABLE 8 - 37

ESTIMATE DETAIL

($ MM)

REGION: Quebec

Refinery #3

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	2.06	-	2.12	2.12
1.2 Hydrotreater	4.84	-	4.99	4.98
--Catalyst	0.11	-	0.11	0.11
1.3 Once Thru Isom.(reactor sect.)	10.92	-	-	-
--Catalyst	1.44	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	26.93	26.84
--Catalyst	-	-	2.66	2.65
Total Onsite Capital Cost:	19.37	-	36.83	36.70
2. Total Offsite Capital Cost (30%)	5.35	-	10.21	10.18
TOTAL INVESTMENT	24.71	-	47.04	46.88

TABLE 8 - 38

ESTIMATE DETAIL

($ MM)

REGION: Quebec | Refinery #4

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	1.91
1.2 Hydrotreater	-	-	-	4.49
--Catalyst	-	-	-	Ø.1Ø
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	24.19
--Catalyst	-	-	-	2.26
Total Onsite Capital Cost:	-	-	-	32.93
2. Total Offsite Capital Cost (3Ø%)	-	-	-	9.17
TOTAL INVESTMENT	-	-	-	42.11

TABLE 8 - 39

ESTIMATE DETAIL

($ MM)

REGION: Ontario | Refinery #1

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	3.27
1.2 Hydrotreater	-	-	-	7.70
--Catalyst	-	-	-	0.22
1.3 Once Thru Isom.(reactor sect.)	-	-	-	17.35
--Catalyst	-	-	-	2.93
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	31.48
2. Total Offsite Capital Cost (30%)	-	-	-	8.50
TOTAL INVESTMENT	-	-	-	39.97

TABLE 8 - 40

ESTIMATE DETAIL

($ MM)

REGION: Ontario

Refinery #2

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	2.46	2.37
1.2 Hydrotreater	-	-	5.79	5.57
--Catalyst	-	-	0.14	0.14
1.3 Once Thru Isom.(reactor sect.)	-	-	13.06	12.57
--Catalyst	-	-	1.89	1.78
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	23.35	22.43
2. Total Offsite Capital Cost (30%)	-	-	6.39	6.15
TOTAL INVESTMENT	-	-	29.75	28.58

TABLE 8 - 41

ESTIMATE DETAIL

($ MM)

REGION: Ontario

Refinery #3

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	2.33	2.26
1.2 Hydrotreater	-	-	5.47	5.31
--Catalyst	-	-	0.13	0.13
1.3 Once Thru Isom.(reactor sect.)	-	-	12.34	11.98
--Catalyst	-	-	1.73	1.66
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	22.01	21.33
2. Total Offsite Capital Cost (30%)	-	-	6.04	5.86
TOTAL INVESTMENT	-	-	28.05	27.19

TABLE 8 - 42

ESTIMATE DETAIL

($ MM)

REGION: Ontario | Refinery #4

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	2.63	-	2.60	-
1.2 Hydrotreater	6.18	-	6.10	-
--Catalyst	0.16	-	0.16	-
1.3 Once Thru Isom.(reactor sect.)	13.93	-	13.76	-
--Catalyst	2.09	-	2.05	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	24.99	-	24.66	-
2. Total Offsite Capital Cost (30%)	6.82	-	6.74	-
TOTAL INVESTMENT	31.81	-	31.40	-

TABLE 8 - 43

ESTIMATE DETAIL

($ MM)

REGION: Ontario | Refinery #5

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	2.70	-	2.72	-
1.2 Hydrotreater	6.34	-	6.40	-
--Catalyst	0.17	-	0.17	-
1.3 Once Thru Isom.(reactor sect.)	14.30	-	14.43	-
--Catalyst	2.18	-	2.21	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	25.68	-	25.94	-
2. Total Offsite Capital Cost (30%)	7.00	-	7.07	-
TOTAL INVESTMENT	32.68	-	33.01	-

TABLE 8 - 44

ESTIMATE DETAIL

($ MM)

REGION: Western

Refinery #1

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (30%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 45

ESTIMATE DETAIL

($ MM)

REGION: Western | Refinery #2

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (30%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 46

ESTIMATE DETAIL

($ MM)

REGION: Western

Refinery #3

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (30%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 47

ESTIMATE DETAIL

($ MM)

REGION: Western

Refinery #4

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (30%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 48

ESTIMATE DETAIL

($ MM)

REGION: Western | Refinery #5

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (30%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 49

ESTIMATE DETAIL

($ MM)

REGION: Western | Refinery #6

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (30%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 5Ø

ESTIMATE DETAIL

($ MM)

REGION: Western

Refinery #7

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (3Ø%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 51

ESTIMATE DETAIL

($ MM)

REGION: Western

Refinery #8

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (30%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 52

ESTIMATE DETAIL

($ MM)

REGION: Western

Refinery #9

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (30%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 53

ESTIMATE DETAIL

($ MM)

REGION: Western

Refinery #1Ø

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (3Ø%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 54

ESTIMATE DETAIL

($ MM)

REGION: Western

Refinery #11

	CGSB Octanes		Market Octanes	
	CASE 2	CASE 3	CASE 2	CASE 3
1. Isomerization				
1.1 Fractionation	-	-	-	-
1.2 Hydrotreater	-	-	-	-
--Catalyst	-	-	-	-
1.3 Once Thru Isom.(reactor sect.)	-	-	-	-
--Catalyst	-	-	-	-
1.4 Total Isom. (reactor&sieve sect.	-	-	-	-
--Catalyst	-	-	-	-
Total Onsite Capital Cost:	-	-	-	-
2. Total Offsite Capital Cost (30%)	-	-	-	-
TOTAL INVESTMENT	-	-	-	-

TABLE 8 - 55

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ATLANTIC

BASE: CGSB OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 2: CGSB OCTANES (0 MMT 70/30 SPLIT)

1.	POWER COST	561
2.	FUEL & STEAM COSTS	-5030
3.	COST OF ADDITIONAL CRUDE	9070
4.	COST OF IMPORTED i-C4	---
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	1700
7.	WAGES*	880
8.	CREDIT FOR LEAD ADDITIVES	---
9.	CREDIT FOR MMT	-5354
	TOTAL $/CD	1827
	TOTAL $MM/YR	0.67

* BASED ON THE FOLLOWING

1 ISOMERIZATION UNITS (ONCE THRU) ADDITIONAL TO BASE CASE

TABLE 8 - 56

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: QUEBEC

BASE: CGSB OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 2: CGSB OCTANES (0 MMT 70/30 SPLIT)

1. POWER COST	653
2. FUEL & STEAM COSTS	-26438
3. COST OF ADDITIONAL CRUDE	55286
4. COST OF IMPORTED i-C4	---
5. CREDIT FOR EXTRA HFO PROD'N	---
6. CATALYSTS REPLACEMENTS COSTS*	4200
7. WAGES*	1760
8. CREDIT FOR LEAD ADDITIVES	---
9. CREDIT FOR MMT	-11251
TOTAL $/CD	24210
TOTAL $MM/YR	8.84

* BASED ON THE FOLLOWING

2 ISOMERIZATION UNITS (ONCE THRU) ADDITIONAL TO BASE CASE

TABLE 8 - 57

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ONTARIO

BASE: CGSB OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 2: CGSB OCTANES (0 MMT 70/30 SPLIT)

1.	POWER COST	1560
2.	FUEL & STEAM COSTS	-17650
3.	COST OF ADDITIONAL CRUDE	38747
4.	COST OF IMPORTED i-C4	-7522
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	8300
7.	WAGES*	1760
8.	CREDIT FOR LEAD ADDITIVES	---
9.	CREDIT FOR MMT	-21765
	TOTAL $/CD	3430
	TOTAL $MM/YR	1.25

* BASED ON THE FOLLOWING

2 ISOMERIZATION UNITS (ONCE THRU) ADDITIONAL TO BASE CASE

TABLE 8 - 58

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: WESTERN

BASE: CGSB OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 2: CGSB OCTANES (0 MMT 70/30 SPLIT)

1.	POWER COST	142
2.	FUEL & STEAM COSTS	-17686
3.	COST OF ADDITIONAL CRUDE	16593
4.	COST OF IMPORTED i-C4	-1374
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	---
7.	WAGES*	---
8.	CREDIT FOR LEAD ADDITIVES	---
9.	CREDIT FOR MMT	-25602
	TOTAL $/CD	-27927
	TOTAL $MM/YR	-10.19

* BASED ON THE FOLLOWING

0 ISOMERIZATION UNITS (--) ADDITIONAL TO BASE CASE

TABLE 8 - 59

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ATLANTIC

BASE: CGSB OCTANES (18mg/L Mn 7Ø/3Ø SPLIT)

CASE 3: CGSB OCTANES (18mg/L 9Ø/1Ø SPLIT)

1.	POWER COST	1.7
2.	FUEL & STEAM COSTS	-387
3.	COST OF ADDITIONAL CRUDE	744
4.	COST OF IMPORTED i-C4	---
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	---
7.	WAGES*	---
8.	CREDIT FOR LEAD ADDITIVES	-17Ø9
9.	CREDIT FOR MMT	1528
	TOTAL $/CD	193
	TOTAL $MM/YR	Ø.Ø7

* BASED ON THE FOLLOWING

Ø ISOMERIZATION UNITS (--) ADDITIONAL TO BASE CASE

TABLE 8 - 60

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: QUEBEC

BASE: CGSB OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 3: CGSB OCTANES (18mg/L Mn 90/10 SPLIT)

1.	POWER COST	32
2.	FUEL & STEAM COSTS	-29640
3.	COST OF ADDITIONAL CRUDE	57696
4.	COST OF IMPORTED i-C4	---
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	---
7.	WAGES*	---
8.	CREDIT FOR LEAD ADDITIVES	-3594
9.	CREDIT FOR MMT	3215
	TOTAL $/CD	27709
	TOTAL $MM/YR	10.11

* BASED ON THE FOLLOWING

0 ISOMERIZATION UNITS (--) ADDITIONAL TO BASE CASE

TABLE 8 - 61

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ONTARIO

BASE: CGSB OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 3: CGSB OCTANES (18mg/L 90/10 SPLIT)

1.	POWER COST	218
2.	FUEL & STEAM COSTS	-18258
3.	COST OF ADDITIONAL CRUDE	22312
4.	COST OF IMPORTED i-C4	-4018
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	---
7.	WAGES*	---
8.	CREDIT FOR LEAD ADDITIVES	-6953
9.	CREDIT FOR MMT	6219
	TOTAL $/CD	-419
	TOTAL $MM/YR	-0.18

* BASED ON THE FOLLOWING

0 ISOMERIZATION UNITS (--) ADDITIONAL TO BASE CASE

TABLE 8 - 62

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: WESTERN

BASE: CGSB OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 3: CGSB OCTANES (18mg/L Mn 90/10 SPLIT)

1. POWER COST	21
2. FUEL & STEAM COSTS	1530
3. COST OF ADDITIONAL CRUDE	5614
4. COST OF IMPORTED i-C4	-1574
5. CREDIT FOR EXTRA HFO PROD'N	---
6. CATALYSTS REPLACEMENTS COSTS*	---
7. WAGES*	---
8. CREDIT FOR LEAD ADDITIVES	-8179
9. CREDIT FOR MMT	7315
TOTAL $/CD	4727
TOTAL $MM/YR	1.7

* BASED ON THE FOLLOWING

0 ISOMERIZATION UNITS (--) ADDITIONAL TO BASE CASE

TABLE 8 - 63

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ATLANTIC

BASE: MARKET OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 2: MARKET OCTANES (0 MMT 70/30 SPLIT)

1.	POWER COST	102
2.	FUEL & STEAM COSTS	1592
3.	COST OF ADDITIONAL CRUDE	-921
4.	COST OF IMPORTED i-C4	---
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	4600
7.	WAGES*	880
8.	CREDIT FOR LEAD ADDITIVES	---
9.	CREDIT FOR MMT	-11251
	TOTAL $/CD	-4998
	TOTAL $MM/YR	-1.8

* BASED ON THE FOLLOWING

2 ISOMERIZATION UNITS (SIEVE SECT) ADDITIONAL TO BASE CASE
1 ISOMERIZATION UNIT (ONCE THRU) LESS THAN BASE CASE

TABLE 8 - 64

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: QUEBEC

BASE: MARKET OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 2: MARKET OCTANES (0 MMT 70/30 SPLIT)

1.	POWER COST	525
2.	FUEL & STEAM COSTS	-22945
3.	COST OF ADDITIONAL CRUDE	47157
4.	COST OF IMPORTED i-C4	---
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	11300
7.	WAGES*	2640
8.	CREDIT FOR LEAD ADDITIVES	---
9.	CREDIT FOR MMT	-11251
	TOTAL $/CD	27426
	TOTAL $MM/YR	10.0

* BASED ON THE FOLLOWING

3 ISOMERIZATION UNITS (SIEVE SECT) ADDITIONAL TO BASE CASE

TABLE 8 - 65

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ONTARIO

BASE: MARKET OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 2: MARKET OCTANES (0 MMT 70/30 SPLIT)

1.	POWER COST	1454
2.	FUEL & STEAM COSTS	-31167
3.	COST OF ADDITIONAL CRUDE	61168
4.	COST OF IMPORTED i-C4	-9395
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	15400
7.	WAGES*	1760
8.	CREDIT FOR LEAD ADDITIVES	---
9.	CREDIT FOR MMT	-21765
	TOTAL $/CD	17455
	TOTAL $MM/YR	6.4

* BASED ON THE FOLLOWING

2 ISOMERIZATION UNITS (ONCE THRU) ADDITIONAL TO BASE CASE

TABLE 8 - 66

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: WESTERN

BASE: MARKET OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 2: MARKET OCTANES (0 MMT 70/30 SPLIT)

1.	POWER COST	904
2.	FUEL & STEAM COSTS	-44527
3.	COST OF ADDITIONAL CRUDE	54077
4.	COST OF IMPORTED i-C4	-3549
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	---
7.	WAGES*	---
8.	CREDIT FOR LEAD ADDITIVES	---
9.	CREDIT FOR MMT	-25602
	TOTAL $/CD	-18697
	TOTAL $MM/YR	-6.82

* BASED ON THE FOLLOWING

0 ISOMERIZATION UNITS (--) ADDITIONAL TO BASE CASE

TABLE 8 - 67

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ATLANTIC

BASE: MARKET OCTANES (18mg/L Mn 7Ø/3Ø SPLIT)

CASE 3: MARKET OCTANES (18mg/L Mn 9Ø/1Ø SPLIT)

1.	POWER COST	-187
2.	FUEL & STEAM COSTS	812
3.	COST OF ADDITIONAL CRUDE	-17Ø1
4.	COST OF IMPORTED i-C4	---
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	35ØØ
7.	WAGES*	88Ø
8.	CREDIT FOR LEAD ADDITIVES	-17Ø9
9.	CREDIT FOR MMT	1397
	TOTAL $/CD	2992
	TOTAL $MM/YR	1.1

* BASED ON THE FOLLOWING

2 ISOMERIZATION UNITS (SIEVE SECT) ADDITIONAL TO BASE CASE
1 ISOMERIZATION UNITS (ONCE THRU) LESS THAN BASE CASE

TABLE 8 - 68

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: QUEBEC

BASE: MARKET OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 3: MARKET OCTANES (18mg/L Mn 90/10 SPLIT)

1.	POWER COST	399
2.	FUEL & STEAM COSTS	-7236
3.	COST OF ADDITIONAL CRUDE	20539
4.	COST OF IMPORTED i-C4	---
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	9300
7.	WAGES*	880
8.	CREDIT FOR LEAD ADDITIVES	-3594
9.	CREDIT FOR MMT	3215
	TOTAL $/CD	23503
	TOTAL $MM/YR	8.58

* BASED ON THE FOLLOWING

2 ISOMERIZATION UNITS (SIEVE SECT) ADDITIONAL TO BASE CASE
1 ISOMERIZATION UNIT (ONCE THRU) LESS THAN BASE CASE

TABLE 8 - 69

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: ONTARIO

BASE: MARKET OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 3: MARKET OCTANES (18mg/L Mn 90/10 SPLIT)

1.	POWER COST	624
2.	FUEL & STEAM COSTS	-2167
3.	COST OF ADDITIONAL CRUDE	5696
4.	COST OF IMPORTED i-C4	-2991
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	12400
7.	WAGES*	880
8.	CREDIT FOR LEAD ADDITIVES	-6953
9.	CREDIT FOR MMT	6219
	TOTAL $/CD	13708
	TOTAL $MM/YR	5.0

* BASED ON THE FOLLOWING

1 ISOMERIZATION UNITS (ONCE THRU) ADDITIONAL TO BASE CASE

TABLE 8 - 70

SUMMARY OF INCREMENTAL PROCESS OPERATING COSTS

REGION: WESTERN

BASE: MARKET OCTANES (18mg/L Mn 70/30 SPLIT)

CASE 3: MARKET OCTANES (18mg/L Mn 90/10 SPLIT)

1.	POWER COST	-112
2.	FUEL & STEAM COSTS	100
3.	COST OF ADDITIONAL CRUDE	5116
4.	COST OF IMPORTED i-C4	-2576
5.	CREDIT FOR EXTRA HFO PROD'N	---
6.	CATALYSTS REPLACEMENTS COSTS*	---
7.	WAGES*	---
8.	CREDIT FOR LEAD ADDITIVES	-8179
9.	CREDIT FOR MMT	7315
	TOTAL $/CD	1664
	TOTAL $MM/YR	0.61

* BASED ON THE FOLLOWING

0 ISOMERIZATION UNITS (--) ADDITIONAL TO BASE CASE

TABLE 8-71

ANNUAL OPERATING COST

REGION: ATLANTIC

	CGSB Octanes		Market Octanes	
	Case2	Case3	Case2	Case3
CAPITAL EQUIPMENT COST - $ MM/YR				
Isomerization Units	14.02	-	41.92	35.30
Offsites	3.92	-	11.80	10.02
Crude Inventory	0.27	0.02	-0.03	0.05
Total	18.21	0.02	53.69	45.37

ANNUAL OPERATING COST $ MM/YR

	CGSB Octanes		Market Octanes	
	Case2	Case3	Case2	Case3
Capital Charges (25%)	4.55	-	13.42	11.34
Insurance (0.5%)	0.09	-	0.27	0.23
Local Taxes (1.0%)	0.18	-	0.54	0.45
Maintenance (5.5%	1.00	-	2.95	2.49
Process Operating Cost (Incremental Total)	0.67	0.07	-1.80	1.10
Total	6.49	0.07	15.38	15.61
Incremental Annual Operating Cost (Case1 - BASE)	6.49	0.07	2.592	2.822

TABLE 8 - 72

ANNUAL OPERATING COST

REGION: QUEBEC

	CGSB Octanes		Market Octanes	
	Case2	Case3	Case2	Case3
CAPITAL EQUIPMENT COST - $ MM/YR				
Isomerization Units	31.38	-	90.84	69.65
Offsites	8.72	-	25.26	19.35
Crude Inventory	1.66	1.73	1.41	0.62
Total	41.76	1.73	117.61	89.62

ANNUAL OPERATING COST $ MM/YR

	CGSB Octanes		Market Octanes	
	Case2	Case3	Case2	Case3
Capital Charges (25%)	10.44	0.43	29.40	22.40
Insurance (0.5%)	0.20	-	0.59	0.45
Local Taxes (1.0%)	0.40	-	1.18	0.90
Maintenance (5.5%	2.22	-	6.47	4.93
Process Operating Cost (Incremental Total)	8.84	10.11	10.00	8.58
Total	22.10	10.54	47.64	37.26
Incremental Annual Operating Cost (Case1 - BASE)	22.10	10.54	25.585	15.205

TABLE 8 - 73

ANNUAL OPERATING COST

REGION: ONTARIO

	CGSB Octanes		Market Octanes	
	Case2	Case3	Case2	Case3
CAPITAL EQUIPMENT COST - $ MM/YR				
Isomerization Units	50.68	-	70.01	75.24
Offsites	13.82	-	19.17	20.51
Crude Inventory	1.16	0.67	1.84	0.17
Total	65.66	0.67	91.02	95.92

ANNUAL OPERATING COST $ MM/YR

	CGSB Octanes		Market Octanes	
	Case2	Case3	Case2	Case3
Capital Charges (25%)	16.42	0.17	22.76	23.98
Insurance (0.5%)	0.33	-	0.46	0.48
Local Taxes (1.0%)	0.66	-	0.91	0.96
Maintenance (5.5%	3.61	-	5.00	5.28
Process Operating Cost (Incremental Total)	1.25	-0.18	6.4	5.00
Total	22.27	-0.01	35.53	35.70
Incremental Annual Operating Cost (Case1 - BASE)	22.27	-0.01	13.31	13.48

TABLE 8 - 74

ANNUAL OPERATING COST

REGION: WESTERN

	CGSB Octanes		Market Octanes	
	Case2	Case3	Case2	Case3
CAPITAL EQUIPMENT COST - $ MM/YR				
Isomerization Units	-	-	-	-
Offsites	-	-	-	-
Crude Inventory	Ø.5	Ø.17	1.62	Ø.15
Total	Ø.5	Ø.17	1.62	Ø.15

ANNUAL OPERATING COST $ MM/YR

	CGSB Octanes		Market Octanes	
	Case2	Case3	Case2	Case3
Capital Charges (25%)	Ø.13	Ø.Ø4	Ø.4	Ø.Ø4
Insurance (Ø.5%)	-	-	-	-
Local Taxes (1.Ø%)	-	-	-	-
Maintenance (5.5%	-	-	-	-
Process Operating Cost (Incremental Total)	-1Ø.19	1.7	-6.82	Ø.61
Total	-1Ø.Ø6	1.74	-6.42	Ø.65
Incremental Annual Operating Cost (Case1 - BASE)	-1Ø.Ø6	1.74	-6.42	Ø.65

TABLE 8 - 75

ANNUAL OPERATING COST

REGION: CANADA

CAPITAL EQUIPMENT COST - $ MM/YR	CGSB Octanes Case2	CGSB Octanes Case3	Market Octanes Case2	Market Octanes Case3
Isomerization Units	96.07	-	202.77	180.19
Offsites	26.46	-	56.33	49.88
Crude Inventory	3.59	2.59	4.84	0.99
Total	126.13	2.59	263.94	231.06

ANNUAL OPERATING COST $ MM/YR

	CGSB Octanes Case2	CGSB Octanes Case3	Market Octanes Case2	Market Octanes Case3
Capital Charges (25%)	31.54	0.64	65.98	57.76
Insurance (0.5%)	0.62	-	1.32	1.16
Local Taxes (1.0%)	1.24	-	2.63	2.31
Maintenance (5.5%	6.83	-	14.42	12.70
Process Operating Cost (Incremental Total)	0.57	11.70	7.78	15.29
Total	40.80	12.34	92.13	89.22
Incremental Annual Operating Cost (Case1 - BASE)	40.80	12.34	35.067	32.157

TABLE 8 - 76

SUMMARY OF ANNUAL INCREMENTAL OPERATING COSTS

(CASE - BASE)

REGION: CANADA

REGION	CGSB OCTANES MM $/YR		MARKET OCTANES MM $/YR	
	CASE 2	CASE 3	CASE 2	CASE 3
ATLANTIC	6.49	0.07	2.592	2.822
QUEBEC	22.10	10.54	25.585	15.205
ONTARIO	22.27	-0.01	13.31	13.48
WESTERN	-10.06	1.74	-6.42	0.65
CANADA	40.80	12.34	35.067	32.157

CONCLUSIONS

(ADDITIONAL STUDY CASES)

Eliminating MMT antiknock additive from unleaded motor gasoline or changing grade split as studied in the four additional cases will require more severe operation of existing, as well as the addition of, new octane improvement facilities with attendent costs and energy penalties.

The overall incremental cost to the oil refining industry in 1990 for the additional cases studied is as follows:

(1st quarter 1984 dollars)

	CSGB OCTANES CASE 2	CSGB OCTANES CASE 3	MARKET OCTANES CASE 2	MARKET OCTANES CASE 3
Capital cost $	126,130,000	2,590,000	85,580,000	52,730,000
Annual Operating Cost $ (including cost of capital)	40,800,000	12,340,000	35,067,000	32,157,000

The study constraints were maximum use of existing equipment and minimum crude oil consumption. In arriving at the above costs priority was first given to maximum use of existing equipment. If existing equipment could not meet octane requirements and additional equipment was shown to be needed, then the new combination of processes was operated for minimum crude consumption.

It is recognized, therefore, that more definitive evaluation of the individual refineries may show some reduction in capital investment at the expense of increased crude oil requirements and energy penalties.

Since no allowance was made in the simulation for any octane give away due to reduced blending flexibility in the absence of MMT additive, these costs, from a study standpoint, may be considered to be the minimum that will be required. To maintain control of blending, the refineries may have to carry larger inventories of the higher octane components, run catalytic reforming at maximum severity or add additional selective processing to separate a blending component of significantly higher octane than those used in the study. All of these carry additional costs and processing penalties over those presented. An overview of processing severity and selectivity is given in Section 5.2.

A complete assessment of all the various possibilities would have to be carried out to determine the optimum solution for any particular location.

The Western region, however, is of particular interest. The area contains 11 refineries made up of several large refineries in the Prairie provinces and a number of smaller refineries on the West Coast and in the interior of British Columbia.

The study showed that all additional cases could be met without the addition of new processing equipment.

While allowance was made for the higher octane requirements in the B.C. market area, the greater processing capabilities of the larger more modern refineries in the prairies may have overshadowed the real effect that withdrawal of MMT or changing grade split would have on smaller, older refineries in British Columbia.

9. - INDEX

REFINERY SIMULATIONS

A - CGSB OCTANES

RUN			
ATLBAS 41	18 mg/l	Mn	70/30 split
ATLBAS 40	0 MMT		90/10 split
QUEBAS 41	18 mg/l	Mn	70/30 split
QUEBAS 40	0 MMT		90/10 split
ONTBAS 41	18 mg/l	Mn	70/30 split
ONTBAS 40	0 MMT		90/10 split
WESBAS 41	18 mg/l	Mn	70/30 split
WESBAS 40	0 MMT		90/10 split

B - MARKET OCTANES

RUN			
ATLBAS 11	18 mg/l	Mn	70/30 split
ATLBAS 10	0 MMT		90/10 split
QUEBAS 11	18 mg/l	Mn	70/30 split
QUEBAS 10	0 MMT		90/10 split
ONTBAS 11	18 mg/l	Mn	70/30 split
ONTBAS 10	0 MMT		90/10 split
WESBAS 11	18 mg/l	Mn	70/30 split
WESBAS 10	0 MMT		90/10 split

9. - INDEX

REFINERY SIMULATIONS

ADDITIONAL CASES

C - CGSB OCTANES

RUN			
ATLBAS 50	0 MMT		70/30 split
ATLBAS 51	18 mg/l	Mn	90/10 split
QUEBAS 50	0 MMT		90/10 split
QUEBAS 51	18 mg/l	Mn	70/30 split
ONTBAS 50	0 MMT		90/10 split
ONTBAS 51	18 mg/l	Mn	70/30 split
WESBAS 50	0 MMT		90/10 split
WESBAS 51	18 mg/l	Mn	70/30 split

D - MARKET OCTANES

RUN			
ATLBAS 20	0 MMT		70/30 split
ATLBAS 21	18 mg/l	Mn	90/10 split
QUEBAS 20	0 MMT		90/10 split
QUEBAS 21	18 mg/l	Mn	70/30 split
ONTBAS 20	0 MMT		90/10 split
ONTBAS 21	18 mg/l	Mn	70/30 split
WESBAS 20	0 MMT		90/10 split
WESBAS 21	18 mg/l	Mn	70/30 split

"A"

TIME:11.03.05 DATE:TUEMAY 11984122 51

REFINERY SIMULATION PROGRAM

CASE:ATLBAS41 REGION:ATLANTIC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	33	44730.5
VENEZL	7	9488.29
ARABL	30.6	41477.4
SYNCRUDE	15	20332.1
MEXL	9.9	13419.2
NORTHSEA	4.5	6099.62

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				135547	1.7126E+06	20596.3
Average		.867354	31.6399	1.20263			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	135547	1.7126E+06	60	1360	.867353	31.64	1.20263	20596.3
	*** PRODUCT ***								
2	OVERHEAD	8661.55	80922.8	60	170.322	.641365	89.1234	.0145586	11.7813
28	LSR	6481.08	63019.7	60	170.322	.667511	80.4815	.0187849	11.8382
3	NAPHTHA	12475.7	132364	170.322	280.176	.728341	62.7771	.0234412	31.0277
4	KEROSENE	35828.8	422344	280.176	540	.809215	43.3608	.174053	735.102
5	LGO	16918.7	214548	540	660	.870536	31.0435	.767538	1646.74
1	REDUCED CRUDE	61662.2	862422	660	1360	.960131	15.8757	2.10705	18171.7

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	61662.2	862422	660	1360	.960131	15.8757	2.10705	18171.7
	*** PRODUCT ***								
6	HVGO	43663	585558	660	1050	.920633	22.1986	1.3757	8055.53
7	RESIDUUM	17999.2	276864	1050	1360	1.05595	2.50256	3.65395	10116.5

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	0	0	540	660	.870536	31.0435	.767538	0
64	HVGO	43600	584714	660	1050	.920633	22.1986	1.3757	8043.9
	*** TOTAL FEED ***								
8	FCCU FEED	43600	584714	540	1050	.920633	22.1986	1.3757	8043.9
	*** PRODUCT ***								
12	LCO	11266.2	157834	430	650	.961731	15.6305	1.72064	2715.76
13	HCO	2816.56	43022	650	787.405	1.04858	3.44441	2.71861	1169.6
14	CRACKED GAS	21741.5	236915			.748055	57.6572	.181333	429.605
39	C3/C4 -FCCU	8575.44	70463.1			.564073	119.354	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 2604.38

AVAILABLE C3/C4 OLEFINS= 8575.44

CONVERSION Wt%= 65.6487 CONVERSION Vol %= 67.7

COKE, WT% 8.2139

COKE ,#/HR 48052.5 Sulfur in Flue Gas,Lbs/hr= 329.278

CAT POLY UNIT

*** FEED ***
< 10 > CAT POLY FEED= 8575.44
*** PRODUCT ***
< 15 > POLYMER= 3500.9
< 16 > LE FROM POLY (FOE)= 2690.58

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 0
< 63 > LE FROM ALKYL (FOE)= 0

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
9	REFORMER FEED	9600	101854	170.322	280.176	.728341	62.7771	0	0
		*** PRODUCT ***							
17	REFORMATE	7661.83	86856.7			.778217	50.3258	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 1736.55
CONVERSION(LV%)= 79.8107   Severity (RON Clear)= 94   FEED KW= 12.1621

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 8661.55
< 57 > LE FROM REFORMER (FOE)= 1736.55
< 18 > LE FROM CAT CRACKER (FOE)= 2604.38
< 16 > LE FROM POLY (FOE)= 2690.58
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 5300.05
< 20 > I-C4 FR. GAS PLANT= 0
< 49 > REF C4 TO BLENDING = 2762.38
< 69 > LSR= 6287.37

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 6287.37
*** PRODUCT ***
< 29 > LSR+ISO= 6287.37

*** BY-PASS= 100 %   ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 6287.37
< 26 > REFORMATE= 7661.83
< 50 > ALKYLATE= 0
< 15 > POLYMER= 3500.9
< 14 > CRACKED GAS= 21741.5
< 49 > REF C4 TO BLENDING = 2762.38
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 12580

< 23 > UNLEADED REGULAR= 26418
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.268387	.11023	0	0
CRACKED GAS	.468261	.6	0	0
REFORMATE	.206894	.0879098	.92581	0
POLYMER	0	.132519	0	0
ALKYLATE	0	0	0	.9786
C4	.0564572	.0693409	.0741903	.0214

<u>TURBO FUEL BLENDING</u>

*** FEED ***
< 30 > LSR= 193.71
< 58 > NAPHTHA= 1527.75
< 59 > KEROSENE= 4442.55
*** PRODUCT ***
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.48	.155
KEROSENE	.41	.845

<u>DISTILLATE BLENDING</u>

*** FEED ***
< 60 > KEROSENE= 31386.3
< 40 > LGO= 16918.5
< 38 > LCO= 8683.24
*** PRODUCT ***
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.607	.451225
LCO	0	.139	.180121
LGO	0	.254	.368654

<u>HEAVY FUEL OIL BLENDING</u>

*** FEED ***
< 41 > LGO= .229248
< 35 > LCO= 2583
< 13 > HCO= 2816.56
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 8501.21

*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 13901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 0
< 36 > HVGO TO LUBE OIL= 63
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	35828.8	35828.8	422344	.174053	0	8.71707E-03
LGO	16918.7	16918.7	214548	.767538	0	.0772877
LCO	11266.2	7886.37	110484	1.72064	29.9997	.64361
HCO	2816.56	0	0	2.71861	100	2.71861
VAC RESIDUUM	8501.21	0	0	3.65395	100	3.65395

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	1761	4403	2390	26607	27991	13901
S.G.	.754808	.79668	.809215	.859293	.84599	1.03695
ASTM 10%	207.037	288.204	351.738	379.771	368.853	
ASTM 20%	223.755	319.815	368.14	421.939	398.955	
ASTM 50%	268.955	393.719	415.548	525.497	484.551	
ASTM 90%	471.652	493.722	497.527	610.724	603.371	
RVP,psia	2.31506					
Sulfur Wt %	.0165099	.0107912	8.70266E-03	.160706	.125713	2.94227
Flash Point,F	64.6157	102.201	129.046	144.607	138.326	
Pour Point,F	-79.7885	-54.2954	-44.1417	-29.9256	-35.6821	
Cetane No.					44.8894	
Visc @100F,cs	.796948	1.26686	1.5093	2.62049	2.19975	1221.66
Visc @122F,cs	.702946	1.09515	1.29361	2.16959	1.84238	463.185
Watsons K	12.0468	11.8554	11.8137	11.4716	11.5483	10.8107
MeABP	291.844	382.566	413.68	497.847	472.502	948.87

GASOLINE

LEADED REGULAR,BPCD	12580
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	87.0715 / 78.3686 / 82.7201
RON / MON / (R+M)/2	91.698 / 82.1707 / 86.9344
RVP,psia	10.2104
MMT Addition,mg/l: 18	
UNLEADED REGULAR,BPCD	26418
RON / MON / (R+M)/2	92.3 / 81.8437 / 87.0718
RVP,psia	9.99489
UNLEADED PREMIUM,BPCD	2956

RON / MON / (R+M)/2	95.1389 / 85.0009 / 90.0699
RVP,psia	9.87528
AVIATION GASOLINE,BPCD	0
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 135547	< 1 > REDUCED CRUDE= 61662.2
< 2 > OVERHEAD= 8661.55	< 3 > NAPHTHA= 12475.7
< 4 > KEROSENE= 35828.8	< 5 > LGO= 16918.7
< 6 > HVGO= 43663	< 7 > RESIDUUM= 17999.2
< 8 > FCCU FEED= 43600	< 9 > REFORMER FEED= 9600
< 10 > CAT POLY FEED= 8575.44	< 11 > ALKYLATION FEED= 0
< 12 > LCO= 11266.2	< 13 > HCO= 2816.56
< 14 > CRACKED GAS= 21741.5	< 15 > POLYMER= 3500.9
< 16 > LE FROM POLY (FOE)= 2690.58	< 17 > REFORMATE= 7661.83
< 18 > LE FROM CAT CRACKER (FOE)= 2604.38	< 19 > FUEL GAS (FOE)= 5300.05
< 20 > I-C4 FR. GAS PLANT= 0	< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 12580	< 23 > UNLEADED REGULAR= 26418
< 24 > UNLEADED PREMIUM= 2956	< 25 > AVIATION GASOLINE= 0
< 26 > REFORMATE= 7661.83	< 27 > NAPHTHA SPECIALTIES= 0
< 28 > LSR= 6481.08	< 29 > LSR+ISO= 6287.37
< 30 > LSR= 193.71	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 61662.2	< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 34 > VAC RESIDUUM= 8501.21	< 35 > LCO= 2583
< 36 > HVGO TO LUBE OIL= 63	< 37 > HVGO= 0
< 38 > LCO= 8683.24	< 39 > C3/C4 -FCCU= 8575.44
< 40 > LGO= 16918.5	< 41 > LGO= .229248
< 42 > JET FUEL B= 1761	< 43 > JET FUEL A= 4403
< 44 > STOVE OIL= 2390	< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991	< 47 > HEAVY FUEL OIL= 13901
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 2762.38
< 50 > ALKYLATE= 0	< 51 > CRUDE LIGHT ENDS= 1.60865
< 52 > TOTAL PRODUCT= 129916	< 53 > C2 % IN CRUDE FEED= .02451
< 54 > C3 % IN CRUDE FEED= .31962	< 55 > I-C4 % IN CRUDE FEED= .19662
< 56 > N-C4 % IN CRUDE FEED= 1.0679	< 57 > LE FROM REFORMER (FOE)= 1736.55
< 58 > NAPHTHA= 1527.75	< 59 > KEROSENE= 4442.55
< 60 > KEROSENE= 31386.3	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 0	< 63 > LE FROM ALKYL (FOE)= 0
< 64 > HVGO= 43600	< 65 > LGO = 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348	< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0	< 69 > LSR= 6287.37

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	174.219	1332.89	8250.92	0	0	0	9758.03
C3 ,#/HR	3205.94	3536.2	7341.38	7576.02	0	0	21659.5
IC4 ,#/HR	2193.4	2205.41	17330.9	18740.1	0	0	40469.8
NC4 ,#/HR	12335.7	3218.57	7019.88	7019.88	0	0	29594
H2 ,#/HR	0	3370.82	3208.63	0	0	0	6579.45
C1 ,#/HR	0	1332.89	3421.11	0	0	0	4754
H2S ,#/HR	0	0	3612.14	0	0	0	3612.14
C2= ,#/HR	0	0	5031.05	0	0	0	5031.05
C3= ,#/HR	0	0	17285.9	0	0	0	17285.9
C4= ,#/HR	0	0	26462.5	0	0	0	26462.5
TOTAL ,#/HR	17909.3	14996.8	98964.4	33336	0	0	165206
BPCD (FOE)	1446.8	1736.55	8169.86	2690.57	0	0	14043.8

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	9758.03	9758.03
C3 ,#/HR	6166.76	0	0	0	0	15492.8	21659.5
IC4 ,#/HR	17330.9	0	11705.7	0	0	11433.2	40469.8
NC4 ,#/HR	7019.88	0	11420	0	0	11154.2	29594
H2 ,#/HR	0	0	0	0	5500.29	1079.16	6579.45
C1 ,#/HR	0	0	0	0	0	4754	4754
H2S ,#/HR	0	0	0	0	0	3612.14	3612.14
C2= ,#/HR	0	0	0	0	0	5031.05	5031.05
C3= ,#/HR	13483	0	0	0	0	3802.9	17285.9
C4= ,#/HR	26462.5	0	0	0	0	0	26462.5
TOTAL ,#/HR	70463.1	0	23125.7	0	5500.29	66117.4	165206
BPCD (FOE)	5614.42	0	1859.85	0	1269.47	5300.05	14043.8

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	135547	1.7126E+06
BUTANE	0	0
TOTAL	135547	1.7126E+06

*** PRODUCT ***

FUEL GAS (FOE)	5300.05	66117.4
MOTOR GASOLINE	41954	445161
AVIATION TURBO FUELS	6164	70460.6
DISTILLATES	56988	706169
HEAVY FUEL OIL	13901	209978
OTHER PRODUCTS	10909	161245
H2 TO DESULFURIZERS (FOE)	1269.47	5500.29
COKE (FOE)	2559.28	48052.5
TOTAL	139045	1.71268E+06

TIME:11.49.55 DATE:TUEMAY 11984122 51

REFINERY SIMULATION PROGRAM

CASE:ATLBAS40 REGION:ATLANTIC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	33	44862.1
VENEZL	7	9516.2
ARABL	30.6	41599.4
SYNCRUDE	15	20391.8
MEXL	9.9	13458.6
NORTHSEA	4.5	6117.55

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				135946	1.71764E+06	20656.9
Average		.867354	31.6399	1.20263			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	135946	1.71764E+06	60	1360	.867352	31.6402	1.20263	20656.9
	*** PRODUCT ***								
2	OVERHEAD	8659.74	80885.6	60	170.026	.641204	89.1785	.0145871	11.7988
28	LSR	6472.86	62927.3	60	170.026	.667379	80.5235	.018782	11.819
3	NAPHTHA	12525.7	132876	170.026	280.063	.728242	62.8035	.0234168	31.1154
4	KEROSENE	35948.2	423741	280.063	540	.809196	43.3649	.174003	737.323
5	LGO	16968.5	215179	540	660	.870536	31.0435	.767538	1651.58
1	REDUCED CRUDE	61843.5	864957	660	1360	.960131	15.8757	2.10705	18225.1

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	61843.5	864957	660	1360	.960131	15.8757	2.10705	18225.1
	*** PRODUCT ***								
6	HVGO	43793	587302	660	1050	.920633	22.1986	1.3757	8079.51
7	RESIDUUM	18050.5	277653	1050	1360	1.05595	2.50256	3.65395	10145.3

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	0	0	540	660	.870536	31.0435	.767538	0
64	HVGO	43730	586457	660	1050	.920633	22.1986	1.3757	8067.89
	*** TOTAL FEED ***								
8	FCCU FEED	43730	586457	540	1050	.920633	22.1986	1.3757	8067.89
	*** PRODUCT ***								
12	LCO	11089.9	155484	430	650	.96247	15.5176	1.74048	2706.16
13	HCO	2772.48	42418.6	650	784.982	1.05031	3.22214	2.74995	1166.49
14	CRACKED GAS	21935	239024			.748055	57.6572	.179053	427.98
39	C3/C4 -FCCU	8706.3	71540.3			.564088	119.347	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 2668.18

AVAILABLE C3/C4 OLEFINS= 8706.3

CONVERSION Wt%= 66.2545   CONVERSION Vol %= 68.3

COKE, WT% 8.33946

COKE ,#/HR 48932.5   Sulfur in Flue Gas,Lbs/hr= 335.18

CAT POLY UNIT

*** FEED ***
< 10 > CAT POLY FEED= 8706.3
*** PRODUCT ***
< 15 > POLYMER= 3553.68
< 16 > LE FROM POLY (FOE)= 2732.35

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 0
< 63 > LE FROM ALKYL (FOE)= 0

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
9	REFORMER FEED	9650	102370	170.026	280.063	.728242	62.8035	0	0
		*** PRODUCT ***							
17	REFORMATE	7515.13	85783.1			.783601	49.0765	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 1936.13
CONVERSION(LV%)= 77.877 Severity (RON Clear)= 96 FEED KW= 12.1627

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 8659.74
< 57 > LE FROM REFORMER (FOE)= 1936.13
< 18 > LE FROM CAT CRACKER (FOE)= 2668.18
< 16 > LE FROM POLY (FOE)= 2732.35
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 5750.72
< 20 > I-C4 FR. GAS PLANT= 0
< 49 > REF C4 TO BLENDING = 2771.5
< 69 > LSR= 6279.15

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 6279.15
*** PRODUCT ***
< 29 > LSR+ISO= 6178.68

*** BY-PASS= 0 % ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 6178.68
< 26 > REFORMATE= 7515.13
< 50 > ALKYLATE= 0
< 15 > POLYMER= 3553.68
< 14 > CRACKED GAS= 21935
< 49 > REF C4 TO BLENDING = 2771.5
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 4195

< 23 > UNLEADED REGULAR= 34803
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.539943	.112451	0	0
CRACKED GAS	.224833	.58	.272692	0
REFORMATE	.200012	.136475	.651671	0
POLYMER	0	.102109	0	0
ALKYLATE	0	0	0	.9786
C4	.0352119	.0689655	.0756379	.0214

<u>TURBO FUEL BLENDING</u>

*** FEED ***
< 30 > LSR= 193.71
< 58 > NAPHTHA= 1527.75
< 59 > KEROSENE= 4442.55
*** PRODUCT ***
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.48	.155
KEROSENE	.41	.845

<u>DISTILLATE BLENDING</u>

*** FEED ***
< 60 > KEROSENE= 31505.6
< 40 > LGO= 16967.5
< 38 > LCO= 8514.93
*** PRODUCT ***
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.607	.455709
LCO	0	.139	.173796
LGO	0	.254	.370495

<u>HEAVY FUEL OIL BLENDING</u>

*** FEED ***
< 41 > LGO= .987061
< 35 > LCO= 2575
< 13 > HCO= 2772.48
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 8552.53

*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 13901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 0
< 36 > HVGO TO LUBE OIL= 63
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	35948.2	35948.2	423741	.174003	0	8.71456E-03
LGO	16968.5	16968.5	215179	.767538	0	.0772877
LCO	11089.9	7762.95	108839	1.74048	29.9998	.651114
HCO	2772.48	0	0	2.74995	100	2.74995
VAC RESIDUUM	8552.53	0	0	3.65395	100	3.65395

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	1761	4403	2390	26607	27991	13901
S.G.	.754738	.796648	.809196	.858561	.846082	1.0375
ASTM 10%	206.861	288.039	351.646	379.136	368.76	
ASTM 20%	223.587	319.689	368.065	421.13	398.882	
ASTM 50%	268.828	393.667	415.499	524.949	484.533	
ASTM 90%	471.636	493.713	497.518	610.728	603.373	
RVP,psia	2.8026					
Sulfur Wt %	.0164968	.0107854	8.70016E-03	.158036	.126936	2.95397
Flash Point,F	64.5172	102.11	128.996	144.254	138.276	
Pour Point,F	-79.8131	-54.3223	-44.1609	-29.6624	-35.7828	
Cetane No.					44.8498	
Visc @100F,cs	.796471	1.2663	1.50884	2.60917	2.1995	1272.06
Visc @122F,cs	.702542	1.0947	1.29323	2.16107	1.84214	478.679
Watsons K	12.0473	11.8555	11.8137	11.4793	11.5469	10.8088
MeABP	291.718	382.486	413.627	497.334	472.463	950.35

GASOLINE

LEADED REGULAR,BPCD	4195
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	84.9992 / 78.7942 / 81.8967
RON / MON / (R+M)/2	90.3824 / 83.5573 / 86.9699
RVP,psia	12.4889
MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	34803
RON / MON / (R+M)/2	91.9 / 82.1494 / 87.0247
RVP,psia	10.3958
UNLEADED PREMIUM,BPCD	2956

RON / MON / (R+M)/2	95 / 85.1105 / 90.0553
RVP,psia	9.84973
AVIATION GASOLINE,BPCD	0
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 135946	< 1 > REDUCED CRUDE= 61843.5
< 2 > OVERHEAD= 8659.74	< 3 > NAPHTHA= 12525.7
< 4 > KEROSENE= 35948.2	< 5 > LGO= 16968.5
< 6 > HVGO= 43793	< 7 > RESIDUUM= 18050.5
< 8 > FCCU FEED= 43730	< 9 > REFORMER FEED= 9650
< 10 > CAT POLY FEED= 8706.3	< 11 > ALKYLATION FEED= 0
< 12 > LCO= 11089.9	< 13 > HCO= 2772.48
< 14 > CRACKED GAS= 21935	< 15 > POLYMER= 3553.68
< 16 > LE FROM POLY (FOE)= 2732.35	< 17 > REFORMATE= 7515.13
< 18 > LE FROM CAT CRACKER (FOE)= 2668.18	< 19 > FUEL GAS (FOE)= 5750.72
< 20 > I-C4 FR. GAS PLANT= 0	< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 4195	< 23 > UNLEADED REGULAR= 34803
< 24 > UNLEADED PREMIUM= 2956	< 25 > AVIATION GASOLINE= 0
< 26 > REFORMATE= 7515.13	< 27 > NAPHTHA SPECIALTIES= 0
< 28 > LSR= 6472.86	< 29 > LSR+ISO= 6178.68
< 30 > LSR= 193.71	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 61843.5	< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 34 > VAC RESIDUUM= 8552.53	< 35 > LCO= 2575
< 36 > HVGO TO LUBE OIL= 63	< 37 > HVGO= 0
< 38 > LCO= 8514.93	< 39 > C3/C4 -FCCU= 8706.3
< 40 > LGO= 16967.5	< 41 > LGO= .987061
< 42 > JET FUEL B= 1761	< 43 > JET FUEL A= 4403
< 44 > STOVE OIL= 2390	< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991	< 47 > HEAVY FUEL OIL= 13901
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 2771.5
< 50 > ALKYLATE= 0	< 51 > CRUDE LIGHT ENDS= 1.60865
< 52 > TOTAL PRODUCT= 129916	< 53 > C2 % IN CRUDE FEED= .02451
< 54 > C3 % IN CRUDE FEED= .31962	< 55 > I-C4 % IN CRUDE FEED= .19662
< 56 > N-C4 % IN CRUDE FEED= 1.0679	< 57 > LE FROM REFORMER (FOE)= 1936.13
< 58 > NAPHTHA= 1527.75	< 59 > KEROSENE= 4442.55
< 60 > KEROSENE= 31505.6	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 0	< 63 > LE FROM ALKYL (FOE)= 0
< 64 > HVGO= 43730	< 65 > LGO = 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348	< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0	< 69 > LSR= 6279.15

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	174.732	1527.79	8468.41	0	0	0	10170.9
C3 ,#/HR	3215.37	3963.49	7466.76	7702.88	0	232.329	22580.8
IC4 ,#/HR	2199.85	2334.86	17598.5	19029.3	0	413.419	41575.9
NC4 ,#/HR	12371.9	3407.49	7121.31	7121.31	0	1177.22	31199.2
H2 ,#/HR	0	3825.59	3296.79	0	0	0	7122.38
C1 ,#/HR	0	1527.79	3511.29	0	0	0	5039.08
H2S ,#/HR	0	0	3646.58	0	0	0	3646.58
C2= ,#/HR	0	0	5163.66	0	0	0	5163.66
C3= ,#/HR	0	0	17515.5	0	0	0	17515.5
C4= ,#/HR	0	0	26886.3	0	0	0	26886.3
TOTAL ,#/HR	17961.9	16587	100675	33853.5	0	1822.97	170900
BPCD (FOE)	1451.05	1936.13	8319.04	2732.35	0	147.033	14585.6

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	10170.9	10170.9
C3 ,#/HR	6272.08	0	0	0	0	16308.8	22580.8
IC4 ,#/HR	17598.5	0	11579.7	0	0	12397.7	41575.9
NC4 ,#/HR	7121.31	0	11628.2	0	0	12449.7	31199.2
H2 ,#/HR	0	0	0	0	5494.48	1627.9	7122.38
C1 ,#/HR	0	0	0	0	0	5039.08	5039.08
H2S ,#/HR	0	0	0	0	0	3646.58	3646.58
C2= ,#/HR	0	0	0	0	0	5163.66	5163.66
C3= ,#/HR	13662.1	0	0	0	0	3853.4	17515.5
C4= ,#/HR	26886.3	0	0	0	0	0	26886.3
TOTAL ,#/HR	71540.3	0	23207.9	0	5494.48	70657.8	170900
BPCD (FOE)	5700.26	0	1866.5	0	1268.13	5750.72	14585.6

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	135946	1.71764E+06
BUTANE	0	0
TOTAL	135946	1.71764E+06

*** PRODUCT ***

FUEL GAS (FOE)	5750.72	70657.8
MOTOR GASOLINE	41954	444923
AVIATION TURBO FUELS	6164	70456.7
DISTILLATES	56988	705923
HEAVY FUEL OIL	13901	210089
OTHER PRODUCTS	10909	161243
H2 TO DESULFURIZERS (FOE)	1268.13	5494.48
COKE (FOE)	2606.14	48932.5
TOTAL	139541	1.71772E+06

TIME:08.55.39 DATE:TUEMAY 11984122 51

REFINERY SIMULATION PROGRAM

CASE:QUEBAS41 REGION:QUEBEC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	16.8	46127.8
VENEZH	11.65	31987.5
ARABH	6.95	19082.7
CANDNH	27.3	74957.8
SYNCRUDE	16.3	44755
MEXH	11.6	31850.2
CONDENSA	9.4	25809.6

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				274571	3.53734E+06	63869.4
Average		.884407	28.4943	1.80558			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	274571	3.53734E+06	60	1460	.884407	28.4943	1.80558	63869.4
	*** PRODUCT ***								
2	OVERHEAD	23634.9	220904	60	169.419	.641624	89.0343	.040342	89.1172
28	LSR	18580.1	179299	60	169.419	.66246	82.0978	.0498436	89.3691
3	NAPHTHA	35981.3	387970	169.419	319.244	.740203	59.6638	.0840581	326.12
4	KEROSENE	49902	600967	319.244	540	.826728	39.6567	.423653	2546.01
5	LGO	32013.9	412691	540	660	.884944	28.3971	1.02294	4221.58
1	REDUCED CRUDE	133039	1.91481E+06	660	1460	.988044	11.7123	2.96043	56686.6

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	133039	1.91481E+06	660	1460	.988044	11.7123	2.96043	56686.6
	*** PRODUCT ***								
6	HVGO	86169.5	1.18095E+06	660	1050	.940819	18.9009	1.9963	23575.2
7	RESIDUUM	46869	733858	1050	1460	1.07487	.143829	4.51195	33111.3

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	8896.5	114685	540	660	.884944	28.3971	1.02294	1173.15
64	HVGO	80068.5	1.09733E+06	660	1050	.940819	18.9009	1.9963	21906
	*** TOTAL FEED ***								
8	FCCU FEED	88965	1.21202E+06	540	1050	.935231	19.7995	1.9042	23079.2
	*** PRODUCT ***								
12	LCO	16689.8	242636	430	650	.998009	10.2823	2.91624	7075.86
13	HCO	4172.46	66114.9	650	751.897	1.08777	-1.41736	4.60767	3046.36
14	CRACKED GAS	46168.4	505703			.751936	56.6809	.219494	1109.99
39	C3/C4 -FCCU	19892.6	164100			.566301	118.367	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 7806.95

AVAILABLE C3/C4 OLEFINS= 19975.3

CONVERSION Wt%= 74.5258 CONVERSION Vol %= 76.55

COKE, WT% 12.2711

COKE ,#/HR 148805 Sulfur in Flue Gas,Lbs/hr= 1152.77

CAT POLY UNIT

*** FEED ***
< 10 > CAT POLY FEED= 17500
*** PRODUCT ***
< 15 > POLYMER= 7037.41
< 16 > LE FROM POLY (FOE)= 5628.85

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 3443.12
< 62 > C3/C4 TO ALKYL= 2392.6
< 20 > I-C4 FR. GAS PLANT= 1050.52
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 2430.87
< 63 > LE FROM ALKYL (FOE)= 322.722

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	32600	351511	169.419	319.244	.740203	59.6638	0	0
	*** PRODUCT ***								
17	REFORMATE	27254.7	311401			.784349	48.9045	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 4589.26
CONVERSION(LV%)= 83.6034 Severity (RON Clear)= 90 FEED KW= 12.0559

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 23634.9
< 57 > LE FROM REFORMER (FOE)= 4589.26
< 18 > LE FROM CAT CRACKER (FOE)= 7806.95
< 16 > LE FROM POLY (FOE)= 5628.85
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 15377.7
< 20 > I-C4 FR. GAS PLANT= 1050.52
< 49 > REF C4 TO BLENDING = 5355.82
< 69 > LSR= 18185.8

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 18185.8
*** PRODUCT ***
< 29 > LSR+ISO= 18185.8

*** BY-PASS= 100 % ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 18185.8
< 26 > REFORMATE= 9705.71
< 50 > ALKYLATE= 2430.87
< 15 > POLYMER= 7037.41
< 14 > CRACKED GAS= 46168.4
< 49 > REF C4 TO BLENDING = 5355.82
< 68 > IMPORTED C4= 0
*** PRODUCT ***

< 22 > LEADED REGULAR= 26456
< 23 > UNLEADED REGULAR= 53805
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.297751	.19159	0	0
CRACKED GAS	.327806	.575	.827521	0
REFORMATE	.320759	.0226693	0	0
POLYMER	0	.130795	0	0
ALKYLATE	0	.0177492	.1	.9786
C4	.0536846	.0621972	.0724793	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 394.35
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
*** PRODUCT ***
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.555	.125
KEROSENE	.335	.875

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 38959.6
< 40 > LGO= 12784.9
< 38 > LCO= 6689.83
*** PRODUCT ***
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.628	.713243
LCO	0	.05	.237141
LGO	0	.322	.049616

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= 10332.5
< 35 > LCO= 10000
< 13 > HCO= 4172.46
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0

< 34 > VAC RESIDUUM= 31396
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 55901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 17549
< 36 > HVGO TO LUBE OIL= 3774
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	49902	49902	600967	.423653	0	.0212683
LGO	23117.4	23117.4	298006	1.02294	0	.103245
LCO	16689.8	13351.9	194110	2.91624	19.9996	.834051
HCO	4172.46	0	0	4.60767	100	4.60767
VAC RESIDUUM	31396	0	0	4.51195	100	4.51195

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	3585	11133	1384	20505	36545	55901
S.G.	.760637	.815912	.826728	.870234	.854038	1.02698
ASTM 10%	206.828	333.013	381.285	392.121	396.444	
ASTM 20%	225.434	359.401	394.587	414.85	423.192	
ASTM 50%	281.672	424.569	439.948	470.58	496.155	
ASTM 90%	470.122	499.664	502.775	569.421	606.454	
RVP,psia	2.39738					
Sulfur Wt %	.0578869	.0283128	.0211826	.241583	.0947179	3.17476
Flash Point,F	64.4001	127.123	143.859	149.675	152.056	
Pour Point,F	-85.1713	-50.4834	-44.7813	-61.2662	-31.7765	
Cetane No.					43.5354	
Visc @100F,cs	.797813	1.50902	1.7244	2.17739	2.45229	561.345
Visc @122F,cs	.703387	1.29204	1.46562	1.81514	2.03955	243.954
Watsons K	11.9527	11.7113	11.6551	11.1988	11.5044	10.8339
MeABP	291.499	412.47	434.628	465.595	488.479	917.44

GASOLINE

LEADED REGULAR,BPCD 26456
TEL Addition,cc/IG: 1.24
RON / MON / (R+M)/2 (Clear) 86.9312 / 78.5814 / 82.7563
RON / MON / (R+M)/2 91.6337 / 82.4774 / 87.0556
RVP,psia 10.7012

MMT Addition,mg/l: 18
UNLEADED REGULAR,BPCD 53805
RON / MON / (R+M)/2 92.05 / 82.0489 / 87.0495
RVP,psia 10.3834

UNLEADED PREMIUM,BPCD	7925
RON / MON / (R+M)/2	94.9204 / 85.1315 / 90.026
RVP,psia	9.72243
AVIATION GASOLINE,BPCD	698
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 274571	< 1 > REDUCED CRUDE= 133039
< 2 > OVERHEAD= 23634.9	< 3 > NAPHTHA= 35981.3
< 4 > KEROSENE= 49902	< 5 > LGO= 32013.9
< 6 > HVGO= 86169.5	< 7 > RESIDUUM= 46869
< 8 > FCCU FEED= 88965	< 9 > REFORMER FEED= 32600
< 10 > CAT POLY FEED= 17500	< 11 > ALKYLATION FEED= 3443.12
< 12 > LCO= 16689.8	< 13 > HCO= 4172.46
< 14 > CRACKED GAS= 46168.4	< 15 > POLYMER= 7037.41
< 16 > LE FROM POLY (FOE)= 5628.85	< 17 > REFORMATE= 27254.7
< 18 > LE FROM CAT CRACKER (FOE)= 7806.95	< 19 > FUEL GAS (FOE)= 15377.7
< 20 > I-C4 FR. GAS PLANT= 1050.52	< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 26456	< 23 > UNLEADED REGULAR= 53805
< 24 > UNLEADED PREMIUM= 7925	< 25 > AVIATION GASOLINE= 698
< 26 > REFORMATE= 9705.71	< 27 > NAPHTHA SPECIALTIES= 17549
< 28 > LSR= 18580.1	< 29 > LSR+ISO= 18185.8
< 30 > LSR= 394.35	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 133039	< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 34 > VAC RESIDUUM= 31396	< 35 > LCO= 10000
< 36 > HVGO TO LUBE OIL= 3774	< 37 > HVGO= 0
< 38 > LCO= 6689.83	< 39 > C3/C4 -FCCU= 19892.6
< 40 > LGO= 12784.9	< 41 > LGO= 10332.5
< 42 > JET FUEL B= 3585	< 43 > JET FUEL A= 11133
< 44 > STOVE OIL= 1384	< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545	< 47 > HEAVY FUEL OIL= 55901
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 5355.82
< 50 > ALKYLATE= 2430.87	< 51 > CRUDE LIGHT ENDS= 1.84108
< 52 > TOTAL PRODUCT= 257060	< 53 > C2 % IN CRUDE FEED= .04423
< 54 > C3 % IN CRUDE FEED= .277635	< 55 > I-C4 % IN CRUDE FEED= .21544
< 56 > N-C4 % IN CRUDE FEED= 1.30377	< 57 > LE FROM REFORMER (FOE)= 4589.26
< 58 > NAPHTHA= 3381.3	< 59 > KEROSENE= 10942.4
< 60 > KEROSENE= 38959.6	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 2392.6	< 63 > LE FROM ALKYL (FOE)= 322.722
< 64 > HVGO= 80068.5	< 65 > LGO = 8896.5
< 66 > NAPHTHA PETROCHEMICAL FEED= 0	< 67 > VGO PETROCHEMICAL FEED= 2327
< 68 > IMPORTED C4= 0	< 69 > LSR= 18185.8

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	636.845	3196.9	25920.9	0	0	0	29754.6
C3 ,#/HR	5641.05	9089.32	18085.4	16196.5	1819.63	0	50831.9
IC4 ,#/HR	4868.33	6481.6	39798.8	37754.2	0	0	88902.9
NC4 ,#/HR	30506.8	9459.22	18012.6	15780.6	2157.52	0	75916.8
H2 ,#/HR	0	8685.37	10079.3	0	0	0	18764.7
C1 ,#/HR	0	3196.9	10747.7	0	0	0	13944.6
H2S ,#/HR	0	0	11362.6	0	0	0	11362.6
C2= ,#/HR	0	0	15805.4	0	0	0	15805.4
C3= ,#/HR	0	0	33496.8	0	0	0	33496.8
C4= ,#/HR	0	0	65651.8	0	0	0	65651.8
TOTAL ,#/HR	41653	40109.3	248961	69731.3	3977.15	0	404432
BPCD (FOE)	3363.49	4589.26	20727.8	5628.86	322.722	0	34632.1

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	29754.6	29754.6
C3 ,#/HR	13309.2	1819.63	0	0	0	35703.1	50831.9
IC4 ,#/HR	34867	13412.8	18484.3	0	0	22138.8	88902.9
NC4 ,#/HR	15780.5	2157.51	26381.4	0	0	31597.3	75916.8
H2 ,#/HR	0	0	0	0	8086.64	10678	18764.7
C1 ,#/HR	0	0	0	0	0	13944.6	13944.6
H2S ,#/HR	0	0	0	0	0	11362.6	11362.6
C2= ,#/HR	0	0	0	0	0	15805.4	15805.4
C3= ,#/HR	22889.8	3129.5	0	0	0	7477.47	33496.8
C4= ,#/HR	57516.4	7863.64	123.668	0	0	148.137	65651.8
TOTAL ,#/HR	144363	28383.1	44989.4	0	8086.64	178610	404432
BPCD (FOE)	11502.2	2266.92	3618.95	0	1866.4	15377.7	34632.1

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	274571	3.53734E+06
BUTANE	0	0
TOTAL	274571	3.53734E+06

*** PRODUCT ***

FUEL GAS (FOE)	15377.7	178610
MOTOR GASOLINE	88884	936118
AVIATION TURBO FUELS	14718	172043
DISTILLATES	58434	731251
HEAVY FUEL OIL	55901	836280
OTHER PRODUCTS	39123	526392
H2 TO DESULFURIZERS (FOE)	1866.4	8086.64
COKE (FOE)	7925.35	148805
TOTAL	282229	3.53759E+06

TIME:10.24.35 DATE:TUEMAY 11984122 51

REFINERY SIMULATION PROGRAM

CASE:QUEBAS40 REGION:QUEBEC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	16.8	46388.3
VENEZH	11.65	32168.1
ARABH	6.95	19190.4
CANDNH	27.3	75380.9
SYNCRUDE	16.3	45007.7
MEXH	11.6	32030
CONDENSA	9.4	25955.3

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				276121	3.55731E+06	64230
Average		.884407	28.4943	1.80558			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	276121	3.55731E+06	60	1460	.884407	28.4942	1.80558	64230
	*** PRODUCT ***								
2	OVERHEAD	23749.7	221961	60	169.332	.641577	89.0502	.0403523	89.5664
28	LSR	18666.4	180121	60	169.332	.662421	82.1104	.0498399	89.7722
3	NAPHTHA	36381.3	392353	169.332	319.983	.740335	59.6297	.0842182	330.432
4	KEROSENE	50005.4	602357	319.983	540	.826927	39.6155	.424667	2558.01
5	LGO	32194.7	415021	540	660	.884944	28.3971	1.02294	4245.42
1	REDUCED CRUDE	133790	1.92562E+06	660	1460	.988044	11.7123	2.96043	57006.6

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	133790	1.92562E+06	660	1460	.988044	11.7123	2.96043	57006.6
	*** PRODUCT ***								
6	HVGO	86658.8	1.18765E+06	660	1050	.940819	18.9009	1.9963	23709.1
7	RESIDUUM	47130.8	737957	1050	1460	1.07487	.143829	4.51195	33296.2

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	7967.25	102706	540	660	.884944	28.3971	1.02294	1050.62
64	HVGO	80557.8	1.10404E+06	660	1050	.940819	18.9009	1.9963	22039.9
	*** TOTAL FEED ***								
8	FCCU FEED	88525	1.20674E+06	540	1050	.93579	19.7091	1.91346	23090.5
	*** PRODUCT ***								
12	LCO	15509.6	226125	430	650	1.00087	9.877	3.07359	6950.15
13	HCO	3877.4	61720.8	650	745.412	1.09275	-2.01018	4.85628	2997.33
14	CRACKED GAS	46305.6	508400			.753706	56.239	.214211	1089.05
39	C3/C4 -FCCU	20371.5	168084			.566414	118.317	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 8133.17

AVAILABLE C3/C4 OLEFINS= 20371.5

CONVERSION Wt%= 76.1469 CONVERSION Vol %= 78.1

COKE, WT% 12.8187

COKE ,#/HR 154768 Sulfur in Flue Gas,Lbs/hr= 1189.89

CAT POLY UNIT

*** FEED ***
< 10 > CAT POLY FEED= 18500
*** PRODUCT ***
< 15 > POLYMER= 7434.02
< 16 > LE FROM POLY (FOE)= 5957.75

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 2691.85
< 62 > C3/C4 TO ALKYL= 1871.52
< 20 > I-C4 FR. GAS PLANT= 820.326
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 1899.69
< 63 > LE FROM ALKYL (FOE)= 253.189

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	33000	355887	169.332	319.983	.740335	59.6297	0	0
	*** PRODUCT ***								
17	REFORMATE	27330.4	312314			.784469	48.8769	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 4984.5
CONVERSION(LV%)= 82.8194   Severity (RON Clear)= 92   FEED KW= 12.0554

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 23749.7
< 57 > LE FROM REFORMER (FOE)= 4984.5
< 18 > LE FROM CAT CRACKER (FOE)= 8133.17
< 16 > LE FROM POLY (FOE)= 5957.75
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 16794.1
< 20 > I-C4 FR. GAS PLANT= 820.326
< 49 > REF C4 TO BLENDING = 5395.92
< 69 > LSR= 18272.1

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 18272.1
*** PRODUCT ***
< 29 > LSR+ISO= 18067.4

*** BY-PASS= 30 %   ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 18067.4
< 26 > REFORMATE= 9781.36
< 50 > ALKYLATE= 1899.69
< 15 > POLYMER= 7434.02
< 14 > CRACKED GAS= 46305.6
< 49 > REF C4 TO BLENDING = 5395.92
< 68 > IMPORTED C4= 0
*** PRODUCT ***

< 22 > LEADED REGULAR= 8820
< 23 > UNLEADED REGULAR= 71441
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.699805	.166503	0	0
CRACKED GAS	.0515802	.55	.827521	0
REFORMATE	.226035	.109009	0	0
POLYMER	0	.104058	0	0
ALKYLATE	0	5.93237E-03	.1	.9786
C4	.0225801	.0644972	.0724793	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 394.35
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
*** PRODUCT ***
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.555	.125
KEROSENE	.335	.875

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 39063.1
< 40 > LGO= 13861.6
< 38 > LCO= 5509.58
*** PRODUCT ***
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.628	.718289
LCO	0	.05	.179582
LGO	0	.322	.102129

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= 10365.8
< 35 > LCO= 10000
< 13 > HCO= 3877.4
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0

< 34 > VAC RESIDUUM= 31657.8
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 55901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 17549
< 36 > HVGO TO LUBE OIL= 3774
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	50005.4	50005.4	602357	.424667	0	.0213194
LGO	24227.5	24227.4	312315	1.02294	2.01541E-04	.103246
LCO	15509.6	12407.7	180900	3.07359	19.9999	.880078
HCO	3877.4	0	0	4.85628	100	4.85628
VAC RESIDUUM	31657.8	0	0	4.51195	100	4.51195

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	3585	11133	1384	20505	36545	55901
S.G.	.760772	.816103	.826927	.864089	.854305	1.02765
ASTM 10%	206.816	333.571	382.001	392.755	397.182	
ASTM 20%	225.538	359.99	395.23	415.118	423.754	
ASTM 50%	282.138	425.021	440.329	472.239	496.304	
ASTM 90%	470.361	499.746	502.856	579.35	606.444	
RVP,psia	2.77847					
Sulfur Wt %	.0579907	.0283755	.0212334	.204309	.0974398	3.19705
Flash Point,F	64.3913	127.435	144.249	150.012	152.459	
Pour Point,F	-85.0671	-50.3611	-44.6618	-53.9616	-31.7991	
Cetane No.					43.4536	
Visc @100F,cs	.799029	1.51276	1.72895	2.1952	2.4578	588.091
Visc @122F,cs	.704418	1.29508	1.46926	1.83165	2.04379	253.554
Watsons K	11.9522	11.7105	11.6542	11.2892	11.502	10.832
MeABP	291.821	412.893	435.057	468.251	488.778	919.41

GASOLINE

LEADED REGULAR,BPCD	8820
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	84.1936 / 78.8085 / 81.5011
RON / MON / (R+M)/2	89.8229 / 83.8954 / 86.8592
RVP,psia	13.8689
MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	71441
RON / MON / (R+M)/2	91.8 / 82.3117 / 87.0559
RVP,psia	10.7653

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	276121	3.55731E+06
BUTANE	0	0
TOTAL	276121	3.55731E+06

*** PRODUCT ***

FUEL GAS (FOE)	16794.1	193785
MOTOR GASOLINE	88884	935987
AVIATION TURBO FUELS	14718	172081
DISTILLATES	58434	729562
HEAVY FUEL OIL	55901	836826
OTHER PRODUCTS	39123	526423
H2 TO DESULFURIZERS (FOE)	1874	8119.59
COKE (FOE)	8242.94	154768
TOTAL	283971	3.55755E+06

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	640.44	3639.56	27305	0	0	0	31585
C3 ,#/HR	5672.9	10141.6	18537.1	17193.5	1430.52	473.247	53448.9
IC4 ,#/HR	4895.82	6807.28	40584.3	39908.7	0	842.123	93038.2
NC4 ,#/HR	30679	9934.51	18392.2	16702.5	1689.68	2397.95	79795.8
H2 ,#/HR	0	9410.53	10642.6	0	0	0	20053.1
C1 ,#/HR	0	3639.56	11321.6	0	0	0	14961.2
H2S ,#/HR	0	0	11543.1	0	0	0	11543.1
C2= ,#/HR	0	0	16649.4	0	0	0	16649.4
C3= ,#/HR	0	0	33760.3	0	0	0	33760.3
C4= ,#/HR	0	0	67203.6	0	0	0	67203.6
TOTAL ,#/HR	41888.2	43573	255939	73804.7	3120.2	3713.32	422039
BPCD (FOE)	3382.48	4984.5	21369	5957.75	253.189	299.502	36246.4

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	31585	31585
C3 ,#/HR	14140.7	1430.52	0	0	0	37877.7	53448.9
IC4 ,#/HR	36855.9	10479.7	19328.9	0	0	26373.7	93038.2
NC4 ,#/HR	16702.5	1689.68	25969.3	0	0	35434.3	79795.8
H2 ,#/HR	0	0	0	0	8119.59	11933.5	20053.1
C1 ,#/HR	0	0	0	0	0	14961.2	14961.2
H2S ,#/HR	0	0	0	0	0	11543.1	11543.1
C2= ,#/HR	0	0	0	0	0	16649.4	16649.4
C3= ,#/HR	23913.8	2419.2	0	0	0	7427.28	33760.3
C4= ,#/HR	61029.7	6173.96	0	0	0	0	67203.6
TOTAL ,#/HR	152643	22193.1	45298.2	0	8119.59	193785	422039
BPCD (FOE)	12161.8	1772.53	3643.87	0	1874	16794.1	36246.4

UNLEADED PREMIUM,BPCD	7925
RON / MON / (R+M)/2	94.7375 / 85.3332 / 90.0354
RVP,psia	9.71993

AVIATION GASOLINE,BPCD	698
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 276121	< 1 > REDUCED CRUDE= 133790
< 2 > OVERHEAD= 23749.7	< 3 > NAPHTHA= 36381.3
< 4 > KEROSENE= 50005.4	< 5 > LGO= 32194.7
< 6 > HVGO= 86658.8	< 7 > RESIDUUM= 47130.8
< 8 > FCCU FEED= 88525	< 9 > REFORMER FEED= 33000
< 10 > CAT POLY FEED= 18500	< 11 > ALKYLATION FEED= 2691.85
< 12 > LCO= 15509.6	< 13 > HCO= 3877.4
< 14 > CRACKED GAS= 46305.6	< 15 > POLYMER= 7434.02
< 16 > LE FROM POLY (FOE)= 5957.75	< 17 > REFORMATE= 27330.4
< 18 > LE FROM CAT CRACKER (FOE)= 8133.17	< 19 > FUEL GAS (FOE)= 16794.1
< 20 > I-C4 FR. GAS PLANT= 820.326	< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 8820	< 23 > UNLEADED REGULAR= 71441
< 24 > UNLEADED PREMIUM= 7925	< 25 > AVIATION GASOLINE= 698
< 26 > REFORMATE= 9781.36	< 27 > NAPHTHA SPECIALTIES= 17549
< 28 > LSR= 18666.4	< 29 > LSR+ISO= 18067.4
< 30 > LSR= 394.35	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 133790	< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 34 > VAC RESIDUUM= 31657.8	< 35 > LCO= 10000
< 36 > HVGO TO LUBE OIL= 3774	< 37 > HVGO= 0
< 38 > LCO= 5509.58	< 39 > C3/C4 -FCCU= 20371.5
< 40 > LGO= 13861.6	< 41 > LGO= 10365.8
< 42 > JET FUEL B= 3585	< 43 > JET FUEL A= 11133
< 44 > STOVE OIL= 1384	< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545	< 47 > HEAVY FUEL OIL= 55901
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 5395.92
< 50 > ALKYLATE= 1899.69	< 51 > CRUDE LIGHT ENDS= 1.84108
< 52 > TOTAL PRODUCT= 257060	< 53 > C2 % IN CRUDE FEED= .04423
< 54 > C3 % IN CRUDE FEED= .277635	< 55 > I-C4 % IN CRUDE FEED= .21544
< 56 > N-C4 % IN CRUDE FEED= 1.30377	< 57 > LE FROM REFORMER (FOE)= 4984.5
< 58 > NAPHTHA= 3381.3	< 59 > KEROSENE= 10942.4
< 60 > KEROSENE= 39063.1	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 1871.52	< 63 > LE FROM ALKYL (FOE)= 253.189
< 64 > HVGO= 80557.8	< 65 > LGO = 7967.25
< 66 > NAPHTHA PETROCHEMICAL FEED= 0	< 67 > VGO PETROCHEMICAL FEED= 2327
< 68 > IMPORTED C4= 0	< 69 > LSR= 18272.1

TIME:15.41.52 DATE:MONAPR301984121 40

REFINERY SIMULATION PROGRAM

CASE:ONTBAS41 REGION:ONTARIO

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	49	217790
CANDNH	9.2	40891.3
SYNCRUDE	30.8	136897
CONDENSA	11	48891.7

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				444470	5.445E+06	26263.7
Average		.84098	36.7562	.482344			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	444470	5.445E+06	60	1300	.840979	36.7562	.482345	26263.7
	*** PRODUCT ***								
2	OVERHEAD	53850.2	502986	60	169.861	.641207	89.1775	.028942	145.574
28	LSR	40581.8	395079	60	169.861	.668317	80.2259	.0368261	145.492
3	NAPHTHA	81358.1	892418	169.861	320.673	.753004	56.414	.0267851	239.035
4	KEROSENE	107914	1.31017E+06	320.673	560	.833448	38.2767	.10658	1396.38
5	LGO	47815.2	615177	560	660	.88321	28.711	.312237	1920.81
1	REDUCED CRUDE	153533	2.12425E+06	660	1300	.949805	17.478	1.06211	22561.9

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	153533	2.12425E+06	660	1300	.949805	17.478	1.06211	22561.9
	*** PRODUCT ***								
6	HVGO	123025	1.65431E+06	660	1050	.923111	21.786	.618341	10229.3
7	RESIDUUM	30507.8	469943	1050	1300	1.05746	2.31122	2.62443	12333.3

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	28931.7	372227	560	660	.88321	28.711	.312237	1162.23
64	HVGO	96858.3	1.30245E+06	660	1050	.923111	21.786	.618341	8053.58
	*** TOTAL FEED ***								
8	FCCU FEED	125790	1.67468E+06	560	1050	.913934	23.3252	.550304	9215.81
	*** PRODUCT ***								
12	LCO	20327.7	285661	430	650	.964702	15.1774	.945391	2700.62
13	HCO	5081.92	79730.7	650	737.274	1.07703	-.120178	1.49372	1190.95
14	CRACKED GAS	71632.4	781925			.749351	57.3301	.0543852	425.251
39	C3/C4 -FCCU	20025.9	164398			.563553	119.586	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 18393.9

AVAILABLE C3/C4 OLEFINS= 31246.3

CONVERSION Wt%= 78.1814 CONVERSION Vol %= 79.8

COKE, WT% 9.60159

COKE ,#/HR 160878 Sulfur in Flue Gas,Lbs/hr= 490.828

CAT POLY UNIT

*** FEED ***

< 10 > CAT POLY FEED= 1E-06
*** PRODUCT ***
< 15 > POLYMER= 4.08483E-07
< 16 > LE FROM POLY (FOE)= 3.12951E-07

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 29000
< 62 > C3/C4 TO ALKYL= 20025.9
< 20 > I-C4 FR. GAS PLANT= 5502.85
< 21 > I-C4 IMPORTED= 3471.21
*** PRODUCT ***
< 50 > ALKYLATE= 20735.9
< 63 > LE FROM ALKYL (FOE)= 2440.82

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
9	REFORMER FEED	61250	671852	169.861	320.673	.753004	56.414	0	0
		*** PRODUCT ***							
17	REFORMATE	51918.2	604592			.799416	45.5043	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 7715.26
CONVERSION(LV%)= 84.7644   Severity (RON Clear)= 93.3 FEED KW= 11.8548

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 53850.2
< 57 > LE FROM REFORMER (FOE)= 7715.26
< 18 > LE FROM CAT CRACKER (FOE)= 18393.9
< 16 > LE FROM POLY (FOE)= 3.12951E-07
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 24944.7
< 20 > I-C4 FR. GAS PLANT= 5502.85
< 49 > REF C4 TO BLENDING = 8894.15
< 69 > LSR= 40111.3

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 40111.3
*** PRODUCT ***
< 29 > LSR+ISO= 40111.3

*** BY-PASS= 100 %   ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 40111.3
< 26 > REFORMATE= 29337.2
< 50 > ALKYLATE= 20735.9
< 15 > POLYMER= 4.08483E-07
< 14 > CRACKED GAS= 71632.4
< 49 > REF C4 TO BLENDING = 8894.15
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 51175
< 23 > UNLEADED REGULAR= 104062
< 24 > UNLEADED PREMIUM= 15348

< 25 > AVIATION GASOLINE= 126

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.425467	.176595	0	0
CRACKED GAS	.383028	.5	0	0
REFORMATE	.147106	.100616	.738776	0
POLYMER	0	3.92538E-12	0	0
ALKYLATE	0	.168582	.2	.9786
C4	.0443994	.0542072	.0612241	.0214

<u>TURBO FUEL BLENDING</u>

*** FEED ***
< 30 > LSR= 470.47
< 58 > NAPHTHA= 4823.08
< 59 > KEROSENE= 18608.5
*** PRODUCT ***
< 42 > JET FUEL B= 4277
< 43 > JET FUEL A= 19625

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.6	.115
KEROSENE	.29	.885

<u>DISTILLATE BLENDING</u>

*** FEED ***
< 60 > KEROSENE= 89305.1
< 40 > LGO= 18883.3
< 38 > LCO= 14277.7
*** PRODUCT ***
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.64	.904409
LCO	0	.14	.0733049
LGO	0	.22	.022286

<u>HEAVY FUEL OIL BLENDING</u>

*** FEED ***
< 41 > LGO= .249023
< 35 > LCO= 6050
< 13 > HCO= 5081.92
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 22141.8
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 33274

OTHER PRODUCTS

< 27 > NAPHTHA SPECIALTIES= 22581
< 36 > HVGO TO LUBE OIL= 10882
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	FEED TO DDS SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	107914	107914	1.31017E+06	.10658	0	5.3344E-03
LGO	18883.5	18883.5	242950	.312237	0	.0313117
LCO	20327.7	18294.9	257095	.945391	10.0001	.181012
HCO	5081.92	0	0	1.49372	100	1.49372
VAC RESIDUUM	22141.8	0	0	2.62443	100	2.62443

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	4277	19625	2264	38243	81959	33274
S.G.	.767017	.824197	.833448	.844178	.862771	1.04358
ASTM 10%	206.631	344.29	383.696	386.959	397.856	
ASTM 20%	224.146	367.732	398.672	404.374	425.724	
ASTM 50%	274.405	432.07	447.59	458.301	498.08	
ASTM 90%	470.583	516.868	519.47	530.639	603.648	
RVP,psia	2.41517					
Sulfur Wt %	.0209863	7.58334E-03	5.32902E-03	.0205336	.038445	2.03526
Flash Point,F	64.3346	133.39	144.02	145.72	151.584	
Pour Point,F	-95.6461	-50.4106	-44.8521	-48.2866	-38.8401	
Cetane No.					40.4687	
Visc @100F,cs	.776442	1.61175	1.8213	1.93572	2.48786	1667.56
Visc @122F,cs	.684835	1.37441	1.54243	1.63154	2.06346	592.884
Watsons K	11.8184	11.6401	11.5969	11.4849	11.3892	10.7665
MeABP	284.886	423.002	442.955	451.344	488.793	958.49

GASOLINE

LEADED REGULAR,BPCD	51175
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	85.9777 / 78.3983 / 82.188
RON / MON / (R+M)/2	91.2613 / 83.0774 / 87.1694
RVP,psia	11.1268
MMT Addition,mg/l: 18	
UNLEADED REGULAR,BPCD	104062
RON / MON / (R+M)/2	90.85 / 83.1875 / 87.0188
RVP,psia	10.3605
UNLEADED PREMIUM,BPCD	15348
RON / MON / (R+M)/2	94.2114 / 85.956 / 90.0837
RVP,psia	9.74662

AVIATION GASOLINE,BPCD	126
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 444470	< 1 > REDUCED CRUDE= 153533
< 2 > OVERHEAD= 53850.2	< 3 > NAPHTHA= 81358.1
< 4 > KEROSENE= 107914	< 5 > LGO= 47815.2
< 6 > HVGO= 123025	< 7 > RESIDUUM= 30507.8
< 8 > FCCU FEED= 125790	< 9 > REFORMER FEED= 61250
< 10 > CAT POLY FEED= 1E-06	< 11 > ALKYLATION FEED= 29000
< 12 > LCO= 20327.7	< 13 > HCO= 5081.92
< 14 > CRACKED GAS= 71632.4	< 15 > POLYMER= 4.08483E-07
< 16 > LE FROM POLY (FOE)= 3.12951E-07	< 17 > REFORMATE= 51918.2
< 18 > LE FROM CAT CRACKER (FOE)= 18393.9	< 19 > FUEL GAS (FOE)= 24944.7
< 20 > I-C4 FR. GAS PLANT= 5502.85	< 21 > I-C4 IMPORTED= 3471.21
< 22 > LEADED REGULAR= 51175	< 23 > UNLEADED REGULAR= 104062
< 24 > UNLEADED PREMIUM= 15348	< 25 > AVIATION GASOLINE= 126
< 26 > REFORMATE= 29337.2	< 27 > NAPHTHA SPECIALTIES= 22581
< 28 > LSR= 40581.8	< 29 > LSR+ISO= 40111.3
< 30 > LSR= 470.47	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 153533	< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 34 > VAC RESIDUUM= 22141.8	< 35 > LCO= 6050
< 36 > HVGO TO LUBE OIL= 10882	< 37 > HVGO= 0
< 38 > LCO= 14277.7	< 39 > C3/C4 -FCCU= 20025.9
< 40 > LGO= 18883.3	< 41 > LGO= .249023
< 42 > JET FUEL B= 4277	< 43 > JET FUEL A= 19625
< 44 > STOVE OIL= 2264	< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959	< 47 > HEAVY FUEL OIL= 33274
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 8894.15
< 50 > ALKYLATE= 20735.9	< 51 > CRUDE LIGHT ENDS= 2.98522
< 52 > TOTAL PRODUCT= 422752	< 53 > C2 % IN CRUDE FEED= .08668
< 54 > C3 % IN CRUDE FEED= .69156	< 55 > I-C4 % IN CRUDE FEED= .36344
< 56 > N-C4 % IN CRUDE FEED= 1.84354	< 57 > LE FROM REFORMER (FOE)= 7715.26
< 58 > NAPHTHA= 4823.08	< 59 > KEROSENE= 18608.5
< 60 > KEROSENE= 89305.1	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20025.9	< 63 > LE FROM ALKYL (FOE)= 2440.82
< 64 > HVGO= 96858.3	< 65 > LGO = 28931.7
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285	< 67 > VGO PETROCHEMICAL FEED= 15285
< 68 > IMPORTED C4= 0	< 69 > LSR= 40111.3

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2020.34	4791.5	35808.5	0	0	0	42620.3
C3 ,#/HR	22746	14883.3	27183.9	0	14634.7	0	79447.9
IC4 ,#/HR	13294.6	11402.8	63979.5	0	0	0	88676.9
NC4 ,#/HR	69829.2	16641.2	24077.1	0	15431.1	0	125979
H2 ,#/HR	0	14749.5	14571.9	0	0	0	29321.4
C1 ,#/HR	0	4791.5	14847.4	0	0	0	19638.9
H2S ,#/HR	0	0	4683.67	0	0	0	4683.67
C2= ,#/HR	0	0	21834.4	0	0	0	21834.4
C3= ,#/HR	0	0	64312	0	0	0	64312
C4= ,#/HR	0	0	95454.9	0	0	0	95454.9
TOTAL ,#/HR	107890	67259.8	366753	3.8773E-06	30065.8	0	571969
BPCD (FOE)	8724.16	7715.27	31430.4	3.12951E-07	2440.82	0	50310.6

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	42620.3	42620.3
C3 ,#/HR	0	14634.7	0	0	0	64813.2	79447.9
IC4 ,#/HR	0	86293.2	1233.3	0	0	1150.37	88676.9
NC4 ,#/HR	0	15431.1	57198.1	0	0	53349.4	125979
H2 ,#/HR	0	0	0	0	10958.6	18362.8	29321.4
C1 ,#/HR	0	0	0	0	0	19638.9	19638.9
H2S ,#/HR	0	0	0	0	0	4683.67	4683.67
C2= ,#/HR	0	0	0	0	0	21834.4	21834.4
C3= ,#/HR	0	32149.9	0	0	0	32162.1	64312
C4= ,#/HR	0	61177.5	17735.4	0	0	16542	95454.9
TOTAL ,#/HR	8.20927E-06	209686	76166.8	0	10958.6	275157	571969
BPCD (FOE)	6.54135E-07	16736.8	6099.96	0	2529.24	24944.7	50310.6

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	444470	5.445E+06
BUTANE	3471.21	28568.1
TOTAL	447941	5.47357E+06

*** PRODUCT ***

FUEL GAS (FOE)	24944.7	275157
MOTOR GASOLINE	170711	1.79841E+06
AVIATION TURBO FUELS	23902	283407
DISTILLATES	122466	1.52783E+06
HEAVY FUEL OIL	33274	505826
OTHER PRODUCTS	72399	911356
H2 TO DESULFURIZERS (FOE)	2529.24	10958.6
COKE (FOE)	8568.36	160878
TOTAL	458794	5.47382E+06

TIME:16.43.24 DATE:MONAPR301984121 40

REFINERY SIMULATION PROGRAM

CASE:ONTBAS40 REGION:ONTARIO

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	49	218653
CANDNH	9.2	41053.3
SYNCRUDE	30.8	137439
CONDENSA	11	49085.4

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				446231	5.46658E+06	26367.7
Average		.840979	36.7563	.482344			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
0	CRUDE FEED	446231	5.46658E+06	60	1300	.840981	36.756	.482344	26367.7
		*** PRODUCT ***							
2	OVERHEAD	54351.7	508007	60	170.44	.641632	89.0314	.0289343	146.988
28	LSR	41030.7	399652	60	170.44	.668656	80.1185	.0367609	146.916
3	NAPHTHA	81858.1	898292	170.44	321.569	.753331	56.3324	.0268373	241.077
4	KEROSENE	107875	1.31E+06	321.569	560	.833644	38.2367	.106867	1399.96
5	LGO	48004.7	617615	560	660	.88321	28.711	.312237	1928.42
1	REDUCED CRUDE	154141	2.13267E+06	660	1300	.949805	17.478	1.06211	22651.3

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
32	REDUCED CRUDE	154141	2.13267E+06	660	1300	.949805	17.478	1.06211	22651.3
		*** PRODUCT ***							
6	HVGO	123514	1.66089E+06	660	1050	.923111	21.786	.618341	10269.9
7	RESIDUUM	30627.2	471782	1050	1300	1.05746	2.31122	2.62443	12381.6

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
65	LGO	29077.7	374106	560	660	.88321	28.711	.312237	1168.1
64	HVGO	97347.3	1.30903E+06	660	1050	.923111	21.786	.618341	8094.24
		*** TOTAL FEED ***							
8	FCCU FEED	126425	1.68313E+06	560	1050	.913934	23.3252	.550304	9262.33
		*** PRODUCT ***							
12	LCO	20228	284333	430	650	.964948	15.14	.952249	2707.56
13	HCO	5057	79381.7	650	736.438	1.0776	-.189667	1.50455	1194.34
14	CRACKED GAS	72125.5	787470			.749506	57.291	.0541336	426.286
39	C3/C4 -FCCU	20026.6	164405			.563555	119.585	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 18680.6

AVAILABLE C3/C4 OLEFINS= 31507.8

CONVERSION Wt%= 78.3906 CONVERSION Vol %= 80

COKE, WT% 9.63115

COKE ,#/HR 162188 Sulfur in Flue Gas,Lbs/hr= 495.217

CAT POLY UNIT

*** FEED ***

< 10 > CAT POLY FEED= 1E-06
*** PRODUCT ***
< 15 > POLYMER= 4.08466E-07
< 16 > LE FROM POLY (FOE)= 3.12969E-07

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 29000
< 62 > C3/C4 TO ALKYL= 20026.6
< 20 > I-C4 FR. GAS PLANT= 5909.61
< 21 > I-C4 IMPORTED= 3063.83
*** PRODUCT ***
< 50 > ALKYLATE= 20735.6
< 63 > LE FROM ALKYL (FOE)= 2441.19

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	61750	677630	170.44	321.569	.753331	56.3324	0	0
	*** PRODUCT ***								
17	REFORMATE	51428.4	598474			.798863	45.6267	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 9072.39
CONVERSION(LV%)= 83.2849 Severity (RON Clear)= 95 FEED KW= 11.8534

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 54351.7
< 57 > LE FROM REFORMER (FOE)= 9072.39
< 18 > LE FROM CAT CRACKER (FOE)= 18680.6
< 16 > LE FROM POLY (FOE)= 3.12969E-07
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 27018.6
< 20 > I-C4 FR. GAS PLANT= 5909.61
< 49 > REF C4 TO BLENDING = 8896.63
< 69 > LSR= 40560.2

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 40560.2
*** PRODUCT ***
< 29 > LSR+ISO= 40105.9

*** BY-PASS= 30 % ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 40105.9
< 26 > REFORMATE= 28847.4
< 50 > ALKYLATE= 20735.6
< 15 > POLYMER= 4.08466E-07
< 14 > CRACKED GAS= 72125.5
< 49 > REF C4 TO BLENDING = 8896.63
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 17058
< 23 > UNLEADED REGULAR= 138179
< 24 > UNLEADED PREMIUM= 15348

< 25 > AVIATION GASOLINE= 126

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.367437	.245099	0	0
CRACKED GAS	.583008	.45	0	0
REFORMATE	0	.116273	.832739	0
POLYMER	0	2.95606E-12	0	0
ALKYLATE	0	.138063	.1	.9786
C4	.0495557	.0505646	.0672607	.0214

TURBO FUEL BLENDING

*** FEED ***

< 30 > LSR= 470.47

< 58 > NAPHTHA= 4823.08

< 59 > KEROSENE= 18608.5

*** PRODUCT ***

< 42 > JET FUEL B= 4277

< 43 > JET FUEL A= 19625

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.6	.115
KEROSENE	.29	.885

DISTILLATE BLENDING

*** FEED ***

< 60 > KEROSENE= 89266.9

< 40 > LGO= 18926.1

< 38 > LCO= 14273

*** PRODUCT ***

< 44 > STOVE OIL= 2264

< 45 > LIGHT FUEL OIL= 38243

< 46 > DIESEL FUEL= 81959

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.64	.90341
LCO	0	.14	.0731831
LGO	0	.22	.023407

HEAVY FUEL OIL BLENDING

*** FEED ***

< 41 > LGO= .789063

< 35 > LCO= 5955

< 13 > HCO= 5057

< 37 > HVGO= 0

< 31 > REDUCED CRUDE= 0

< 34 > VAC RESIDUUM= 22261.2

*** PRODUCT ***

< 47 > HEAVY FUEL OIL= 33274

OTHER PRODUCTS

< 27 > NAPHTHA SPECIALTIES= 22581
< 36 > HVGO TO LUBE OIL= 10882
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	FEED TO DDS SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	107875	107875	1.31E+06	.106867	0	5.34878E-03
LGO	18927	18926.9	243508	.312237	5.26282E-04	.0313132
LCO	20228	18205.2	255900	.952249	10	.182334
HCO	5057	0	0	1.50455	100	1.50455
VAC RESIDUUM	22261.2	0	0	2.62443	100	2.62443

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	4277	19625	2264	38243	81959	33274
S.G.	.767308	.824408	.833644	.844413	.862931	1.04396
ASTM 10%	206.981	345.107	384.615	387.913	398.792	
ASTM 20%	224.638	368.561	399.503	405.252	426.436	
ASTM 50%	275.127	432.646	448.116	458.877	498.303	
ASTM 90%	470.995	516.957	519.565	530.906	603.637	
RVP,psia	2.76616					
Sulfur Wt %	.0210164	7.60205E-03	5.34336E-03	.020661	.0386587	2.04448
Flash Point,F	64.5267	133.847	144.51	146.229	152.087	
Pour Point,F	-95.4851	-50.2025	-44.6415	-48.0537	-38.7127	
Cetane No.					40.4425	
Visc @100F,cs	.778646	1.61725	1.82758	1.94354	2.49454	1759.68
Visc @122F,cs	.686702	1.37886	1.54746	1.63775	2.06864	619.625
Watsons K	11.817	11.6396	11.5966	11.4844	11.3887	10.7678
MeABP	285.484	423.579	443.518	451.985	489.184	960.56

GASOLINE

LEADED REGULAR,BPCD 17058
TEL Addition,cc/IG: 1.24
RON / MON / (R+M)/2 (Clear) 89.7419 / 81.9945 / 85.8682
RON / MON / (R+M)/2 94.4449 / 86.0918 / 90.2684
RVP,psia 11.9713

MMT Addition,mg/l: 0
UNLEADED REGULAR,BPCD 138179
RON / MON / (R+M)/2 90.688 / 83.3986 / 87.0433
RVP,psia 11.2279

UNLEADED PREMIUM,BPCD 15348
RON / MON / (R+M)/2 94.4391 / 85.5919 / 90.0155
RVP,psia 9.73702

AVIATION GASOLINE,BPCD	126
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 446231
< 1 > REDUCED CRUDE= 154141
< 2 > OVERHEAD= 54351.7
< 3 > NAPHTHA= 81858.1
< 4 > KEROSENE= 107875
< 5 > LGO= 48004.7
< 6 > HVGO= 123514
< 7 > RESIDUUM= 30627.2
< 8 > FCCU FEED= 126425
< 9 > REFORMER FEED= 61750
< 10 > CAT POLY FEED= 1E-06
< 11 > ALKYLATION FEED= 29000
< 12 > LCO= 20228
< 13 > HCO= 5057
< 14 > CRACKED GAS= 72125.5
< 15 > POLYMER= 4.08466E-07
< 16 > LE FROM POLY (FOE)= 3.12969E-07
< 17 > REFORMATE= 51428.4
< 18 > LE FROM CAT CRACKER (FOE)= 18680.6
< 19 > FUEL GAS (FOE)= 27018.6
< 20 > I-C4 FR. GAS PLANT= 5909.61
< 21 > I-C4 IMPORTED= 3063.83
< 22 > LEADED REGULAR= 17058
< 23 > UNLEADED REGULAR= 138179
< 24 > UNLEADED PREMIUM= 15348
< 25 > AVIATION GASOLINE= 126
< 26 > REFORMATE= 28847.4
< 27 > NAPHTHA SPECIALTIES= 22581
< 28 > LSR= 41030.7
< 29 > LSR+ISO= 40105.9
< 30 > LSR= 470.47
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 154141
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 34 > VAC RESIDUUM= 22261.2
< 35 > LCO= 5955
< 36 > HVGO TO LUBE OIL= 10882
< 37 > HVGO= 0
< 38 > LCO= 14273
< 39 > C3/C4 -FCCU= 20026.6
< 40 > LGO= 18926.1
< 41 > LGO= .789063
< 42 > JET FUEL B= 4277
< 43 > JET FUEL A= 19625
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959
< 47 > HEAVY FUEL OIL= 33274
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 8896.63
< 50 > ALKYLATE= 20735.6
< 51 > CRUDE LIGHT ENDS= 2.98522
< 52 > TOTAL PRODUCT= 422752
< 53 > C2 % IN CRUDE FEED= .08668
< 54 > C3 % IN CRUDE FEED= .69156
< 55 > I-C4 % IN CRUDE FEED= .36344
< 56 > N-C4 % IN CRUDE FEED= 1.84354
< 57 > LE FROM REFORMER (FOE)= 9072.39
< 58 > NAPHTHA= 4823.08
< 59 > KEROSENE= 18608.5
< 60 > KEROSENE= 89266.9
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20026.6
< 63 > LE FROM ALKYL (FOE)= 2441.19
< 64 > HVGO= 97347.3
< 65 > LGO = 29077.7
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285
< 68 > IMPORTED C4= 0
< 69 > LSR= 40560.2

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2028.34	6527.92	36197.3	0	0	0	44753.6
C3 ,#/HR	22836.1	18211.2	27420.8	0	14640.2	1050.51	84158.8
IC4 ,#/HR	13347.3	12469.9	64516.4	0	0	1869.34	92202.9
NC4 ,#/HR	70105.8	18198.6	24276.2	0	15430.1	5322.96	133334
H2 ,#/HR	0	17220.7	14731.2	0	0	0	31951.9
C1 ,#/HR	0	6527.92	15008.6	0	0	0	21536.5
H2S ,#/HR	0	0	4716.37	0	0	0	4716.37
C2= ,#/HR	0	0	22071.5	0	0	0	22071.5
C3= ,#/HR	0	0	64825.5	0	0	0	64825.5
C4= ,#/HR	0	0	96267.2	0	0	0	96267.2
TOTAL ,#/HR	108318	79156.2	370031	3.87753E-06	30070.3	8242.81	595818
BPCD (FOE)	8758.72	9072.39	31717.1	3.12969E-07	2441.19	664.833	52654.3

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	44753.6	44753.6
C3 ,#/HR	0	14640.3	0	0	0	69518.6	84158.8
IC4 ,#/HR	0	89643.2	1253.61	0	0	1306.11	92202.9
NC4 ,#/HR	0	15430.1	57741.2	0	0	60162.3	133334
H2 ,#/HR	0	0	0	0	10953	20998.9	31951.9
C1 ,#/HR	0	0	0	0	0	21536.5	21536.5
H2S ,#/HR	0	0	0	0	0	4716.37	4716.37
C2= ,#/HR	0	0	0	0	0	22071.5	22071.5
C3= ,#/HR	0	32138.8	0	0	0	32686.7	64825.5
C4= ,#/HR	0	61188.2	17179.4	0	0	17899.6	96267.2
TOTAL ,#/HR	8.20931E-06	213041	76174.2	0	10953	295650	595818
BPCD (FOE)	6.54138E-07	17006.1	6101.63	0	2527.96	27018.6	52654.3

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	446231	5.46658E+06
BUTANE	3063.83	25215.3
TOTAL	449295	5.4918E+06

*** PRODUCT ***

FUEL GAS (FOE)	27018.6	295650
MOTOR GASOLINE	170711	1.79435E+06
AVIATION TURBO FUELS	23902	283485
DISTILLATES	122466	1.52815E+06
HEAVY FUEL OIL	33274	506010
OTHER PRODUCTS	72399	911247
H2 TO DESULFURIZERS (FOE)	2527.96	10953
COKE (FOE)	8638.13	162188
TOTAL	460937	5.49204E+06

TIME:14.34.13 DATE:MONAPR301984121 40

REFINERY SIMULATION PROGRAM

CASE:WESBAS41 REGION:WESTERN

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	65.1	319677
SYNCRUDE	31.5	154683
CONDENSA	3.4	16695.9

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				491056	6.03835E+06	18791.4
Average		.844145	36.1252	.311201			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	491056	6.03835E+06	60	1240	.844145	36.1252	.311201	18791.4
	*** PRODUCT ***								
2	OVERHEAD	48884.4	453178	60	170.144	.636398	90.8453	.014716	66.6895
28	LSR	33522	329279	60	170.144	.674316	78.3423	.0202627	66.7207
3	NAPHTHA	85542.2	942528	170.144	321.814	.756386	55.5738	.0148748	140.199
4	KEROSENE	127297	1.54469E+06	321.814	560	.833017	38.3645	.0623558	963.206
5	LGO	56015.7	718865	560	660	.880983	29.116	.219173	1575.56
1	REDUCED CRUDE	173317	2.37909E+06	660	1240	.942321	18.6611	.67445	16045.7

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	173317	2.37909E+06	660	1240	.942321	18.6611	.67445	16045.7
	*** PRODUCT ***								
6	HVGO	141892	1.90018E+06	660	1050	.919318	22.4184	.412657	7841.21
7	RESIDUUM	31424.9	478920	1050	1240	1.04621	3.75011	1.7133	8205.33

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	4219.17	54145.8	560	660	.880983	29.116	.219173	118.673
64	HVGO	136420	1.8269E+06	660	1050	.919318	22.4184	.412657	7538.82
	*** TOTAL FEED ***								
8	FCCU FEED	140639	1.88104E+06	560	1050	.918167	22.6114	.407088	7657.49
	*** PRODUCT ***								
12	LCO	22502.2	318776	430	650	.972502	14.001	.703057	2241.18
13	HCO	5625.56	88640.2	650	736.636	1.08167	-.683762	1.11083	984.642
14	CRACKED GAS	78989.4	863821			.750732	56.9827	.0407984	352.425
39	C3/C4 -FCCU	34776	285729			.564034	119.371	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 13087.4

AVAILABLE C3/C4 OLEFINS= 34776

CONVERSION Wt%= 78.3409   CONVERSION Vol %= 80

COKE, WT% 10.4089

COKE ,#/HR 195896   Sulfur in Flue Gas,Lbs/hr= 409.427

CAT POLY UNIT

*** FEED ***

< 10 > CAT POLY FEED= 15000

*** PRODUCT ***
< 15 > POLYMER= 6114.52
< 16 > LE FROM POLY (FOE)= 4713.78

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 28624
< 62 > C3/C4 TO ALKYL= 19776
< 20 > I-C4 FR. GAS PLANT= 6994.63
< 21 > I-C4 IMPORTED= 1853.34
*** PRODUCT ***
< 50 > ALKYLATE= 20421.8
< 63 > LE FROM ALKYL (FOE)= 2457.09

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	71000	782298	170.144	321.814	.756386	55.5738	0	0
	*** PRODUCT ***								
17	REFORMATE	61795.7	729045			.80989	43.2152	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 5848.58
CONVERSION(LV%)= 87.0362 Severity (RON Clear)= 90 FEED KW= 11.815

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 48884.4
< 57 > LE FROM REFORMER (FOE)= 5848.58
< 18 > LE FROM CAT CRACKER (FOE)= 13087.4
< 16 > LE FROM POLY (FOE)= 4713.78
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 19499
< 20 > I-C4 FR. GAS PLANT= 6994.63
< 49 > REF C4 TO BLENDING = 12083.4
< 69 > LSR= 30807.2

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 30807.2
*** PRODUCT ***
< 29 > LSR+ISO= 30807.2

*** BY-PASS= 100 % ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 30807.2
< 26 > REFORMATE= 54813.7
< 50 > ALKYLATE= 20421.8
< 15 > POLYMER= 6114.52
< 14 > CRACKED GAS= 78989.4
< 49 > REF C4 TO BLENDING = 12083.4
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 60195
< 23 > UNLEADED REGULAR= 126555
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.158861	.167869	0	0
CRACKED GAS	.637762	.25	.644597	0
REFORMATE	.138055	.352472	.136421	0
POLYMER	0	.0483151	0	0
ALKYLATE	0	.124939	.15	.9786
C4	.0653232	.0564045	.0689819	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 2714.79
< 58 > NAPHTHA= 14165.2
< 59 > KEROSENE= 21112
*** PRODUCT ***
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.13	0
NAPHTHA	.58	.12
KEROSENE	.29	.88

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 106185
< 40 > LGO= 51796
< 38 > LCO= 19146.2
*** PRODUCT ***
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.63	.0632695
LCO	0	.1	.25113
LGO	0	.27	.685601

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= .564941
< 35 > LCO= 3356
< 13 > HCO= 5625.56
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 15359.9
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 24342

OTHER PRODUCTS

< 27 > NAPHTHA SPECIALTIES= 6982
< 36 > HVGO TO LUBE OIL= 5472
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	127297	127297	1.54469E+06	.0623558	0	3.11964E-03
LGO	51796.5	51796.6	664720	.219173	-1.35748E-04	.0219604
LCO	22502.2	11251.1	159388	.703057	50	.387909
HCO	5625.56	0	0	1.11083	100	1.11083
VAC RESIDUUM	15359.9	0	0	1.7133	100	1.7133

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	20883	17109	5913	13398	157816	24342
S.G.	.76794	.823821	.833017	.900931	.859916	1.04424
ASTM 10%	198.253	340.685	386.182	511.187	400.792	
ASTM 20%	219.647	366.419	400.551	545.273	428.233	
ASTM 50%	275.418	431.587	447.744	592.996	504.115	
ASTM 90%	470.866	516.886	519.593	626.728	607.382	
RVP,psia	2.56867					
Sulfur Wt %	.0117914	4.41314E-03	3.11779E-03	.119698	.0516962	1.39871
Flash Point,F	59.6312	131.397	145.354	215.095	153.175	
Pour Point,F	-97.9965	-50.694	-43.8387	-10.8165	-33.2053	
Cetane No.					42.4845	
Visc @100F,cs	.769495	1.60317	1.83069	4.93126	2.55453	1217.58
Visc @122F,cs	.678863	1.36749	1.55016	3.89203	2.11737	454.812
Watsons K	11.7932	11.6414	11.6071	11.2411	11.4465	10.7236
MeABP	282.812	422.107	443.937	578.75	493.661	944.27

GASOLINE

LEADED REGULAR,BPCD 60195
TEL Addition,cc/IG: .22
RON / MON / (R+M)/2 (Clear) 90.6615 / 81.503 / 86.0823
RON / MON / (R+M)/2 91.7444 / 82.4373 / 87.0909
RVP,psia 10.17

MMT Addition,mg/l: 18
UNLEADED REGULAR,BPCD 126555
RON / MON / (R+M)/2 91.3 / 82.8917 / 87.0959
RVP,psia 10.1745

UNLEADED PREMIUM,BPCD 13901
RON / MON / (R+M)/2 94.6999 / 85.4017 / 90.0508
RVP,psia 9.7869

AVIATION GASOLINE,BPCD	2579
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 491056
< 1 > REDUCED CRUDE= 173317
< 2 > OVERHEAD= 48884.4
< 3 > NAPHTHA= 85542.2
< 4 > KEROSENE= 127297
< 5 > LGO= 56015.7
< 6 > HVGO= 141892
< 7 > RESIDUUM= 31424.9
< 8 > FCCU FEED= 140639
< 9 > REFORMER FEED= 71000
< 10 > CAT POLY FEED= 15000
< 11 > ALKYLATION FEED= 28624
< 12 > LCO= 22502.2
< 13 > HCO= 5625.56
< 14 > CRACKED GAS= 78989.4
< 15 > POLYMER= 6114.52
< 16 > LE FROM POLY (FOE)= 4713.78
< 17 > REFORMATE= 61795.7
< 18 > LE FROM CAT CRACKER (FOE)= 13087.4
< 19 > FUEL GAS (FOE)= 19499
< 20 > I-C4 FR. GAS PLANT= 6994.63
< 21 > I-C4 IMPORTED= 1853.34
< 22 > LEADED REGULAR= 60195
< 23 > UNLEADED REGULAR= 126555
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579
< 26 > REFORMATE= 54813.7
< 27 > NAPHTHA SPECIALTIES= 6982
< 28 > LSR= 33522
< 29 > LSR+ISO= 30807.2
< 30 > LSR= 2714.79
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 173317
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 34 > VAC RESIDUUM= 15359.9
< 35 > LCO= 3356
< 36 > HVGO TO LUBE OIL= 5472
< 37 > HVGO= 0
< 38 > LCO= 19146.2
< 39 > C3/C4 -FCCU= 34776
< 40 > LGO= 51796
< 41 > LGO= .564941
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816
< 47 > HEAVY FUEL OIL= 24342
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 12083.4
< 50 > ALKYLATE= 20421.8
< 51 > CRUDE LIGHT ENDS= 3.12845
< 52 > TOTAL PRODUCT= 471587
< 53 > C2 % IN CRUDE FEED= .10416
< 54 > C3 % IN CRUDE FEED= .87234
< 55 > I-C4 % IN CRUDE FEED= .41795
< 56 > N-C4 % IN CRUDE FEED= 1.734
< 57 > LE FROM REFORMER (FOE)= 5848.58
< 58 > NAPHTHA= 14165.2
< 59 > KEROSENE= 21112
< 60 > KEROSENE= 106185
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 19776
< 63 > LE FROM ALKYL (FOE)= 2457.09
< 64 > HVGO= 136420
< 65 > LGO = 4219.17
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0
< 69 > LSR= 30807.2

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2682.22	2574.06	42926	0	0	0	48182.3
C3 ,#/HR	31699.2	11657.6	30503.8	13517	14571.1	0	101949
IC4 ,#/HR	16891	10728.5	70737.1	32976.1	0	0	131333
NC4 ,#/HR	72564.1	15657.1	27604.5	11906.7	15697.8	0	143430
H2 ,#/HR	0	10061.4	17569.2	0	0	0	27630.6
C1 ,#/HR	0	2574.06	17798.6	0	0	0	20372.7
H2S ,#/HR	0	0	3899.18	0	0	0	3899.18
C2= ,#/HR	0	0	26174.4	0	0	0	26174.4
C3= ,#/HR	0	0	69276.4	0	0	0	69276.4
C4= ,#/HR	0	0	107729	0	0	0	107729
TOTAL ,#/HR	123837	53252.7	414218	58399.8	30268.9	0	679976
BPCD (FOE)	10022	5848.57	35802.2	4713.78	2457.09	0	58843.6

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	48182.3	48182.3
C3 ,#/HR	11052.1	14571.1	0	0	0	76325.5	101949
IC4 ,#/HR	30511.2	97791.7	2622.58	0	0	407.209	131333
NC4 ,#/HR	11906.7	15697.8	100259	0	0	15566.7	143430
H2 ,#/HR	0	0	0	0	15896	11734.6	27630.6
C1 ,#/HR	0	0	0	0	0	20372.7	20372.7
H2S ,#/HR	0	0	0	0	0	3899.18	3899.18
C2= ,#/HR	0	0	0	0	0	26174.4	26174.4
C3= ,#/HR	23307.3	30728.3	0	0	0	15240.8	69276.4
C4= ,#/HR	46467	61262	0	0	0	0	107729
TOTAL ,#/HR	123244	220051	102882	0	15896	217903	679976
BPCD (FOE)	9820.21	17570.1	8285.48	0	3668.8	19499	58843.6

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	491056	6.03835E+06
BUTANE	1853.34	15253
TOTAL	492909	6.0536E+06

*** PRODUCT ***

FUEL GAS (FOE)	19499	217903
MOTOR GASOLINE	203230	2.18587E+06
AVIATION TURBO FUELS	37992	438928
DISTILLATES	177127	2.22445E+06
HEAVY FUEL OIL	24342	370277
OTHER PRODUCTS	28896	404637
H2 TO DESULFURIZERS (FOE)	3668.8	15896
COKE (FOE)	10433.4	195896
TOTAL	505188	6.05386E+06

TIME:14.52.47 DATE:MONAPR301984121 40

REFINERY SIMULATION PROGRAM

CASE:WESBAS40 REGION:WESTERN

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	65.1	320336
SYNCRUDE	31.5	155002
CONDENSA	3.4	16730.3

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				492068	6.0508E+06	18830.1
Average		.844145	36.1252	.311201			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	492068	6.0508E+06	60	1240	.844146	36.125	.3112	18830.1
	*** PRODUCT ***								
2	OVERHEAD	48920	453436	60	170.011	.636296	90.8807	.0147132	66.7149
28	LSR	33525.9	329273	60	170.011	.674227	78.37	.0202738	66.7562
3	NAPHTHA	86251.1	950527	170.011	322.634	.756536	55.5367	.014897	141.6
4	KEROSENE	127092	1.5425E+06	322.634	560	.833178	38.3317	.0625075	964.18
5	LGO	56131.2	720347	560	660	.880983	29.116	.219173	1578.81
1	REDUCED CRUDE	173674	2.38399E+06	660	1240	.942321	18.6611	.67445	16078.8

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	173674	2.38399E+06	660	1240	.942321	18.6611	.67445	16078.8
	*** PRODUCT ***								
6	HVGO	142187	1.90413E+06	660	1050	.919318	22.4184	.412657	7857.51
7	RESIDUUM	31486.5	479859	1050	1240	1.04621	3.75011	1.7133	8221.42

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	4519.52	58000.3	560	660	.880983	29.116	.219173	127.121
64	HVGO	136715	1.83085E+06	660	1050	.919318	22.4184	.412657	7555.12
	*** TOTAL FEED ***								
8	FCCU FEED	141235	1.88885E+06	560	1050	.918091	22.6242	.406714	7682.24
	*** PRODUCT ***								
12	LCO	22597.6	320082	430	650	.972365	14.0215	.702439	2248.38
13	HCO	5649.4	89010.1	650	736.633	1.0816	-.675293	1.10985	987.878
14	CRACKED GAS	79344.8	867682			.75071	56.9882	.0407482	353.565
39	C3/C4 -FCCU	34928.6	286979			.564025	119.375	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 13133.8

AVAILABLE C3/C4 OLEFINS= 34928.6

CONVERSION Wt%= 78.3418 CONVERSION Vol %= 80

COKE, WT% 10.3958

COKE ,#/HR 196463 Sulfur in Flue Gas,Lbs/hr= 410.719

CAT POLY UNIT

*** FEED ***

< 10 > CAT POLY FEED= 15000

*** PRODUCT ***
< 15 > POLYMER= 6114.78
< 16 > LE FROM POLY (FOE)= 4713.39

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 28845.2
< 62 > C3/C4 TO ALKYL= 19928.6
< 20 > I-C4 FR. GAS PLANT= 7194.93
< 21 > I-C4 IMPORTED= 1721.69
*** PRODUCT ***
< 50 > ALKYLATE= 20580.5
< 63 > LE FROM ALKYL (FOE)= 2475.18

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	71500	787963	170.011	322.634	.756536	55.5367	0	0
	*** PRODUCT ***								
17	REFORMATE	61284.9	719317			.805744	44.1142	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 7754.42
CONVERSION(LV%)= 85.7132   Severity (RON Clear)= 92.8   FEED KW= 11.8145

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 48920
< 57 > LE FROM REFORMER (FOE)= 7754.42
< 18 > LE FROM CAT CRACKER (FOE)= 13133.8
< 16 > LE FROM POLY (FOE)= 4713.39
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 21368.5
< 20 > I-C4 FR. GAS PLANT= 7194.93
< 49 > REF C4 TO BLENDING = 12075.9
< 69 > LSR= 30811.1

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 30811.1
*** PRODUCT ***
< 29 > LSR+ISO= 30811.1

*** BY-PASS= 100 %   ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 30811.1
< 26 > REFORMATE= 54302.9
< 50 > ALKYLATE= 20580.5
< 15 > POLYMER= 6114.78
< 14 > CRACKED GAS= 79344.8
< 49 > REF C4 TO BLENDING = 12075.9
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 20065
< 23 > UNLEADED REGULAR= 166685
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.448439	.130865	0	0
CRACKED GAS	.457405	.37	.611003	0
REFORMATE	.0511585	.319623	0	0
POLYMER	0	.0366846	0	0
ALKYLATE	0	.0808004	.33	.9786
C4	.0429977	.0620271	.0589972	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 2714.79
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 20903.2
*** PRODUCT ***
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.13	0
NAPHTHA	.59	.12
KEROSENE	.28	.88

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 106189
< 40 > LGO= 51611.6
< 38 > LCO= 19326.6
*** PRODUCT ***
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.63	.0635674
LCO	0	.1	.264592
LGO	0	.27	.671841

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= .0532227
< 35 > LCO= 3271
< 13 > HCO= 5649.4
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 15421.5
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 24342

OTHER PRODUCTS

< 27 > NAPHTHA SPECIALTIES= 6982
< 36 > HVGO TO LUBE OIL= 5472
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	FEED TO DDS SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	127092	127092	1.5425E+06	.0625075	0	3.12723E-03
LGO	51611.7	51611.7	662347	.219173	-3.78427E-05	.0219605
LCO	22597.6	11298.8	160041	.702439	50	.387567
HCO	5649.4	0	0	1.10985	100	1.10985
VAC RESIDUUM	15421.5	0	0	1.7133	100	1.7133

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	20883	17109	5913	13398	157816	24342
S.G.	.767296	.823981	.833178	.902123	.860004	1.0445
ASTM 10%	198.065	341.3	386.942	508.926	401.571	
ASTM 20%	219.227	367.077	401.235	543.747	428.835	
ASTM 50%	274.306	432.077	448.188	592.34	504.294	
ASTM 90%	468.413	516.962	519.673	626.474	607.371	
RVP,psia	2.57134					
Sulfur Wt %	.0119321	4.42234E-03	3.12537E-03	.124746	.0516514	1.40227
Flash Point,F	59.5304	131.741	145.76	213.842	153.595	
Pour Point,F	-98.1424	-50.5157	-43.6621	-12.4326	-33.0639	
Cetane No.					42.478	
Visc @100F,cs	.765706	1.60759	1.83594	4.90789	2.56007	1269.82
Visc @122F,cs	.67566	1.37106	1.55436	3.87306	2.12168	470.884
Watsons K	11.7976	11.6412	11.6069	11.2227	11.4467	10.7253
MeABP	281.782	422.574	444.405	577.76	493.985	945.99

GASOLINE

LEADED REGULAR,BPCD	20065
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	85.3115 / 78.1682 / 81.7399
RON / MON / (R+M)/2	90.823 / 83.1471 / 86.9851
RVP,psia	10.8717
MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	166685
RON / MON / (R+M)/2	91.3 / 82.759 / 87.0295
RVP,psia	10.092
UNLEADED PREMIUM,BPCD	13901
RON / MON / (R+M)/2	93.7429 / 86.3273 / 90.0351
RVP,psia	9.80215

AVIATION GASOLINE,BPCD	2579
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 492068
< 1 > REDUCED CRUDE= 173674
< 2 > OVERHEAD= 48920
< 3 > NAPHTHA= 86251.1
< 4 > KEROSENE= 127092
< 5 > LGO= 56131.2
< 6 > HVGO= 142187
< 7 > RESIDUUM= 31486.5
< 8 > FCCU FEED= 141235
< 9 > REFORMER FEED= 71500
< 10 > CAT POLY FEED= 15000
< 11 > ALKYLATION FEED= 28845.2
< 12 > LCO= 22597.6
< 13 > HCO= 5649.4
< 14 > CRACKED GAS= 79344.8
< 15 > POLYMER= 6114.78
< 16 > LE FROM POLY (FOE)= 4713.39
< 17 > REFORMATE= 61284.9
< 18 > LE FROM CAT CRACKER (FOE)= 13133.8
< 19 > FUEL GAS (FOE)= 21368.5
< 20 > I-C4 FR. GAS PLANT= 7194.93
< 21 > I-C4 IMPORTED= 1721.69
< 22 > LEADED REGULAR= 20065
< 23 > UNLEADED REGULAR= 166685
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579
< 26 > REFORMATE= 54302.9
< 27 > NAPHTHA SPECIALTIES= 6982
< 28 > LSR= 33525.9
< 29 > LSR+ISO= 30811.1
< 30 > LSR= 2714.79
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 173674
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 34 > VAC RESIDUUM= 15421.5
< 35 > LCO= 3271
< 36 > HVGO TO LUBE OIL= 5472
< 37 > HVGO= 0
< 38 > LCO= 19326.6
< 39 > C3/C4 -FCCU= 34928.6
< 40 > LGO= 51611.6
< 41 > LGO= .0532227
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816
< 47 > HEAVY FUEL OIL= 24342
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 12075.9
< 50 > ALKYLATE= 20580.5
< 51 > CRUDE LIGHT ENDS= 3.12845
< 52 > TOTAL PRODUCT= 471587
< 53 > C2 % IN CRUDE FEED= .10416
< 54 > C3 % IN CRUDE FEED= .87234
< 55 > I-C4 % IN CRUDE FEED= .41795
< 56 > N-C4 % IN CRUDE FEED= 1.734
< 57 > LE FROM REFORMER (FOE)= 7754.42
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 20903.2
< 60 > KEROSENE= 106189
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 19928.6
< 63 > LE FROM ALKYL (FOE)= 2475.18
< 64 > HVGO= 136715
< 65 > LGO = 4519.52
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0
< 69 > LSR= 30811.1

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2687.75	4355.44	43070.5	0	0	0	50113.7
C3 ,#/HR	31764.6	15069.3	30633	13515.3	14681.3	0	105663
IC4 ,#/HR	16925.8	12425.4	71055.6	32979.5	0	0	133386
NC4 ,#/HR	72713.7	18133.6	27710.7	11900.3	15810.4	0	146269
H2 ,#/HR	0	14306.4	17628.4	0	0	0	31934.8
C1 ,#/HR	0	4355.44	17858.5	0	0	0	22213.9
H2S ,#/HR	0	0	3911.8	0	0	0	3911.8
C2= ,#/HR	0	0	26262.5	0	0	0	26262.5
C3= ,#/HR	0	0	69624.1	0	0	0	69624.1
C4= ,#/HR	0	0	108174	0	0	0	108174
TOTAL ,#/HR	124092	68645.6	415929	58395.1	30491.7	0	697553
BPCD (FOE)	10042.7	7754.4	35948	4713.4	2475.18	0	60933.6

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	50113.7	50113.7
C3 ,#/HR	11050.4	14681.3	0	0	0	79931.8	105663
IC4 ,#/HR	30514.7	99755.2	2633.53	0	0	482.907	133386
NC4 ,#/HR	11900.3	15810.4	100184	0	0	18374	146269
H2 ,#/HR	0	0	0	0	15869	16065.8	31934.8
C1 ,#/HR	0	0	0	0	0	22213.9	22213.9
H2S ,#/HR	0	0	0	0	0	3911.8	3911.8
C2= ,#/HR	0	0	0	0	0	26262.5	26262.5
C3= ,#/HR	23321.9	30984.9	0	0	0	15317.3	69624.1
C4= ,#/HR	46455.1	61718.9	0	0	0	0	108174
TOTAL ,#/HR	123242	222951	102818	0	15869	232674	697553
BPCD (FOE)	9820.06	17802.2	8280.32	0	3662.56	21368.5	60933.6

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	492068	6.0508E+06
BUTANE	1721.69	14169.5
TOTAL	493790	6.06497E+06

*** PRODUCT ***

FUEL GAS (FOE)	21368.5	232674
MOTOR GASOLINE	203230	2.18195E+06
AVIATION TURBO FUELS	37992	438772
DISTILLATES	177127	2.2249E+06
HEAVY FUEL OIL	24342	370369
OTHER PRODUCTS	28896	404217
H2 TO DESULFURIZERS (FOE)	3662.56	15869
COKE (FOE)	10463.6	196463
TOTAL	507082	6.06522E+06

"B"

TIME:00.38.31 DATE:WEDAPR251984116 42

REFINERY SIMULATION PROGRAM

CASE:ATLBAS11 REGION:ATLANTIC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	33	45007.3
VENEZL	7	9547
ARABL	30.6	41734
SYNCRUDE	15	20457.9
MEXL	9.9	13502.2
NORTHSEA	4.5	6137.36

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				136386	1.7232E+06	20723.8
Average		.867354	31.6399	1.20263			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	136386	1.7232E+06	60	1360	.867353	31.6401	1.20263	20723.8
	*** PRODUCT ***								
2	OVERHEAD	8701.33	81284.9	60	170.173	.641289	89.1493	.0146331	11.8945
28	LSR	6507.37	63269	60	170.173	.667445	80.5025	.0187834	11.8841
3	NAPHTHA	11533.6	122041	170.173	272.139	.726394	63.2979	.0227664	27.7844
4	KEROSENE	37083.7	436241	272.139	540	.807557	43.7198	.170345	743.114
5	LGO	17023.4	215875	540	660	.870536	31.0435	.767538	1656.93
1	REDUCED CRUDE	62043.7	867757	660	1360	.960131	15.8757	2.10705	18284.1

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	62043.7	867757	660	1360	.960131	15.8757	2.10705	18284.1
	*** PRODUCT ***								
6	HVGO	43933	589179	660	1050	.920633	22.1986	1.3757	8105.34
7	RESIDUUM	18110.7	278579	1050	1360	1.05595	2.50256	3.65395	10179.1

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	0	0	540	660	.870536	31.0435	.767538	0
64	HVGO	43870	588335	660	1050	.920633	22.1986	1.3757	8093.72
	*** TOTAL FEED ***								
8	FCCU FEED	43870	588335	540	1050	.920633	22.1986	1.3757	8093.72
	*** PRODUCT ***								
12	LCO	10283.1	144615	430	650	.965424	15.0677	1.82822	2643.87
13	HCO	2570.78	39591.7	650	775.239	1.05723	2.34032	2.88859	1143.64
14	CRACKED GAS	22517.4	245370			.748055	57.6572	.170228	417.689
39	C3/C4 -FCCU	9156.68	75248.9			.564147	119.321	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 2906.93

AVAILABLE C3/C4 OLEFINS= 9156.68

CONVERSION Wt%= 68.6902 CONVERSION Vol %= 70.7

COKE, WT% 8.85311

COKE ,#/HR 52112.7 Sulfur in Flue Gas,Lbs/hr= 356.051

CAT POLY UNIT

*** FEED ***
< 10 > CAT POLY FEED= 9156.68
*** PRODUCT ***
< 15 > POLYMER= 3734.99
< 16 > LE FROM POLY (FOE)= 2876.54

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 0
< 63 > LE FROM ALKYL (FOE)= 0

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	8900	94174.3	170.173	272.139	.726394	63.2979	0	0
	*** PRODUCT ***								
17	REFORMATE	6716.79	77211.3			.789131	47.8111	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 1997.19
CONVERSION(LV%)= 75.4696   Severity (RON Clear)= 98   FEED KW= 12.1711

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 8701.33
< 57 > LE FROM REFORMER (FOE)= 1997.19
< 18 > LE FROM CAT CRACKER (FOE)= 2906.93
< 16 > LE FROM POLY (FOE)= 2876.54
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 6206.62
< 20 > I-C4 FR. GAS PLANT= 0
< 49 > REF C4 TO BLENDING = 2772.15
< 69 > LSR= 6313.66

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 6313.66
*** PRODUCT ***
< 29 > LSR+ISO= 6212.64

*** BY-PASS= 0 %   ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 6212.64
< 26 > REFORMATE= 6716.79
< 50 > ALKYLATE= 0
< 15 > POLYMER= 3734.99
< 14 > CRACKED GAS= 22517.4
< 49 > REF C4 TO BLENDING = 2772.15
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 12580

< 23 > UNLEADED REGULAR= 26418
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.308657	.0881875	0	0
CRACKED GAS	.382179	.63	.360708	0
REFORMATE	.256065	.0692869	.563287	0
POLYMER	0	.141381	0	0
ALKYLATE	0	0	0	.9786
C4	.0530985	.071145	.0760044	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 193.71
< 58 > NAPHTHA= 1285.58
< 59 > KEROSENE= 4684.71
*** PRODUCT ***
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.48	.1
KEROSENE	.41	.9

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 32399
< 40 > LGO= 17022.9
< 38 > LCO= 7566.13
*** PRODUCT ***
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.607	.489286
LCO	0	.139	.138136
LGO	0	.254	.372578

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= .491455
< 35 > LCO= 2717
< 13 > HCO= 2570.78
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 8612.73

*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 13901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 0
< 36 > HVGO TO LUBE OIL= 63
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	FEED TO DDS SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	37083.7	37083.7	436241	.170345	0	8.53106E-03
LGO	17023.4	17023.4	215875	.767538	0	.0772877
LCO	10283.1	7198.19	101231	1.82822	29.9998	.68432
HCO	2570.78	0	0	2.88859	100	2.88859
VAC RESIDUUM	8612.73	0	0	3.65395	100	3.65395

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	1761	4403	2390	26607	27991	13901
S.G.	.753186	.79944	.807557	.852828	.845497	1.03849
ASTM 10%	205.915	311.756	344.898	368.892	361.971	
ASTM 20%	221.322	335.361	362.423	410.794	393.61	
ASTM 50%	262.03	398.298	411.931	518.424	483.289	
ASTM 90%	470.149	494.512	496.885	610.471	603.48	
RVP,psia	2.85336					
Sulfur Wt %	.0161143	9.81198E-03	8.51726E-03	.138914	.132373	2.96873
Flash Point,F	64.0597	115.238	126.491	140.022	135.913	
Pour Point,F	-80.9626	-50.3417	-45.3705	-29.3593	-37.1592	
Cetane No.					44.8839	
Visc @100F,cs	.78293	1.33347	1.47524	2.4814	2.16093	1261.13
Visc @122F,cs	.691046	1.15008	1.26588	2.06315	1.81158	474.214
Watsons K	12.0525	11.8584	11.8201	11.5295	11.5432	10.796
MeABP	288.074	392.009	409.731	490.653	469.649	949.36

GASOLINE

LEADED REGULAR,BPCD 12580
TEL Addition,cc/IG: 1.24
RON / MON / (R+M)/2 (Clear) 89.8754 / 81.7256 / 85.8005
RON / MON / (R+M)/2 94.3376 / 85.478 / 89.9078
RVP,psia 11.3527

MMT Addition,mg/l: 18
UNLEADED REGULAR,BPCD 26418
RON / MON / (R+M)/2 93.9 / 84.2098 / 89.0549
RVP,psia 10.2756

UNLEADED PREMIUM,BPCD 2956

RON / MON / (R+M)/2	96.7 / 87.0223 / 91.8611
RVP,psia	9.84803

AVIATION GASOLINE,BPCD	0
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 136386
< 1 > REDUCED CRUDE= 62043.7
< 2 > OVERHEAD= 8701.33
< 3 > NAPHTHA= 11533.6
< 4 > KEROSENE= 37083.7
< 5 > LGO= 17023.4
< 6 > HVGO= 43933
< 7 > RESIDUUM= 18110.7
< 8 > FCCU FEED= 43870
< 9 > REFORMER FEED= 8900
< 10 > CAT POLY FEED= 9156.68
< 11 > ALKYLATION FEED= 0
< 12 > LCO= 10283.1
< 13 > HCO= 2570.78
< 14 > CRACKED GAS= 22517.4
< 15 > POLYMER= 3734.99
< 16 > LE FROM POLY (FOE)= 2876.54
< 17 > REFORMATE= 6716.79
< 18 > LE FROM CAT CRACKER (FOE)= 2906.93
< 19 > FUEL GAS (FOE)= 6206.62
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 12580
< 23 > UNLEADED REGULAR= 26418
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0
< 26 > REFORMATE= 6716.79
< 27 > NAPHTHA SPECIALTIES= 0
< 28 > LSR= 6507.37
< 29 > LSR+ISO= 6212.64
< 30 > LSR= 193.71
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 62043.7
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 34 > VAC RESIDUUM= 8612.73
< 35 > LCO= 2717
< 36 > HVGO TO LUBE OIL= 63
< 37 > HVGO= 0
< 38 > LCO= 7566.13
< 39 > C3/C4 -FCCU= 9156.68
< 40 > LGO= 17022.9
< 41 > LGO= .491455
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991
< 47 > HEAVY FUEL OIL= 13901
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 2772.15
< 50 > ALKYLATE= 0
< 51 > CRUDE LIGHT ENDS= 1.60865
< 52 > TOTAL PRODUCT= 129916
< 53 > C2 % IN CRUDE FEED= .02451
< 54 > C3 % IN CRUDE FEED= .31962
< 55 > I-C4 % IN CRUDE FEED= .19662
< 56 > N-C4 % IN CRUDE FEED= 1.0679
< 57 > LE FROM REFORMER (FOE)= 1997.19
< 58 > NAPHTHA= 1285.58
< 59 > KEROSENE= 4684.71
< 60 > KEROSENE= 32399
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 63 > LE FROM ALKYL (FOE)= 0
< 64 > HVGO= 43870
< 65 > LGO = 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0
< 69 > LSR= 6313.66

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	175.297	1620.97	9289.55	0	0	0	11085.8
C3 ,#/HR	3225.78	4115.03	7905.94	8145.97	0	233.606	23626.3
IC4 ,#/HR	2206.97	2271.03	18521.3	20026.3	0	415.692	43441.3
NC4 ,#/HR	12412	3314.34	7467.12	7467.12	0	1183.69	31844.3
H2 ,#/HR	0	4020.61	3630.98	0	0	0	7651.59
C1 ,#/HR	0	1620.97	3851.76	0	0	0	5472.73
H2S ,#/HR	0	0	3753.24	0	0	0	3753.24
C2= ,#/HR	0	0	5664.36	0	0	0	5664.36
C3= ,#/HR	0	0	18286.1	0	0	0	18286.1
C4= ,#/HR	0	0	28356.4	0	0	0	28356.4
TOTAL ,#/HR	18020	16963	106727	35639.4	0	1832.99	179182
BPCD (FOE)	1455.75	1997.19	8851.88	2876.54	0	147.842	15329.2

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	11085.8	11085.8
C3 ,#/HR	6640.99	0	0	0	0	16985.3	23626.3
IC4 ,#/HR	18521.3	0	11731.8	0	0	13188.2	43441.3
NC4 ,#/HR	7467.12	0	11476.2	0	0	12901	31844.3
H2 ,#/HR	0	0	0	0	5460.73	2190.86	7651.59
C1 ,#/HR	0	0	0	0	0	5472.73	5472.73
H2S ,#/HR	0	0	0	0	0	3753.24	3753.24
C2= ,#/HR	0	0	0	0	0	5664.36	5664.36
C3= ,#/HR	14263.1	0	0	0	0	4023	18286.1
C4= ,#/HR	28356.4	0	0	0	0	0	28356.4
TOTAL ,#/HR	75248.9	0	23208	0	5460.73	75264.5	179182
BPCD (FOE)	5995.78	0	1866.47	0	1260.34	6206.62	15329.2

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	136386	1.7232E+06
BUTANE	0	0
TOTAL	136386	1.7232E+06

*** PRODUCT ***

FUEL GAS (FOE)	6206.62	75264.5
MOTOR GASOLINE	41954	444952
AVIATION TURBO FUELS	6164	70596
DISTILLATES	56988	703405
HEAVY FUEL OIL	13901	210290
OTHER PRODUCTS	10909	161207
H2 TO DESULFURIZERS (FOE)	1260.34	5460.73
COKE (FOE)	2775.52	52112.7
TOTAL	140158	1.72329E+06

TIME:15.30.26 DATE:FRIAPR271984118 44

REFINERY SIMULATION PROGRAM

CASE:ATLBAS10 REGION:ATLANTIC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	33	45002.1
VENEZL	7	9545.91
ARABL	30.6	41729.3
SYNCRUDE	15	20455.5
MEXL	9.9	13500.6
NORTHSEA	4.5	6136.66

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				136370	1.723E+06	20721.4
Average		.867354	31.6399	1.20263			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
0	CRUDE FEED	136370	1.723E+06	60	1360	.867354	31.6399	1.20264	20721.4
		*** PRODUCT ***							
2	OVERHEAD	8689.26	81161.3	60	170.053	.641204	89.1788	.0145977	11.8477
28	LSR	6495.55	63149	60	170.053	.667391	80.5197	.0187823	11.8608
3	NAPHTHA	11533.6	122034	170.053	272.064	.726348	63.3102	.0227565	27.7706
4	KEROSENE	37089.2	436297	272.064	540	.807541	43.7233	.170311	743.062
5	LGO	17021.4	215850	540	660	.870536	31.0435	.767538	1656.73
1	REDUCED CRUDE	62036.6	867658	660	1360	.960131	15.8757	2.10705	18282

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
32	REDUCED CRUDE	62036.6	867658	660	1360	.960131	15.8757	2.10705	18282
		*** PRODUCT ***							
6	HVGO	43928	589112	660	1050	.920633	22.1986	1.3757	8104.42
7	RESIDUUM	18108.6	278547	1050	1360	1.05595	2.50256	3.65395	10178

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
65	LGO	0	0	540	660	.870536	31.0435	.767538	0
64	HVGO	43865	588267	660	1050	.920633	22.1986	1.3757	8092.79
		*** TOTAL FEED ***							
8	FCCU FEED	43865	588267	540	1050	.920633	22.1986	1.3757	8092.79
		*** PRODUCT ***							
12	LCO	10282	144599	430	650	.965424	15.0677	1.82822	2643.59
13	HCO	2570.49	39587.3	650	775.239	1.05723	2.34032	2.88859	1143.51
14	CRACKED GAS	22514.8	245342			.748055	57.6572	.170229	417.642
39	C3/C4 -FCCU	9155.64	75240.4			.564147	119.321	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 2906.6

AVAILABLE C3/C4 OLEFINS= 9155.64

CONVERSION Wt%= 68.6902   CONVERSION Vol %= 70.7

COKE, WT% 8.8531

COKE ,#/HR 52106.7   Sulfur in Flue Gas,Lbs/hr= 355.982

CAT POLY UNIT

*** FEED ***
< 10 > CAT POLY FEED= 9155.64
*** PRODUCT ***
< 15 > POLYMER= 3734.57
< 16 > LE FROM POLY (FOE)= 2876.22

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 0
< 63 > LE FROM ALKYL (FOE)= 0

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
9	REFORMER FEED	8900	94168.3	170.053	272.064	.726348	63.3102	0	0
		*** PRODUCT ***							
17	REFORMATE	6716.57	77204.4			.789086	47.8215	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 1997.32
CONVERSION(LV%)= 75.4671 Severity (RON Clear)= 98 FEED KW= 12.1713

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 8689.26
< 57 > LE FROM REFORMER (FOE)= 1997.32
< 18 > LE FROM CAT CRACKER (FOE)= 2906.6
< 16 > LE FROM POLY (FOE)= 2876.22
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 6183.82
< 20 > I-C4 FR. GAS PLANT= 0
< 49 > REF C4 TO BLENDING = 2771.88
< 69 > LSR= 6301.84

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 6301.84
*** PRODUCT ***
< 29 > LSR+ISO= 6216.14

*** BY-PASS= 15 % ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 6216.14
< 26 > REFORMATE= 6716.57
< 50 > ALKYLATE= 0
< 15 > POLYMER= 3734.57
< 14 > CRACKED GAS= 22514.8
< 49 > REF C4 TO BLENDING = 2771.88
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 4915

< 23 > UNLEADED REGULAR= 34083
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.666679	.0862427	0	0
CRACKED GAS	.307208	.6	.187792	0
REFORMATE	0	.133152	.736924	0
POLYMER	0	.109573	0	0
ALKYLATE	0	0	0	.9786
C4	.0261127	.0710324	.0752844	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 193.71
< 58 > NAPHTHA= 1285.58
< 59 > KEROSENE= 4684.71
*** PRODUCT ***
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.48	.1
KEROSENE	.41	.9

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 32404.5
< 40 > LGO= 17020.6
< 38 > LCO= 7562.96
*** PRODUCT ***
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.607	.489493
LCO	0	.139	.138017
LGO	0	.254	.37249

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= .878174
< 35 > LCO= 2719
< 13 > HCO= 2570.49
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 8610.63

*** PRODUCT ***

< 47 > HEAVY FUEL OIL= 13901

OTHER PRODUCTS

< 27 > NAPHTHA SPECIALTIES= 0
< 36 > HVGO TO LUBE OIL= 63
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	37089.2	37089.2	436297	.170311	0	8.52935E-03
LGO	17021.4	17021.4	215850	.767538	0	.0772877
LCO	10282	7197.37	101219	1.82822	30.0003	.684328
HCO	2570.49	0	0	2.88859	100	2.88859
VAC RESIDUUM	8610.63	0	0	3.65395	100	3.65395

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	1761	4403	2390	26607	27991	13901
S.G.	.753152	.799422	.807541	.852797	.845488	1.03847
ASTM 10%	205.842	311.686	344.833	368.809	361.906	
ASTM 20%	221.245	335.298	362.366	410.712	393.56	
ASTM 50%	261.946	398.264	411.897	518.364	483.277	
ASTM 90%	470.137	494.505	496.879	610.466	603.481	
RVP,psia	2.78681					
Sulfur Wt %	.0161087	9.80948E-03	8.51555E-03	.138822	.132373	2.96825
Flash Point,F	64.0193	115.198	126.456	139.977	135.878	
Pour Point,F	-80.9778	-50.3543	-45.3832	-29.37	-37.1694	
Cetane No.					44.8859	
Visc @100F,cs	.782688	1.33316	1.47491	2.48043	2.16056	1258.06
Visc @122F,cs	.69084	1.14983	1.26562	2.0624	1.81128	473.258
Watsons K	12.0527	11.8585	11.8202	11.5297	11.5432	10.7959
MeABP	288.008	391.967	409.693	490.597	469.621	949.26

GASOLINE

LEADED REGULAR,BPCD	4915
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	88.4257 / 83.0072 / 85.7165
RON / MON / (R+M)/2	93.3037 / 87.2714 / 90.2876
RVP,psia	12.7507

MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	34083
RON / MON / (R+M)/2	94.0016 / 84.0638 / 89.0327
RVP,psia	10.2205

UNLEADED PREMIUM,BPCD 2956

RON / MON / (R+M)/2	96.85 / 86.8178 / 91.8339
RVP,psia	9.86704
AVIATION GASOLINE,BPCD	0
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 136370	< 1 > REDUCED CRUDE= 62036.6
< 2 > OVERHEAD= 8689.26	< 3 > NAPHTHA= 11533.6
< 4 > KEROSENE= 37089.2	< 5 > LGO= 17021.4
< 6 > HVGO= 43928	< 7 > RESIDUUM= 18108.6
< 8 > FCCU FEED= 43865	< 9 > REFORMER FEED= 8900
< 10 > CAT POLY FEED= 9155.64	< 11 > ALKYLATION FEED= 0
< 12 > LCO= 10282	< 13 > HCO= 2570.49
< 14 > CRACKED GAS= 22514.8	< 15 > POLYMER= 3734.57
< 16 > LE FROM POLY (FOE)= 2876.22	< 17 > REFORMATE= 6716.57
< 18 > LE FROM CAT CRACKER (FOE)= 2906.6	< 19 > FUEL GAS (FOE)= 6183.82
< 20 > I-C4 FR. GAS PLANT= 0	< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 4915	< 23 > UNLEADED REGULAR= 34083
< 24 > UNLEADED PREMIUM= 2956	< 25 > AVIATION GASOLINE= 0
< 26 > REFORMATE= 6716.57	< 27 > NAPHTHA SPECIALTIES= 0
< 28 > LSR= 6495.55	< 29 > LSR+ISO= 6216.14
< 30 > LSR= 193.71	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 62036.6	< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 34 > VAC RESIDUUM= 8610.63	< 35 > LCO= 2719
< 36 > HVGO TO LUBE OIL= 63	< 37 > HVGO= 0
< 38 > LCO= 7562.96	< 39 > C3/C4 -FCCU= 9155.64
< 40 > LGO= 17020.6	< 41 > LGO= .878174
< 42 > JET FUEL B= 1761	< 43 > JET FUEL A= 4403
< 44 > STOVE OIL= 2390	< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991	< 47 > HEAVY FUEL OIL= 13901
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 2771.88
< 50 > ALKYLATE= 0	< 51 > CRUDE LIGHT ENDS= 1.60865
< 52 > TOTAL PRODUCT= 129916	< 53 > C2 % IN CRUDE FEED= .02451
< 54 > C3 % IN CRUDE FEED= .31962	< 55 > I-C4 % IN CRUDE FEED= .19662
< 56 > N-C4 % IN CRUDE FEED= 1.0679	< 57 > LE FROM REFORMER (FOE)= 1997.32
< 58 > NAPHTHA= 1285.58	< 59 > KEROSENE= 4684.71
< 60 > KEROSENE= 32404.5	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 0	< 63 > LE FROM ALKYL (FOE)= 0
< 64 > HVGO= 43865	< 65 > LGO = 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348	< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0	< 69 > LSR= 6301.84

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	175.277	1621.09	9288.49	0	0	0	11084.9
C3 ,#/HR	3225.41	4115.26	7905.04	8145.04	0	198.193	23588.9
IC4 ,#/HR	2206.72	2271.15	18519.2	20024	0	352.676	43373.7
NC4 ,#/HR	12410.6	3314.5	7466.27	7466.27	0	1004.25	31661.9
H2 ,#/HR	0	4020.88	3630.57	0	0	0	7651.45
C1 ,#/HR	0	1621.09	3851.32	0	0	0	5472.41
H2S ,#/HR	0	0	3752.82	0	0	0	3752.82
C2= ,#/HR	0	0	5663.71	0	0	0	5663.71
C3= ,#/HR	0	0	18284	0	0	0	18284
C4= ,#/HR	0	0	28353.2	0	0	0	28353.2
TOTAL ,#/HR	18018	16964	106715	35635.3	0	1555.12	178887
BPCD (FOE)	1455.59	1997.32	8850.87	2876.21	0	125.43	15305.4

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	11084.9	11084.9
C3 ,#/HR	6640.23	0	0	0	0	16948.7	23588.9
IC4 ,#/HR	18519.2	0	11758.3	0	0	13096.2	43373.7
NC4 ,#/HR	7466.27	0	11446.5	0	0	12749.1	31661.9
H2 ,#/HR	0	0	0	0	5460.55	2190.9	7651.45
C1 ,#/HR	0	0	0	0	0	5472.41	5472.41
H2S ,#/HR	0	0	0	0	0	3752.82	3752.82
C2= ,#/HR	0	0	0	0	0	5663.71	5663.71
C3= ,#/HR	14261.5	0	0	0	0	4022.5	18284
C4= ,#/HR	28353.2	0	0	0	0	0	28353.2
TOTAL ,#/HR	75240.4	0	23204.8	0	5460.55	74981.3	178887
BPCD (FOE)	5995.1	0	1866.21	0	1260.29	6183.82	15305.4

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	136370	1.723E+06
BUTANE	0	0
TOTAL	136370	1.723E+06

*** PRODUCT ***

FUEL GAS (FOE)	6183.82	74981.3
MOTOR GASOLINE	41954	445067
AVIATION TURBO FUELS	6164	70593.9
DISTILLATES	56988	703389
HEAVY FUEL OIL	13901	210286
OTHER PRODUCTS	10909	161206
H2 TO DESULFURIZERS (FOE)	1260.29	5460.55
COKE (FOE)	2775.2	52106.7
TOTAL	140135	1.72309E+06

TIME:16.06.50 DATE:FRIAPR271984118 44

REFINERY SIMULATION PROGRAM

CASE:QUEBAS11 REGION:QUEBEC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	16.8	46487.3
VENEZH	11.65	32236.7
ARABH	6.95	19231.3
CANDNH	27.3	75541.8
SYNCRUDE	16.3	45103.7
MEXH	11.6	32098.4
CONDENSA	9.4	26010.7

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				276710	3.5649E+06	64367.1
Average		.884407	28.4943	1.80558			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
0	CRUDE FEED	276710	3.5649E+06	60	1460	.884407	28.4941	1.80558	64367.1
		*** PRODUCT ***							
2	OVERHEAD	23913.4	223597	60	169.859	.641881	88.9458	.0405305	90.625
28	LSR	18819.3	181663	60	169.859	.662662	82.0327	.0498626	90.5817
3	NAPHTHA	36181.3	390184	169.859	319.302	.740313	59.6354	.0841478	328.331
4	KEROSENE	50276.8	605492	319.302	540	.826744	39.6534	.423732	2565.67
5	LGO	32263.4	415907	540	660	.884944	28.3971	1.02294	4254.48
1	REDUCED CRUDE	134075	1.92972E+06	660	1460	.988044	11.7123	2.96043	57128

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
32	REDUCED CRUDE	134075	1.92972E+06	660	1460	.988044	11.7123	2.96043	57128
		*** PRODUCT ***							
6	HVGO	86841.8	1.19016E+06	660	1050	.940819	18.9009	1.9963	23759.1
7	RESIDUUM	47233.4	739563	1050	1460	1.07487	.143829	4.51195	33368.7

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
65	LGO	9979.2	128642	540	660	.884944	28.3971	1.02294	1315.93
64	HVGO	80740.8	1.10655E+06	660	1050	.940819	18.9009	1.9963	22090
		*** TOTAL FEED ***							
8	FCCU FEED	90720	1.23519E+06	540	1050	.934673	19.8898	1.89493	23405.9
		*** PRODUCT ***							
12	LCO	16765.1	243603	430	650	.997483	10.357	2.93314	7145.2
13	HCO	4191.26	66442.7	650	750.404	1.08826	-1.47594	4.63436	3079.2
14	CRACKED GAS	47262.8	517852			.75217	56.6224	.216429	1120.78
39	C3/C4 -FCCU	20520	169252			.566222	118.402	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 7962.08

AVAILABLE C3/C4 OLEFINS= 20520

CONVERSION Wt%= 74.899 CONVERSION Vol %= 76.9

COKE, WT% 12.2899

COKE ,#/HR 151882 Sulfur in Flue Gas,Lbs/hr= 1177.42

CAT POLY UNIT

*** FEED ***
< 10 > CAT POLY FEED= 18400
*** PRODUCT ***
< 15 > POLYMER= 7403.5
< 16 > LE FROM POLY (FOE)= 5913.05

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 3051.58
< 62 > C3/C4 TO ALKYL= 2119.98
< 20 > I-C4 FR. GAS PLANT= 931.599
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 2155.28
< 63 > LE FROM ALKYL (FOE)= 285.143

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	32800	353720	169.859	319.302	.740313	59.6354	0	0
	*** PRODUCT ***								
17	REFORMATE	26045.6	300844			.792935	46.951	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 6144.31
CONVERSION(LV%)= 79.4073   Severity (RON Clear)= 96   FEED KW= 12.0554

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 23913.4
< 57 > LE FROM REFORMER (FOE)= 6144.31
< 18 > LE FROM CAT CRACKER (FOE)= 7962.08
< 16 > LE FROM POLY (FOE)= 5913.05
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 17792.3
< 20 > I-C4 FR. GAS PLANT= 931.599
< 49 > REF C4 TO BLENDING = 5376.73
< 69 > LSR= 18424.9

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 18424.9
*** PRODUCT ***
< 29 > LSR+ISO= 18189.1

*** BY-PASS= 20 %   ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 18189.1
< 26 > REFORMATE= 8496.65
< 50 > ALKYLATE= 2155.28
< 15 > POLYMER= 7403.5
< 14 > CRACKED GAS= 47262.8
< 49 > REF C4 TO BLENDING = 5376.73
< 68 > IMPORTED C4= 0
*** PRODUCT ***

< 22 > LEADED REGULAR= 26456
< 23 > UNLEADED REGULAR= 53805
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.297393	.192253	0	0
CRACKED GAS	.647564	.56	0	0
REFORMATE	0	.0365192	.824193	0
POLYMER	0	.137599	0	0
ALKYLATE	0	.0111542	.11	.9786
C4	.055043	.0624744	.0658068	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 394.35
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
*** PRODUCT ***
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.555	.125
KEROSENE	.335	.875

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 39334.5
< 40 > LGO= 14334.8
< 38 > LCO= 4765.05
*** PRODUCT ***
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.7	.603202
LCO	0	0	.232385
LGO	0	.3	.164413

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= 7949.38
< 35 > LCO= 12000
< 13 > HCO= 4191.26
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0

< 34 > VAC RESIDUUM= 31760.4
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 55901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 17549
< 36 > HVGO TO LUBE OIL= 3774
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	50276.8	50276.8	605492	.423732	0	.0212722
LGO	22284.2	22284.2	287265	1.02294	8.76462E-06	.103245
LCO	16765.1	13412	194881	2.93314	20.0005	.839011
HCO	4191.26	0	0	4.63436	100	4.63436
VAC RESIDUUM	31760.4	0	0	4.51195	100	4.51195

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	3585	11133	1384	20505	36545	55901
S.G.	.760726	.81594	.826744	.87599	.844204	1.03225
ASTM 10%	207.052	333.141	381.341	397.911	393.082	
ASTM 20%	225.682	359.489	394.638	425.011	416.516	
ASTM 50%	281.819	424.61	439.978	488.006	484.452	
ASTM 90%	470.134	499.671	502.781	597.645	603.436	
RVP,psia	2.81866					
Sulfur Wt %	.0579402	.0283273	.0211866	.246375	.046693	3.21846
Flash Point,F	64.5252	127.194	143.889	152.871	150.182	
Pour Point,F	-85.1373	-50.4689	-44.772	-54.8607	-29.7012	
Cetane No.					45.5979	
Visc @100F,cs	.798432	1.50952	1.72476	2.43087	2.28809	613.629
Visc @122F,cs	.703911	1.29245	1.4659	2.01237	1.91356	260.729
Watsons K	11.9521	11.7112	11.6551	11.1909	11.6012	10.7823
MeABP	291.661	412.526	434.662	482.094	479.399	918.88

GASOLINE

LEADED REGULAR,BPCD	26456
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	90.515 / 82.0132 / 86.2641
RON / MON / (R+M)/2	94.5367 / 85.1819 / 89.8593
RVP,psia	11.5938
MMT Addition,mg/l: 18	
UNLEADED REGULAR,BPCD	53805
RON / MON / (R+M)/2	93.9841 / 84.141 / 89.0626
RVP,psia	10.9893

UNLEADED PREMIUM,BPCD	7925
RON / MON / (R+M)/2	96.6484 / 87.0631 / 91.8558
RVP,psia	9.80441
AVIATION GASOLINE,BPCD	698
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 276710	< 1 > REDUCED CRUDE= 134075
< 2 > OVERHEAD= 23913.4	< 3 > NAPHTHA= 36181.3
< 4 > KEROSENE= 50276.8	< 5 > LGO= 32263.4
< 6 > HVGO= 86841.8	< 7 > RESIDUUM= 47233.4
< 8 > FCCU FEED= 90720	< 9 > REFORMER FEED= 32800
< 10 > CAT POLY FEED= 18400	< 11 > ALKYLATION FEED= 3051.58
< 12 > LCO= 16765.1	< 13 > HCO= 4191.26
< 14 > CRACKED GAS= 47262.8	< 15 > POLYMER= 7403.5
< 16 > LE FROM POLY (FOE)= 5913.05	< 17 > REFORMATE= 26045.6
< 18 > LE FROM CAT CRACKER (FOE)= 7962.08	< 19 > FUEL GAS (FOE)= 17792.3
< 20 > I-C4 FR. GAS PLANT= 931.599	< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 26456	< 23 > UNLEADED REGULAR= 53805
< 24 > UNLEADED PREMIUM= 7925	< 25 > AVIATION GASOLINE= 698
< 26 > REFORMATE= 8496.65	< 27 > NAPHTHA SPECIALTIES= 17549
< 28 > LSR= 18819.3	< 29 > LSR+ISO= 18189.1
< 30 > LSR= 394.35	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 134075	< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 34 > VAC RESIDUUM= 31760.4	< 35 > LCO= 12000
< 36 > HVGO TO LUBE OIL= 3774	< 37 > HVGO= 0
< 38 > LCO= 4765.05	< 39 > C3/C4 -FCCU= 20520
< 40 > LGO= 14334.8	< 41 > LGO= 7949.38
< 42 > JET FUEL B= 3585	< 43 > JET FUEL A= 11133
< 44 > STOVE OIL= 1384	< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545	< 47 > HEAVY FUEL OIL= 55901
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 5376.73
< 50 > ALKYLATE= 2155.28	< 51 > CRUDE LIGHT ENDS= 1.84108
< 52 > TOTAL PRODUCT= 257060	< 53 > C2 % IN CRUDE FEED= .04423
< 54 > C3 % IN CRUDE FEED= .277635	< 55 > I-C4 % IN CRUDE FEED= .21544
< 56 > N-C4 % IN CRUDE FEED= 1.30377	< 57 > LE FROM REFORMER (FOE)= 6144.31
< 58 > NAPHTHA= 3381.3	< 59 > KEROSENE= 10942.4
< 60 > KEROSENE= 39334.5	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 2119.98	< 63 > LE FROM ALKYL (FOE)= 285.143
< 64 > HVGO= 80740.8	< 65 > LGO = 9979.2
< 66 > NAPHTHA PETROCHEMICAL FEED= 0	< 67 > VGO PETROCHEMICAL FEED= 2327
< 68 > IMPORTED C4= 0	< 69 > LSR= 18424.9

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	641.807	4764.46	26606.7	0	0	0	32013
C3 ,#/HR	5685.01	12575.6	18567.4	17020.6	1611.33	545.378	56005.3
IC4 ,#/HR	4906.27	7623.52	40908.7	39717.6	0	970.477	94126.6
NC4 ,#/HR	30744.5	11125.7	18416.4	16513.8	1902.65	2763.44	81466.5
H2 ,#/HR	0	12021.6	10351.8	0	0	0	22373.4
C1 ,#/HR	0	4764.46	11032	0	0	0	15796.5
H2S ,#/HR	0	0	11563.5	0	0	0	11563.5
C2= ,#/HR	0	0	16223.6	0	0	0	16223.6
C3= ,#/HR	0	0	34629.6	0	0	0	34629.6
C4= ,#/HR	0	0	67319.2	0	0	0	67319.2
TOTAL ,#/HR	41977.6	52875.3	255619	73252	3513.98	4279.3	431517
BPCD (FOE)	3389.7	6144.3	21290.7	5913.05	285.143	345.151	37368

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	32013	32013
C3 ,#/HR	13985.3	1611.33	0	0	0	40408.7	56005.3
IC4 ,#/HR	36682.3	11893.5	18936.8	0	0	26614.1	94126.6
NC4 ,#/HR	16513.7	1902.65	26211.8	0	0	36838.3	81466.5
H2 ,#/HR	0	0	0	0	7984.64	14388.8	22373.4
C1 ,#/HR	0	0	0	0	0	15796.5	15796.5
H2S ,#/HR	0	0	0	0	0	11563.5	11563.5
C2= ,#/HR	0	0	0	0	0	16223.6	16223.6
C3= ,#/HR	24220.5	2790.59	0	0	0	7618.53	34629.6
C4= ,#/HR	60364.2	6954.94	0	0	0	0	67319.2
TOTAL ,#/HR	151766	25153	45148.6	0	7984.64	201465	431517
BPCD (FOE)	12092	2008.94	3631.91	0	1842.86	17792.3	37368

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	276710	3.5649E+06
BUTANE	0	0
TOTAL	276710	3.5649E+06

*** PRODUCT ***

	BPCD	#/HR
FUEL GAS (FOE)	17792.3	201465
MOTOR GASOLINE	88884	934872
AVIATION TURBO FUELS	14718	172052
DISTILLATES	58434	727736
HEAVY FUEL OIL	55901	840571
OTHER PRODUCTS	39123	528587
H2 TO DESULFURIZERS (FOE)	1842.86	7984.64
COKE (FOE)	8089.24	151882
TOTAL	284784	3.56515E+06

TIME:16.29.16 DATE:FRIAPR271984118 44

REFINERY SIMULATION PROGRAM

CASE:QUEBAS10 REGION:QUEBEC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	16.8	46601.4
VENEZH	11.65	32315.9
ARABH	6.95	19278.6
CANDNH	27.3	75727.3
SYNCRUDE	16.3	45214.5
MEXH	11.6	32177.2
CONDENSA	9.4	26074.6

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				277390	3.57365E+06	64525.1
Average		.884407	28.4942	1.80558			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
0	CRUDE FEED	277389	3.57365E+06	60	1460	.884408	28.494	1.80558	64525.1
		*** PRODUCT ***							
2	OVERHEAD	23944.3	223862	60	169.73	.641812	88.9696	.0405332	90.7383
28	LSR	18837.7	181824	60	169.73	.662603	82.0517	.0498571	90.6522
3	NAPHTHA	36281.3	391240	169.73	319.234	.74027	59.6465	.0841091	329.068
4	KEROSENE	50416.9	607166	319.234	540	.826725	39.6573	.423638	2572.19
5	LGO	32342.6	416928	540	660	.884944	28.3971	1.02294	4264.92
1	REDUCED CRUDE	134404	1.93445E+06	660	1460	.988044	11.7123	2.96043	57268.2

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
32	REDUCED CRUDE	134404	1.93445E+06	660	1460	.988044	11.7123	2.96043	57268.2
		*** PRODUCT ***							
6	HVGO	87055.4	1.19309E+06	660	1050	.940819	18.9009	1.9963	23817.6
7	RESIDUUM	47348.9	741372	1050	1460	1.07487	.143829	4.51195	33450.3

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
65	LGO	10005.6	128982	540	660	.884944	28.3971	1.02294	1319.41
64	HVGO	80954.4	1.10947E+06	660	1050	.940819	18.9009	1.9963	22148.4
		*** TOTAL FEED ***							
8	FCCU FEED	90960	1.23846E+06	540	1050	.934673	19.8898	1.89493	23467.8
		*** PRODUCT ***							
12	LCO	16518.3	240135	430	650	.997975	10.2871	2.96913	7129.92
13	HCO	4129.58	65534.1	650	748.726	1.08941	-1.61317	4.69123	3074.36
14	CRACKED GAS	47509.4	520842			.752587	56.5181	.214673	1118.11
39	C3/C4 -FCCU	20713.6	170851			.566229	118.399	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 8084.66

AVAILABLE C3/C4 OLEFINS= 20713.6

CONVERSION Wt%= 75.3185 CONVERSION Vol %= 77.3

COKE, WT% 12.4059

COKE ,#/HR 153721 Sulfur in Flue Gas,Lbs/hr= 1190.14

CAT POLY UNIT

*** FEED ***
< 10 > CAT POLY FEED= 18600
*** PRODUCT ***
< 15 > POLYMER= 7483.67
< 16 > LE FROM POLY (FOE)= 5977.75

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 3042.22
< 62 > C3/C4 TO ALKYL= 2113.6
< 20 > I-C4 FR. GAS PLANT= 928.623
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 2148.66
< 63 > LE FROM ALKYL (FOE)= 284.297

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	32900	354778	169.73	319.234	.74027	59.6465	0	0
	*** PRODUCT ***								
17	REFORMATE	25761.6	298756			.79611	46.2392	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 6539.65
CONVERSION(LV%)= 78.3027   Severity (RON Clear)= 97   FEED KW= 12.0555

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 23944.3
< 57 > LE FROM REFORMER (FOE)= 6539.65
< 18 > LE FROM CAT CRACKER (FOE)= 8084.66
< 16 > LE FROM POLY (FOE)= 5977.75
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 18470.4
< 20 > I-C4 FR. GAS PLANT= 928.623
< 49 > REF C4 TO BLENDING = 5381.5
< 69 > LSR= 18443.3

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 18443.3
*** PRODUCT ***
< 29 > LSR+ISO= 18148.2

*** BY-PASS= 0 %   ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 18148.2
< 26 > REFORMATE= 8212.57
< 50 > ALKYLATE= 2148.66
< 15 > POLYMER= 7483.67
< 14 > CRACKED GAS= 47509.4
< 49 > REF C4 TO BLENDING = 5381.5
< 68 > IMPORTED C4= 0
*** PRODUCT ***

< 22 > LEADED REGULAR= 8820
< 23 > UNLEADED REGULAR= 71441
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.252852	.22284	0	0
CRACKED GAS	.688616	.58	0	0
REFORMATE	0	.014363	.90681	0
POLYMER	0	.104753	0	0
ALKYLATE	0	.0182918	.02	.9786
C4	.0585324	.0597518	.0731903	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 394.35
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
*** PRODUCT ***
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.555	.125
KEROSENE	.335	.875

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 39474.5
< 40 > LGO= 18441.5
< 38 > LCO= 518.332
*** PRODUCT ***
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.7	.610033
LCO	0	0	.0252783
LGO	0	.3	.364689

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= 3895.52
< 35 > LCO= 16000
< 13 > HCO= 4129.58
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0

< 34 > VAC RESIDUUM= 31875.9
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 55901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 17549
< 36 > HVGO TO LUBE OIL= 3774
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	FEED TO DDS SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	50416.9	50416.9	607166	.423638	0	.0212675
LGO	22337	22337	287946	1.02294	0	.103245
LCO	16518.3	13214.7	192109	2.96913	19.9996	.849507
HCO	4129.58	0	0	4.69123	100	4.69123
VAC RESIDUUM	31875.9	0	0	4.51195	100	4.51195

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	3585	11133	1384	20505	36545	55901
S.G.	.760689	.815918	.826725	.852286	.844191	1.0407
ASTM 10%	206.983	333.063	381.275	397.202	393.014	
ASTM 20%	225.599	359.421	394.578	425.053	416.458	
ASTM 50%	281.742	424.562	439.942	502.763	484.434	
ASTM 90%	470.114	499.663	502.774	608.753	603.437	
RVP,psia	2.93185					
Sulfur Wt %	.0579166	.0283185	.0211819	.0758767	.0466901	3.2543
Flash Point,F	64.487	127.151	143.853	152.496	150.145	
Pour Point,F	-85.155	-50.4827	-44.7829	-27.6283	-29.7114	
Cetane No.					45.6002	
Visc @100F,cs	.798158	1.5091	1.72434	2.51015	2.28761	627.833
Visc @122F,cs	.703679	1.29211	1.46557	2.08615	1.91318	261.743
Watsons K	11.9523	11.7113	11.6552	11.5448	11.6012	10.685
MeABP	291.589	412.479	434.622	492.627	479.368	915.08

GASOLINE

LEADED REGULAR,BPCD	8820
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	92.9224 / 84.4627 / 88.6926
RON / MON / (R+M)/2	96.6952 / 87.4263 / 92.0608
RVP,psia	11.5212

MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	71441
RON / MON / (R+M)/2	93.3494 / 84.5419 / 88.9457
RVP,psia	11.3514

UNLEADED PREMIUM,BPCD	7925
RON / MON / (R+M)/2	96.7125 / 86.9379 / 91.8252
RVP,psia	9.80434
AVIATION GASOLINE,BPCD	698
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 277389	< 1 > REDUCED CRUDE= 134404
< 2 > OVERHEAD= 23944.3	< 3 > NAPHTHA= 36281.3
< 4 > KEROSENE= 50416.9	< 5 > LGO= 32342.6
< 6 > HVGO= 87055.4	< 7 > RESIDUUM= 47348.9
< 8 > FCCU FEED= 90960	< 9 > REFORMER FEED= 32900
< 10 > CAT POLY FEED= 18600	< 11 > ALKYLATION FEED= 3042.22
< 12 > LCO= 16518.3	< 13 > HCO= 4129.58
< 14 > CRACKED GAS= 47509.4	< 15 > POLYMER= 7483.67
< 16 > LE FROM POLY (FOE)= 5977.75	< 17 > REFORMATE= 25761.6
< 18 > LE FROM CAT CRACKER (FOE)= 8084.66	< 19 > FUEL GAS (FOE)= 18470.4
< 20 > I-C4 FR. GAS PLANT= 928.623	< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 8820	< 23 > UNLEADED REGULAR= 71441
< 24 > UNLEADED PREMIUM= 7925	< 25 > AVIATION GASOLINE= 698
< 26 > REFORMATE= 8212.57	< 27 > NAPHTHA SPECIALTIES= 17549
< 28 > LSR= 18837.7	< 29 > LSR+ISO= 18148.2
< 30 > LSR= 394.35	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 134404	< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 34 > VAC RESIDUUM= 31875.9	< 35 > LCO= 16000
< 36 > HVGO TO LUBE OIL= 3774	< 37 > HVGO= 0
< 38 > LCO= 518.332	< 39 > C3/C4 -FCCU= 20713.6
< 40 > LGO= 18441.5	< 41 > LGO= 3895.52
< 42 > JET FUEL B= 3585	< 43 > JET FUEL A= 11133
< 44 > STOVE OIL= 1384	< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545	< 47 > HEAVY FUEL OIL= 55901
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 5381.5
< 50 > ALKYLATE= 2148.66	< 51 > CRUDE LIGHT ENDS= 1.84108
< 52 > TOTAL PRODUCT= 257060	< 53 > C2 % IN CRUDE FEED= .04423
< 54 > C3 % IN CRUDE FEED= .277635	< 55 > I-C4 % IN CRUDE FEED= .21544
< 56 > N-C4 % IN CRUDE FEED= 1.30377	< 57 > LE FROM REFORMER (FOE)= 6539.65
< 58 > NAPHTHA= 3381.3	< 59 > KEROSENE= 10942.4
< 60 > KEROSENE= 39474.5	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 2113.6	< 63 > LE FROM ALKYL (FOE)= 284.297
< 64 > HVGO= 80954.4	< 65 > LGO = 10005.6
< 66 > NAPHTHA PETROCHEMICAL FEED= 0	< 67 > VGO PETROCHEMICAL FEED= 2327
< 68 > IMPORTED C4= 0	< 69 > LSR= 18443.3

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	643.383	5151.26	27036.9	0	0	0	32831.5
C3 ,#/HR	5698.96	13423.8	18760	17218.8	1607.97	682.403	57391.9
IC4 ,#/HR	4918.31	7876.44	41299.1	40153.3	0	1214.31	95461.5
NC4 ,#/HR	30820	11494.8	18576.8	16681.2	1895.56	3457.75	82926.1
H2 ,#/HR	0	12924.3	10525.7	0	0	0	23450
C1 ,#/HR	0	5151.26	11210.4	0	0	0	16361.7
H2S ,#/HR	0	0	11640	0	0	0	11640
C2= ,#/HR	0	0	16485.9	0	0	0	16485.9
C3= ,#/HR	0	0	34917.2	0	0	0	34917.2
C4= ,#/HR	0	0	67981.4	0	0	0	67981.4
TOTAL ,#/HR	42080.7	56021.9	258433	74053.3	3503.53	5354.46	439447
BPCD (FOE)	3398.03	6539.66	21539.6	5977.75	284.297	431.87	38171.2

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	32831.5	32831.5
C3 ,#/HR	14150.4	1607.98	0	0	0	41633.5	57391.9
IC4 ,#/HR	37085	11856.7	18960.7	0	0	27559.1	95461.5
NC4 ,#/HR	16681.2	1895.56	26227.7	0	0	38121.6	82926.1
H2 ,#/HR	0	0	0	0	7969.08	15480.9	23450
C1 ,#/HR	0	0	0	0	0	16361.7	16361.7
H2S ,#/HR	0	0	0	0	0	11640	11640
C2= ,#/HR	0	0	0	0	0	16485.9	16485.9
C3= ,#/HR	24456.3	2779.08	0	0	0	7681.8	34917.2
C4= ,#/HR	61044.6	6936.77	0	0	0	0	67981.4
TOTAL ,#/HR	153418	25076.1	45188.4	0	7969.08	207796	439447
BPCD (FOE)	12223.6	2002.8	3635.11	0	1839.26	18470.4	38171.2

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	277389	3.57365E+06
BUTANE	0	0
TOTAL	277389	3.57365E+06

*** PRODUCT ***

FUEL GAS (FOE)	18470.4	207796
MOTOR GASOLINE	88884	934871
AVIATION TURBO FUELS	14718	172046
DISTILLATES	58434	720648
HEAVY FUEL OIL	55901	847452
OTHER PRODUCTS	39123	529399
H2 TO DESULFURIZERS (FOE)	1839.26	7969.08
COKE (FOE)	8187.18	153721
TOTAL	285557	3.5739E+06

TIME:13.41.09 DATE:MONAPR301984121 40

REFINERY SIMULATION PROGRAM

CASE:ONTBAS11 REGION:ONTARIO

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	49	219127
CANDNH	9.2	41142.1
SYNCRUDE	30.8	137737
CONDENSA	11	49191.7

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				447197	5.47841E+06	26424.8
Average		.84098	36.7562	.482344			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	447197	5.47841E+06	60	1300	.84098	36.7561	.482344	26424.8
	*** PRODUCT ***								
2	OVERHEAD	54291.6	507241	60	170.084	.641374	89.1202	.0289326	146.758
28	LSR	40941.8	398662	60	170.084	.668448	80.1844	.036801	146.712
3	NAPHTHA	82650.8	907116	170.084	322.409	.753435	56.3065	.0268925	243.946
4	KEROSENE	107671	1.30782E+06	322.409	560	.83383	38.1989	.107138	1401.17
5	LGO	48108.6	618952	560	660	.88321	28.711	.312237	1932.6
1	REDUCED CRUDE	154475	2.13729E+06	660	1300	.949805	17.478	1.06211	22700.3

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	154475	2.13729E+06	660	1300	.949805	17.478	1.06211	22700.3
	*** PRODUCT ***								
6	HVGO	123780	1.66446E+06	660	1050	.923111	21.786	.618341	10292.1
7	RESIDUUM	30695.2	472829	1050	1300	1.05746	2.31122	2.62443	12409.1

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	29157.1	375127	560	660	.88321	28.711	.312237	1171.29
64	HVGO	97612.9	1.3126E+06	660	1050	.923111	21.786	.618341	8116.32
	*** TOTAL FEED ***								
8	FCCU FEED	126770	1.68772E+06	560	1050	.913934	23.3252	.550304	9287.61
	*** PRODUCT ***								
12	LCO	20283.2	285109	430	650	.964948	15.14	.95225	2714.95
13	HCO	5070.8	79598.4	650	736.438	1.0776	-.189667	1.50455	1197.6
14	CRACKED GAS	72322.3	789619			.749506	57.291	.0541336	427.449
39	C3/C4 -FCCU	20095.6	164971			.563555	119.585	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 18722.1

AVAILABLE C3/C4 OLEFINS= 31593.8

CONVERSION Wt%= 78.3906 CONVERSION Vol %= 80

COKE, WT% 9.63115

COKE ,#/HR 162631 Sulfur in Flue Gas,Lbs/hr= 496.565

CAT POLY UNIT

*** FEED ***

< 10 > CAT POLY FEED= 1E-06
*** PRODUCT ***
< 15 > POLYMER= 4.08466E-07
< 16 > LE FROM POLY (FOE)= 3.12969E-07

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 29100
< 62 > C3/C4 TO ALKYL= 20095.6
< 20 > I-C4 FR. GAS PLANT= 5954.16
< 21 > I-C4 IMPORTED= 3050.22
*** PRODUCT ***
< 50 > ALKYLATE= 20807.1
< 63 > LE FROM ALKYL (FOE)= 2449.61

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
9	REFORMER FEED	62500	685955	170.084	322.409	.753435	56.3065	0	0
		*** PRODUCT ***							
17	REFORMATE	51094.7	596603			.801567	45.0293	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 10294.4
CONVERSION(LV%)= 81.7515 Severity (RON Clear)= 96.5 FEED KW= 11.8529

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 54291.6
< 57 > LE FROM REFORMER (FOE)= 10294.4
< 18 > LE FROM CAT CRACKER (FOE)= 18722.1
< 16 > LE FROM POLY (FOE)= 3.12969E-07
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 28045.8
< 20 > I-C4 FR. GAS PLANT= 5954.16
< 49 > REF C4 TO BLENDING = 8888.02
< 69 > LSR= 40471.3

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 40471.3
*** PRODUCT ***
< 29 > LSR+ISO= 40179.9

*** BY-PASS= 55 % ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 40179.9
< 26 > REFORMATE= 28513.7
< 50 > ALKYLATE= 20807.1
< 15 > POLYMER= 4.08466E-07
< 14 > CRACKED GAS= 72322.3
< 49 > REF C4 TO BLENDING = 8888.02
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 51175
< 23 > UNLEADED REGULAR= 104062
< 24 > UNLEADED PREMIUM= 15348

< 25 > AVIATION GASOLINE= 126

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.316064	.230691	0	0
CRACKED GAS	.630356	.385	0	0
REFORMATE	0	.166777	.727033	0
POLYMER	0	3.92521E-12	0	0
ALKYLATE	0	.167791	.21	.9786
C4	.0535803	.0497413	.0629671	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 470.47
< 58 > NAPHTHA= 4865.84
< 59 > KEROSENE= 18565.7
*** PRODUCT ***
< 42 > JET FUEL B= 4277
< 43 > JET FUEL A= 19625

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.61	.115
KEROSENE	.28	.885

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 89105.3
< 40 > LGO= 18950.5
< 38 > LCO= 14410.2
*** PRODUCT ***
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.68	.813461
LCO	0	.1	.162495
LGO	0	.22	.0240436

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= .99707
< 35 > LCO= 5873
< 13 > HCO= 5070.8
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 22329.2
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 33274

OTHER PRODUCTS

< 27 > NAPHTHA SPECIALTIES= 22581
< 36 > HVGO TO LUBE OIL= 10882
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	107671	107671	1.30782E+06	.107138	0	5.36236E-03
LGO	18951.5	18951.5	243825	.312237	1.03059E-05	.0313117
LCO	20283.2	18254.9	256598	.95225	9.9999	.182333
HCO	5070.8	0	0	1.50455	100	1.50455
VAC RESIDUUM	22329.2	0	0	2.62443	100	2.62443

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	4277	19625	2264	38243	81959	33274
S.G.	.766597	.824584	.83383	.856323	.857805	1.04419
ASTM 10%	206.691	345.761	385.477	392.019	397.689	
ASTM 20%	224.1	369.282	400.281	412.211	423.405	
ASTM 50%	273.952	433.187	448.61	468.452	493.805	
ASTM 90%	468.602	517.041	519.654	539.158	602.177	
RVP,psia	2.6426					
Sulfur Wt %	.0212841	7.61981E-03	5.35691E-03	.0381467	.0309661	2.04968
Flash Point,F	64.3719	134.212	144.969	148.411	151.473	
Pour Point,F	-95.6193	-50.009	-44.4456	-52.9434	-36.6125	
Cetane No.					41.7016	
Visc @100F,cs	.774538	1.62213	1.8335	2.06617	2.42603	1822.77
Visc @122F,cs	.683231	1.3828	1.5522	1.73195	2.01704	637.794
Watsons K	11.8222	11.6394	11.5963	11.3572	11.4435	10.7688
MeABP	284.384	424.091	444.046	459.87	485.89	961.91

GASOLINE

LEADED REGULAR,BPCD	51175
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	89.6255 / 81.354 / 85.4898
RON / MON / (R+M)/2	94.2635 / 85.3426 / 89.8031
RVP,psia	11.3809
MMT Addition,mg/l: 18	
UNLEADED REGULAR,BPCD	104062
RON / MON / (R+M)/2	92.824 / 85.2032 / 89.0136
RVP,psia	10.92
UNLEADED PREMIUM,BPCD	15348
RON / MON / (R+M)/2	96.085 / 87.5367 / 91.8109
RVP,psia	9.74553

AVIATION GASOLINE,BPCD	126
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 447197	< 1 > REDUCED CRUDE= 154475
< 2 > OVERHEAD= 54291.6	< 3 > NAPHTHA= 82650.8
< 4 > KEROSENE= 107671	< 5 > LGO= 48108.6
< 6 > HVGO= 123780	< 7 > RESIDUUM= 30695.2
< 8 > FCCU FEED= 126770	< 9 > REFORMER FEED= 62500
< 10 > CAT POLY FEED= 1E-06	< 11 > ALKYLATION FEED= 29100
< 12 > LCO= 20283.2	< 13 > HCO= 5070.8
< 14 > CRACKED GAS= 72322.3	< 15 > POLYMER= 4.08466E-07
< 16 > LE FROM POLY (FOE)= 3.12969E-07	< 17 > REFORMATE= 51094.7
< 18 > LE FROM CAT CRACKER (FOE)= 18722.1	< 19 > FUEL GAS (FOE)= 28045.8
< 20 > I-C4 FR. GAS PLANT= 5954.16	< 21 > I-C4 IMPORTED= 3050.22
< 22 > LEADED REGULAR= 51175	< 23 > UNLEADED REGULAR= 104062
< 24 > UNLEADED PREMIUM= 15348	< 25 > AVIATION GASOLINE= 126
< 26 > REFORMATE= 28513.7	< 27 > NAPHTHA SPECIALTIES= 22581
< 28 > LSR= 40941.8	< 29 > LSR+ISO= 40179.9
< 30 > LSR= 470.47	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 154475	< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 34 > VAC RESIDUUM= 22329.2	< 35 > LCO= 5873
< 36 > HVGO TO LUBE OIL= 10882	< 37 > HVGO= 0
< 38 > LCO= 14410.2	< 39 > C3/C4 -FCCU= 20095.6
< 40 > LGO= 18950.5	< 41 > LGO= .99707
< 42 > JET FUEL B= 4277	< 43 > JET FUEL A= 19625
< 44 > STOVE OIL= 2264	< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959	< 47 > HEAVY FUEL OIL= 33274
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 8888.02
< 50 > ALKYLATE= 20807.1	< 51 > CRUDE LIGHT ENDS= 2.98522
< 52 > TOTAL PRODUCT= 422752	< 53 > C2 % IN CRUDE FEED= .08668
< 54 > C3 % IN CRUDE FEED= .69156	< 55 > I-C4 % IN CRUDE FEED= .36344
< 56 > N-C4 % IN CRUDE FEED= 1.84354	< 57 > LE FROM REFORMER (FOE)= 10294.4
< 58 > NAPHTHA= 4865.84	< 59 > KEROSENE= 18565.7
< 60 > KEROSENE= 89105.3	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20095.6	< 63 > LE FROM ALKYL (FOE)= 2449.61
< 64 > HVGO= 97612.9	< 65 > LGO = 29157.1
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285	< 67 > VGO PETROCHEMICAL FEED= 15285
< 68 > IMPORTED C4= 0	< 69 > LSR= 40471.3

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2032.73	7711.27	36296.1	0	0	0	46040.1
C3 ,#/HR	22885.5	21062.2	27495.7	0	14690.7	673.847	86808
IC4 ,#/HR	13376.2	13462.6	64692.5	0	0	1199.08	92730.4
NC4 ,#/HR	70257.6	19647.2	24342.5	0	15483.3	3414.4	133145
H2 ,#/HR	0	19757.9	14771.4	0	0	0	34529.3
C1 ,#/HR	0	7711.27	15049.6	0	0	0	22760.9
H2S ,#/HR	0	0	4729.24	0	0	0	4729.24
C2= ,#/HR	0	0	22131.8	0	0	0	22131.8
C3= ,#/HR	0	0	65002.4	0	0	0	65002.4
C4= ,#/HR	0	0	96529.9	0	0	0	96529.9
TOTAL ,#/HR	108552	89352.4	371041	3.87753E-06	30174	5287.33	604407
BPCD (FOE)	8777.68	10294.4	31803.7	3.12969E-07	2449.61	426.455	53751.8

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	46040.1	46040.1
C3 ,#/HR	0	14690.7	0	0	0	72117.3	86808
IC4 ,#/HR	0	90151.2	1263.24	0	0	1315.99	92730.4
NC4 ,#/HR	0	15483.3	57630.8	0	0	60030.9	133145
H2 ,#/HR	0	0	0	0	10960.5	23568.8	34529.3
C1 ,#/HR	0	0	0	0	0	22760.9	22760.9
H2S ,#/HR	0	0	0	0	0	4729.24	4729.24
C2= ,#/HR	0	0	0	0	0	22131.8	22131.8
C3= ,#/HR	0	32249.5	0	0	0	32752.9	65002.4
C4= ,#/HR	0	61399	17207.1	0	0	17923.9	96529.9
TOTAL ,#/HR	8.2093E-06	213974	76101.1	0	10960.5	303372	604407
BPCD (FOE)	6.54138E-07	17080.7	6095.69	0	2529.68	28045.8	53751.8

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	447197	5.47841E+06
BUTANE	3050.22	25103.3
TOTAL	450247	5.50351E+06

*** PRODUCT ***

FUEL GAS (FOE)	28045.8	303372
MOTOR GASOLINE	170711	1.79635E+06
AVIATION TURBO FUELS	23902	283491
DISTILLATES	122466	1.52868E+06
HEAVY FUEL OIL	33274	506121
OTHER PRODUCTS	72399	912159
H2 TO DESULFURIZERS (FOE)	2529.68	10960.5
COKE (FOE)	8661.73	162631
TOTAL	461989	5.50376E+06

TIME:13.56.22 DATE:MONAPR301984121 40

REFINERY SIMULATION PROGRAM

CASE:ONTBAS10 REGION:ONTARIO

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	49	220036
CANDNH	9.2	41312.8
SYNCRUDE	30.8	138308
CONDENSA	11	49395.7

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				449052	5.50114E+06	26534.4
Average		.840979	36.7563	.482344			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
0	CRUDE FEED	449052	5.50114E+06	60	1300	.840981	36.756	.482344	26534.4
		*** PRODUCT ***							
2	OVERHEAD	54542.7	509612	60	170.136	.641406	89.1092	.028921	147.385
28	LSR	41137.5	400585	60	170.136	.668478	80.1749	.0367951	147.396
3	NAPHTHA	82650.8	906971	170.136	321.804	.753314	56.3367	.0268543	243.561
4	KEROSENE	108435	1.31688E+06	321.804	560	.833696	38.2261	.106943	1408.31
5	LGO	48308.1	621519	560	660	.88321	28.711	.312237	1940.61
1	REDUCED CRUDE	155116	2.14616E+06	660	1300	.949805	17.478	1.06211	22794.5

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
32	REDUCED CRUDE	155116	2.14616E+06	660	1300	.949805	17.478	1.06211	22794.5
		*** PRODUCT ***							
6	HVGO	124294	1.67138E+06	660	1050	.923111	21.786	.618341	10334.8
7	RESIDUUM	30822.4	474789	1050	1300	1.05746	2.31122	2.62443	12460.5

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
65	LGO	30648.4	394314	560	660	.88321	28.711	.312237	1231.19
64	HVGO	98126.6	1.3195E+06	660	1050	.923111	21.786	.618341	8159.04
		*** TOTAL FEED ***							
8	FCCU FEED	128775	1.71382E+06	560	1050	.913615	23.3792	.547913	9390.23
		*** PRODUCT ***							
12	LCO	20604	289446	430	650	.964375	15.2272	.948254	2744.68
13	HCO	5151	80834.1	650	736.422	1.07729	-.151901	1.49824	1211.09
14	CRACKED GAS	73561	803044			.749414	57.3142	.0538167	432.172
39	C3/C4 -FCCU	20096.2	164966			.563522	119.6	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 19203

AVAILABLE C3/C4 OLEFINS= 32111.2

CONVERSION Wt%= 78.3944 CONVERSION Vol %= 80

COKE, WT% 9.5674

COKE ,#/HR 164052 Sulfur in Flue Gas,Lbs/hr= 502.061

CAT POLY UNIT

*** FEED ***

< 10 > CAT POLY FEED= 1E-06
*** PRODUCT ***
< 15 > POLYMER= 4.08517E-07
< 16 > LE FROM POLY (FOE)= 3.12884E-07

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 29101.3
< 62 > C3/C4 TO ALKYL= 20096.2
< 20 > I-C4 FR. GAS PLANT= 6349.09
< 21 > I-C4 IMPORTED= 2655.97
*** PRODUCT ***
< 50 > ALKYLATE= 20811.3
< 63 > LE FROM ALKYL (FOE)= 2446.24

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	62500	685845	170.136	321.804	.753314	56.3367	0	0
	*** PRODUCT ***								
17	REFORMATE	49998.2	587059			.806041	44.0493	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 11472
CONVERSION(LV%)= 79.9971   Severity (RON Clear)= 98   FEED KW= 11.8534

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 54542.7
< 57 > LE FROM REFORMER (FOE)= 11472
< 18 > LE FROM CAT CRACKER (FOE)= 19203
< 16 > LE FROM POLY (FOE)= 3.12884E-07
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 30017.8
< 20 > I-C4 FR. GAS PLANT= 6349.09
< 49 > REF C4 TO BLENDING = 8905.13
< 69 > LSR= 40667

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 40667
*** PRODUCT ***
< 29 > LSR+ISO= 40016.4

*** BY-PASS= 0 %   ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 40016.4
< 26 > REFORMATE= 27417.2
< 50 > ALKYLATE= 20811.3
< 15 > POLYMER= 4.08517E-07
< 14 > CRACKED GAS= 73561
< 49 > REF C4 TO BLENDING = 8905.13
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 17058
< 23 > UNLEADED REGULAR= 138179
< 24 > UNLEADED PREMIUM= 15348

< 25 > AVIATION GASOLINE= 126

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.860006	.183432	0	0
CRACKED GAS	.129027	.494	.201956	0
REFORMATE	0	.129695	.618718	0
POLYMER	0	2.95644E-12	0	0
ALKYLATE	0	.1375	.11	.9786
C4	.0109674	.055373	.0693267	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 470.47
< 58 > NAPHTHA= 4865.84
< 59 > KEROSENE= 18565.7
*** PRODUCT ***
< 42 > JET FUEL B= 4277
< 43 > JET FUEL A= 19625

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.61	.115
KEROSENE	.28	.885

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 89868.9
< 40 > LGO= 17659
< 38 > LCO= 14938
*** PRODUCT ***
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.7	.790567
LCO	0	.1	.176296
LGO	0	.2	.0331366

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= .648438
< 35 > LCO= 5666
< 13 > HCO= 5151
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 22456.4
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 33274

OTHER PRODUCTS

< 27 > NAPHTHA SPECIALTIES= 22581
< 36 > HVGO TO LUBE OIL= 10882
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	108435	108435	1.31688E+06	.106943	0	5.35259E-03
LGO	17659.7	17659.7	227205	.312237	1.10598E-05	.0313117
LCO	20604	18543.6	260501	.948254	10	.181563
HCO	5151	0	0	1.49824	100	1.49824
VAC RESIDUUM	22456.4	0	0	2.62443	100	2.62443

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	4277	19625	2264	38243	81959	33274
S.G.	.766489	.824452	.833696	.858375	.856667	1.04467
ASTM 10%	206.68	345.264	384.856	392.281	396.166	
ASTM 20%	224.011	368.75	399.72	413.449	421.119	
ASTM 50%	273.608	432.797	448.254	470.853	489.775	
ASTM 90%	468.319	516.981	519.59	545.86	599.315	
RVP,psia	2.9364					
Sulfur Wt %	.021258	7.60705E-03	5.34713E-03	.0408557	.0303629	2.06038
Flash Point,F	64.3686	133.934	144.638	148.55	150.645	
Pour Point,F	-95.7017	-50.1482	-44.5865	-52.9935	-37.8347	
Cetane No.					41.5094	
Visc @100F,cs	.773613	1.61855	1.82924	2.1032	2.37375	1961.98
Visc @122F,cs	.682447	1.37991	1.54879	1.76072	1.9762	677.461
Watsons K	11.8225	11.6396	11.5965	11.3404	11.4455	10.7709
MeABP	284.131	423.715	443.665	462.4	482.628	964.72

GASOLINE

LEADED REGULAR,BPCD	17058
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	86.1166 / 82.7487 / 84.4327
RON / MON / (R+M)/2	91.6879 / 87.9536 / 89.8208
RVP,psia	15.7255
MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	138179
RON / MON / (R+M)/2	92.9311 / 85.2141 / 89.0726
RVP,psia	11.1044
UNLEADED PREMIUM,BPCD	15348
RON / MON / (R+M)/2	96.3999 / 87.2319 / 91.8159
RVP,psia	9.75758

AVIATION GASOLINE,BPCD	126
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 449052	< 1 > REDUCED CRUDE= 155116
< 2 > OVERHEAD= 54542.7	< 3 > NAPHTHA= 82650.8
< 4 > KEROSENE= 108435	< 5 > LGO= 48308.1
< 6 > HVGO= 124294	< 7 > RESIDUUM= 30822.4
< 8 > FCCU FEED= 128775	< 9 > REFORMER FEED= 62500
< 10 > CAT POLY FEED= 1E-06	< 11 > ALKYLATION FEED= 29101.3
< 12 > LCO= 20604	< 13 > HCO= 5151
< 14 > CRACKED GAS= 73561	< 15 > POLYMER= 4.08517E-07
< 16 > LE FROM POLY (FOE)= 3.12884E-07	< 17 > REFORMATE= 49998.2
< 18 > LE FROM CAT CRACKER (FOE)= 19203	< 19 > FUEL GAS (FOE)= 30017.8
< 20 > I-C4 FR. GAS PLANT= 6349.09	< 21 > I-C4 IMPORTED= 2655.97
< 22 > LEADED REGULAR= 17058	< 23 > UNLEADED REGULAR= 138179
< 24 > UNLEADED PREMIUM= 15348	< 25 > AVIATION GASOLINE= 126
< 26 > REFORMATE= 27417.2	< 27 > NAPHTHA SPECIALTIES= 22581
< 28 > LSR= 41137.5	< 29 > LSR+ISO= 40016.4
< 30 > LSR= 470.47	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 155116	< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 34 > VAC RESIDUUM= 22456.4	< 35 > LCO= 5666
< 36 > HVGO TO LUBE OIL= 10882	< 37 > HVGO= 0
< 38 > LCO= 14938	< 39 > C3/C4 -FCCU= 20096.2
< 40 > LGO= 17659	< 41 > LGO= .648438
< 42 > JET FUEL B= 4277	< 43 > JET FUEL A= 19625
< 44 > STOVE OIL= 2264	< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959	< 47 > HEAVY FUEL OIL= 33274
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 8905.13
< 50 > ALKYLATE= 20811.3	< 51 > CRUDE LIGHT ENDS= 2.98522
< 52 > TOTAL PRODUCT= 422752	< 53 > C2 % IN CRUDE FEED= .08668
< 54 > C3 % IN CRUDE FEED= .69156	< 55 > I-C4 % IN CRUDE FEED= .36344
< 56 > N-C4 % IN CRUDE FEED= 1.84354	< 57 > LE FROM REFORMER (FOE)= 11472
< 58 > NAPHTHA= 4865.84	< 59 > KEROSENE= 18565.7
< 60 > KEROSENE= 89868.9	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20096.2	< 63 > LE FROM ALKYL (FOE)= 2446.24
< 64 > HVGO= 98126.6	< 65 > LGO = 30648.4
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285	< 67 > VGO PETROCHEMICAL FEED= 15285
< 68 > IMPORTED C4= 0	< 69 > LSR= 40667

LIGHT ENDS BA .NCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2041.17	8853.66	36731.2	0	0	0	47626
C3 ,#/HR	22980.4	23547.1	27930.5	0	14683.1	1504.68	90645.8
IC4 ,#/HR	13431.7	14278.5	65787.3	0	0	2677.52	96175
NC4 ,#/HR	70549	20838	24685.9	0	15449.2	7624.26	139146
H2 ,#/HR	0	22415.2	14948.7	0	0	0	37363.9
C1 ,#/HR	0	8853.66	15230	0	0	0	24083.7
H2S ,#/HR	0	0	4781.49	0	0	0	4781.49
C2= ,#/HR	0	0	22397	0	0	0	22397
C3= ,#/HR	0	0	66215.3	0	0	0	66215.3
C4= ,#/HR	0	0	98012.3	0	0	0	98012.3
TOTAL ,#/HR	109002	98786.1	376720	3.87649E-06	30132.3	11806.5	626447
BPCD (FOE)	8814.09	11472	32283.5	3.12884E-07	2446.24	952.263	55968.1

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	47626	47626
C3 ,#/HR	0	14683	0	0	0	75962.8	90645.8
IC4 ,#/HR	0	93424.8	1285.46	0	0	1464.78	96175
NC4 ,#/HR	0	15449.2	57817.7	0	0	65879.5	139146
H2 ,#/HR	0	0	0	0	10838.7	26525.2	37363.9
C1 ,#/HR	0	0	0	0	0	24083.7	24083.7
H2S ,#/HR	0	0	0	0	0	4781.49	4781.49
C2= ,#/HR	0	0	0	0	0	22397	22397
C3= ,#/HR	0	32322.9	0	0	0	33892.4	66215.3
C4= ,#/HR	0	61339.2	17141.5	0	0	19531.6	98012.3
TOTAL ,#/HR	8.20882E-06	217219	76244.7	0	10838.7	322144	626447
BPCD (FOE)	6.541E-07	17341.4	6107.37	0	2501.57	30017.8	55968.1

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	449052	5.50114E+06
BUTANE	2655.97	21858.6
TOTAL	451708	5.523E+06

*** PRODUCT ***

FUEL GAS (FOE)	30017.8	322144
MOTOR GASOLINE	170711	1.79435E+06
AVIATION TURBO FUELS	23902	283447
DISTILLATES	122466	1.52846E+06
HEAVY FUEL OIL	33274	506354
OTHER PRODUCTS	72399	913604
H2 TO DESULFURIZERS (FOE)	2501.57	10838.7
COKE (FOE)	8737.41	164052
TOTAL	464009	5.52325E+06

TIME:10.09.41 DATE:MONAPR301984121 40

REFINERY SIMULATION PROGRAM

CASE:WESBAS11 REGION:WESTERN

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	65.1	321986
SYNCRUDE	31.5	155800
CONDENSA	3.4	16816.5

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				494602	6.08195E+06	18927.1
Average		.844146	36.1252	.311201			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	494602	6.08195E+06	60	1240	.844145	36.1253	.311201	18927.1
	*** PRODUCT ***								
2	OVERHEAD	49203	456098	60	170.075	.636351	90.8617	.0147284	67.1758
28	LSR	33729.7	331296	60	170.075	.67427	78.3566	.0202685	67.1488
3	NAPHTHA	86951.1	958394	170.075	323.136	.756657	55.5068	.0149104	142.9
4	KEROSENE	127459	1.54714E+06	323.136	560	.833278	38.3113	.0626007	968.522
5	LGO	56420.2	724056	560	660	.880983	29.116	.219173	1586.94
1	REDUCED CRUDE	174568	2.39626E+06	660	1240	.942321	18.6611	.67445	16161.6

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	174568	2.39626E+06	660	1240	.942321	18.6611	.67445	16161.6
	*** PRODUCT ***								
6	HVGO	142918	1.91392E+06	660	1050	.919318	22.4184	.412657	7897.91
7	RESIDUUM	31650.1	482352	1050	1240	1.04621	3.75011	1.7133	8264.14

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	5726.92	73495.2	560	660	.880983	29.116	.219173	161.082
64	HVGO	137446	1.84064E+06	660	1050	.919318	22.4184	.412657	7595.51
	*** TOTAL FEED ***								
8	FCCU FEED	143173	1.91413E+06	560	1050	.917784	22.6757	.405228	7756.6
	*** PRODUCT ***								
12	LCO	22907.7	324293	430	650	.97182	14.1031	.699967	2269.94
13	HCO	5726.92	90207.3	650	736.619	1.08131	-.640213	1.10595	997.647
14	CRACKED GAS	80517.6	880405			.750622	57.0103	.040548	356.986
39	C3/C4 -FCCU	35429	291071			.563988	119.392	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 13277.3

AVAILABLE C3/C4 OLEFINS= 35429.1

CONVERSION Wt%= 78.3453   CONVERSION Vol %= 80

COKE, WT% 10.3436

COKE ,#/HR 198091   Sulfur in Flue Gas,Lbs/hr= 414.702

CAT POLY UNIT

*** FEED ***

< 10 > CAT POLY FEED= 15000

*** PRODUCT ***
< 15 > POLYMER= 6115.81
< 16 > LE FROM POLY (FOE)= 4711.87

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 29571
< 62 > C3/C4 TO ALKYL= 20429
< 20 > I-C4 FR. GAS PLANT= 7529.12
< 21 > I-C4 IMPORTED= 1612.87
*** PRODUCT ***
< 50 > ALKYLATE= 21101.8
< 63 > LE FROM ALKYL (FOE)= 2533.77

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	72200	795804	170.075	323.136	.756657	55.5068	0	0
	*** PRODUCT ***								
17	REFORMATE	59424.8	695850			.803856	44.5267	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 11491
CONVERSION(LV%)= 82.3058 Severity (RON Clear)= 96.5 FEED KW= 11.814

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 49203
< 57 > LE FROM REFORMER (FOE)= 11491
< 18 > LE FROM CAT CRACKER (FOE)= 13277.3
< 16 > LE FROM POLY (FOE)= 4711.87
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 25185.2
< 20 > I-C4 FR. GAS PLANT= 7529.12
< 49 > REF C4 TO BLENDING = 12037
< 69 > LSR= 31014.9

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 31014.9
*** PRODUCT ***
< 29 > LSR+ISO= 31014.9

*** BY-PASS= 100 % ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 31014.9
< 26 > REFORMATE= 52442.8
< 50 > ALKYLATE= 21101.8
< 15 > POLYMER= 6115.81
< 14 > CRACKED GAS= 80517.6
< 49 > REF C4 TO BLENDING = 12037
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 60195
< 23 > UNLEADED REGULAR= 126555
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.256619	.123281	0	0
CRACKED GAS	.580743	.36	0	0
REFORMATE	.104836	.28442	.729259	0
POLYMER	0	.0483253	0	0
ALKYLATE	0	.123722	.21	.9786
C4	.0578024	.0602511	.0607415	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 2714.79
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 20903.2
*** PRODUCT ***
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.13	0
NAPHTHA	.59	.12
KEROSENE	.28	.88

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 106556
< 40 > LGO= 50692.3
< 38 > LCO= 19878.7
*** PRODUCT ***
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.63	.0909767
LCO	0	.1	.305798
LGO	0	.27	.603226

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= .955078
< 35 > LCO= 3029
< 13 > HCO= 5726.92
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 15585.1
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 24342

OTHER PRODUCTS

< 27 > NAPHTHA SPECIALTIES= 6982
< 36 > HVGO TO LUBE OIL= 5472
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	FEED TO DDS SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	127459	127459	1.54714E+06	.0626007	0	3.1319E-03
LGO	50693.3	50693.3	650561	.219173	-3.85283E-05	.0219605
LCO	22907.7	11453.8	162146	.699967	50.0002	.3862
HCO	5726.92	0	0	1.10595	100	1.10595
VAC RESIDUUM	15585.1	0	0	1.7133	100	1.7133

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	20883	17109	5913	13398	157816	24342
S.G.	.7674	.824083	.833278	.904421	.860013	1.0452
ASTM 10%	198.144	341.696	387.407	493.294	402.047	
ASTM 20%	219.367	367.489	401.652	533.262	429.203	
ASTM 50%	274.628	432.377	448.46	587.986	504.403	
ASTM 90%	468.637	517.008	519.723	624.902	607.364	
RVP,psia	2.56684					
Sulfur Wt %	.0119408	4.42802E-03	3.13004E-03	.139641	.0514758	1.41173
Flash Point,F	59.5734	131.963	146.009	205.191	153.852	
Pour Point,F	-98.0589	-50.4064	-43.5552	-18.7481	-32.9398	
Cetane No.					42.4918	
Visc @100F,cs	.766605	1.61034	1.83916	4.69241	2.56327	1425.29
Visc @122F,cs	.676423	1.37329	1.55694	3.7103	2.1242	517.996
Watsons K	11.7974	11.6411	11.6067	11.1701	11.4473	10.73
MeABP	282.032	422.866	444.691	571.07	494.182	950.67

GASOLINE

LEADED REGULAR,BPCD 60195
TEL Addition,cc/IG: 1.24
RON / MON / (R+M)/2 (Clear) 89.6654 / 81.0294 / 85.3474
RON / MON / (R+M)/2 94.4682 / 85.2468 / 89.8575
RVP,psia 10.4108

MMT Addition,mg/l: 18
UNLEADED REGULAR,BPCD 126555
RON / MON / (R+M)/2 93.43 / 84.5971 / 89.0136
RVP,psia 10.0791

UNLEADED PREMIUM,BPCD 13901
RON / MON / (R+M)/2 95.8859 / 87.7336 / 91.8098
RVP,psia 9.73116

AVIATION GASOLINE,BPCD	2579
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 494602
< 1 > REDUCED CRUDE= 174568
< 2 > OVERHEAD= 49203
< 3 > NAPHTHA= 86951.1
< 4 > KEROSENE= 127459
< 5 > LGO= 56420.2
< 6 > HVGO= 142918
< 7 > RESIDUUM= 31650.1
< 8 > FCCU FEED= 143173
< 9 > REFORMER FEED= 72200
< 10 > CAT POLY FEED= 15000
< 11 > ALKYLATION FEED= 29571
< 12 > LCO= 22907.7
< 13 > HCO= 5726.92
< 14 > CRACKED GAS= 80517.6
< 15 > POLYMER= 6115.81
< 16 > LE FROM POLY (FOE)= 4711.87
< 17 > REFORMATE= 59424.8
< 18 > LE FROM CAT CRACKER (FOE)= 13277.3
< 19 > FUEL GAS (FOE)= 25185.2
< 20 > I-C4 FR. GAS PLANT= 7529.12
< 21 > I-C4 IMPORTED= 1612.87
< 22 > LEADED REGULAR= 60195
< 23 > UNLEADED REGULAR= 126555
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579
< 26 > REFORMATE= 52442.8
< 27 > NAPHTHA SPECIALTIES= 6982
< 28 > LSR= 33729.7
< 29 > LSR+ISO= 31014.9
< 30 > LSR= 2714.79
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 174568
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 34 > VAC RESIDUUM= 15585.1
< 35 > LCO= 3029
< 36 > HVGO TO LUBE OIL= 5472
< 37 > HVGO= 0
< 38 > LCO= 19878.7
< 39 > C3/C4 -FCCU= 35429
< 40 > LGO= 50692.3
< 41 > LGO= .955078
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816
< 47 > HEAVY FUEL OIL= 24342
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 12037
< 50 > ALKYLATE= 21101.8
< 51 > CRUDE LIGHT ENDS= 3.12845
< 52 > TOTAL PRODUCT= 471587
< 53 > C2 % IN CRUDE FEED= .10416
< 54 > C3 % IN CRUDE FEED= .87234
< 55 > I-C4 % IN CRUDE FEED= .41795
< 56 > N-C4 % IN CRUDE FEED= 1.734
< 57 > LE FROM REFORMER (FOE)= 11491
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 20903.2
< 60 > KEROSENE= 106556
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20429
< 63 > LE FROM ALKYL (FOE)= 2533.77
< 64 > HVGO= 137446
< 65 > LGO = 5726.92
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0
< 69 > LSR= 31014.9

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2701.59	8526.86	43509.9	0	0	0	54738.4
C3 ,#/HR	31928.1	23522.7	31053.4	13508.5	15041	0	115054
IC4 ,#/HR	17013	15219.7	72106.5	32993.2	0	0	137332
NC4 ,#/HR	73088	22211.5	28046.9	11874.5	16172.3	0	151393
H2 ,#/HR	0	21946.5	17808.3	0	0	0	39754.8
C1 ,#/HR	0	8526.86	18040.7	0	0	0	26567.6
H2S ,#/HR	0	0	3949.65	0	0	0	3949.65
C2= ,#/HR	0	0	26530.4	0	0	0	26530.4
C3= ,#/HR	0	0	70798	0	0	0	70798
C4= ,#/HR	0	0	109611	0	0	0	109611
TOTAL ,#/HR	124731	99954.1	421455	58376.2	31213.3	0	735729
BPCD (FOE)	10094.4	11491	36417.1	4711.86	2533.77	0	65248.1

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	54738.4	54738.4
C3 ,#/HR	11043.8	15040.9	0	0	0	88969	115054
IC4 ,#/HR	30528.5	103542	2639.95	0	0	621.495	137332
NC4 ,#/HR	11874.5	16172.3	99846.1	0	0	23500.3	151393
H2 ,#/HR	0	0	0	0	15771.5	23983.3	39754.8
C1 ,#/HR	0	0	0	0	0	26567.6	26567.6
H2S ,#/HR	0	0	0	0	0	3949.65	3949.65
C2= ,#/HR	0	0	0	0	0	26530.4	26530.4
C3= ,#/HR	23380.1	31842.2	0	0	0	15575.7	70798
C4= ,#/HR	46407.2	63203.5	0	0	0	0	109611
TOTAL ,#/HR	123234	229801	102486	0	15771.5	264436	735729
BPCD (FOE)	9819.42	18349.8	8253.63	0	3640.05	25185.2	65248.1

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	494602	6.08195E+06
BUTANE	1612.87	13273.9
TOTAL	496215	6.09522E+06

*** PRODUCT ***

FUEL GAS (FOE)	25185.2	264436
MOTOR GASOLINE	203230	2.17834E+06
AVIATION TURBO FUELS	37992	438829
DISTILLATES	177127	2.22538E+06
HEAVY FUEL OIL	24342	370617
OTHER PRODUCTS	28896	404025
H2 TO DESULFURIZERS (FOE)	3640.05	15771.5
COKE (FOE)	10550.3	198091
TOTAL	510963	6.09548E+06

TIME:11.16.16 DATE:MONAPR301984121 40

REFINERY SIMULATION PROGRAM

CASE:WESBAS10 REGION:WESTERN

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	65.1	322250
SYNCRUDE	31.5	155928
CONDENSA	3.4	16830.3

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				495008	6.08695E+06	18942.6
Average		.844145	36.1252	.311201			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
0	CRUDE FEED	495008	6.08695E+06	60	1240	.844146	36.1251	.3112	18942.6
		*** PRODUCT ***							
2	OVERHEAD	49059	454529	60	169.7	.636022	90.9765	.0147045	66.8359
28	LSR	33572.9	329633	60	169.7	.674018	78.4351	.0203	66.9155
3	NAPHTHA	86951.1	958175	169.7	322.689	.756484	55.5496	.0148985	142.754
4	KEROSENE	127820	1.55136E+06	322.689	560	.833189	38.3294	.0625177	969.874
5	LGO	56466.6	724652	560	660	.880983	29.116	.219173	1588.24
1	REDUCED CRUDE	174712	2.39823E+06	660	1240	.942321	18.6611	.67445	16174.9

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
32	REDUCED CRUDE	174712	2.39823E+06	660	1240	.942321	18.6611	.67445	16174.9
		*** PRODUCT ***							
6	HVGO	143041	1.91556E+06	660	1050	.919318	22.4184	.412657	7904.7
7	RESIDUUM	31670.8	482667	1050	1240	1.04621	3.75011	1.7133	8269.54

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
65	LGO	6031.2	77400.1	560	660	.880983	29.116	.219173	169.64
64	HVGO	137569	1.84228E+06	660	1050	.919318	22.4184	.412657	7602.31
		*** TOTAL FEED ***							
8	FCCU FEED	143600	1.91968E+06	560	1050	.917707	22.6886	.404857	7771.95
		*** PRODUCT ***							
12	LCO	22976	325214	430	650	.971684	14.1235	.699348	2274.38
13	HCO	5744	90469.6	650	736.615	1.08123	-.630524	1.10497	999.662
14	CRACKED GAS	80778.8	883235			.7506	57.0159	.040498	357.692
39	C3/C4 -FCCU	35540	291979			.563981	119.395	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 13307.7

AVAILABLE C3/C4 OLEFINS= 35540

CONVERSION Wt%= 78.3462 CONVERSION Vol %= 80

COKE, WT% 10.3305

COKE ,#/HR 198414 Sulfur in Flue Gas,Lbs/hr= 415.55

CAT POLY UNIT

*** FEED ***

< 10 > CAT POLY FEED= 15000

*** PRODUCT ***
< 15 > POLYMER= 6116.06
< 16 > LE FROM POLY (FOE)= 4711.49

ALKYLATION UNIT

*** FEED ***
< 11 > ALKYLATION FEED= 29732.1
< 62 > C3/C4 TO ALKYL= 20540
< 20 > I-C4 FR. GAS PLANT= 7744.22
< 21 > I-C4 IMPORTED= 1447.81
*** PRODUCT ***
< 50 > ALKYLATE= 21217.6
< 63 > LE FROM ALKYL (FOE)= 2546.65

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
		*** FEED ***							
9	REFORMER FEED	72200	795622	169.7	322.689	.756484	55.5496	0	0
		*** PRODUCT ***							
17	REFORMATE	59418.6	695628			.803682	44.5646	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 11495.8
CONVERSION(LV%)= 82.2972 Severity (RON Clear)= 96.5 FEED KW= 11.8146

GAS PLANT

*** FEED ***
< 2 > OVERHEAD= 49059
< 57 > LE FROM REFORMER (FOE)= 11495.8
< 18 > LE FROM CAT CRACKER (FOE)= 13307.7
< 16 > LE FROM POLY (FOE)= 4711.49
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 25741.2
< 20 > I-C4 FR. GAS PLANT= 7744.22
< 49 > REF C4 TO BLENDING = 12061.3
< 69 > LSR= 31067

ISOMERIZATION UNIT

*** FEED ***
< 69 > LSR= 31067
*** PRODUCT ***
< 29 > LSR+ISO= 30619.6

*** BY-PASS= 10 % ***

GASOLINE BLENDING

*** FEED ***
< 29 > LSR+ISO= 30619.6
< 26 > REFORMATE= 52436.6
< 50 > ALKYLATE= 21217.6
< 15 > POLYMER= 6116.06
< 14 > CRACKED GAS= 80778.8
< 49 > REF C4 TO BLENDING = 12061.3
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 20065
< 23 > UNLEADED REGULAR= 166685
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.611335	.11048	0	0
CRACKED GAS	.287593	.45	0	0
REFORMATE	.070918	.25217	.646047	0
POLYMER	0	.0366923	0	0
ALKYLATE	0	.0871247	.3	.9786
C4	.0301543	.0635331	.0539527	.0214

TURBO FUEL BLENDING

*** FEED ***
< 30 > LSR= 2505.96
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 21112
*** PRODUCT ***
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.12	0
NAPHTHA	.59	.12
KEROSENE	.29	.88

DISTILLATE BLENDING

*** FEED ***
< 60 > KEROSENE= 106708
< 40 > LGO= 50435.2
< 38 > LCO= 19984
*** PRODUCT ***
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.63	.102309
LCO	0	.1	.313659
LGO	0	.27	.584033

HEAVY FUEL OIL BLENDING

*** FEED ***
< 41 > LGO= .171875
< 35 > LCO= 2992
< 13 > HCO= 5744
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 15605.8
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 24342

OTHER PRODUCTS

< 27 > NAPHTHA SPECIALTIES= 6982
< 36 > HVGO TO LUBE OIL= 5472
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	127820	127820	1.55136E+06	.0625177	0	3.12774E-03
LGO	50435.4	50435.4	647252	.219173	7.74506E-06	.0219606
LCO	22976	11488	162607	.699348	50	.385856
HCO	5744	0	0	1.10497	100	1.10497
VAC RESIDUUM	15605.8	0	0	1.7133	100	1.7133

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	20883	17109	5913	13398	157816	24342
S.G.	.768832	.823985	.833189	.904543	.859943	1.04531
ASTM 10%	203.517	341.298	386.993	488.95	401.623	
ASTM 20%	223.182	367.1	401.28	530.189	428.876	
ASTM 50%	276.719	432.11	448.218	586.527	504.306	
ASTM 90%	471.285	516.967	519.679	624.393	607.37	
RVP,psia	2.93949					
Sulfur Wt %	.0117669	4.42286E-03	3.12588E-03	.142363	.0514327	1.413
Flash Point,F	62.571	131.74	145.788	202.782	153.623	
Pour Point,F	-97.0854	-50.5051	-43.6504	-20.1955	-32.999	
Cetane No.					42.5035	
Visc @100F,cs	.77824	1.60777	1.83629	4.62382	2.56018	1448.49
Visc @122F,cs	.686281	1.37121	1.55464	3.65926	2.1218	524.922
Watsons K	11.7922	11.6413	11.6069	11.1613	11.4476	10.7305
MeABP	285.22	422.594	444.436	569.04	494.006	951.31

GASOLINE

LEADED REGULAR,BPCD	20065
TEL Addition,cc/IG: 1.02	
RON / MON / (R+M)/2 (Clear)	87.6558 / 82.6899 / 85.1729
RON / MON / (R+M)/2	92.4291 / 87.1973 / 89.8132
RVP,psia	13.332
MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	166685
RON / MON / (R+M)/2	93.15 / 84.9156 / 89.0328
RVP,psia	10.438
UNLEADED PREMIUM,BPCD	13901
RON / MON / (R+M)/2	95.5493 / 88.1018 / 91.8256
RVP,psia	9.74078

AVIATION GASOLINE,BPCD	2579
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 495008	< 1 > REDUCED CRUDE= 174712
< 2 > OVERHEAD= 49059	< 3 > NAPHTHA= 86951.1
< 4 > KEROSENE= 127820	< 5 > LGO= 56466.6
< 6 > HVGO= 143041	< 7 > RESIDUUM= 31670.8
< 8 > FCCU FEED= 143600	< 9 > REFORMER FEED= 72200
< 10 > CAT POLY FEED= 15000	< 11 > ALKYLATION FEED= 29732.1
< 12 > LCO= 22976	< 13 > HCO= 5744
< 14 > CRACKED GAS= 80778.8	< 15 > POLYMER= 6116.06
< 16 > LE FROM POLY (FOE)= 4711.49	< 17 > REFORMATE= 59418.6
< 18 > LE FROM CAT CRACKER (FOE)= 13307.7	< 19 > FUEL GAS (FOE)= 25741.2
< 20 > I-C4 FR. GAS PLANT= 7744.22	< 21 > I-C4 IMPORTED= 1447.81
< 22 > LEADED REGULAR= 20065	< 23 > UNLEADED REGULAR= 166685
< 24 > UNLEADED PREMIUM= 13901	< 25 > AVIATION GASOLINE= 2579
< 26 > REFORMATE= 52436.6	< 27 > NAPHTHA SPECIALTIES= 6982
< 28 > LSR= 33572.9	< 29 > LSR+ISO= 30619.6
< 30 > LSR= 2505.96	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 174712	< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 34 > VAC RESIDUUM= 15605.8	< 35 > LCO= 2992
< 36 > HVGO TO LUBE OIL= 5472	< 37 > HVGO= 0
< 38 > LCO= 19984	< 39 > C3/C4 -FCCU= 35540
< 40 > LGO= 50435.2	< 41 > LGO= .171875
< 42 > JET FUEL B= 20883	< 43 > JET FUEL A= 17109
< 44 > STOVE OIL= 5913	< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816	< 47 > HEAVY FUEL OIL= 24342
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 12061.3
< 50 > ALKYLATE= 21217.6	< 51 > CRUDE LIGHT ENDS= 3.12845
< 52 > TOTAL PRODUCT= 471587	< 53 > C2 % IN CRUDE FEED= .10416
< 54 > C3 % IN CRUDE FEED= .87234	< 55 > I-C4 % IN CRUDE FEED= .41795
< 56 > N-C4 % IN CRUDE FEED= 1.734	< 57 > LE FROM REFORMER (FOE)= 11495.8
< 58 > NAPHTHA= 14374	< 59 > KEROSENE= 21112
< 60 > KEROSENE= 106708	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20540	< 63 > LE FROM ALKYL (FOE)= 2546.65
< 64 > HVGO= 137569	< 65 > LGO = 6031.2
< 66 > NAPHTHA PETROCHEMICAL FEED= 377	< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0	< 69 > LSR= 31067

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2703.81	8531.36	43601.6	0	0	0	54836.8
C3 ,#/HR	31954.3	23531.4	31146	13506.8	15120.4	1034.53	116293
IC4 ,#/HR	17026.9	15224.9	72340.6	32996.7	0	1840.9	139430
NC4 ,#/HR	73148.1	22219.2	28119.5	11868.1	16251.4	5241.99	156848
H2 ,#/HR	0	21956.5	17845.9	0	0	0	39802.4
C1 ,#/HR	0	8531.36	18078.7	0	0	0	26610.1
H2S ,#/HR	0	0	3957.46	0	0	0	3957.46
C2= ,#/HR	0	0	26586.4	0	0	0	26586.4
C3= ,#/HR	0	0	71063.7	0	0	0	71063.7
C4= ,#/HR	0	0	109927	0	0	0	109927
TOTAL ,#/HR	124833	99994.7	422667	58371.6	31371.8	8117.42	745356
BPCD (FOE)	10102.7	11495.8	36519.7	4711.49	2546.64	654.719	66031.1

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	54836.8	54836.8
C3 ,#/HR	11042.2	15120.4	0	0	0	90130.8	116293
IC4 ,#/HR	30532.1	105543	2608.07	0	0	746.391	139430
NC4 ,#/HR	11868.1	16251.4	100086	0	0	28642.8	156848
H2 ,#/HR	0	0	0	0	15752.7	24049.7	39802.4
C1 ,#/HR	0	0	0	0	0	26610.1	26610.1
H2S ,#/HR	0	0	0	0	0	3957.46	3957.46
C2= ,#/HR	0	0	0	0	0	26586.4	26586.4
C3= ,#/HR	23394.6	32035.1	0	0	0	15634	71063.7
C4= ,#/HR	46395.8	63531.3	0	0	0	0	109927
TOTAL ,#/HR	123233	232482	102694	0	15752.7	271194	745356
BPCD (FOE)	9819.31	18564.5	8270.38	0	3635.73	25741.2	66031.1

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	495008	6.08695E+06
BUTANE	1447.81	11915.5
TOTAL	496456	6.09887E+06

*** PRODUCT ***

FUEL GAS (FOE)	25741.2	271194
MOTOR GASOLINE	203230	2.17461E+06
AVIATION TURBO FUELS	37992	439240
DISTILLATES	177127	2.22523E+06
HEAVY FUEL OIL	24342	370656
OTHER PRODUCTS	28896	404007
H2 TO DESULFURIZERS (FOE)	3635.73	15752.7
COKE (FOE)	10567.5	198414
TOTAL	511531	6.09911E+06

"C"

TIME:05.52.09 DATE:THUJUN211984173 63
REFINERY SIMULATION PROGRAM

CASE:ATLBAS50 REGION:ATLANTIC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	33	44814.9
VENEZL	7	9506.18
ARABL	30.6	41555.6
SYNCRUDE	15	20370.4
MEXL	9.9	13444.5
NORTHSEA	4.5	6111.12

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				135803	1.71583E+06	20635.2
Average		.867354	31.6398	1.20263			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	135803	1.71583E+06	60	1360	.867351	31.6404	1.20264	20635.2
	*** PRODUCT ***								
2	OVERHEAD	8573.97	80017.5	60	169.193	.640668	89.3633	.0145574	11.6484
28	LSR	6389.39	62080.5	60	169.193	.667	80.644	.0187739	11.6549
3	NAPHTHA	12525.7	132823	169.193	279.565	.727948	62.8821	.0233518	31.0165
4	KEROSENE	35973.8	423989	279.565	540	.809093	43.3872	.17377	736.766
5	LGO	16950.6	214952	540	660	.870536	31.0435	.767538	1649.84
1	REDUCED CRUDE	61778.5	864048	660	1360	.960131	15.8757	2.10705	18205.9

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	61778.5	864048	660	1360	.960131	15.8757	2.10705	18205.9
	*** PRODUCT ***								
6	HVGO	43743.7	586641	660	1050	.920633	22.1986	1.3757	8070.42
7	RESIDUUM	18034.7	277410	1050	1360	1.05595	2.50256	3.65395	10136.4

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	352.266	4467.12	540	660	.870536	31.0435	.767538	34.2868
64	HVGO	43680.7	585796	660	1050	.920633	22.1986	1.3757	8058.79
	*** TOTAL FEED ***								
8	FCCU FEED	44033	590264	540	1050	.920233	22.2654	1.3711	8093.08
	*** PRODUCT ***								
12	LCO	11378.1	159285	430	650	.961023	15.7389	1.71521	2732.06
13	HCO	2844.53	43433.5	650	787.375	1.0482	3.49333	2.71003	1177.06
14	CRACKED GAS	21975.9	239470			.748055	57.6572	.180496	432.232
39	C3/C4 -FCCU	8575.44	70456.9			.564024	119.376	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 2681.86

AVAILABLE C3/C4 OLEFINS= 8666.71

CONVERSION Wt%= 65.6563 CONVERSION Vol %= 67.7

COKE, WT% 8.16897

COKE ,#/HR 48243.2 Sulfur in Flue Gas,Lbs/hr= 331.28

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 8575.44
*** PRODUCT ***
< 15 > POLYMER= 3501.87
< 16 > LE FROM POLY (FOE)= 2689.24

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 0
< 63 > LE FROM ALKYL (FOE)= 0

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	9650	102329	169.193	279.565	.727948	62.8821	0	0
	*** PRODUCT ***								
17	REFORMATE	7563.54	86134.9			.781779	49.4975	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 1886.38
CONVERSION(LV%)= 78.3787   Severity (RON Clear)= 95.5 FEED KW= 12.1642

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 8573.97
< 57 > LE FROM REFORMER (FOE)= 1886.38
< 18 > LE FROM CAT CRACKER (FOE)= 2681.86
< 16 > LE FROM POLY (FOE)= 2689.24
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 5611.07
< 20 > I-C4 FR. GAS PLANT= 0
< 49 > REF C4 TO BLENDING = 2774.48
< 69 > LSR= 6195.68

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 6195.68
*** PRODUCT ***
< 29 > LSR+ISO= 6138.18

*** BY-PASS= 42 %   ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 6138.18
< 26 > REFORMATE= 7563.54
< 50 > ALKYLATE= 0
< 15 > POLYMER= 3501.87
< 14 > CRACKED GAS= 21975.9
< 49 > REF C4 TO BLENDING = 2774.48
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 12580

< 23 > UNLEADED REGULAR= 26418
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.328977	.0756929	0	0
CRACKED GAS	.561135	.55	.130902	0
REFORMATE	.0575586	.170845	.794051	0
POLYMER	0	.132556	0	0
ALKYLATE	0	0	0	.9786
C4	.05233	.071706	.0750476	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 193.71
< 58 > NAPHTHA= 1527.75
< 59 > KEROSENE= 4442.55
*** PRODUCT ***
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.48	.155
KEROSENE	.41	.845

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 31531.3
< 40 > LGO= 16178.6
< 38 > LCO= 9278.13
*** PRODUCT ***
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.607	.456674
LCO	0	.139	.20248
LGO	0	.254	.340846

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 419.738
< 35 > LCO= 2100
< 13 > HCO= 2844.53
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 8536.73

*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 13901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 0
< 36 > HVGO TO LUBE OIL= 63
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	FEED TO DDS SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	35973.8	35973.8	423989	.17377	0	8.70287E-03
LGO	16598.3	16598.3	210485	.767538	2.00039E-04	.0772891
LCO	11378.1	7964.69	111499	1.71521	29.9998	.641558
HCO	2844.53	0	0	2.71003	100	2.71003
VAC RESIDUUM	8536.73	0	0	3.65395	100	3.65395

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	1761	4403	2390	26607	27991	13901
S.G.	.754513	.796516	.809093	.860798	.845818	1.03443
ASTM 10%	206.364	287.448	351.225	379.149	368.337	
ASTM 20%	223.069	319.198	367.718	420.799	398.553	
ASTM 50%	268.337	393.43	415.276	520.339	484.455	
ASTM 90%	471.553	493.673	497.478	609.812	603.379	
RVP,psia	2.63197					
Sulfur Wt %	.0164598	.0107656	8.68848E-03	.173647	.125338	2.94357
Flash Point,F	64.2404	101.783	129.951	145.66	139.392	
Pour Point,F	-79.9104	-54.4261	-44.234	-32.6327	-35.6808	
Cetane No.					44.9436	
Visc @100F,cs	.794852	1.26406	1.50673	2.58976	2.19642	1291.96
Visc @122F,cs	.70117	1.09285	1.29152	2.14464	1.83979	488.171
Watsons K	12.0486	11.856	11.8142	11.4427	11.5497	10.8475
MeABP	291.291	382.162	413.386	495.629	472.288	952.93

GASOLINE

LEADED REGULAR,BPCD	12580
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	86.8996 / 78.7256 / 82.8126
RON / MON / (R+M)/2	91.5212 / 82.4998 / 87.0105
RVP,psia	11.0166
MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	26418
RON / MON / (R+M)/2	92.055 / 81.952 / 87.0035
RVP,psia	10.1215
UNLEADED PREMIUM,BPCD	2956
RON / MON / (R+M)/2	95 / 85.2263 / 90.1132
RVP,psia	9.86518
AVIATION GASOLINE,BPCD	0
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 135803
< 1 > REDUCED CRUDE= 61778.5
< 2 > OVERHEAD= 8573.97
< 3 > NAPHTHA= 12525.7
< 4 > KEROSENE= 35973.8
< 5 > LGO= 16950.6
< 6 > HVGO= 43743.7
< 7 > RESIDUUM= 18034.7
< 8 > FCCU FEED= 44033
< 9 > REFORMER FEED= 9650
< 10 > CAT POLY FEED= 8575.44
< 11 > ALKYLATION FEED= 0
< 12 > LCO= 11378.1
< 13 > HCO= 2844.53
< 14 > CRACKED GAS= 21975.9
< 15 > POLYMER= 3501.87
< 16 > LE FROM POLY (FOE)= 2689.24
< 17 > REFORMATE= 7563.54
< 18 > LE FROM CAT CRACKER (FOE)= 2681.86
< 19 > FUEL GAS (FOE)= 5611.07
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 12580
< 23 > UNLEADED REGULAR= 26418
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0
< 26 > REFORMATE= 7563.54
< 27 > NAPHTHA SPECIALTIES= 0
< 28 > LSR= 6389.39
< 29 > LSR+ISO= 6138.18
< 30 > LSR= 193.71
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 61778.5
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 34 > VAC RESIDUUM= 8536.73
< 35 > LCO= 2100
< 36 > HVGO TO LUBE OIL= 63
< 37 > HVGO= 0
< 38 > LCO= 9278.13
< 39 > C3/C4 -FCCU= 8575.44
< 40 > LGO= 16178.6
< 41 > LGO= 419.738
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991
< 47 > HEAVY FUEL OIL= 13901
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 2774.48
< 50 > ALKYLATE= 0
< 51 > CRUDE LIGHT ENDS= 1.60865
< 52 > TOTAL PRODUCT= 129916
< 53 > C2 % IN CRUDE FEED= .02451
< 54 > C3 % IN CRUDE FEED= .31962
< 55 > I-C4 % IN CRUDE FEED= .19662
< 56 > N-C4 % IN CRUDE FEED= 1.0679
< 57 > LE FROM REFORMER (FOE)= 1886.38
< 58 > NAPHTHA= 1527.75
< 59 > KEROSENE= 4442.55
< 60 > KEROSENE= 31531.3
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 63 > LE FROM ALKYL (FOE)= 0
< 64 > HVGO= 43680.7
< 65 > LGO = 352.266
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0
< 69 > LSR= 6195.68

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	174.548	1478.38	8297.84	0	0	0	9950.77
C3 ,#/HR	3211.99	3855.73	7414.29	7571.56	0	132.959	22186.5
IC4 ,#/HR	2197.53	2305.79	17525.9	18750.5	0	236.596	41016.3
NC4 ,#/HR	12358.9	3365.06	7072.01	6997.53	0	673.708	30467.2
H2 ,#/HR	0	3710.54	3226.79	0	0	0	6937.33
C1 ,#/HR	0	1478.38	3440.57	0	0	0	4918.95
H2S ,#/HR	0	0	3634.22	0	0	0	3634.22
C2= ,#/HR	0	0	5059.66	0	0	0	5059.66
C3= ,#/HR	0	0	17527.9	0	0	0	17527.9
C4= ,#/HR	0	0	26709.1	0	0	0	26709.1
TOTAL ,#/HR	17943	16193.9	99908.3	33319.6	0	1043.26	168408
BPCD (FOE)	1449.53	1886.38	8246.57	2689.24	0	84.1455	14355.9

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	9950.77	9950.77
C3 ,#/HR	6162.42	0	0	0	0	16024.1	22186.5
IC4 ,#/HR	17341.3	0	11599.3	0	0	12075.7	41016.3
NC4 ,#/HR	6997.53	0	11498.7	0	0	11971	30467.2
H2 ,#/HR	0	0	0	0	5469.5	1467.83	6937.33
C1 ,#/HR	0	0	0	0	0	4918.95	4918.95
H2S ,#/HR	0	0	0	0	0	3634.22	3634.22
C2= ,#/HR	0	0	0	0	0	5059.66	5059.66
C3= ,#/HR	13527.8	0	0	0	0	4000.08	17527.9
C4= ,#/HR	26427.8	0	137.808	0	0	143.471	26709.1
TOTAL ,#/HR	70456.9	0	23235.8	0	5469.5	69245.7	168408
BPCD (FOE)	5613.94	0	1868.48	0	1262.36	5611.07	14355.9

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	135803	1.71583E+06
BUTANE	0	0
TOTAL	135803	1.71583E+06

*** PRODUCT ***

FUEL GAS (FOE)	5611.07	69245.7
MOTOR GASOLINE	41954	445133
AVIATION TURBO FUELS	6164	70442.5
DISTILLATES	56988	706678
HEAVY FUEL OIL	13901	209468
OTHER PRODUCTS	10909	161238
H2 TO DESULFURIZERS (FOE)	1262.36	5469.5
COKE (FOE)	2569.43	48243.2
TOTAL	139359	1.71592E+06

TIME:00.30.22 DATE:WEDJUN271984179 62
REFINERY SIMULATION PROGRAM

CASE:ATLBAS51 REGION:ATLANTIC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	33	44737.5
VENEZL	7	9489.77
ARABL	30.6	41483.9
SYNCRUDE	15	20335.2
MEXL	9.9	13421.2
NORTHSEA	4.5	6100.57

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				135568	1.71287E+06	20599.6
Average		.867354	31.6398	1.20263			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	135568	1.71287E+06	60	1360	.867355	31.6396	1.20264	20599.6
	*** PRODUCT ***								
2	OVERHEAD	8585.66	80152.1	60	169.481	.640872	89.2929	.0146255	11.7227
28	LSR	6404.85	62243.1	60	169.481	.667132	80.6019	.0187767	11.6872
3	NAPHTHA	12525.7	132849	169.481	279.941	.728092	62.8436	.0233882	31.071
4	KEROSENE	35863.6	422732	279.941	540	.809173	43.3699	.173948	735.334
5	LGO	16921.3	214581	540	660	.870536	31.0435	.767538	1646.99
1	REDUCED CRUDE	61671.8	862556	660	1360	.960131	15.8757	2.10705	18174.5

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	61671.8	862556	660	1360	.960131	15.8757	2.10705	18174.5
	*** PRODUCT ***								
6	HVGO	43668	585626	660	1050	.920633	22.1986	1.3757	8056.45
7	RESIDUUM	18003.8	276935	1050	1360	1.05595	2.50256	3.65395	10119.1

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	0	0	540	660	.870536	31.0435	.767538	0
64	HVGO	43605	584781	660	1050	.920633	22.1986	1.3757	8044.83
	*** TOTAL FEED ***								
8	FCCU FEED	43605	584781	540	1050	.920633	22.1986	1.3757	8044.83
	*** PRODUCT ***								
12	LCO	11232.6	157384	430	650	.961855	15.6116	1.72389	2713.12
13	HCO	2808.16	42905.6	650	787.002	1.04887	3.40709	2.72375	1168.64
14	CRACKED GAS	21765.4	237176			.748055	57.6572	.180951	429.172
39	C3/C4 -FCCU	8593.93	70615.3			.564075	119.353	0	0

*** PRODUCT ***
< 18 > LE FROM CAT CRACKER (FOE)= 2613.95
AVAILABLE C3/C4 OLEFINS= 8593.93
CONVERSION Wt%= 65.7496 CONVERSION Vol %= 67.8
COKE, WT% 8.23475
COKE ,#/HR 48180 Sulfur in Flue Gas,Lbs/hr= 330.135

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 8593.93
*** PRODUCT ***
< 15 > POLYMER= 3508.34
< 16 > LE FROM POLY (FOE)= 2696.49

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 0
< 63 > LE FROM ALKYL (FOE)= 0

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	9650	102349	169.481	279.941	.728092	62.8436	0	0
	*** PRODUCT ***								
17	REFORMATE	7700.91	87270.7			.777958	50.3865	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 1745.99
CONVERSION(LV%)= 79.8022   Severity (RON Clear)= 94   FEED KW= 12.1635

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 8585.66
< 57 > LE FROM REFORMER (FOE)= 1745.99
< 18 > LE FROM CAT CRACKER (FOE)= 2613.95
< 16 > LE FROM POLY (FOE)= 2696.49
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 5321.57
< 20 > I-C4 FR. GAS PLANT= 0
< 49 > REF C4 TO BLENDING = 2768.2
< 69 > LSR= 6211.14

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 6211.14
*** PRODUCT ***
< 29 > LSR+ISO= 6211.14

*** BY-PASS= 100 %   ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 6211.14
< 26 > REFORMATE= 7700.91
< 50 > ALKYLATE= 0
< 15 > POLYMER= 3508.34
< 14 > CRACKED GAS= 21765.4
< 49 > REF C4 TO BLENDING = 2768.2
< 68 > IMPORTED C4= 0

*** PRODUCT ***
< 22 > LEADED REGULAR= 4195
< 23 > UNLEADED REGULAR= 34803
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.24037	.15033	0	0
CRACKED GAS	.70012	.541	0	0
REFORMATE	0	.141889	.934621	0
POLYMER	0	.100806	0	0
ALKYLATE	0	0	0	.9786
C4	.0595102	.0659756	.0653794	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 193.71
< 58 > NAPHTHA= 1527.75
< 59 > KEROSENE= 4442.55
*** PRODUCT ***
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.48	.155
KEROSENE	.41	.845

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 31421.1
< 40 > LGO= 16909.3
< 38 > LCO= 8657.65
*** PRODUCT ***
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.607	.452531
LCO	0	.139	.17916
LGO	0	.254	.368309

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 12.0339
< 35 > LCO= 2575
< 13 > HCO= 2808.16
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 8505.81
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 13901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 0
< 36 > HVGO TO LUBE OIL= 63
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	Lbs/hr	SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	35863.6	35863.6	422732	.173948	0	8.7118E-03
LGO	16921.3	16921.3	214581	.767538	0	.0772877
LCO	11232.6	7862.85	110169	1.72389	29.9997	.644839
HCO	2808.16	0	0	2.72375	100	2.72375
VAC RESIDUUM	8505.81	0	0	3.65395	100	3.65395

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	1761	4403	2390	26607	27991	13901
S.G.	.75463	.796605	.809173	.859128	.845982	1.03693
ASTM 10%	206.554	287.791	351.545	379.434	368.658	
ASTM 20%	223.301	319.517	367.981	421.598	398.803	
ASTM 50%	268.663	393.61	415.445	525.194	484.514	
ASTM 90%	471.622	493.703	497.508	610.699	603.374	
RVP,psia	2.34049					
Sulfur Wt %	.0164812	.0107786	8.69738E-03	.160291	.125914	2.94303
Flash Point,F	64.3448	101.974	130.126	145.858	139.568	
Pour Point,F	-79.8496	-54.3573	-44.1798	-29.9542	-35.7286	
Cetane No.					44.8872	
Visc @100F,cs	.795745	1.26556	1.50833	2.61572	2.19865	1224.23
Visc @122F,cs	.701927	1.09409	1.29282	2.16592	1.8415	464.026
Watsons K	12.048	11.8556	11.8138	11.4728	11.5481	10.8112
MeABP	291.527	382.379	413.569	497.598	472.421	948.97

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	174.246	1340.2	8283.78	0	0	0	9798.23
C3 ,#/HR	3206.44	3555.21	7359.42	7594.22	0	0	21715.3
IC4 ,#/HR	2193.74	2217.46	17368.8	18781.1	0	0	40561.1
NC4 ,#/HR	12337.6	3236.15	7034.07	7034.07	0	0	29641.9
H2 ,#/HR	0	3389.15	3222	0	0	0	6611.15
C1 ,#/HR	0	1340.2	3434.74	0	0	0	4774.94
H2S ,#/HR	0	0	3616.49	0	0	0	3616.49
C2= ,#/HR	0	0	5051.08	0	0	0	5051.08
C3= ,#/HR	0	0	17317.5	0	0	0	17317.5
C4= ,#/HR	0	0	26522.9	0	0	0	26522.9
TOTAL ,#/HR	17912	15078.4	99210.8	33409.4	0	0	165611
BPCD (FOE)	1447.03	1745.99	8191.51	2696.5	0	0	14081

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	9798.23	9798.23
C3 ,#/HR	6181.92	0	0	0	0	15533.4	21715.3
IC4 ,#/HR	17368.8	0	11735	0	0	11457.3	40561.1
NC4 ,#/HR	7034.07	0	11439.2	0	0	11168.6	29641.9
H2 ,#/HR	0	0	0	0	5498.94	1112.21	6611.15
C1 ,#/HR	0	0	0	0	0	4774.94	4774.94
H2S ,#/HR	0	0	0	0	0	3616.49	3616.49
C2= ,#/HR	0	0	0	0	0	5051.08	5051.08
C3= ,#/HR	13507.6	0	0	0	0	3809.9	17317.5
C4= ,#/HR	26522.9	0	0	0	0	0	26522.9
TOTAL ,#/HR	70615.3	0	23174.2	0	5498.94	66322.2	165611
BPCD (FOE)	5626.56	0	1863.75	0	1269.15	5321.57	14081

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	135568	1.71287E+06
BUTANE	0	0
TOTAL	135568	1.71287E+06

*** PRODUCT ***

FUEL GAS (FOE)	5321.57	66322.2
MOTOR GASOLINE	41954	445187
AVIATION TURBO FUELS	6164	70451.2
DISTILLATES	56988	706101
HEAVY FUEL OIL	13901	209974
OTHER PRODUCTS	10909	161240
H2 TO DESULFURIZERS (FOE)	1269.15	5498.94
COKE (FOE)	2566.07	48180
TOTAL	139073	1.71295E+06

TIME:02.29.00 DATE:SUNJUL 11984183 76
REFINERY SIMULATION PROGRAM

CASE:QUEBAS50 REGION:QUEBEC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	16.8	46386.1
VENEZH	11.65	32166.6
ARABH	6.95	19189.5
CANDNH	27.3	75377.4
SYNCRUDE	16.3	45005.6
MEXH	11.6	32028.5
CONDENSA	9.4	25954.1

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				276108	3.55714E+06	64227
Average		.884407	28.4943	1.80558			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	276108	3.55714E+06	60	1460	.884406	28.4943	1.80558	64227
	*** PRODUCT ***								
2	OVERHEAD	23786.7	222347	60	169.511	.641693	89.0103	.0405176	90.0898
28	LSR	18703.7	180503	60	169.511	.662502	82.0843	.0498476	89.9765
3	NAPHTHA	35981.3	387899	169.511	318.491	.740068	59.6987	.0838934	325.422
4	KEROSENE	50363.3	606375	318.491	540	.826527	39.6983	.422624	2562.69
5	LGO	32193.2	415002	540	660	.884944	28.3971	1.02294	4245.22
1	REDUCED CRUDE	133783	1.92552E+06	660	1460	.988044	11.7123	2.96043	57003.6

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	133783	1.92552E+06	660	1460	.988044	11.7123	2.96043	57003.6
	*** PRODUCT ***								
6	HVGO	86654.2	1.18759E+06	660	1050	.940819	18.9009	1.9963	23707.8
7	RESIDUUM	47129.2	737932	1050	1460	1.07487	.143829	4.51195	33295.1

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	7966.8	102700	540	660	.884944	28.3971	1.02294	1050.56
64	HVGO	80553.2	1.10397E+06	660	1050	.940819	18.9009	1.9963	22038.6
	*** TOTAL FEED ***								
8	FCCU FEED	88520	1.20667E+06	540	1050	.93579	19.7091	1.91346	23089.2
	*** PRODUCT ***								
12	LCO	15225.4	222092	430	650	1.00137	9.8064	3.11412	6916.22
13	HCO	3806.36	60653.7	650	743.727	1.0939	-2.1463	4.92031	2984.35
14	CRACKED GAS	46410.4	509837			.754129	56.1337	.212507	1083.44
39	C3/C4 -FCCU	19924.5	164397			.566419	118.315	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 8616.09

AVAILABLE C3/C4 OLEFINS= 20505.5

CONVERSION Wt%= 76.5682   CONVERSION Vol %= 78.5

COKE, WT% 12.9445

COKE ,#/HR 156279   Sulfur in Flue Gas,Lbs/hr= 1199.12

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 17500
*** PRODUCT ***
< 15 > POLYMER= 7031.94
< 16 > LE FROM POLY (FOE)= 5636.06

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 3487
< 62 > C3/C4 TO ALKYL= 2424.48
< 20 > I-C4 FR. GAS PLANT= 1062.52
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 2460.84
< 63 > LE FROM ALKYL (FOE)= 328.006

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	32600	351447	169.511	318.491	.740068	59.6987	0	0
	*** PRODUCT ***								
17	REFORMATE	26993.8	308364			.784206	48.9373	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 4928.54
CONVERSION(LV%)= 82.8031 Severity (RON Clear)= 92 FEED KW= 12.0564

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 23786.7
< 57 > LE FROM REFORMER (FOE)= 4928.54
< 18 > LE FROM CAT CRACKER (FOE)= 8616.09
< 16 > LE FROM POLY (FOE)= 5636.06
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 16731.9
< 20 > I-C4 FR. GAS PLANT= 1062.52
< 49 > REF C4 TO BLENDING = 5355.57

< 69 > LSR= 18309.4

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 18309.4
*** PRODUCT ***
< 29 > LSR+ISO= 18180.5

*** BY-PASS= 56 % ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 18180.5
< 26 > REFORMATE= 9444.81
< 50 > ALKYLATE= 2460.84
< 15 > POLYMER= 7031.94
< 14 > CRACKED GAS= 46410.4
< 49 > REF C4 TO BLENDING = 5355.57
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 26456
< 23 > UNLEADED REGULAR= 53805
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.486292	.0987849	0	0
CRACKED GAS	.426165	.545	.733383	0
REFORMATE	.047496	.152184	0	0
POLYMER	0	.130693	0	0
ALKYLATE	0	3.57708E-03	.2	.9786
C4	.0400474	.0697613	.0666176	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 394.35
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
*** PRODUCT ***
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.555	.125
KEROSENE	.335	.875

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 39420.9
< 40 > LGO= 13787.9
< 38 > LCO= 5225.44

*** PRODUCT ***
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.628	.735742
LCO	0	.05	.165725
LGO	0	.322	.0985328

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 10438.5
< 35 > LCO= 10000
< 13 > HCO= 3806.36
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 31656.2
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 55901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 17549
< 36 > HVGO TO LUBE OIL= 3774
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	50363.3	50363.3	606375	.422624	0	.0212164
LGO	24226.4	24226.4	312302	1.02294	0	.103245
LCO	15225.4	12180.4	177675	3.11412	19.9995	.891938
HCO	3806.36	0	0	4.92031	100	4.92031
VAC RESIDUUM	31656.2	0	0	4.51195	100	4.51195

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	3585	11133	1384	20505	36545	55901
S.G.	.760499	.815719	.826527	.861258	.854079	1.02755
ASTM 10%	206.84	332.442	380.64	390.593	395.689	
ASTM 20%	225.329	358.797	393.974	412.285	422.617	
ASTM 50%	281.197	424.042	439.559	469.824	496.002	
ASTM 90%	469.877	499.58	502.694	575.975	606.465	
RVP,psia	2.63795					
Sulfur Wt %	.0577802	.0282489	.0211312	.193289	.0980873	3.19785
Flash Point,F	64.4094	126.803	143.508	148.825	151.644	
Pour Point,F	-85.2775	-50.6189	-44.8898	-53.3527	-32.0124	
Cetane No.					43.4953	
Visc @100F,cs	.796577	1.5051	1.72	2.15133	2.44777	584.869
Visc @122F,cs	.702339	1.28886	1.46208	1.79793	2.03596	252.412
Watsons K	11.9531	11.7121	11.6562	11.3152	11.5026	10.8325
MeABP	291.172	412.024	434.212	465.536	488.172	919.2

GASOLINE

LEADED REGULAR,BPCD	26456
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	86.4154 / 79.0141 / 82.7148
RON / MON / (R+M)/2	91.1409 / 82.888 / 87.0145
RVP,psia	12.1096

MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	53805
RON / MON / (R+M)/2	92 / 82.0197 / 87.0099
RVP,psia	10.2628

UNLEADED PREMIUM,BPCD	7925
RON / MON / (R+M)/2	94.2704 / 85.7463 / 90.0084
RVP,psia	9.73036

AVIATION GASOLINE,BPCD	698
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 276108
< 1 > REDUCED CRUDE= 133783
< 2 > OVERHEAD= 23786.7
< 3 > NAPHTHA= 35981.3
< 4 > KEROSENE= 50363.3
< 5 > LGO= 32193.2
< 6 > HVGO= 86654.2
< 7 > RESIDUUM= 47129.2
< 8 > FCCU FEED= 88520
< 9 > REFORMER FEED= 32600
< 10 > CAT POLY FEED= 17500
< 11 > ALKYLATION FEED= 3487
< 12 > LCO= 15225.4
< 13 > HCO= 3806.36
< 14 > CRACKED GAS= 46410.4
< 15 > POLYMER= 7031.94
< 16 > LE FROM POLY (FOE)= 5636.06
< 17 > REFORMATE= 26993.8
< 18 > LE FROM CAT CRACKER (FOE)= 8616.09
< 19 > FUEL GAS (FOE)= 16731.9
< 20 > I-C4 FR. GAS PLANT= 1062.52
< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 26456
< 23 > UNLEADED REGULAR= 53805
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698
< 26 > REFORMATE= 9444.81
< 27 > NAPHTHA SPECIALTIES= 17549
< 28 > LSR= 18703.7
< 29 > LSR+ISO= 18180.5
< 30 > LSR= 394.35
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 133783
< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 34 > VAC RESIDUUM= 31656.2
< 35 > LCO= 10000
< 36 > HVGO TO LUBE OIL= 3774
< 37 > HVGO= 0
< 38 > LCO= 5225.44
< 39 > C3/C4 -FCCU= 19924.5
< 40 > LGO= 13787.9
< 41 > LGO= 10438.5
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505

< 46 > DIESEL FUEL= 36545
< 47 > HEAVY FUEL OIL= 55901
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 5355.57
< 50 > ALKYLATE= 2460.84
< 51 > CRUDE LIGHT ENDS= 1.84108
< 52 > TOTAL PRODUCT= 257060
< 53 > C2 % IN CRUDE FEED= .04423
< 54 > C3 % IN CRUDE FEED= .277635
< 55 > I-C4 % IN CRUDE FEED= .21544
< 56 > N-C4 % IN CRUDE FEED= 1.30377
< 57 > LE FROM REFORMER (FOE)= 4928.54
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
< 60 > KEROSENE= 39420.9
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 2424.48
< 63 > LE FROM ALKYL (FOE)= 328.006
< 64 > HVGO= 80553.2
< 65 > LGO = 7966.8
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327
< 68 > IMPORTED C4= 0
< 69 > LSR= 18309.4

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	640.41	3599.56	27663.8	0	0	0	31903.8
C3 ,#/HR	5672.63	10026.8	18675.7	16276.2	1854.84	298.076	52804.2
IC4 ,#/HR	4895.59	6729.54	40855.2	37755	0	530.415	90765.8
NC4 ,#/HR	30677.6	9821.07	18499.8	15788.3	2187.34	1510.36	78484.5
H2 ,#/HR	0	9305.69	10788.7	0	0	0	20094.4
C1 ,#/HR	0	3599.56	11470.4	0	0	0	15070
H2S ,#/HR	0	0	11587.7	0	0	0	11587.7
C2= ,#/HR	0	0	16868.2	0	0	0	16868.2
C3= ,#/HR	0	0	33945.3	0	0	0	33945.3
C4= ,#/HR	0	0	67671.4	0	0	0	67671.4
TOTAL ,#/HR	41886.2	43082.2	258026	69819.5	4042.18	2338.85	419195
BPCD (FOE)	3382.33	4928.54	21557.5	5636.06	328.006	188.643	36021.1

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	31903.8	31903.8
C3 ,#/HR	13388.3	1854.83	0	0	0	37561.2	52804.2
IC4 ,#/HR	34867	13575.1	18187.7	0	0	24135.9	90765.8
NC4 ,#/HR	15788.3	2187.34	26002.5	0	0	34506.4	78484.5
H2 ,#/HR	0	0	0	0	8097.38	11997	20094.4
C1 ,#/HR	0	0	0	0	0	15070	15070
H2S ,#/HR	0	0	0	0	0	11587.7	11587.7
C2= ,#/HR	0	0	0	0	0	16868.2	16868.2
C3= ,#/HR	22596.5	3130.56	0	0	0	8218.23	33945.3
C4= ,#/HR	57752.8	8001.17	823.93	0	0	1093.53	67671.4
TOTAL ,#/HR	144393	28749	45014.1	0	8097.38	192942	419195
BPCD (FOE)	11504.5	2296.13	3619.67	0	1868.88	16731.9	36021.1

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	276108	3.55714E+06
BUTANE	0	0
TOTAL	276108	3.55714E+06

*** PRODUCT ***

FUEL GAS (FOE)	16731.9	192942
MOTOR GASOLINE	88884	936383
AVIATION TURBO FUELS	14718	172004
DISTILLATES	58434	728588
HEAVY FUEL OIL	55901	836744
OTHER PRODUCTS	39123	526356
H2 TO DESULFURIZERS (FOE)	1868.88	8097.38
COKE (FOE)	8323.42	156279
TOTAL	283984	3.55739E+06

TIME:02.22.44 DATE:THUJUN141984166 63
REFINERY SIMULATION PROGRAM

CASE:QUEBAS51 REGION:QUEBEC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	16.8	46397.4
VENEZH	11.65	32174.4
ARABH	6.95	19194.2
CANDNH	27.3	75395.8
SYNCRUDE	16.3	45016.5
MEXH	11.6	32036.3
CONDENSA	9.4	25960.4

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				276175	3.55801E+06	64242.6
Average		.884407	28.4942	1.80558			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	276175	3.55801E+06	60	1460	.884408	28.494	1.80558	64242.6
	*** PRODUCT ***								
2	OVERHEAD	23866.4	223157	60	169.856	.64188	88.9461	.0404668	90.3047
28	LSR	18782.2	181304	60	169.856	.66266	82.0333	.0498625	90.4027
3	NAPHTHA	36381.3	392476	169.856	320.418	.740567	59.5698	.0845112	331.686
4	KEROSENE	49910.3	601283	320.418	540	.827025	39.5952	.42521	2556.72
5	LGO	32201	415102	540	660	.884944	28.3971	1.02294	4246.25
1	REDUCED CRUDE	133816	1.92599E+06	660	1460	.988044	11.7123	2.96043	57017.6

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	133816	1.92599E+06	660	1460	.988044	11.7123	2.96043	57017.6
	*** PRODUCT ***								
6	HVGO	86674.4	1.18786E+06	660	1050	.940819	18.9009	1.9963	23713.3
7	RESIDUUM	47141.5	738124	1050	1460	1.07487	.143829	4.51195	33303.8

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	7871.6	101473	540	660	.884944	28.3971	1.02294	1038
64	HVGO	80573.4	1.10425E+06	660	1050	.940819	18.9009	1.9963	22044.2
	*** TOTAL FEED ***								
8	FCCU FEED	88445	1.20572E+06	540	1050	.935846	19.7001	1.91438	23082.2
	*** PRODUCT ***								
12	LCO	15495.6	225943	430	650	1.00097	9.86289	3.07501	6947.78
13	HCO	3873.89	61667.7	650	745.415	1.0928	-2.01611	4.85852	2996.14
14	CRACKED GAS	46255.7	507862			.75372	56.2355	.21436	1088.65
39	C3/C4 -FCCU	20111.9	165944			.566421	118.314	0	0

*** PRODUCT ***
< 18 > LE FROM CAT CRACKER (FOE)= 8285.71
AVAILABLE C3/C4 OLEFINS= 20350.2
CONVERSION Wt%= 76.1462   CONVERSION Vol %= 78.1
COKE, WT% 12.8274
COKE ,#/HR 154743   Sulfur in Flue Gas,Lbs/hr= 1189.36

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 18500
*** PRODUCT ***
< 15 > POLYMER= 7433.57
< 16 > LE FROM POLY (FOE)= 5958.32

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 2318.42
< 62 > C3/C4 TO ALKYL= 1611.95
< 20 > I-C4 FR. GAS PLANT= 706.477
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 1636.09
< 63 > LE FROM ALKYL (FOE)= 218.135

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	33000	355999	169.856	320.418	.740567	59.5698	0	0
	*** PRODUCT ***								
17	REFORMATE	27333.6	312446			.784708	48.8218	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 4982.09
CONVERSION(LV%)= 82.8291   Severity (RON Clear)= 92   FEED KW= 12.0541

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 23866.4
< 57 > LE FROM REFORMER (FOE)= 4982.09

< 18 > LE FROM CAT CRACKER (FOE)= 8285.71
< 16 > LE FROM POLY (FOE)= 5958.32
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 16691.9
< 20 > I-C4 FR. GAS PLANT= 706.477
< 49 > REF C4 TO BLENDING = 5386.26
< 69 > LSR= 18387.8

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 18387.8
*** PRODUCT ***
< 29 > LSR+ISO= 18387.8

*** BY-PASS= 100 %   ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 18387.8
< 26 > REFORMATE= 9784.62
< 50 > ALKYLATE= 1636.09
< 15 > POLYMER= 7433.57
< 14 > CRACKED GAS= 46255.7
< 49 > REF C4 TO BLENDING = 5386.26
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 8820
< 23 > UNLEADED REGULAR= 71441
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.348019	.214419	0	0
CRACKED GAS	.157901	.55	.702893	0
REFORMATE	.444848	.0692065	.115695	0
POLYMER	0	.104052	0	0
ALKYLATE	0	1.13334E-03	.11	.9786
C4	.0492319	.0611898	.0714124	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 394.35
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
*** PRODUCT ***
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.555	.125
KEROSENE	.335	.875

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 38968
< 40 > LGO= 13970.8
< 38 > LCO= 5495.56
*** PRODUCT ***
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.628	.713651
LCO	0	.05	.178899
LGO	0	.322	.10745

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 10358.6
< 35 > LCO= 10000
< 13 > HCO= 3873.89
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 31668.5
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 55901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 17549
< 36 > HVGO TO LUBE OIL= 3774
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	49910.3	49910.3	601283	.42521	0	.0213467
LGO	24329.4	24329.4	313630	1.02294	0	.103245
LCO	15495.6	12396.5	180755	3.07501	19.9999	.880493
HCO	3873.89	0	0	4.85852	100	4.85852
VAC RESIDUUM	31668.5	0	0	4.51195	100	4.51195

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	3585	11133	1384	20505	36545	55901
S.G.	.76096	.816217	.827025	.864366	.854372	1.0277
ASTM 10%	207.098	334.007	382.421	393.375	397.616	
ASTM 20%	225.908	360.391	395.607	415.917	424.085	
ASTM 50%	282.554	425.278	440.554	473.065	496.392	
ASTM 90%	470.493	499.795	502.903	580.934	606.438	
RVP,psia	2.37957					
Sulfur Wt %	.0581636	.028434	.0212605	.204145	.0974784	3.19775
Flash Point,F	64.5479	127.679	143.383	149.145	151.442	
Pour Point,F	-84.9798	-50.2741	-44.576	-53.5457	-31.7375	
Cetane No.					43.4414	
Visc @100F,cs	.800424	1.51519	1.73159	2.20882	2.46073	589.618
Visc @122F,cs	.705599	1.29705	1.47138	1.84234	2.04607	254.097
Watsons K	11.9512	11.7101	11.6539	11.2894	11.5018	10.8318
MeABP	292.186	413.168	435.31	469.205	488.955	919.52

GASOLINE

LEADED REGULAR,BPCD	8820
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	86.3617 / 78.3661 / 82.3639
RON / MON / (R+M)/2	91.4082 / 82.7184 / 87.0633
RVP,psia	10.8445
MMT Addition,mg/l: 18	
UNLEADED REGULAR,BPCD	71441
RON / MON / (R+M)/2	92.13 / 82.1577 / 87.1439
RVP,psia	10.4339
UNLEADED PREMIUM,BPCD	7925
RON / MON / (R+M)/2	95.0399 / 85.258 / 90.149
RVP,psia	9.73252
AVIATION GASOLINE,BPCD	698
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 276175
< 1 > REDUCED CRUDE= 133816
< 2 > OVERHEAD= 23866.4
< 3 > NAPHTHA= 36381.3
< 4 > KEROSENE= 49910.3
< 5 > LGO= 32201
< 6 > HVGO= 86674.4
< 7 > RESIDUUM= 47141.5
< 8 > FCCU FEED= 88445
< 9 > REFORMER FEED= 33000
< 10 > CAT POLY FEED= 18500
< 11 > ALKYLATION FEED= 2318.42
< 12 > LCO= 15495.6
< 13 > HCO= 3873.89
< 14 > CRACKED GAS= 46255.7
< 15 > POLYMER= 7433.57
< 16 > LE FROM POLY (FOE)= 5958.32
< 17 > REFORMATE= 27333.6
< 18 > LE FROM CAT CRACKER (FOE)= 8285.71
< 19 > FUEL GAS (FOE)= 16691.9
< 20 > I-C4 FR. GAS PLANT= 706.477
< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 8820
< 23 > UNLEADED REGULAR= 71441
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698
< 26 > REFORMATE= 9784.62
< 27 > NAPHTHA SPECIALTIES= 17549
< 28 > LSR= 18782.2
< 29 > LSR+ISO= 18387.8
< 30 > LSR= 394.35
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 133816
< 33 > VAC RESID TO ASPHALT PLANT= 15473

< 34 > VAC RESIDUUM= 31668.5
< 35 > LCO= 10000
< 36 > HVGO TO LUBE OIL= 3774
< 37 > HVGO= 0
< 38 > LCO= 5495.56
< 39 > C3/C4 -FCCU= 20111.9
< 40 > LGO= 13970.8
< 41 > LGO= 10358.6
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545
< 47 > HEAVY FUEL OIL= 55901
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 5386.26
< 50 > ALKYLATE= 1636.09
< 51 > CRUDE LIGHT ENDS= 1.84108
< 52 > TOTAL PRODUCT= 257060
< 53 > C2 % IN CRUDE FEED= .04423
< 54 > C3 % IN CRUDE FEED= .277635
< 55 > I-C4 % IN CRUDE FEED= .21544
< 56 > N-C4 % IN CRUDE FEED= 1.30377
< 57 > LE FROM REFORMER (FOE)= 4982.09
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
< 60 > KEROSENE= 38968
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 1611.95
< 63 > LE FROM ALKYL (FOE)= 218.135
< 64 > HVGO= 80573.4
< 65 > LGO = 7871.6
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327
< 68 > IMPORTED C4= 0
< 69 > LSR= 18387.8

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	640.566	3637.37	27294.6	0	0	0	31572.5
C3 ,#/HR	5674.01	10137.5	18520.4	17195.6	1232.29	0	52759.8
IC4 ,#/HR	4896.78	6804.33	40539.7	39906.9	0	0	92147.7
NC4 ,#/HR	30685	9930.21	18380.4	16709.3	1455.92	0	77160.8
H2 ,#/HR	0	9405.72	10638.5	0	0	0	20044.2
C1 ,#/HR	0	3637.37	11317.3	0	0	0	14954.7
H2S ,#/HR	0	0	11539	0	0	0	11539
C2= ,#/HR	0	0	16643.1	0	0	0	16643.1
C3= ,#/HR	0	0	33699.5	0	0	0	33699.5
C4= ,#/HR	0	0	67147.8	0	0	0	67147.8
TOTAL ,#/HR	41896.4	43552.5	255720	73811.8	2688.21	0	417669
BPCD (FOE)	3383.14	4982.09	21351.1	5958.32	218.135	0	35892.8

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	31572.5	31572.5
C3 ,#/HR	14142.7	1232.29	0	0	0	37384.8	52759.8
IC4 ,#/HR	36853.9	9025.48	19724.4	0	0	26543.9	92147.7
NC4 ,#/HR	16709.3	1455.92	25150.2	0	0	33845.4	77160.8
H2 ,#/HR	0	0	0	0	8129.48	11914.7	20044.2
C1 ,#/HR	0	0	0	0	0	14954.7	14954.7
H2S ,#/HR	0	0	0	0	0	11539	11539
C2= ,#/HR	0	0	0	0	0	16643.1	16643.1
C3= ,#/HR	23895.8	2082.1	0	0	0	7721.64	33699.5
C4= ,#/HR	61042.9	5318.81	335.083	0	0	451.05	67147.8
TOTAL ,#/HR	152645	19114.6	45209.7	0	8129.48	192571	417669
BPCD (FOE)	12162	1526.65	3636	0	1876.28	16691.9	35892.8

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	276175	3.55801E+06
BUTANE	0	0
TOTAL	276175	3.55801E+06

*** PRODUCT ***

FUEL GAS (FOE)	16691.9	192571
MOTOR GASOLINE	88884	937674
AVIATION TURBO FUELS	14718	172109
DISTILLATES	58434	729682
HEAVY FUEL OIL	55901	836866
OTHER PRODUCTS	39123	526484
H2 TO DESULFURIZERS (FOE)	1876.28	8129.48
COKE (FOE)	8241.61	154743
TOTAL	283870	3.55826E+06

TIME:00.53.12 DATE:FRIJUN221984174 64
REFINERY SIMULATION PROGRAM

CASE:ONTBAS50 REGION:ONTARIO

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	49	218173
CANDNH	9.2	40963.2
SYNCRUDE	30.8	137138
CONDENSA	11	48977.7

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				445252	5.45458E+06	26309.8
Average		.84098	36.7562	.482344			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	445538	5.45808E+06	60	1300	.840979	36.7563	.482344	26326.7
	*** PRODUCT ***								
2	OVERHEAD	54351	508072	60	170.609	.641723	89.0001	.0289118	146.893
28	LSR	41050.7	399905	60	170.609	.668753	80.0878	.0367421	146.933
3	NAPHTHA	81358.1	892705	170.609	321.012	.753246	56.3536	.0268008	239.252
4	KEROSENE	107997	1.31129E+06	321.012	560	.833522	38.2615	.106689	1399
5	LGO	47930	616654	560	660	.88321	28.711	.312237	1925.42
1	REDUCED CRUDE	153902	2.12936E+06	660	1300	.949805	17.478	1.06211	22616.1

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	153902	2.12936E+06	660	1300	.949805	17.478	1.06211	22616.1
	*** PRODUCT ***								
6	HVGO	123319	1.65827E+06	660	1050	.923111	21.786	.618341	10253.7
7	RESIDUUM	30582.8	471098	1050	1300	1.05746	2.31122	2.62443	12363.6

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	29348	377583	560	660	.88321	28.711	.312237	1178.95
64	HVGO	97152	1.3064E+06	660	1050	.923111	21.786	.618341	8078
	*** TOTAL FEED ***								
8	FCCU FEED	126500	1.68398E+06	560	1050	.913854	23.3387	.549706	9256.96
	*** PRODUCT ***								
12	LCO	20442.4	287230	430	650	.964558	15.1993	.9444	2712.6
13	HCO	5110.6	80174.7	650	737.271	1.07695	-.110413	1.49215	1196.33
14	CRACKED GAS	72060	786568			.749328	57.3359	.0543055	427.15
39	C3/C4 -FCCU	20025.9	164396			.563544	119.589	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 18566.1

AVAILABLE C3/C4 OLEFINS= 31427

CONVERSION Wt%= 78.1824 CONVERSION Vol %= 79.8

COKE, WT% 9.5857

COKE ,#/HR 161504 Sulfur in Flue Gas,Lbs/hr= 493.035

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 1E-06
*** PRODUCT ***
< 15 > POLYMER= 4.08496E-07
< 16 > LE FROM POLY (FOE)= 3.12929E-07

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 29000
< 62 > C3/C4 TO ALKYL= 20025.9

< 20 > I-C4 FR. GAS PLANT= 5752.27
< 21 > I-C4 IMPORTED= 3221.86
*** PRODUCT ***
< 50 > ALKYLATE= 20736.8
< 63 > LE FROM ALKYL (FOE)= 2439.95

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	61250	672068	170.609	321.012	.753246	56.3536	0	0
	*** PRODUCT ***								
17	REFORMATE	51294.5	596968			.798933	45.6113	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 8612.22
CONVERSION(LV%)= 83.7461 Severity (RON Clear)= 94.5 FEED KW= 11.8537

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 54351
< 57 > LE FROM REFORMER (FOE)= 8612.22
< 18 > LE FROM CAT CRACKER (FOE)= 18566.1
< 16 > LE FROM POLY (FOE)= 3.12929E-07
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 26264.7
< 20 > I-C4 FR. GAS PLANT= 5752.27
< 49 > REF C4 TO BLENDING = 8880.29
< 69 > LSR= 40580.3

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 40580.3
*** PRODUCT ***
< 29 > LSR+ISO= 40320.5

*** BY-PASS= 60 % ***

GASOLINE BLENDING

*** FEED ***

< 29 > LSR+ISO= 40320.5

< 26 > REFORMATE= 28713.5

< 50 > ALKYLATE= 20736.8

< 15 > POLYMER= 4.08496E-07

< 14 > CRACKED GAS= 72060

< 49 > REF C4 TO BLENDING = 8880.29

< 68 > IMPORTED C4= 0

*** PRODUCT ***

< 22 > LEADED REGULAR= 51175

< 23 > UNLEADED REGULAR= 104062

< 24 > UNLEADED PREMIUM= 15348

< 25 > AVIATION GASOLINE= 126

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.584177	.100183	0	0
CRACKED GAS	.383247	.4	.705141	0
REFORMATE	3.81656E-08	.275926	0	0
POLYMER	0	3.92551E-12	0	0
ALKYLATE	0	.164165	.23	.9786
C4	.032576	.0597252	.064859	.0214

TURBO FUEL BLENDING

*** FEED ***

< 30 > LSR= 470.47

< 58 > NAPHTHA= 4823.08

< 59 > KEROSENE= 18608.5

*** PRODUCT ***

< 42 > JET FUEL B= 4277

< 43 > JET FUEL A= 19625

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.6	.115
KEROSENE	.29	.885

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 89388.1
< 40 > LGO= 18580.5
< 38 > LCO= 14497.4
*** PRODUCT ***
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.8	.563683
LCO	0	.1	.164775
LGO	0	.1	.271542

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 1.55762
< 35 > LCO= 5945
< 13 > HCO= 5110.6
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 22216.8
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 33274

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 22501
< 36 > HVGO TO LUBE OIL= 10882
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	FEED TO DDS SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	107997	107997	1.31129E+06	.106689	0	5.33986E-03
LGO	18582	18582	239071	.312237	0	.0313117
LCO	20442.4	18398.2	258508	.9444	9.99981	.180818
HCO	5110.6	0	0	1.49215	100	1.49215
VAC RESIDUUM	22216.8	0	0	2.62443	100	2.62443

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	4277	19625	2264	38243	81959	33274
S.G.	.767232	.82429	.833522	.868606	.851594	1.04384
ASTM 10%	207.036	344.665	384.044	402.533	391.207	
ASTM 20%	224.623	368.079	398.987	433.921	412.112	
ASTM 50%	274.843	432.288	447.789	512.361	472.43	
ASTM 90%	470.745	516.902	519.506	608.724	569.951	
RVP,psia	2.60473					
Sulfur Wt %	.0209908	7.59029E-03	5.33443E-03	.0443393	.0277391	2.04124
Flash Point,F	64.56	133.6	144.206	154.17	147.969	
Pour Point,F	-95.5545	-50.3315	-44.7721	-36.6558	-44.291	
Cetane No.					40.7048	
Visc @100F,cs	.777936	1.61401	1.82367	2.6834	2.13864	1736.08
Visc @122F,cs	.686099	1.37624	1.54433	2.21393	1.79148	612.827
Watsons K	11.8172	11.6398	11.5968	11.3546	11.4481	10.7677
MeABP	285.29	423.238	443.168	499.382	466.618	960.06

GASOLINE

LEADED REGULAR,BPCD	51175
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	84.9964 / 78.7772 / 81.8868
RON / MON / (R+M)/2	90.4661 / 83.6788 / 87.0725
RVP,psia	12.4795

MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	104062
RON / MON / (R+M)/2	91.0908 / 83.0834 / 87.0871
RVP,psia	10.249

UNLEADED PREMIUM,BPCD	15348
RON / MON / (R+M)/2	94.1481 / 85.8703 / 90.0092
RVP,psia	9.8178

AVIATION GASOLINE,BPCD	126
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 445538
< 1 > REDUCED CRUDE= 153902
< 2 > OVERHEAD= 54351
< 3 > NAPHTHA= 81358.1
< 4 > KEROSENE= 107997
< 5 > LGO= 47930
< 6 > HVGO= 123319
< 7 > RESIDUUM= 30582.8
< 8 > FCCU FEED= 126500
< 9 > REFORMER FEED= 61250
< 10 > CAT POLY FEED= 1E-06
< 11 > ALKYLATION FEED= 29000
< 12 > LCO= 20442.4
< 13 > HCO= 5110.6
< 14 > CRACKED GAS= 72060
< 15 > POLYMER= 4.08496E-07
< 16 > LE FROM POLY (FOE)= 3.12929E-07
< 17 > REFORMATE= 51294.5
< 18 > LE FROM CAT CRACKER (FOE)= 18566.1
< 19 > FUEL GAS (FOE)= 26264.7
< 20 > I-C4 FR. GAS PLANT= 5752.27
< 21 > I-C4 IMPORTED= 3221.86
< 22 > LEADED REGULAR= 51175
< 23 > UNLEADED REGULAR= 104062
< 24 > UNLEADED PREMIUM= 15348
< 25 > AVIATION GASOLINE= 126
< 26 > REFORMATE= 28713.5
< 27 > NAPHTHA SPECIALTIES= 22581
< 28 > LSR= 41050.7
< 29 > LSR+ISO= 40320.5
< 30 > LSR= 470.47
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 153902
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 34 > VAC RESIDUUM= 22216.8
< 35 > LCO= 5945
< 36 > HVGO TO LUBE OIL= 10882
< 37 > HVGO= 0
< 38 > LCO= 14497.4
< 39 > C3/C4 -FCCU= 20025.9
< 40 > LGO= 18580.5
< 41 > LGO= 1.55762
< 42 > JET FUEL B= 4277
< 43 > JET FUEL A= 19625
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959
< 47 > HEAVY FUEL OIL= 33274
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 8880.29
< 50 > ALKYLATE= 20736.8
< 51 > CRUDE LIGHT ENDS= 2.98522
< 52 > TOTAL PRODUCT= 422752
< 53 > C2 % IN CRUDE FEED= .08668
< 54 > C3 % IN CRUDE FEED= .69156
< 55 > I-C4 % IN CRUDE FEED= .36344
< 56 > N-C4 % IN CRUDE FEED= 1.84354
< 57 > LE FROM REFORMER (FOE)= 8612.22
< 58 > NAPHTHA= 4823.08
< 59 > KEROSENE= 18608.5
< 60 > KEROSENE= 89388.1
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20025.9
< 63 > LE FROM ALKYL (FOE)= 2439.95
< 64 > HVGO= 97152
< 65 > LGO = 29348
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285
< 68 > IMPORTED C4= 0
< 69 > LSR= 40580.3

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2025.19	5950.2	35976.7	0	0	0	43952.1
C3 ,#/HR	22800.6	17072.3	27337.3	0	14632.6	600.588	82443.4
IC4 ,#/HR	13326.5	12089.6	64358.1	0	0	1068.72	90842.9
NC4 ,#/HR	69996.8	17643.5	24202.8	0	15422.5	3043.19	130309
H2 ,#/HR	0	16394	14640.4	0	0	0	31034.4
C1 ,#/HR	0	5950.2	14917.2	0	0	0	20867.4
H2S ,#/HR	0	0	4704.58	0	0	0	4704.58
C2= ,#/HR	0	0	21937	0	0	0	21937
C3= ,#/HR	0	0	64720.3	0	0	0	64720.3
C4= ,#/HR	0	0	95982.9	0	0	0	95982.9
TOTAL ,#/HR	108149	75099.8	368777	3.87704E-06	30055.1	4712.5	586794
BPCD (FOE)	8745.1	8612.22	31602.2	3.12929E-07	2439.95	380.092	51779.5

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	43952.1	43952.1
C3 ,#/HR	0	14632.7	0	0	0	67810.7	82443.4
IC4 ,#/HR	0	88351.4	1244.86	0	0	1246.63	90842.9
NC4 ,#/HR	0	15422.5	57398.6	0	0	57487.7	130309
H2 ,#/HR	0	0	0	0	10931.5	20102.9	31034.4
C1 ,#/HR	0	0	0	0	0	20867.4	20867.4
H2S ,#/HR	0	0	0	0	0	4704.58	4704.58
C2= ,#/HR	0	0	0	0	0	21937	21937
C3= ,#/HR	0	32168	0	0	0	32552.3	64720.3
C4= ,#/HR	0	61162.2	17396.9	0	0	17423.8	95982.9
TOTAL ,#/HR	8.20915E-06	211737	76040.4	0	10931.5	288085	586794
BPCD (FOE)	6.54125E-07	16901.4	6090.43	0	2522.99	26264.7	51779.5

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	445538	5.45808E+06
BUTANE	3221.86	26515.9
TOTAL	448760	5.4846E+06

*** PRODUCT ***

FUEL GAS (FOE)	26264.7	288085
MOTOR GASOLINE	170711	1.79558E+06
AVIATION TURBO FUELS	23902	283447
DISTILLATES	122466	1.52809E+06
HEAVY FUEL OIL	33274	505952
OTHER PRODUCTS	72399	911251
H2 TO DESULFURIZERS (FOE)	2522.99	10931.5
COKE (FOE)	8601.7	161504
TOTAL	460141	5.48485E+06

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REFINERY SIMULATION PROGRAM

CASE:ONTBAS51 REGION:ONTARIO

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	49	218092
CANDNH	9.2	40947.8
SYNCRUDE	30.8	137086
CONDENSA	11	48959.4

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				445085	5.45254E+06	26300
Average		.84098	36.7562	.482344			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	445085	5.45254E+06	60	1300	.84098	36.756	.482344	26300
	*** PRODUCT ***								
2	OVERHEAD	53625.7	500570	60	169.258	.640799	89.3181	.0289229	144.779
28	LSR	40338.9	392505	60	169.258	.66796	80.339	.0368951	144.815
3	NAPHTHA	81108.1	889216	169.258	319.402	.752615	56.5111	.0267354	237.735
4	KEROSENE	108724	1.31953E+06	319.402	560	.833148	38.3378	.10616	1400.81
5	LGO	47881.4	616029	560	660	.88321	28.711	.312237	1923.47
1	REDUCED CRUDE	153746	2.1272E+06	660	1300	.949805	17.478	1.06211	22593.2

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	153746	2.1272E+06	660	1300	.949805	17.478	1.06211	22593.2
	*** PRODUCT ***								
6	HVGO	123198	1.65664E+06	660	1050	.923111	21.786	.618341	10243.7
7	RESIDUUM	30548	470562	1050	1300	1.05746	2.31122	2.62443	12349.6

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	29806.8	383486	560	660	.88321	28.711	.312237	1197.39
64	HVGO	97030.6	1.30477E+06	660	1050	.923111	21.786	.618341	8067.91
	*** TOTAL FEED ***								
8	FCCU FEED	126837	1.68825E+06	560	1050	.913734	23.3591	.548812	9265.29
	*** PRODUCT ***								
12	LCO	20294	285155	430	650	.96459	15.1945	.949982	2708.92
13	HCO	5073.49	79626.6	650	736.428	1.07741	-.166519	1.50097	1195.17
14	CRACKED GAS	72419.1	790614			.749448	57.3057	.0539486	426.525
39	C3/C4 -FCCU	20026.4	164397			.563534	119.594	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 18770.2

AVAILABLE C3/C4 OLEFINS= 31621.5

CONVERSION Wt%= 78.393 CONVERSION Vol %= 80

COKE, WT% 9.5913

COKE ,#/HR 162009 Sulfur in Flue Gas,Lbs/hr= 493.255

CAT POLY UNIT
*** FEED ***

< 10 > CAT POLY FEED= 1E-06
*** PRODUCT ***
< 15 > POLYMER= 4.08498E-07
< 16 > LE FROM POLY (FOE)= 3.12916E-07

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 29000
< 62 > C3/C4 TO ALKYL= 20026.4
< 20 > I-C4 FR. GAS PLANT= 5635.77
< 21 > I-C4 IMPORTED= 3337.84
*** PRODUCT ***
< 50 > ALKYLATE= 20737.6
< 63 > LE FROM ALKYL (FOE)= 2439.02

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	61000	668764	169.258	319.402	.752615	56.5111	0	0
	*** PRODUCT ***								
17	REFORMATE	51351.4	597262			.79844	45.7205	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 8204.98
CONVERSION(LV%)= 84.1826   Severity (RON Clear)= 94   FEED KW= 11.8562

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 53625.7
< 57 > LE FROM REFORMER (FOE)= 8204.98
< 18 > LE FROM CAT CRACKER (FOE)= 18770.2
< 16 > LE FROM POLY (FOE)= 3.12916E-07
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 25740.3
< 20 > I-C4 FR. GAS PLANT= 5635.77
< 49 > REF C4 TO BLENDING = 8915.43
< 69 > LSR= 39868.5

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 39868.5
*** PRODUCT ***
< 29 > LSR+ISO= 39868.5

*** BY-PASS= 100 %   ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 39868.5
< 26 > REFORMATE= 28770.4
< 50 > ALKYLATE= 20737.6
< 15 > POLYMER= 4.08498E-07
< 14 > CRACKED GAS= 72419.1
< 49 > REF C4 TO BLENDING = 8915.43
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 17058
< 23 > UNLEADED REGULAR= 138179
< 24 > UNLEADED PREMIUM= 15348

< 25 > AVIATION GASOLINE= 126

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.436652	.236492	0	0
CRACKED GAS	.519215	.46	0	0
REFORMATE	0	.124683	.752004	0
POLYMER	0	2.9563E-12	0	0
ALKYLATE	0	.126971	.2	.9786
C4	.0441333	.0518542	.0479963	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 470.47
< 58 > NAPHTHA= 4823.08
< 59 > KEROSENE= 18608.5
*** PRODUCT ***
< 42 > JET FUEL B= 4277
< 43 > JET FUEL A= 19625

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.6	.115
KEROSENE	.29	.885

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 90116
< 40 > LGO= 16556.1
< 38 > LCO= 15794
*** PRODUCT ***
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.71	.775595
LCO	0	.14	.112954
LGO	0	.15	.111451

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 1518.53
< 35 > LCO= 4500
< 13 > HCO= 5073.49
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 22182
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 33274

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 22581
< 36 > HVGO TO LUBE OIL= 10882
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	108724	108724	1.31953E+06	.10616	0	5.31336E-03
LGO	18074.6	18074.6	232543	.312237	-1.08059E-05	.0313117
LCO	20294	18264.6	256639	.949982	10	.181896
HCO	5073.49	0	0	1.50097	100	1.50097
VAC RESIDUUM	22182	0	0	2.62443	100	2.62443

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	4277	19625	2264	38243	81959	33274
S.G.	.766658	.823886	.833148	.853574	.859059	1.03999
ASTM 10%	206.26	343.175	382.385	390.5	393.234	
ASTM 20%	223.575	366.576	397.488	412.648	418.231	
ASTM 50%	273.446	431.248	446.841	475.04	484.559	
ASTM 90%	470.033	516.742	519.336	577.549	592.404	
RVP,psia	2.43894					
Sulfur Wt %	.0209562	7.55899E-03	5.30801E-03	.0306586	.036944	2.0399
Flash Point,F	64.1324	132.767	144.408	148.765	150.275	
Pour Point,F	-95.8209	-50.6906	-45.1355	-44.3254	-43.1612	
Cetane No.					39.7747	
Visc @100F,cs	.773847	1.60405	1.81235	2.17592	2.31032	1747.32
Visc @122F,cs	.682638	1.3682	1.53527	1.82044	1.92494	621.553
Watsons K	11.8202	11.6409	11.5977	11.4316	11.3937	10.8144
MeABP	284.181	422.194	442.153	469.061	477.7	962.74

GASOLINE

LEADED REGULAR,BPCD	17058
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	85.9286 / 78.2615 / 82.0951
RON / MON / (R+M)/2	91.1183 / 82.7953 / 86.9568
RVP,psia	11.2313

MMT Addition,mg/l: 18	
UNLEADED REGULAR,BPCD	138179
RON / MON / (R+M)/2	90.8678 / 83.2098 / 87.0388
RVP,psia	10.5686

UNLEADED PREMIUM,BPCD	15348
RON / MON / (R+M)/2	94.7087 / 85.3494 / 90.0291
RVP,psia	9.74816

AVIATION GASOLINE,BPCD	126
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 445085
< 1 > REDUCED CRUDE= 153746
< 2 > OVERHEAD= 53625.7
< 3 > NAPHTHA= 81108.1
< 4 > KEROSENE= 108724
< 5 > LGO= 47881.4
< 6 > HVGO= 123198
< 7 > RESIDUUM= 30548
< 8 > FCCU FEED= 126837
< 9 > REFORMER FEED= 61000
< 10 > CAT POLY FEED= 1E-06
< 11 > ALKYLATION FEED= 29000
< 12 > LCO= 20294
< 13 > HCO= 5073.49
< 14 > CRACKED GAS= 72419.1
< 15 > POLYMER= 4.08498E-07
< 16 > LE FROM POLY (FOE)= 3.12916E-07
< 17 > REFORMATE= 51351.4
< 18 > LE FROM CAT CRACKER (FOE)= 18770.2
< 19 > FUEL GAS (FOE)= 25740.3
< 20 > I-C4 FR. GAS PLANT= 5635.77
< 21 > I-C4 IMPORTED= 3337.84
< 22 > LEADED REGULAR= 17058
< 23 > UNLEADED REGULAR= 138179
< 24 > UNLEADED PREMIUM= 15348
< 25 > AVIATION GASOLINE= 126
< 26 > REFORMATE= 28770.4
< 27 > NAPHTHA SPECIALTIES= 22581
< 28 > LSR= 40338.9
< 29 > LSR+ISO= 39868.5
< 30 > LSR= 470.47
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 153746
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 34 > VAC RESIDUUM= 22182
< 35 > LCO= 4500
< 36 > HVGO TO LUBE OIL= 10882
< 37 > HVGO= 0
< 38 > LCO= 15794
< 39 > C3/C4 -FCCU= 20026.4
< 40 > LGO= 16556.1
< 41 > LGO= 1518.53
< 42 > JET FUEL B= 4277
< 43 > JET FUEL A= 19625
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959
< 47 > HEAVY FUEL OIL= 33274
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 8915.43
< 50 > ALKYLATE= 20737.6
< 51 > CRUDE LIGHT ENDS= 2.98522
< 52 > TOTAL PRODUCT= 422752
< 53 > C2 % IN CRUDE FEED= .08668
< 54 > C3 % IN CRUDE FEED= .69156
< 55 > I-C4 % IN CRUDE FEED= .36344
< 56 > N-C4 % IN CRUDE FEED= 1.84354
< 57 > LE FROM REFORMER (FOE)= 8204.98
< 58 > NAPHTHA= 4823.08
< 59 > KEROSENE= 18608.5
< 60 > KEROSENE= 90116
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20026.4
< 63 > LE FROM ALKYL (FOE)= 2439.02
< 64 > HVGO= 97030.6
< 65 > LGO = 29806.8
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285
< 68 > IMPORTED C4= 0
< 69 > LSR= 39868.5

LIGHT ENDS BALANCE

	*** FROM ***						
	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2023.13	5427.31	36229.4	0	0	0	43679.8
C3 ,#/HR	22777.4	16056.6	27510.3	0	14635	0	80979.3
IC4 ,#/HR	13313	11760.1	64771	0	0	0	89844.1
NC4 ,#/HR	69925.8	17162.6	24329.8	0	15408.4	0	126827
H2 ,#/HR	0	15667.9	14744.3	0	0	0	30412.2
C1 ,#/HR	0	5427.31	15021.9	0	0	0	20449.2
H2S ,#/HR	0	0	4719.01	0	0	0	4719.01
C2= ,#/HR	0	0	22091.1	0	0	0	22091.1
C3= ,#/HR	0	0	65150.9	0	0	0	65150.9
C4= ,#/HR	0	0	96553.9	0	0	0	96553.9
TOTAL ,#/HR	108039	71501.8	371122	3.87688E-06	30043.4	0	580706
BPCD (FOE)	8736.22	8204.99	31806.2	3.12916E-07	2439.01	0	51186.4

	*** TO ***						
	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	43679.8	43679.8
C3 ,#/HR	0	14635	0	0	0	66344.3	80979.3
IC4 ,#/HR	0	87402.9	1248.79	0	0	1192.41	89844.1
NC4 ,#/HR	0	15408.5	56996.2	0	0	54422	126827
H2 ,#/HR	0	0	0	0	10862.7	19549.5	30412.2
C1 ,#/HR	0	0	0	0	0	20449.2	20449.2
H2S ,#/HR	0	0	0	0	0	4719.01	4719.01
C2= ,#/HR	0	0	0	0	0	22091.1	22091.1
C3= ,#/HR	0	32183.7	0	0	0	32967.2	65150.9
C4= ,#/HR	0	61149.1	18111.4	0	0	17293.4	96553.9
TOTAL ,#/HR	8.209E-06	210779	76356.4	0	10862.7	282708	580706
BPCD (FOE)	6.54114E-07	16824.5	6114.5	0	2507.1	25740.3	51186.4

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	445085	5.45254E+06
BUTANE	3337.84	27470.4
TOTAL	448423	5.48001E+06

*** PRODUCT ***

FUEL GAS (FOE)	25740.3	282708
MOTOR GASOLINE	170711	1.79773E+06
AVIATION TURBO FUELS	23902	283296
DISTILLATES	122466	1.52862E+06
HEAVY FUEL OIL	33274	504086
OTHER PRODUCTS	72399	910948
H2 TO DESULFURIZERS (FOE)	2507.1	10862.7
COKE (FOE)	8628.6	162009
TOTAL	459628	5.48026E+06

TIME:02.45.38 DATE:SATJUN1619B4168 65
REFINERY SIMULATION PROGRAM

CASE:WESBAS50 REGION:WESTERN

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	65.1	319982
SYNCRUDE	31.5	154830
CONDENSA	3.4	16711.8

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				491523	6.0441E+06	18809.3
Average		.844146	36.1251	.311201			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	491523	6.0441E+06	60	1240	.844146	36.125	.311201	18809.3
	*** PRODUCT ***								
2	OVERHEAD	48946.9	453786	60	170.177	.636437	90.8316	.0147195	66.7949
28	LSR	33569.9	329760	60	170.177	.674338	78.3354	.02026	66.8093
3	NAPHTHA	85542.2	942505	170.177	321.699	.756368	55.5782	.0148716	140.166
4	KEROSENE	127483	1.54691E+06	321.699	560	.832995	38.369	.0623346	964.26
5	LGO	56069	719549	560	660	.880983	29.116	.219173	1577.06
1	REDUCED CRUDE	173482	2.38135E+06	660	1240	.942321	18.6611	.67445	16061

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	173482	2.38135E+06	660	1240	.942321	18.6611	.67445	16061
	*** PRODUCT ***								
6	HVGO	142030	1.90202E+06	660	1050	.919318	22.4184	.412657	7848.83
7	RESIDUUM	31451.8	479330	1050	1240	1.04621	3.75011	1.7133	8212.36

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	4587.2	58868.8	560	660	.880983	29.116	.219173	129.025
64	HVGO	136558	1.82874E+06	660	1050	.919318	22.4184	.412657	7546.44
	*** TOTAL FEED ***								
8	FCCU FEED	141145	1.88761E+06	560	1050	.918072	22.6273	.406623	7675.47
	*** PRODUCT ***								
12	LCO	22583.2	319867	430	650	.972331	14.0266	.702285	2246.38
13	HCO	5645.8	88951.7	650	736.632	1.08158	-.672867	1.10961	987.017
14	CRACKED GAS	79299.4	867180			.750705	56.9895	.0407357	353.252
39	C3/C4 -FCCU	34906.4	286795			.564022	119.377	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 13124

AVAILABLE C3/C4 OLEFINS= 34907.7

CONVERSION Wt%= 78.342 CONVERSION Vol %= 80

COKE, WT% 10.3926

COKE ,#/HR 196272 Sulfur in Flue Gas,Lbs/hr= 410.389

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 15000

*** PRODUCT ***
< 15 > POLYMER= 6114.84
< 16 > LE FROM POLY (FOE)= 4713.3

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 28813.2
< 62 > C3/C4 TO ALKYL= 19906.4
< 20 > I-C4 FR. GAS PLANT= 7101.73
< 21 > I-C4 IMPORTED= 1805.06
*** PRODUCT ***
< 50 > ALKYLATE= 20557.9
< 63 > LE FROM ALKYL (FOE)= 2472.21

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	71000	782279	170.177	321.699	.756368	55.5782	0	0
	*** PRODUCT ***								
17	REFORMATE	61311.1	721154			.807456	43.7418	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 6817.94
CONVERSION(LV%)= 86.3537   Severity (RON Clear)= 91.8 FEED KW= 11.8151

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 48946.9
< 57 > LE FROM REFORMER (FOE)= 6817.94
< 18 > LE FROM CAT CRACKER (FOE)= 13124
< 16 > LE FROM POLY (FOE)= 4713.3
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 20473
< 20 > I-C4 FR. GAS PLANT= 7101.73
< 49 > REF C4 TO BLENDING = 12073.6
< 69 > LSR= 30855.1

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 30855.1
*** PRODUCT ***
< 29 > LSR+ISO= 30855.1

*** BY-PASS= 100 %   ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 30855.1
< 26 > REFORMATE= 54329.1
< 50 > ALKYLATE= 20557.9
< 15 > POLYMER= 6114.84
< 14 > CRACKED GAS= 79299.4
< 49 > REF C4 TO BLENDING = 12073.6
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 60195
< 23 > UNLEADED REGULAR= 126555
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.349322	.0776554	0	0
CRACKED GAS	.335308	.4	.611003	0
REFORMATE	.265497	.303011	0	0
POLYMER	0	.0483177	0	0
ALKYLATE	0	.106243	.33	.9786
C4	.0498737	.064773	.0589972	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 2714.79
< 58 > NAPHTHA= 14165.2
< 59 > KEROSENE= 21112
*** PRODUCT ***
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.13	0
NAPHTHA	.58	.12
KEROSENE	.29	.88

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 106371
< 40 > LGO= 50172.5
< 38 > LCO= 20583.2
*** PRODUCT ***
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.63	.077194
LCO	0	.1	.358382
LGO	0	.27	.564424

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 1309.36
< 35 > LCO= 2000
< 13 > HCO= 5645.8
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 15386.8
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 24342

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 6982
< 36 > HVGO TO LUBE OIL= 5472
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	127483	127483	1.54691E+06	.0623346	0	3.11858E-03
LGO	51481.8	51481.8	660680	.219173	0	.0219606
LCO	22583.2	11291.6	159934	.702285	50	.387481
HCO	5645.8	0	0	1.10961	100	1.10961
VAC RESIDUUM	15386.8	0	0	1.7133	100	1.7133

PRODUCT SLATES & SPECIFICATIONS

	JE[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
BPCD	20883	1710[illegible]	[illegible]	[illegible]	[illegible]	
S.G	[illegible]		[illegible]995	.910016	.859885	1.03945
ASTM 10%	198.282	340.601	386.075	493.667	4[illegible]0.683	
AS[illegible]	[illegible]	366.328	400.455	532.463	428.149	
ASTM 50%	275.357	431.518	447.681	586.345	504.39	
ASTM 90%	470.816	516.876	519.582	624.189	607.383	
RVP,psia	2.56814					
Sulfur Wt %	.011789	4.41186E-03	3.11673E-03	.160103	.0516417	1.38851
Flash Point,F	59.6478	131.35	145.297	205.356	153.116	
Pour Point,F	-98.0086	-50.7191	-43.8634	-24.0942	-33.2096	
Cetane No.					42.4929	
Visc @100F,cs	.769368	1.60256	1.82995	4.7148	2.55367	1276.14
Visc @122F,cs	.678756	1.367	1.54957	3.7195	2.11671	477.972
Watsons K	11.7932	11.6415	11.6072	11.0979	11.4468	10.7858
MeABP	282.777	422.041	443.872	570.08	493.616	949.3

GASOLINE

LEADED REGULAR,BPCD 60195
TEL Addition,cc/IG: 1.24
RON / MON / (R+M)/2 (Clear) 86.7608 / 79.1221 / 82.9415
RON / MON / (R+M)/2 92.1802 / 84.0629 / 88.1216
RVP,psia 10.5988

MMT Addition,mg/l: 0
UNLEADED REGULAR,BPCD 126555
RON / MON / (R+M)/2 91.4 / 82.9313 / 87.1657
RVP,psia 9.96698

UNLEADED PREMIUM,BPCD 13901
RON / MON / (R+M)/2 93.7429 / 86.3273 / 90.0351
RVP,psia 9.80222

AVIATION GASOLINE,BPCD 2579
RON / MON / (R+M)/2 93 / 90.8 / 91.9
RVP,psia 10

STREAMS

< 0 > CRUDE FEED= 491523
< 1 > REDUCED CRUDE= 173482
< 2 > OVERHEAD= 48946.9
< 3 > NAPHTHA= 85542.2
< 4 > KEROSENE= 127483
< 5 > LGO= 56069
< 6 > HVGO= 142030
< 7 > RESIDUUM= 31451.8
< 8 > FCCU FEED= 141145
< 9 > REFORMER FEED= 71000
< 10 > CAT POLY FEED= 15000
< 11 > ALKYLATION FEED= 28813.2
< 12 > LCO= 22583.2
< 13 > HCO= 5645.8
< 14 > CRACKED GAS= 79299.4
< 15 > POLYMER= 6114.84
< 16 > LE FROM POLY (FOE)= 4713.3
< 17 > REFORMATE= 61311.1
< 18 > LE FROM CAT CRACKER (FOE)= 13124
< 19 > FUEL GAS (FOE)= 20473
< 20 > I-C4 FR. GAS PLANT= 7101.73
< 21 > I-C4 IMPORTED= 1805.06
< 22 > LEADED REGULAR= 60195
< 23 > UNLEADED REGULAR= 126555
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579
< 26 > REFORMATE= 54329.1
< 27 > NAPHTHA SPECIALTIES= 6982
< 28 > LSR= 33569.9
< 29 > LSR+ISO= 30855.1
< 30 > LSR= 2714.79
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 173482
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 34 > VAC RESIDUUM= 15386.8
< 35 > LCO= 2000
< 36 > HVGO TO LUBE OIL= 5472
< 37 > HVGO= 0
< 38 > LCO= 20583.2
< 39 > C3/C4 -FCCU= 34906.4
< 40 > LGO= 50172.5
< 41 > LGO= 1309.36
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816
< 47 > HEAVY FUEL OIL= 24342
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 12073.6
< 50 > ALKYLATE= 20557.9
< 51 > CRUDE LIGHT ENDS= 3.12845
< 52 > TOTAL PRODUCT= 471587
< 53 > C2 % IN CRUDE FEED= .10416
< 54 > C3 % IN CRUDE FEED= .87234
< 55 > I-C4 % IN CRUDE FEED= .41795
< 56 > N-C4 % IN CRUDE FEED= 1.734
< 57 > LE FROM REFORMER (FOE)= 6817.94
< 58 > NAPHTHA= 14165.2
< 59 > KEROSENE= 21112
< 60 > KEROSENE= 106371
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 19906.4
< 63 > LE FROM ALKYL (FOE)= 2472.21
< 64 > HVGO= 136558
< 65 > LGO = 4587.2
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0
< 69 > LSR= 30855.1

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2684.77	3476.88	43033.7	0	0	0	49195.4
C3 ,#/HR	31729.4	13361.6	30613.5	13514.9	14664.4	0	103884
IC4 ,#/HR	16907.1	11633.5	71015	32980.3	0	0	132536
NC4 ,#/HR	72633.1	16977.9	27690.3	11898.7	15790.7	0	144991
H2 ,#/HR	0	12198.2	17613.4	0	0	0	29811.6
C1 ,#/HR	0	3476.88	17843.3	0	0	0	21320.2
H2S ,#/HR	0	0	3908.33	0	0	0	3908.33
C2= ,#/HR	0	0	26240.1	0	0	0	26240.1
C3= ,#/HR	0	0	69593.2	0	0	0	69593.2
C4= ,#/HR	0	0	108102	0	0	0	108102
TOTAL ,#/HR	123954	61125	415653	58393.9	30455.1	0	689581
BPCD (FOE)	10031.5	6817.94	35923.6	4713.3	2472.21	0	59958.6

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	49195.4	49195.4
C3 ,#/HR	11050	14664.4	0	0	0	78169.5	103884
IC4 ,#/HR	30515.5	98944.1	2626.87	0	0	449.435	132536
NC4 ,#/HR	11898.7	15790.6	100168	0	0	17133.4	144991
H2 ,#/HR	0	0	0	0	15861.7	13949.9	29811.6
C1 ,#/HR	0	0	0	0	0	21320.2	21320.2
H2S ,#/HR	0	0	0	0	0	3908.33	3908.33
C2= ,#/HR	0	0	0	0	0	26240.1	26240.1
C3= ,#/HR	23325.5	30955.2	0	0	0	15312.5	69593.2
C4= ,#/HR	46451.9	61646.1	3.26232	0	0	0	108102
TOTAL ,#/HR	123242	222000	102798	0	15861.7	225679	689581
BPCD (FOE)	9820	17726	8278.75	0	3660.89	20473	59958.6

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	491523	6.0441E+06
BUTANE	1805.06	14855.6
TOTAL	493328	6.05896E+06

*** PRODUCT ***

FUEL GAS (FOE)	20473	225679
MOTOR GASOLINE	203230	2.18335E+06
AVIATION TURBO FUELS	37992	438918
DISTILLATES	177127	2.22615E+06
HEAVY FUEL OIL	24342	368578
OTHER PRODUCTS	28896	404390
H2 TO DESULFURIZERS (FOE)	3660.89	15861.7
COKE (FOE)	10453.4	196272
TOTAL	506174	6.0592E+06

TIME:03.24.26 DATE:SATJUN161984168 65
REFINERY SIMULATION PROGRAM

CASE:WESBAS51 REGION:WESTERN

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	65.1	319780
SYNCRUDE	31.5	154732
CONDENSA	3.4	16701.3

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				491214	6.04029E+06	18797.4
Average		.844146	36.1252	.311201			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	491214	6.04029E+06	60	1240	.844145	36.1253	.3112	18797.4
	*** PRODUCT ***								
2	OVERHEAD	48733.1	451588	60	169.803	.636133	90.9379	.0147219	66.4824
28	LSR	33365.8	327633	60	169.803	.674087	78.4136	.0202913	66.481
3	NAPHTHA	86251.1	950495	169.803	322.718	.756511	55.5429	.0148992	141.616
4	KEROSENE	126823	1.53927E+06	322.718	560	.833195	38.3282	.0625231	962.399
5	LGO	56033.7	719096	560	660	.880983	29.116	.219173	1576.06
1	REDUCED CRUDE	173372	2.37984E+06	660	1240	.942321	18.6611	.67445	16050.8

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	173372	2.37984E+06	660	1240	.942321	18.6611	.67445	16050.8
	*** PRODUCT ***								
6	HVGO	141941	1.90083E+06	660	1050	.919318	22.4184	.412657	7843.92
7	RESIDUUM	31431.3	479017	1050	1240	1.04621	3.75011	1.7133	8207.01

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	3931.2	50450.2	560	660	.880983	29.116	.219173	110.573
64	HVGO	136469	1.82755E+06	660	1050	.919318	22.4184	.412657	7541.52
	*** TOTAL FEED ***								
8	FCCU FEED	140400	1.878E+06	560	1050	.918244	22.5985	.40746	7652.1
	*** PRODUCT ***								
12	LCO	22464	318279	430	650	.972638	13.9806	.703695	2239.72
13	HCO	5616.01	88496.3	650	736.64	1.08175	-.693436	1.11184	983.937
14	CRACKED GAS	78834.7	862155			.750754	56.9772	.0408496	352.187
39	C3/C4 -FCCU	34711.7	285206			.564044	119.367	0	0

*** PRODUCT ***
< 18 > LE FROM CAT CRACKER (FOE)= 13074.1
AVAILABLE C3/C4 OLEFINS= 34711.7
CONVERSION Wt%= 78.34 CONVERSION Vol %= 80
COKE, WT% 10.422
COKE ,#/HR 195826 Sulfur in Flue Gas,Lbs/hr= 408.916

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 15000
*** PRODUCT ***
< 15 > POLYMER= 6114.26
< 16 > LE FROM POLY (FOE)= 4714.16

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 28530.6
< 62 > C3/C4 TO ALKYL= 19711.7
< 20 > I-C4 FR. GAS PLANT= 7020.46
< 21 > I-C4 IMPORTED= 1798.4
*** PRODUCT ***
< 50 > ALKYLATE= 20354.4
< 63 > LE FROM ALKYL (FOE)= 2449.97

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	71500	787937	169.803	322.718	.756511	55.5429	0	0
	*** PRODUCT ***								
17	REFORMATE	62159.6	733114			.809643	43.2685	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 6035.57
CONVERSION(LV%)= 86.9365 Severity (RON Clear)= 90.5 FEED KW= 11.8145

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 48733.1
< 57 > LE FROM REFORMER (FOE)= 6035.57
< 18 > LE FROM CAT CRACKER (FOE)= 13074.1
< 16 > LE FROM POLY (FOE)= 4714.16
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 19636
< 20 > I-C4 FR. GAS PLANT= 7020.46
< 49 > REF C4 TO BLENDING = 12098.1
< 69 > LSR= 30651

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 30651
*** PRODUCT ***
< 29 > LSR+ISO= 30651

*** BY-PASS= 100 % ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 30651
< 26 > REFORMATE= 55177.6
< 50 > ALKYLATE= 20354.4
< 15 > POLYMER= 6114.26
< 14 > CRACKED GAS= 78834.7
< 49 > REF C4 TO BLENDING = 12098.1
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 20065
< 23 > UNLEADED REGULAR= 166685
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.395272	.136304	0	0
CRACKED GAS	.343843	.37	.738224	0
REFORMATE	.214399	.301684	.0424044	0
POLYMER	0	.0366815	0	0
ALKYLATE	0	.0944551	.15	.9786
C4	.0464858	.0608749	.0693716	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 2714.79
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 20903.2
*** PRODUCT ***
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.13	0
NAPHTHA	.59	.12
KEROSENE	.28	.88

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 105920
< 40 > LGO= 52013.8
< 38 > LCO= 19193
*** PRODUCT ***
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.63	.0435172
LCO	0	.1	.254623
LGO	0	.27	.701859

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 88.6919
< 35 > LCO= 3271
< 13 > HCO= 5616.01
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 15366.3
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 24342

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 6982
< 36 > HVGO TO LUBE OIL= 5472
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	126823	126823	1.53927E+06	.0625231	0	3.12801E-03
LGO	52102.5	52102.5	668646	.219173	0	.0219606
LCO	22464	11232	159140	.703695	50	.388262
HCO	5616.01	0	0	1.11184	100	1.11184
VAC RESIDUUM	15366.3	0	0	1.7133	100	1.7133

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	20883	17109	5913	13398	157816	24342
S.G.	.767268	.823993	.833195	.902241	.860042	1.04392
ASTM 10%	197.859	341.335	387.02	520.72	401.651	
ASTM 20%	219.075	367.131	401.304	550.849	428.897	
ASTM 50%	274.292	432.127	448.234	594.304	504.312	
ASTM 90%	468.448	516.97	519.682	627.167	607.37	
RVP,psia	2.57771					
Sulfur Wt %	.0119354	4.42322E-03	3.12616E-03	.121383	.0517399	1.39825
Flash Point,F	59.4154	131.761	145.802	220.356	153.638	
Pour Point,F	-98.162	-50.4982	-43.6443	-9.78706	-33.0732	
Cetane No.					42.4664	
Visc @100F,cs	.765478	1.60797	1.83648	5.06586	2.56075	1222.61
Visc @122F,cs	.675467	1.37137	1.55479	3.98968	2.1222	456.7
Watsons K	11.7977	11.6412	11.6069	11.2363	11.4463	10.7279
MeABP	281.719	422.615	444.453	581.94	494.018	944.65

GASOLINE

LEADED REGULAR,BPCD 20065

TEL Addition,cc/IG: 1.24
RON / MON / (R+M)/2 (Clear) 85.6094 / 78.3248 / 81.9671
RON / MON / (R+M)/2 91.1917 / 83.4319 / 87.3118
RVP,psia 10.7361

MMT Addition,mg/l: 18
UNLEADED REGULAR,BPCD 166685
RON / MON / (R+M)/2 91.4 / 82.5566 / 86.9783
RVP,psia 10.1114

UNLEADED PREMIUM,BPCD 13901
RON / MON / (R+M)/2 94.7999 / 85.2726 / 90.0363
RVP,psia 9.79575

AVIATION GASOLINE,BPCD 2579
RON / MON / (R+M)/2 93 / 90.8 / 91.9
RVP,psia 10

STREAMS

< 0 > CRUDE FEED= 491214
< 1 > REDUCED CRUDE= 173372
< 2 > OVERHEAD= 48733.1
< 3 > NAPHTHA= 86251.1
< 4 > KEROSENE= 126823
< 5 > LGO= 56033.7
< 6 > HVGO= 141941
< 7 > RESIDUUM= 31431.3
< 8 > FCCU FEED= 140400
< 9 > REFORMER FEED= 71500
< 10 > CAT POLY FEED= 15000
< 11 > ALKYLATION FEED= 28530.6
< 12 > LCO= 22464
< 13 > HCO= 5616.01
< 14 > CRACKED GAS= 78834.7
< 15 > POLYMER= 6114.26
< 16 > LE FROM POLY (FOE)= 4714.16
< 17 > REFORMATE= 62159.6
< 18 > LE FROM CAT CRACKER (FOE)= 13074.1
< 19 > FUEL GAS (FOE)= 19636
< 20 > I-C4 FR. GAS PLANT= 7020.46
< 21 > I-C4 IMPORTED= 1798.4
< 22 > LEADED REGULAR= 20065
< 23 > UNLEADED REGULAR= 166685
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579
< 26 > REFORMATE= 55177.6
< 27 > NAPHTHA SPECIALTIES= 6982
< 28 > LSR= 33365.8
< 29 > LSR+ISO= 30651
< 30 > LSR= 2714.79
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 173372
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 34 > VAC RESIDUUM= 15366.3
< 35 > LCO= 3271
< 36 > HVGO TO LUBE OIL= 5472
< 37 > HVGO= 0
< 38 > LCO= 19193
< 39 > C3/C4 -FCCU= 34711.7
< 40 > LGO= 52013.8
< 41 > LGO= 88.6919
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816
< 47 > HEAVY FUEL OIL= 24342
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 12098.1
< 50 > ALKYLATE= 20354.4
< 51 > CRUDE LIGHT ENDS= 3.12845
< 52 > TOTAL PRODUCT= 471587
< 53 > C2 % IN CRUDE FEED= .10416
< 54 > C3 % IN CRUDE FEED= .87234
< 55 > I-C4 % IN CRUDE FEED= .41795
< 56 > N-C4 % IN CRUDE FEED= 1.734
< 57 > LE FROM REFORMER (FOE)= 6035.57
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 20903.2
< 60 > KEROSENE= 105920
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 19711.7
< 63 > LE FROM ALKYL (FOE)= 2449.97
< 64 > HVGO= 136469
< 65 > LGO = 3931.2

< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0
< 69 > LSR= 30651

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2683.08	2725.42	42890.3	0	0	0	48298.8
C3 ,#/HR	31709.4	11992.3	30452	13518.7	14525.9	0	102198
IC4 ,#/HR	16896.4	10950.3	70598.5	32972.7	0	0	131418
NC4 ,#/HR	72587.4	15980.8	27568.4	11913.2	15655.3	0	143705
H2 ,#/HR	0	10448.3	17554.6	0	0	0	28002.9
C1 ,#/HR	0	2725.42	17783.8	0	0	0	20509.2
H2S ,#/HR	0	0	3896.55	0	0	0	3896.55
C2= ,#/HR	0	0	26152.6	0	0	0	26152.6
C3= ,#/HR	0	0	69104.9	0	0	0	69104.9
C4= ,#/HR	0	0	107558	0	0	0	107558
TOTAL ,#/HR	123876	54822.5	413560	58404.6	30181.2	0	680844
BPCD (FOE)	10025.2	6035.58	35747.3	4714.17	2449.97	0	58972.2

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	48298.8	48298.8
C3 ,#/HR	11053.8	14525.9	0	0	0	76618.6	102198
IC4 ,#/HR	30507.8	97869.1	2628.34	0	0	412.676	131418
NC4 ,#/HR	11913.2	15655.2	100378	0	0	15758.7	143705
H2 ,#/HR	0	0	0	0	15922.9	12080.1	28002.9
C1 ,#/HR	0	0	0	0	0	20509.2	20509.2
H2S ,#/HR	0	0	0	0	0	3896.55	3896.55
C2= ,#/HR	0	0	0	0	0	26152.6	26152.6
C3= ,#/HR	23292.6	30609.2	0	0	0	15203.1	69104.9
C4= ,#/HR	46479.1	61078.9	0	0	0	0	107558
TOTAL ,#/HR	123247	219738	103006	0	15922.9	218930	680844
BPCD (FOE)	9820.39	17545.3	8295.53	0	3674.99	19636	58972.2

**** OVERALL MASS BALANCE ****.

*** FEED ***

	BPCD	#/HR
CRUDE	491214	6.04029E+06
BUTANE	1798.4	14800.8
TOTAL	493012	6.05509E+06

*** PRODUCT ***

FUEL GAS (FOE)	19636	218930
MOTOR GASOLINE	203230	2.1861E+06
AVIATION TURBO FUELS	37992	438766
DISTILLATES	177127	2.22501E+06
HEAVY FUEL OIL	24342	370164
OTHER PRODUCTS	28896	404613
H2 TO DESULFURIZERS (FOE)	3674.99	15922.9
COKE (FOE)	10429.7	195826
TOTAL	505328	6.05534E+06

"D"

TIME:05.13.01 DATE:SATJUN161984169 65
REFINERY SIMULATION PROGRAM

CASE:ATLBAS20 REGION:ATLANTIC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	33	44998.7
VENEZL	7	9545.19
ARABL	30.6	41726.1
SYNCRUDE	15	20454
MEXL	9.9	13499.6
NORTHSEA	4.5	6136.19

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				136360	1.72287E+06	20719.8
Average		.867354	31.6399	1.20263			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	136360	1.72287E+06	60	1360	.867352	31.6402	1.20263	20719.8
	*** PRODUCT ***								
2	OVERHEAD	8690.18	81169.8	60	170.07	.641203	89.179	.014548	11.8086
28	LSR	6496.63	63160.1	60	170.07	.667398	80.5174	.0187824	11.863
3	NAPHTHA	11513.6	121817	170.07	271.927	.726316	63.3188	.0227447	27.7068
4	KEROSENE	37104	436456	271.927	540	.807514	43.7292	.17025	743.067
5	LGO	17020.2	215835	540	660	.870536	31.0435	.767538	1656.61
1	REDUCED CRUDE	62031.9	867592	660	1360	.960131	15.8757	2.10705	18280.6

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	62031.9	867592	660	1360	.960131	15.8757	2.10705	18280.6
	*** PRODUCT ***								
6	HVGO	43928	589112	660	1050	.920633	22.1986	1.3757	8104.42
7	RESIDUUM	18103.9	278475	1050	1360	1.05595	2.50256	3.65395	10175.3

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	0	0	540	660	.870536	31.0435	.767538	0
64	HVGO	43865	588267	660	1050	.920633	22.1986	1.3757	8092.79
	*** TOTAL FEED ***								
8	FCCU FEED	43865	588267	540	1050	.920633	22.1986	1.3757	8092.79
	*** PRODUCT ***								
12	LCO	10274.9	144503	430	650	.965448	15.0641	1.82902	2642.99
13	HCO	2568.73	39562.4	650	775.158	1.05729	2.33272	2.88985	1143.29
14	CRACKED GAS	22519.1	245389			.748055	57.6572	.170157	417.545
39	C3/C4 -FCCU	9158.12	75260.9			.564148	119.321	0	0

*** PRODUCT ***
< 18 > LE FROM CAT CRACKER (FOE)= 2909.24
AVAILABLE C3/C4 OLEFINS= 9159.16
CONVERSION Wt%= 68.7106   CONVERSION Vol %= 70.72
COKE, WT% 8.85746
COKE ,#/HR 52132.4   Sulfur in Flue Gas,Lbs/hr= 356.159

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 9158.12
*** PRODUCT ***
< 15 > POLYMER= 3735.56
< 16 > LE FROM POLY (FOE)= 2877.02

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 0
< 63 > LE FROM ALKYL (FOE)= 0

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	8880	93952.6	170.07	271.927	.726316	63.3188	0	0
	*** PRODUCT ***								
17	REFORMATE	6701	77023.5			.789066	47.8259	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 1993.24
CONVERSION(LV%)= 75.4617   Severity (RON Clear)= 98   FEED KW= 12.1715

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 8690.18
< 57 > LE FROM REFORMER (FOE)= 1993.24
< 18 > LE FROM CAT CRACKER (FOE)= 2909.24
< 16 > LE FROM POLY (FOE)= 2877.02
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 6169.02
< 20 > I-C4 FR. GAS PLANT= 0
< 49 > REF C4 TO BLENDING = 2771.07
< 69 > LSR= 6302.92

ISOMERIZATION UNIT (TOTAL RECYCLE)
*** FEED ***
< 69 > LSR= 6302.92
*** PRODUCT ***
< 29 > LSR+ISO= 6227.29

*** BY-PASS= 25 %   ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 6227.29
< 26 > REFORMATE= 6701
< 50 > ALKYLATE= 0
< 15 > POLYMER= 3735.56
< 14 > CRACKED GAS= 22519.1
< 49 > REF C4 TO BLENDING = 2771.07
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 12580

< 23 > UNLEADED REGULAR= 26418
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.387351	.0512686	0	0
CRACKED GAS	.564654	.563	.183493	0
REFORMATE	0	.170713	.74124	0
POLYMER	0	.141402	0	0
ALKYLATE	0	0	0	.9786
C4	.0479956	.0736166	.0752666	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 193.71
< 58 > NAPHTHA= 1285.58
< 59 > KEROSENE= 4684.71
*** PRODUCT ***
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.48	.1
KEROSENE	.41	.9

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 32419.2
< 40 > LGO= 17010.8
< 38 > LCO= 7557.94
*** PRODUCT ***
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.607	.490048
LCO	0	.139	.137828
LGO	0	.254	.372124

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 9.33228
< 35 > LCO= 2717
< 13 > HCO= 2568.73
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 8605.93

*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 13901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 0
< 36 > HVGO TO LUBE OIL= 63
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	Lbs/hr	SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	37104	37104	436456	.17025	0	8.52629E-03
LGO	17020.2	17020.2	215835	.767538	0	.0772877
LCO	10274.9	7192.46	101152	1.82902	29.9997	.684621
HCO	2568.73	0	0	2.88985	100	2.88985
VAC RESIDUUM	8605.93	0	0	3.65395	100	3.65395

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	1761	4403	2390	26607	27991	13901
S.G.	.753126	.799394	.807514	.852734	.845474	1.03839
ASTM 10%	205.831	311.57	344.717	368.648	361.788	
ASTM 20%	221.21	335.19	362.264	410.536	393.468	
ASTM 50%	261.828	398.203	411.836	518.188	483.256	
ASTM 90%	470.111	494.495	496.868	610.451	603.483	
RVP,psia	2.73982					
Sulfur Wt %	.0161019	9.8056E-03	8.51249E-03	.138711	.132423	2.96714
Flash Point,F	64.0145	115.134	126.392	139.887	135.813	
Pour Point,F	-80.9974	-50.3793	-45.4064	-29.4067	-37.1906	
Cetane No.					44.8877	
Visc @100F,cs	.782465	1.33262	1.47432	2.47814	2.1599	1250.89
Visc @122F,cs	.69065	1.14938	1.26513	2.06062	1.81076	471.07
Watsons K	12.0528	11.8586	11.8202	11.53	11.5432	10.7963
MeABP	287.948	391.894	409.623	490.463	469.573	949.05

GASOLINE

LEADED REGULAR,BPCD	12580
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	89.595 / 82.0098 / 85.8024
RON / MON / (R+M)/2	93.9807 / 85.6232 / 89.802
RVP,psia	11.3923
MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	26418
RON / MON / (R+M)/2	94.1342 / 83.8664 / 89.0003
RVP,psia	10.0551
UNLEADED PREMIUM,BPCD	2956
RON / MON / (R+M)/2	96.82 / 86.7888 / 91.8044
RVP,psia	9.86766
AVIATION GASOLINE,BPCD	0
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 136360	< 1 > REDUCED CRUDE= 62031.9
< 2 > OVERHEAD= 8690.18	< 3 > NAPHTHA= 11513.6
< 4 > KEROSENE= 37104	< 5 > LGO= 17020.2
< 6 > HVGO= 43928	< 7 > RESIDUUM= 18103.9
< 8 > FCCU FEED= 43865	< 9 > REFORMER FEED= 8880
< 10 > CAT POLY FEED= 9158.12	< 11 > ALKYLATION FEED= 0
< 12 > LCO= 10274.9	< 13 > HCO= 2568.73
< 14 > CRACKED GAS= 22519.1	< 15 > POLYMER= 3735.56
< 16 > LE FROM POLY (FOE)= 2877.02	< 17 > REFORMATE= 6701
< 18 > LE FROM CAT CRACKER (FOE)= 2909.24	< 19 > FUEL GAS (FOE)= 6169.02
< 20 > I-C4 FR. GAS PLANT= 0	< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 12580	< 23 > UNLEADED REGULAR= 26418
< 24 > UNLEADED PREMIUM= 2956	< 25 > AVIATION GASOLINE= 0
< 26 > REFORMATE= 6701	< 27 > NAPHTHA SPECIALTIES= 0
< 28 > LSR= 6496.63	< 29 > LSR+ISO= 6227.29
< 30 > LSR= 193.71	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 62031.9	< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 34 > VAC RESIDUUM= 8605.93	< 35 > LCO= 2717
< 36 > HVGO TO LUBE OIL= 63	< 37 > HVGO= 0
< 38 > LCO= 7557.94	< 39 > C3/C4 -FCCU= 9158.12
< 40 > LGO= 17010.8	< 41 > LGO= 9.33228
< 42 > JET FUEL B= 1761	< 43 > JET FUEL A= 4403
< 44 > STOVE OIL= 2390	< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991	< 47 > HEAVY FUEL OIL= 13901
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 2771.07
< 50 > ALKYLATE= 0	< 51 > CRUDE LIGHT ENDS= 1.60865
< 52 > TOTAL PRODUCT= 129916	< 53 > C2 % IN CRUDE FEED= .02451
< 54 > C3 % IN CRUDE FEED= .31962	< 55 > I-C4 % IN CRUDE FEED= .19662
< 56 > N-C4 % IN CRUDE FEED= 1.0679	< 57 > LE FROM REFORMER (FOE)= 1993.24
< 58 > NAPHTHA= 1285.58	< 59 > KEROSENE= 4684.71
< 60 > KEROSENE= 32419.2	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 0	< 63 > LE FROM ALKYL (FOE)= 0
< 64 > HVGO= 43865	< 65 > LGO = 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348	< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0	< 69 > LSR= 6302.92

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	175.264	1617.86	9295.23	0	0	0	11088.4
C3 ,#/HR	3225.17	4106.89	7908.5	8147.6	0	174.906	23563.1
IC4 ,#/HR	2206.55	2266.29	18526.4	20029.5	0	311.238	43340
NC4 ,#/HR	12409.6	3307.41	7468.96	7468.11	0	886.254	31540.3
H2 ,#/HR	0	4012.8	3633.32	0	0	0	7646.12
C1 ,#/HR	0	1617.86	3854.12	0	0	0	5471.98
H2S ,#/HR	0	0	3753.61	0	0	0	3753.61
C2= ,#/HR	0	0	5667.83	0	0	0	5667.83
C3= ,#/HR	0	0	18290	0	0	0	18290
C4= ,#/HR	0	0	28364.7	0	0	0	28364.7
TOTAL ,#/HR	18016.6	16929.1	106763	35645.2	0	1372.4	178726
BPCD (FOE)	1455.47	1993.24	8855.13	2877.01	0	110.692	15291.5

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	11088.4	11088.4
C3 ,#/HR	6642.39	0	0	0	0	16920.7	23563.1
IC4 ,#/HR	18524.3	0	11774.3	0	0	13041.4	43340
NC4 ,#/HR	7468.11	0	11421.5	0	0	12650.7	31540.3
H2 ,#/HR	0	0	0	0	5460.11	2186.01	7646.12
C1 ,#/HR	0	0	0	0	0	5471.98	5471.98
H2S ,#/HR	0	0	0	0	0	3753.61	3753.61
C2= ,#/HR	0	0	0	0	0	5667.83	5667.83
C3= ,#/HR	14264.6	0	0	0	0	4025.42	18290
C4= ,#/HR	28361.5	0	1.53554	0	0	1.68516	28364.7
TOTAL ,#/HR	75260.9	0	23197.3	0	5460.11	74807.7	178726
BPCD (FOE)	5996.73	0	1865.6	0	1260.19	6169.02	15291.5

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	136360	1.72287E+06
BUTANE	0	0
TOTAL	136360	1.72287E+06

*** PRODUCT ***

FUEL GAS (FOE)	6169.02	74807.7
MOTOR GASOLINE	41954	445130
AVIATION TURBO FUELS	6164	70591.5
DISTILLATES	56988	703358
HEAVY FUEL OIL	13901	210270
OTHER PRODUCTS	10909	161206
H2 TO DESULFURIZERS (FOE)	1260.19	5460.11
COKE (FOE)	2776.57	52132.4
TOTAL	140122	1.72295E+06

TIME:06.06.43 DATE:MONJUN111984163 60
REFINERY SIMULATION PROGRAM

CASE:ATLBAS21 REGION:ATLANTIC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	33	44991.5
VENEZL	7	9543.66
ARABL	30.6	41719.4
SYNCRUDE	15	20450.7
MEXL	9.9	13497.5
NORTHSEA	4.5	6135.21

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				136338	1.7226E+06	20716.5
Average		.867354	31.6399	1.20263			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	136338	1.7226E+06	60	1360	.867356	31.6395	1.20263	20716.5
	*** PRODUCT ***								
2	OVERHEAD	8664.22	80912.5	60	169.804	.641086	89.2193	.0145532	11.7754
28	LSR	6471.02	62900	60	169.804	.667279	80.5553	.0187799	11.8125
3	NAPHTHA	11533.6	122018	169.804	271.906	.726253	63.3357	.022736	27.742
4	KEROSENE	37100.8	436417	271.906	540	.80751	43.73	.17024	742.956
5	LGO	17017.4	215799	540	660	.870536	31.0435	.767538	1656.34
1	REDUCED CRUDE	62022	867454	660	1360	.960131	15.8757	2.10705	18277.7

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	62022	867454	660	1360	.960131	15.8757	2.10705	18277.7
	*** PRODUCT ***								
6	HVGO	43918	588978	660	1050	.920633	22.1986	1.3757	8102.57
7	RESIDUUM	18104	278476	1050	1360	1.05595	2.50256	3.65395	10175.4

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	0	0	540	660	.870536	31.0435	.767538	0
64	HVGO	43855	588133	660	1050	.920633	22.1986	1.3757	8090.95
	*** TOTAL FEED ***								
8	FCCU FEED	43855	588133	540	1050	.920633	22.1986	1.3757	8090.95
	*** PRODUCT ***								
12	LCO	10279.6	144565	430	650	.965424	15.0677	1.82822	2642.97
13	HCO	2569.9	39578.2	650	775.239	1.05723	2.34032	2.88859	1143.25
14	CRACKED GAS	22509.7	245286			.748055	57.6572	.170228	417.547
39	C3/C4 -FCCU	9150.84	75201			.564148	119.321	0	0

*** PRODUCT ***

< 18 > LE FROM CAT CRACKER (FOE)= 2907.72

AVAILABLE C3/C4 OLEFINS= 9153.55

CONVERSION Wt%= 68.6902 CONVERSION Vol %= 70.7

COKE, WT% 8.8531

COKE ,#/HR 52094.8 Sulfur in Flue Gas,Lbs/hr= 355.92

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 9150.84
*** PRODUCT ***
< 15 > POLYMER= 3732.61
< 16 > LE FROM POLY (FOE)= 2874.71

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 0
< 63 > LE FROM ALKYL (FOE)= 0

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	8900	94156	169.804	271.906	.726253	63.3357	0	0
	*** PRODUCT ***								
17	REFORMATE	6715.87	77188.1			.789002	47.8405	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 1997.8
CONVERSION(LV%)= 75.4592   Severity (RON Clear)= 98   FEED KW= 12.1718

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 8664.22
< 57 > LE FROM REFORMER (FOE)= 1997.8
< 18 > LE FROM CAT CRACKER (FOE)= 2907.72
< 16 > LE FROM POLY (FOE)= 2874.71
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 6136.01
< 20 > I-C4 FR. GAS PLANT= 0
< 49 > REF C4 TO BLENDING = 2771.22
< 69 > LSR= 6277.31

ISOMERIZATION UNIT (TOTAL RECYCLE)
*** FEED ***
< 69 > LSR= 6277.31
*** PRODUCT ***
< 29 > LSR+ISO= 6224.58

*** BY-PASS= 47.5 %   ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 6224.58
< 26 > REFORMATE= 6715.87
< 50 > ALKYLATE= 0
< 15 > POLYMER= 3732.61
< 14 > CRACKED GAS= 22509.7
< 49 > REF C4 TO BLENDING = 2771.22
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 4915

< 23 > UNLEADED REGULAR= 34083
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.428988	.120767	0	0
CRACKED GAS	.181365	.603	.360708	0
REFORMATE	.34635	.0982451	.563287	0
POLYMER	0	.109515	0	0
ALKYLATE	0	0	0	.9786
C4	.0432972	.0684725	.0760044	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 193.71
< 58 > NAPHTHA= 1285.58
< 59 > KEROSENE= 4684.71
*** PRODUCT ***
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.48	.1
KEROSENE	.41	.9

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 32416.1
< 40 > LGO= 17011.4
< 38 > LCO= 7560.61
*** PRODUCT ***
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.607	.489927
LCO	0	.139	.137928
LGO	0	.254	.372145

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 6.07349
< 35 > LCO= 2719
< 13 > HCO= 2569.9
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 8606.02

*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 13901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 0
< 36 > HVGO TO LUBE OIL= 63
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	37100.8	37100.8	436417	.17024	0	8.52579E-03
LGO	17017.4	17017.4	215799	.767538	0	.0772877
LCO	10279.6	7195.73	101196	1.82822	29.9999	.684322
HCO	2569.9	0	0	2.88859	100	2.88859
VAC RESIDUUM	8606.02	0	0	3.65395	100	3.65395

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	1761	4403	2390	26607	27991	13901
S.G.	.753081	.799384	.80751	.852745	.845468	1.0384
ASTM 10%	205.693	311.542	344.699	368.64	361.77	
ASTM 20%	221.086	335.168	362.248	410.544	393.454	
ASTM 50%	261.77	398.193	411.826	518.215	483.253	
ASTM 90%	470.112	494.493	496.867	610.453	603.483	
RVP,psia	2.64159					
Sulfur Wt %	.0160971	9.80428E-03	8.51201E-03	.138738	.132374	2.96712
Flash Point,F	63.9365	115.118	126.382	139.883	135.803	
Pour Point,F	-81.0092	-50.3801	-45.4097	-29.4095	-37.1909	
Cetane No.					44.8897	
Visc @100F,cs	.782184	1.33251	1.47423	2.47833	2.15977	1251.42
Visc @122F,cs	.690413	1.14929	1.26506	2.06077	1.81066	471.222
Watsons K	12.0531	11.8587	11.8203	11.5299	11.5433	10.7961
MeABP	287.872	391.88	409.613	490.473	469.565	949.06

GASOLINE

LEADED REGULAR,BPCD	4915
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	88.9879 / 81.5165 / 85.2522
RON / MON / (R+M)/2	93.8671 / 85.8249 / 89.846
RVP,psia	11.2753
MMT Addition,mg/l: 18	
UNLEADED REGULAR,BPCD	34083
RON / MON / (R+M)/2	94.19 / 83.8989 / 89.0445
RVP,psia	10.2409
UNLEADED PREMIUM,BPCD	2956
RON / MON / (R+M)/2	97.28 / 86.4623 / 91.8712
RVP,psia	9.84855
AVIATION GASOLINE,BPCD	0
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 136338
< 1 > REDUCED CRUDE= 62022
< 2 > OVERHEAD= 8664.22
< 3 > NAPHTHA= 11533.6
< 4 > KEROSENE= 37100.8
< 5 > LGO= 17017.4
< 6 > HVGO= 43918
< 7 > RESIDUUM= 18104
< 8 > FCCU FEED= 43855
< 9 > REFORMER FEED= 8900
< 10 > CAT POLY FEED= 9150.84
< 11 > ALKYLATION FEED= 0
< 12 > LCO= 10279.6
< 13 > HCO= 2569.9
< 14 > CRACKED GAS= 22509.7
< 15 > POLYMER= 3732.61
< 16 > LE FROM POLY (FOE)= 2874.71
< 17 > REFORMATE= 6715.87
< 18 > LE FROM CAT CRACKER (FOE)= 2907.72
< 19 > FUEL GAS (FOE)= 6136.01
< 20 > I-C4 FR. GAS PLANT= 0
< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 4915
< 23 > UNLEADED REGULAR= 34083
< 24 > UNLEADED PREMIUM= 2956
< 25 > AVIATION GASOLINE= 0
< 26 > REFORMATE= 6715.87
< 27 > NAPHTHA SPECIALTIES= 0
< 28 > LSR= 6471.02
< 29 > LSR+ISO= 6224.58
< 30 > LSR= 193.71
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 62022
< 33 > VAC RESID TO ASPHALT PLANT= 9498
< 34 > VAC RESIDUUM= 8606.02
< 35 > LCO= 2719
< 36 > HVGO TO LUBE OIL= 63
< 37 > HVGO= 0
< 38 > LCO= 7560.61
< 39 > C3/C4 -FCCU= 9150.84
< 40 > LGO= 17011.4
< 41 > LGO= 6.07349
< 42 > JET FUEL B= 1761
< 43 > JET FUEL A= 4403
< 44 > STOVE OIL= 2390
< 45 > LIGHT FUEL OIL= 26607
< 46 > DIESEL FUEL= 27991
< 47 > HEAVY FUEL OIL= 13901
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 2771.22
< 50 > ALKYLATE= 0
< 51 > CRUDE LIGHT ENDS= 1.60865
< 52 > TOTAL PRODUCT= 129916
< 53 > C2 % IN CRUDE FEED= .02451
< 54 > C3 % IN CRUDE FEED= .31962
< 55 > I-C4 % IN CRUDE FEED= .19662
< 56 > N-C4 % IN CRUDE FEED= 1.0679
< 57 > LE FROM REFORMER (FOE)= 1997.8
< 58 > NAPHTHA= 1285.58
< 59 > KEROSENE= 4684.71
< 60 > KEROSENE= 32416.1
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 0
< 63 > LE FROM ALKYL (FOE)= 0
< 64 > HVGO= 43855
< 65 > LGO = 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 1348
< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0
< 69 > LSR= 6277.31

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	175.236	1621.58	9286.37	0	0	0	11083.2
C3 ,#/HR	3224.65	4116.25	7903.24	8140.77	0	121.937	23506.8
IC4 ,#/HR	2206.2	2271.5	18515	20013.5	0	216.982	43223.2
NC4 ,#/HR	12407.6	3315.02	7464.57	7462.36	0	617.857	31267.4
H2 ,#/HR	0	4021.98	3629.74	0	0	0	7651.72
C1 ,#/HR	0	1621.58	3850.45	0	0	0	5472.03
H2S ,#/HR	0	0	3751.96	0	0	0	3751.96
C2= ,#/HR	0	0	5662.42	0	0	0	5662.42
C3= ,#/HR	0	0	18279.8	0	0	0	18279.8
C4= ,#/HR	0	0	28346.7	0	0	0	28346.7
TOTAL ,#/HR	18013.7	16967.9	106690	35616.6	0	956.776	178245
BPCD (FOE)	1455.24	1997.81	8848.85	2874.71	0	77.1698	15253.8

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	11083.2	11083.2
C3 ,#/HR	6636.76	0	0	0	0	16870.1	23506.9
IC4 ,#/HR	18509.5	0	11813.8	0	0	12899.9	43223.2
NC4 ,#/HR	7462.36	0	11379.5	0	0	12425.6	31267.4
H2 ,#/HR	0	0	0	0	5460.2	2191.53	7651.72
C1 ,#/HR	0	0	0	0	0	5472.03	5472.03
H2S ,#/HR	0	~0	0	0	0	3751.96	3751.96
C2= ,#/HR	0	0	0	0	0	5662.42	5662.42
C3= ,#/HR	14254.1	0	0	0	0	4025.72	18279.8
C4= ,#/HR	28338.3	0	4.01748	0	0	4.3751	28346.7
TOTAL ,#/HR	75201	0	23197.3	0	5460.2	74386.7	178245
BPCD (FOE)	5991.96	0	1865.59	0	1260.21	6136.01	15253.8

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	136338	1.7226E+06
BUTANE	0	0
TOTAL	136338	1.7226E+06

*** PRODUCT ***

FUEL GAS (FOE)	6136.01	74386.7
MOTOR GASOLINE	41954	445316
AVIATION TURBO FUELS	6164	70589.7
DISTILLATES	56988	703359
HEAVY FUEL OIL	13901	210272
OTHER PRODUCTS	10909	161204
H2 TO DESULFURIZERS (FOE)	1260.21	5460.2
COKE (FOE)	2774.57	52094.8
TOTAL	140087	1.72268E+06

TIME:05.55.22 DATE:SUNJUN171984169 66
REFINERY SIMULATION PROGRAM

CASE:QUEBAS20 REGION:QUEBEC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	16.8	46707.5
VENEZH	11.65	32389.4
ARABH	6.95	19322.4
CANDNH	27.3	75899.6
SYNCRUDE	16.3	45317.4
MEXH	11.6	32250.4
CONDENSA	9.4	26133.9

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				278021	3.58179E+06	64672
Average		.884407	28.4943	1.80558			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	278021	3.58179E+06	60	1460	.884408	28.4941	1.80558	64672
	*** PRODUCT ***								
2	OVERHEAD	24122.3	225641	60	170.304	.642139	88.8572	.0406065	91.625
29	LSR	19004.1	183502	60	170.304	.662863	81.968	.0498816	91.5338
3	NAPHTHA	36381.3	392450	170.304	319.814	.740518	59.5825	.0843461	331.016
4	KEROSENE	50390.6	606964	319.814	540	.826881	39.625	.424434	2576.16
5	LGO	32416.2	417877	540	660	.884944	28.3971	1.02294	4274.63
1	REDUCED CRUDE	134710	1.93886E+06	660	1460	.988044	11.7123	2.96043	57398.6

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	134710	1.93886E+06	660	1460	.988044	11.7123	2.96043	57398.6
	*** PRODUCT ***								
6	HVGO	87252.1	1.19578E+06	660	1050	.940819	18.9009	1.9963	23871.4
7	RESIDUUM	47458.1	743081	1050	1460	1.07487	.143829	4.51195	33527.5

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	10029.9	129295	540	660	.884944	28.3971	1.02294	1322.61
64	HVGO	81151.1	1.11217E+06	660	1050	.940819	18.9009	1.9963	22202.2
	*** TOTAL FEED ***								
8	FCCU FEED	91181	1.24146E+06	540	1050	.934673	19.8898	1.89493	23524.8
	*** PRODUCT ***								
12	LCO	16412.6	238657	430	650	.998221	10.2522	2.98762	7130.17
13	HCO	4103.15	65149.3	650	747.886	1.08999	-1.6823	4.72043	3075.33
14	CRACKED GAS	47684.9	522912			.752796	56.4659	.213805	1118.01
39	C3/C4 -FCCU	20554.5	169539			.566231	118.398	0	0

*** PRODUCT ***
< 18 > LE FROM CAT CRACKER (FOE)= 8338.91
AVAILABLE C3/C4 OLEFINS= 20833.8
CONVERSION Wt%= 75.5284   CONVERSION Vol %= 77.5
COKE, WT% 12.4647
COKE ,#/HR 154824   Sulfur in Flue Gas,Lbs/hr= 1197.76

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 19000
*** PRODUCT ***
< 15 > POLYMER= 7644.45
< 16 > LE FROM POLY (FOE)= 6106.52

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 2237.4
< 62 > C3/C4 TO ALKYL= 1554.49
< 20 > I-C4 FR. GAS PLANT= 682.913
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 1580.23
< 63 > LE FROM ALKYL (FOE)= 209.097

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	33000	355975	170.304	319.814	.740518	59.5825	0	0
	*** PRODUCT ***								
17	REFORMATE	25727	298852			.797437	45.9436	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 6677.58
CONVERSION(LV%)= 77.9606   Severity (RON Clear)= 97.3 FEED KW= 12.0545

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 24122.3
< 57 > LE FROM REFORMER (FOE)= 6677.58
< 18 > LE FROM CAT CRACKER (FOE)= 8338.91
< 16 > LE FROM POLY (FOE)= 6106.52
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 18953.1
< 20 > I-C4 FR. GAS PLANT= 682.913
< 49 > REF C4 TO BLENDING = 5395.14
< 69 > LSR= 18609.7

ISOMERIZATION UNIT (TOTAL RECYCLE)
*** FEED ***
< 69 > LSR= 18609.7
*** PRODUCT ***
< 29 > LSR+ISO= 18401.3

*** BY-PASS= 30 %   ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 18401.3
< 26 > REFORMATE= 8177.99
< 50 > ALKYLATE= 1580.23
< 15 > POLYMER= 7644.45
< 14 > CRACKED GAS= 47684.9
< 49 > REF C4 TO BLENDING = 5395.14
< 68 > IMPORTED C4= 0
*** PRODUCT ***

< 22 > LEADED REGULAR= 26456
< 23 > UNLEADED REGULAR= 53805
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.476934	.107491	0	0
CRACKED GAS	.482088	.64	.0625302	0
REFORMATE	0	.0388474	.768177	0
POLYMER	0	.142077	0	0
ALKYLATE	0	1.93945E-03	.1	.9786
C4	.0409775	.0696453	.0692932	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 394.35
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
*** PRODUCT ***
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.555	.125
KEROSENE	.335	.875

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 39448.3
< 40 > LGO= 14573.5
< 38 > LCO= 4412.58
*** PRODUCT ***
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.7	.608751
LCO	0	0	.215195
LGO	0	.3	.176054

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 7812.77
< 35 > LCO= 12000
< 13 > HCO= 4103.15
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0

< 34 > VAC RESIDUUM= 31985.1
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 55901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 17549
< 36 > HVGO TO LUBE OIL= 3774
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	50390.6	50390.6	606964	.424434	0	.0213076
LGO	22386.3	22386.3	288581	1.02294	-8.72464E-06	.103244
LCO	16412.6	13130.1	190926	2.98762	19.9999	.85492
HCO	4103.15	0	0	4.72043	100	4.72043
VAC RESIDUUM	31985.1	0	0	4.51195	100	4.51195

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	3585	11133	1384	20505	36545	55901
S.G.	.760907	.816086	.826881	.873975	.8443	1.03298
ASTM 10%	207.305	333.622	381.837	398.114	393.59	
ASTM 20%	226.029	359.945	395.083	424.913	416.925	
ASTM 50%	282.266	424.92	440.242	488.168	484.593	
ASTM 90%	470.293	499.728	502.837	598.299	603.43	
RVP,psia	2.74817					
Sulfur Wt %	.0580633	.0283816	.0212217	.236067	.0467141	3.23768
Flash Point,F	64.6652	127.463	144.16	152.977	150.46	
Pour Point,F	-85.0346	-50.38	-44.6892	-52.9178	-29.634	
Cetane No.					45.5817	
Visc @100F,cs	.799874	1.51233	1.7279	2.42745	2.29149	645.754
Visc @122F,cs	.705131	1.29473	1.46843	2.01063	1.91622	271.955
Watsons K	11.9513	11.7105	11.6544	11.2176	11.6008	10.7802
MeABP	292.04	412.843	434.959	482.326	479.623	921

GASOLINE

LEADED REGULAR,BPCD 26456
TEL Addition,cc/IG: 1.24
RON / MON / (R+M)/2 (Clear) 89.5981 / 82.4733 / 86.0357
RON / MON / (R+M)/2 93.9415 / 86.0126 / 89.9771
RVP,psia 12.4834

MMT Addition,mg/l: 0
UNLEADED REGULAR,BPCD 53805
RON / MON / (R+M)/2 93.9771 / 83.9834 / 88.9803
RVP,psia 10.3998

UNLEADED PREMIUM,BPCD 7925
RON / MON / (R+M)/2 96.3999 / 87.2656 / 91.8328
RVP,psia 9.79749

AVIATION GASOLINE,BPCD 698
RON / MON / (R+M)/2 93 / 90.8 / 91.9
RVP,psia 10

STREAMS

< 0 > CRUDE FEED= 278021
< 1 > REDUCED CRUDE= 134710
< 2 > OVERHEAD= 24122.3
< 3 > NAPHTHA= 36381.3
< 4 > KEROSENE= 50390.6
< 5 > LGO= 32416.2
< 6 > HVGO= 87252.1
< 7 > RESIDUUM= 47458.1
< 8 > FCCU FEED= 91181
< 9 > REFORMER FEED= 33000
< 10 > CAT POLY FEED= 19000
< 11 > ALKYLATION FEED= 2237.4
< 12 > LCO= 16412.6
< 13 > HCO= 4103.15
< 14 > CRACKED GAS= 47684.9
< 15 > POLYMER= 7644.45
< 16 > LE FROM POLY (FOE)= 6106.52
< 17 > REFORMATE= 25727
< 18 > LE FROM CAT CRACKER (FOE)= 8338.91
< 19 > FUEL GAS (FOE)= 18953.1
< 20 > I-C4 FR. GAS PLANT= 682.913
< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 26456
< 23 > UNLEADED REGULAR= 53805
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698
< 26 > REFORMATE= 8177.99
< 27 > NAPHTHA SPECIALTIES= 17549
< 28 > LSR= 19004.1
< 29 > LSR+ISO= 18401.3
< 30 > LSR= 394.35
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 134710
< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 34 > VAC RESIDUUM= 31985.1
< 35 > LCO= 12000
< 36 > HVGO TO LUBE OIL= 3774
< 37 > HVGO= 0
< 38 > LCO= 4412.58
< 39 > C3/C4 -FCCU= 20554.5
< 40 > LGO= 14573.5
< 41 > LGO= 7812.77
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545
< 47 > HEAVY FUEL OIL= 55901
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 5395.14
< 50 > ALKYLATE= 1580.23
< 51 > CRUDE LIGHT ENDS= 1.84108
< 52 > TOTAL PRODUCT= 257060
< 53 > C2 % IN CRUDE FEED= .04423
< 54 > C3 % IN CRUDE FEED= .277635
< 55 > I-C4 % IN CRUDE FEED= .21544
< 56 > N-C4 % IN CRUDE FEED= 1.30377
< 57 > LE FROM REFORMER (FOE)= 6677.58
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
< 60 > KEROSENE= 39448.3
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 1554.49
< 63 > LE FROM ALKYL (FOE)= 209.097
< 64 > HVGO= 81151.1
< 65 > LGO = 10029.9
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327
< 68 > IMPORTED C4= 0
< 69 > LSR= 18609.7

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	644.847	5284.38	27283.7	0	0	0	33212.9
C3 ,#/HR	5711.93	13720.9	18877.5	17595.8	1183.16	481.992	57571.3
IC4 ,#/HR	4929.5	7968.18	41540.8	41018.8	0	857.686	96315
NC4 ,#/HR	30890.1	11628.7	18677.9	17033.9	1393.63	2442.27	82066.5
H2 ,#/HR	0	13237.1	10625	0	0	0	23862.1
C1 ,#/HR	0	5284.38	11312.8	0	0	0	16597.2
H2S ,#/HR	0	0	11691.3	0	0	0	11691.3
C2= ,#/HR	0	0	16636.4	0	0	0	16636.4
C3= ,#/HR	0	0	35100.3	0	0	0	35100.3
C4= ,#/HR	0	0	68389.2	0	0	0	68389.2
TOTAL ,#/HR	42176.4	57123.6	260135	75648.5	2576.79	3781.95	441442
BPCD (FOE)	3405.75	6677.57	21688.7	6106.52	209.096	305.037	38392.7

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	33212.9	33212.9
C3 ,#/HR	14461.4	1183.16	0	0	0	41926.8	57571.3
IC4 ,#/HR	37884.4	8719.89	19701.7	0	0	30009	96315
NC4 ,#/HR	17033.9	1393.63	25221.8	0	0	38417.2	82066.5
H2 ,#/HR	0	0	0	0	7963.12	15899	23862.1
C1 ,#/HR	0	0	0	0	0	16597.2	16597.2
H2S ,#/HR	0	0	0	0	0	11691.3	11691.3
C2= ,#/HR	0	0	0	0	0	16636.4	16636.4
C3= ,#/HR	24968.4	2042.79	0	0	0	8089.15	35100.3
C4= ,#/HR	62369.6	5102.78	363.333	0	0	553.534	68389.2
TOTAL ,#/HR	156718	18442.3	45286.8	0	7963.12	213033	441442
BPCD (FOE)	12486.6	1472.96	3642.17	0	1837.89	18953.1	38392.7

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	278021	3.58179E+06
BUTANE	0	0
TOTAL	278021	3.58179E+06

*** PRODUCT ***

FUEL GAS (FOE)	18953.1	213033
MOTOR GASOLINE	88884	936043
AVIATION TURBO FUELS	14718	172085
DISTILLATES	58434	727188
HEAVY FUEL OIL	55901	841166
OTHER PRODUCTS	39123	529738
H2 TO DESULFURIZERS (FOE)	1837.89	7963.12
COKE (FOE)	8245.93	154824
TOTAL	286097	3.58204E+06

TIME:03.42.26 DATE:MONJUN111984163 60
REFINERY SIMULATION PROGRAM

CASE:QUEBAS21 REGION:QUEBEC

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
FRONTIER	16.8	46583.2
VENEZH	11.65	32303.3
ARABH	6.95	19271
CANDNH	27.3	75697.8
SYNCRUDE	16.3	45196.8
MEXH	11.6	32164.6
CONDENSA	9.4	26064.4

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				277281	3.57226E+06	64500
Average		.884407	28.4942	1.80558			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	277281	3.57226E+06	60	1460	.884409	28.494	1.80558	64500
	*** PRODUCT ***								
2	OVERHEAD	23867	223077	60	169.414	.641632	89.0315	.040443	90.2188
28	LSR	18762.4	181058	60	169.414	.662458	82.0985	.0498434	90.2453
3	NAPHTHA	36281.3	391179	169.414	319.012	.740154	59.6764	.0840017	328.597
4	KEROSENE	50451	607533	319.012	540	.826666	39.6695	.423334	2571.89
5	LGO	32330	416765	540	660	.884944	28.3971	1.02294	4263.26
1	REDUCED CRUDE	134352	1.93371E+06	660	1460	.988044	11.7123	2.96043	57246

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	134352	1.93371E+06	660	1460	.988044	11.7123	2.96043	57246
	*** PRODUCT ***								
6	HVGO	87019.8	1.1926E+06	660	1050	.940819	18.9009	1.9963	23807.8
7	RESIDUUM	47332.1	741109	1050	1460	1.07487	.143829	4.51195	33438.5

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	10001.2	128925	540	660	.884944	28.3971	1.02294	1318.83
64	HVGO	80918.8	1.10898E+06	660	1050	.940819	18.9009	1.9963	22138.7
	*** TOTAL FEED ***								
8	FCCU FEED	90920	1.23791E+06	540	1050	.934673	19.8898	1.89493	23457.5
	*** PRODUCT ***								
12	LCO	16511.1	240030	430	650	.997975	10.2871	2.96913	7126.81
13	HCO	4127.77	65505.4	650	748.726	1.08941	-1.61317	4.69123	3073.01
14	CRACKED GAS	47488.5	520613			.752587	56.5181	.214674	1117.62
39	C3/C4 -FCCU	20689.4	170651			.566229	118.399	0	0

*** PRODUCT ***
< 18 > LE FROM CAT CRACKER (FOE)= 8091
AVAILABLE C3/C4 OLEFINS= 20704.5
CONVERSION Wt%= 75.3185 CONVERSION Vol %= 77.3
COKE, WT% 12.406
COKE ,#/HR 153654 Sulfur in Flue Gas,Lbs/hr= 1189.66

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 18600
*** PRODUCT ***
< 15 > POLYMER= 7483.67
< 16 > LE FROM POLY (FOE)= 5977.75

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 3007.42
< 62 > C3/C4 TO ALKYL= 2089.42
< 20 > I-C4 FR. GAS PLANT= 918.001
< 21 > I-C4 IMPORTED= 0
*** PRODUCT ***
< 50 > ALKYLATE= 2124.08
< 63 > LE FROM ALKYL (FOE)= 281.045

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	32900	354722	169.414	319.012	.740154	59.6764	0	0
	*** PRODUCT ***								
17	REFORMATE	25758.8	298683			.796003	46.2631	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 6541.76
CONVERSION(LV%)= 78.2942 Severity (RON Clear)= 97 FEED KW= 12.0561

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 23867
< 57 > LE FROM REFORMER (FOE)= 6541.76
< 18 > LE FROM CAT CRACKER (FOE)= 8091
< 16 > LE FROM POLY (FOE)= 5977.75
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 18299.2
< 20 > I-C4 FR. GAS PLANT= 918.001
< 49 > REF C4 TO BLENDING = 5378.98
< 69 > LSR= 18368

ISOMERIZATION UNIT (TOTAL RECYCLE)
*** FEED ***
< 69 > LSR= 18368
*** PRODUCT ***
< 29 > LSR+ISO= 18199

*** BY-PASS= 42.5 % ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 18199
< 26 > REFORMATE= 8209.76
< 50 > ALKYLATE= 2124.08
< 15 > POLYMER= 7483.67
< 14 > CRACKED GAS= 47488.5
< 49 > REF C4 TO BLENDING = 5378.98
< 68 > IMPORTED C4= 0
*** PRODUCT ***

< 22 > LEADED REGULAR= 8820
< 23 > UNLEADED REGULAR= 71441
< 24 > UNLEADED PREMIUM= 7925
< 25 > AVIATION GASOLINE= 698

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.396393	.205804	0	0
CRACKED GAS	.471595	.58	.238894	0
REFORMATE	.085078	.0367471	.609985	0
POLYMER	0	.104753	0	0
ALKYLATE	0	.0112919	.08	.9786
C4	.0469344	.0614039	.0711215	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 394.35
< 58 > NAPHTHA= 3381.3
< 59 > KEROSENE= 10942.4
*** PRODUCT ***
< 42 > JET FUEL B= 3585
< 43 > JET FUEL A= 11133

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.555	.125
KEROSENE	.335	.875

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 39508.7
< 40 > LGO= 18414.6
< 38 > LCO= 511.068
*** PRODUCT ***
< 44 > STOVE OIL= 1384
< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.7	.611695
LCO	0	0	.0249241
LGO	0	.3	.363381

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 3914.14
< 35 > LCO= 16000
< 13 > HCO= 4127.77
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0

< 34 > VAC RESIDUUM= 31859.1
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 55901

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 17549
< 36 > HVGO TO LUBE OIL= 3774
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 0
< 67 > VGO PETROCHEMICAL FEED= 2327

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	50451	50451	607533	.423334	0	.0212522
LGO	22328.8	22328.8	287840	1.02294	0	.103245
LCO	16511.1	13208.9	192024	2.96913	19.9999	.849514
HCO	4127.77	0	0	4.69123	100	4.69123
VAC RESIDUUM	31859.1	0	0	4.51195	100	4.51195

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	3585	11133	1384	20505	36545	55901
S.G.	.760589	.815852	.826666	.852113	.844149	1.04064
ASTM 10%	206.815	332.83	381.078	396.897	392.793	
ASTM 20%	225.384	359.211	394.394	424.708	416.27	
ASTM 50%	281.517	424.407	439.828	502.334	484.373	
ASTM 90%	470.047	499.638	502.75	608.675	603.439	
RVP,psia	2.71207					
Sulfur Wt %	.0578506	.0282923	.0211667	.0754324	.046681	3.25297
Flash Point,F	64.3937	127.021	143.746	152.327	150.024	
Pour Point,F	-85.206	-50.5253	-44.8161	-27.7017	-29.7435	
Cetane No.					45.6072	
Visc @100F,cs	.797391	1.5078	1.72302	2.5044	2.28608	625.089
Visc @122F,cs	.70303	1.29105	1.46451	2.08168	1.91198	260.801
Watsons K	11.9528	11.7116	11.6554	11.5459	11.6014	10.6852
MeABP	291.388	412.331	434.498	492.299	479.267	914.9

GASOLINE

LEADED REGULAR,BPCD	8820
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	89.8688 / 82.0896 / 85.9792
RON / MON / (R+M)/2	94.1315 / 85.5438 / 89.8377
RVP,psia	11.8968

MMT Addition,mg/l: 18	
UNLEADED REGULAR,BPCD	71441
RON / MON / (R+M)/2	93.83 / 84.1475 / 88.9888
RVP,psia	10.8957

UNLEADED PREMIUM,BPCD	7925
RON / MON / (R+M)/2	96.89 / 86.8017 / 91.8459
RVP,psia	9.78228

AVIATION GASOLINE,BPCD	698
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 277281	< 1 > REDUCED CRUDE= 134352
< 2 > OVERHEAD= 23867	< 3 > NAPHTHA= 36281.3
< 4 > KEROSENE= 50451	< 5 > LGO= 32330
< 6 > HVGO= 87019.8	< 7 > RESIDUUM= 47332.1
< 8 > FCCU FEED= 90920	< 9 > REFORMER FEED= 32900
< 10 > CAT POLY FEED= 18600	< 11 > ALKYLATION FEED= 3007.42
< 12 > LCO= 16511.1	< 13 > HCO= 4127.77
< 14 > CRACKED GAS= 47488.5	< 15 > POLYMER= 7483.67
< 16 > LE FROM POLY (FOE)= 5977.75	< 17 > REFORMATE= 25758.8
< 18 > LE FROM CAT CRACKER (FOE)= 8091	< 19 > FUEL GAS (FOE)= 18299.2
< 20 > I-C4 FR. GAS PLANT= 918.001	< 21 > I-C4 IMPORTED= 0
< 22 > LEADED REGULAR= 8820	< 23 > UNLEADED REGULAR= 71441
< 24 > UNLEADED PREMIUM= 7925	< 25 > AVIATION GASOLINE= 698
< 26 > REFORMATE= 8209.76	< 27 > NAPHTHA SPECIALTIES= 17549
< 28 > LSR= 18762.4	< 29 > LSR+ISO= 18199
< 30 > LSR= 394.35	< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 134352	< 33 > VAC RESID TO ASPHALT PLANT= 15473
< 34 > VAC RESIDUUM= 31859.1	< 35 > LCO= 16000
< 36 > HVGO TO LUBE OIL= 3774	< 37 > HVGO= 0
< 38 > LCO= 511.068	< 39 > C3/C4 -FCCU= 20689.4
< 40 > LGO= 18414.6	< 41 > LGO= 3914.14
< 42 > JET FUEL B= 3585	< 43 > JET FUEL A= 11133
< 44 > STOVE OIL= 1384	< 45 > LIGHT FUEL OIL= 20505
< 46 > DIESEL FUEL= 36545	< 47 > HEAVY FUEL OIL= 55901
< 48 > RESID TO COKING= 0	< 49 > REF C4 TO BLENDING = 5378.98
< 50 > ALKYLATE= 2124.08	< 51 > CRUDE LIGHT ENDS= 1.84108
< 52 > TOTAL PRODUCT= 257060	< 53 > C2 % IN CRUDE FEED= .04423
< 54 > C3 % IN CRUDE FEED= .277635	< 55 > I-C4 % IN CRUDE FEED= .21544
< 56 > N-C4 % IN CRUDE FEED= 1.30377	< 57 > LE FROM REFORMER (FOE)= 6541.76
< 58 > NAPHTHA= 3381.3	< 59 > KEROSENE= 10942.4
< 60 > KEROSENE= 39508.7	< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 2089.42	< 63 > LE FROM ALKYL (FOE)= 281.045
< 64 > HVGO= 80918.8	< 65 > LGO = 10001.2
< 66 > NAPHTHA PETROCHEMICAL FEED= 0	< 67 > VGO PETROCHEMICAL FEED= 2327
< 68 > IMPORTED C4= 0	< 69 > LSR= 18368

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	643.132	5153.32	27025	0	0	0	32821.5
C3 ,#/HR	5696.74	13427.9	18751.8	17218.8	1589.58	390.78	57075.6
IC4 ,#/HR	4916.39	7878.14	41280.9	40153.3	0	695.377	94924.1
NC4 ,#/HR	30808	11497.3	18568.6	16681.2	1873.87	1980.09	81409.1
H2 ,#/HR	0	12928.9	10521.1	0	0	0	23450
C1 ,#/HR	0	5153.32	11205.5	0	0	0	16358.8
H2S ,#/HR	0	0	11634.8	0	0	0	11634.8
C2= ,#/HR	0	0	16478.7	0	0	0	16478.7
C3= ,#/HR	0	0	34901.9	0	0	0	34901.9
C4= ,#/HR	0	0	67951.5	0	0	0	67951.5
TOTAL ,#/HR	42064.3	56038.9	258320	74053.3	3463.45	3066.25	437006
BPCD (FOE)	3396.7	6541.76	21530.2	5977.75	281.045	247.311	37974.7

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	32821.5	32821.5
C3 ,#/HR	14150.4	1589.58	0	0	0	41335.6	57075.6
IC4 ,#/HR	37084.9	11721.1	19104.5	0	0	27013.6	94924.1
NC4 ,#/HR	16681.2	1873.87	26037.3	0	0	36816.7	81409.1
H2 ,#/HR	0	0	0	0	7968.42	15481.6	23450
C1 ,#/HR	0	0	0	0	0	16358.8	16358.8
H2S ,#/HR	0	0	0	0	0	11634.8	11634.8
C2= ,#/HR	0	0	0	0	0	16478.7	16478.7
C3= ,#/HR	24456.4	2747.29	0	0	0	7698.23	34901.9
C4= ,#/HR	61044.6	6857.41	20.4892	0	0	29.0045	67951.5
TOTAL ,#/HR	153418	24789.2	45162.3	0	7968.42	205669	437006
BPCD (FOE)	12223.6	1979.89	3632.94	0	1839.11	18299.2	37974.7

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	277281	3.57226E+06
BUTANE	0	0
TOTAL	277281	3.57226E+06

*** PRODUCT ***

FUEL GAS (FOE)	18299.2	205669
MOTOR GASOLINE	88884	935846
AVIATION TURBO FUELS	14718	172030
DISTILLATES	58434	720573
HEAVY FUEL OIL	55901	847404
OTHER PRODUCTS	39123	529372
H2 TO DESULFURIZERS (FOE)	1839.11	7960.42
COKE (FOE)	8183.61	153654
TOTAL	285382	3.57252E+06

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REFINERY SIMULATION PROGRAM

CASE:ONTBAS20 REGION:ONTARIO

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	49	219953
CANDNH	9.2	41297.2
SYNCRUDE	30.8	138256
CONDENSA	11	49377.1

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				448883	5.49906E+06	26524.4
Average		.84098	36.7562	.482344			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	448883	5.49906E+06	60	1300	.840979	36.7563	.482344	26524.4
	*** PRODUCT ***								
2	OVERHEAD	54422.8	508388	60	169.937	.641274	89.1544	.0289395	147.125
28	LSR	41022.7	399398	60	169.937	.668362	80.2116	.0368175	147.048
3	NAPHTHA	82650.8	906884	169.937	321.673	.753242	56.3546	.0268476	243.477
4	KEROSENE	108462	1.31717E+06	321.673	560	.833667	38.232	.106901	1408.06
5	LGO	48289.9	621284	560	660	.88321	28.711	.312237	1939.88
1	REDUCED CRUDE	155057	2.14534E+06	660	1300	.949805	17.478	1.06211	22785.9

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	155057	2.14534E+06	660	1300	.949805	17.478	1.06211	22785.9
	*** PRODUCT ***								
6	HVGO	124246	1.67073E+06	660	1050	.923111	21.786	.618341	10330.8
7	RESIDUUM	30811.1	474615	1050	1300	1.05746	2.31122	2.62443	12455.9

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	30633.7	394125	560	660	.88321	28.711	.312237	1230.6
64	HVGO	98079.3	1.31887E+06	660	1050	.923111	21.786	.618341	8155.1
	*** TOTAL FEED ***								
8	FCCU FEED	128713	1.71299E+06	560	1050	.913615	23.3792	.547913	9385.71
	*** PRODUCT ***								
12	LCO	20594.1	289307	430	650	.964375	15.2272	.948254	2743.37
13	HCO	5148.52	80795.1	650	736.422	1.07729	-.151901	1.49824	1210.5!
14	CRACKED GAS	73525.6	802658			.749414	57.3142	.0538167	431.964
39	C3/C4 -FCCU	20095.4	164959			.563521	119.6	0	0

*** PRODUCT ***
< 18 > LE FROM CAT CRACKER (FOE)= 19188
AVAILABLE C3/C4 OLEFINS= 32095.8
CONVERSION Wt%= 78.3944 CONVERSION Vol %= 80
COKE, WT% 9.56739
COKE ,#/HR 163973 Sulfur in Flue Gas,Lbs/hr= 501.812

CAT POLY UNIT
*** FEED ***

< 10 > CAT POLY FEED= 1E-06
*** PRODUCT ***
< 15 > POLYMER= 4.08518E-07
< 16 > LE FROM POLY (FOE)= 3.12884E-07

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 29100
< 62 > C3/C4 TO ALKYL= 20095.4
< 20 > I-C4 FR. GAS PLANT= 6265.26
< 21 > I-C4 IMPORTED= 2739.39
*** PRODUCT ***
< 50 > ALKYLATE= 20810.4
< 63 > LE FROM ALKYL (FOE)= 2446.13

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	62500	685780	169.937	321.673	.753242	56.3546	0	0
	*** PRODUCT ***								
17	REFORMATE	49983.1	586872			.806028	44.0523	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 11487.3
CONVERSION(LV%)= 79.973   Severity (RON Clear)= 98   FEED KW= 11.8537

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 54422.8
< 57 > LE FROM REFORMER (FOE)= 11487.3
< 18 > LE FROM CAT CRACKER (FOE)= 19188
< 16 > LE FROM POLY (FOE)= 3.12884E-07
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 29823.5
< 20 > I-C4 FR. GAS PLANT= 6265.26
< 49 > REF C4 TO BLENDING = 8900.89
< 69 > LSR= 40552.2

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 40552.2
*** PRODUCT ***
< 29 > LSR+ISO= 40072.1

*** BY-PASS= 26 %   ***

GASOLINE BLENDING

*** FEED ***

< 29 > LSR+ISO= 40072.1

< 26 > REFORMATE= 27402.1

< 50 > ALKYLATE= 20810.4

< 15 > POLYMER= 4.08516E-07

< 14 > CRACKED GAS= 73525.6

< 49 > REF C4 TO BLENDING = 8900.89

< 68 > IMPORTED C4= 0

*** PRODUCT ***

< 22 > LEADED REGULAR= 51175

< 23 > UNLEADED REGULAR= 104062

< 24 > UNLEADED PREMIUM= 15348

< 25 > AVIATION GASOLINE= 126

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.436674	.170334	0	0
CRACKED GAS	.519194	.4227	.193432	0
REFORMATE	0	.183746	.539553	0
POLYMER	0	3.92571E-12	0	0
ALKYLATE	0	.168884	.2028	.9786
C4	.0441315	.0543352	.0642154	.0214

TURBO FUEL BLENDING

*** FEED ***

< 30 > LSR= 470.47

< 58 > NAPHTHA= 4865.84

< 59 > KEROSENE= 18565.7

*** PRODUCT ***

< 42 > JET FUEL B= 4277

< 43 > JET FUEL A= 19625

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.61	.115
KEROSENE	.28	.885

DISTILLATE BLENDING

*** FEED ***

< 60 > KEROSENE= 89896.1

< 40 > LGO= 17530.8

< 38 > LCO= 15039.1

*** PRODUCT ***

< 44 > STOVE OIL= 2264

< 45 > LIGHT FUEL OIL= 38243

< 46 > DIESEL FUEL= 81959

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.8	.576966
LCO	0	.1	.178939
LGO	0	.1	.244095

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 125.402
< 35 > LCO= 5555
< 13 > HCO= 5148.52
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 22445.1
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 33274

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 22581
< 36 > HVGO TO LUBE OIL= 10882
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285

DISTILLATE DESULFURIZATION

STREAM	TOTAL BPCD	FEED TO DDS BPCD	FEED TO DDS Lbs/hr	FEED TO DDS SULFUR WT%	% BYPASS	FINAL STREAM SULFUR WT%
KEROSENE	108462	108462	1.31717E+06	.106901	0	5.35049E-03
LGO	17656.2	17656.2	227160	.312237	0	.0313117
LCO	20594.1	18534.7	260376	.948254	9.99995	.181562
HCO	5148.52	0	0	1.49824	100	1.49824
VAC RESIDUUM	22445.1	0	0	2.62443	100	2.62443

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	4277	19625	2264	38243	81959	33274
S.G.	.766424	.824418	.833667	.869149	.851692	1.04433
ASTM 10%	206.573	345.131	384.722	402.487	391.887	
ASTM 20%	223.878	368.622	399.599	432.863	412.698	
ASTM 50%	273.467	432.714	448.178	508.005	472.688	
ASTM 90%	468.255	516.968	519.576	606.922	569.938	
RVP,psia	2.80531					
Sulfur Wt %	.021255	7.60434E-03	5.34503E-03	.0464743	.027824	2.05959
Flash Point,F	64.3088	133.86	144.567	154.126	148.333	
Pour Point,F	-95.7316	-50.1785	-44.6169	-38.925	-44.1401	
Cetane No.					40.7028	
Visc @100F,cs	.773153	1.6177	1.82832	2.6398	2.14338	1955.18
Visc @122F,cs	.682057	1.37922	1.54805	2.17952	1.79522	676.041
Watsons K	11.8229	11.6397	11.5966	11.3369	11.4482	10.7746
MeABP	284.006	423.628	443.583	496.69	466.965	964.79

GASOLINE

LEADED REGULAR,BPCD 51175
TEL Addition,cc/IG: 1.24
RON / MON / (R+M)/2 (Clear) 89.0475 / 81.865 / 85.4563
RON / MON / (R+M)/2 93.8752 / 86.1039 / 89.9896
RVP,psia 12.477

MMT Addition,mg/l: 0
UNLEADED REGULAR,BPCD 104062
RON / MON / (R+M)/2 92.8307 / 85.2063 / 89.0185
RVP,psia 10.8306

UNLEADED PREMIUM,BPCD 15348
RON / MON / (R+M)/2 95.9999 / 87.5832 / 91.7916
RVP,psia 9.76459

AVIATION GASOLINE,BPCD 126
RON / MON / (R+M)/2 93 / 90.8 / 91.9
RVP,psia 10

STREAMS

< 0 > CRUDE FEED= 448883
< 1 > REDUCED CRUDE= 155057
< 2 > OVERHEAD= 54422.8
< 3 > NAPHTHA= 82650.8
< 4 > KEROSENE= 108462
< 5 > LGO= 48289.9
< 6 > HVGO= 124246
< 7 > RESIDUUM= 30811.1
< 8 > FCCU FEED= 128713
< 9 > REFORMER FEED= 62500
< 10 > CAT POLY FEED= 1E-06
< 11 > ALKYLATION FEED= 29100
< 12 > LCO= 20594.1
< 13 > HCO= 5148.52
< 14 > CRACKED GAS= 73525.6
< 15 > POLYMER= 4.08518E-07
< 16 > LE FROM POLY (FOE)= 3.12884E-07
< 17 > REFORMATE= 49983.1
< 18 > LE FROM CAT CRACKER (FOE)= 19188
< 19 > FUEL GAS (FOE)= 29823.5
< 20 > I-C4 FR. GAS PLANT= 6265.26
< 21 > I-C4 IMPORTED= 2739.39
< 22 > LEADED REGULAR= 51175
< 23 > UNLEADED REGULAR= 104062
< 24 > UNLEADED PREMIUM= 15348
< 25 > AVIATION GASOLINE= 126
< 26 > REFORMATE= 27402.1
< 27 > NAPHTHA SPECIALTIES= 22581
< 28 > LSR= 41022.7
< 29 > LSR+ISO= 40072.1
< 30 > LSR= 470.47
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 155057
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 34 > VAC RESIDUUM= 22445.1
< 35 > LCO= 5555
< 36 > HVGO TO LUBE OIL= 10882
< 37 > HVGO= 0
< 38 > LCO= 15039.1
< 39 > C3/C4 -FCCU= 20095.4
< 40 > LGO= 17530.8
< 41 > LGO= 125.402
< 42 > JET FUEL B= 4277
< 43 > JET FUEL A= 19625
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959
< 47 > HEAVY FUEL OIL= 33274
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 8900.69
< 50 > ALKYLATE= 20810.4
< 51 > CRUDE LIGHT ENDS= 2.98522
< 52 > TOTAL PRODUCT= 422752
< 53 > C2 % IN CRUDE FEED= .08668
< 54 > C3 % IN CRUDE FEED= .69156
< 55 > I-C4 % IN CRUDE FEED= .36344
< 56 > N-C4 % IN CRUDE FEED= 1.84354
< 57 > LE FROM REFORMER (FOE)= 11487.3
< 58 > NAPHTHA= 4865.84
< 59 > KEROSENE= 18565.7
< 60 > KEROSENE= 89896.1
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20095.4
< 63 > LE FROM ALKYL (FOE)= 2446.13
< 64 > HVGO= 98079.3
< 65 > LGO = 30633.7
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285
< 68 > IMPORTED C4= 0
< 69 > LSR= 40552.2

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2040.4	8868.59	36713.5	0	0	0	47622.5
C3 ,#/HR	22971.8	23579.1	27917.1	0	14682.4	1110.32	90260.7
IC4 ,#/HR	13426.6	14288.9	65755.6	0	0	1975.77	95446.9
NC4 ,#/HR	70522.4	20853.2	24674	0	15448.5	5626.02	137124
H2 ,#/HR	0	22449.7	14941.5	0	0	0	37391.2
C1 ,#/HR	0	8868.59	15222.7	0	0	0	24091.3
H2S ,#/HR	0	0	4779.19	0	0	0	4779.19
C2= ,#/HR	0	0	22386.3	0	0	0	22386.3
C3= ,#/HR	0	0	66183.4	0	0	0	66183.4
C4= ,#/HR	0	0	97965.1	0	0	0	97965.1
TOTAL ,#/HR	108961	98908.1	376538	3.87649E-06	30130.9	8712.11	623251
BPCD (FOE)	8810.76	11487.3	32267.9	3.12884E-07	2446.12	702.685	55714.8

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	47622.5	47622.5
C3 ,#/HR	0	14682.4	0	0	0	75578.3	90260.7
IC4 ,#/HR	0	92733.1	1284.52	0	0	1429.23	95446.9
NC4 ,#/HR	0	15448.6	57591.5	0	0	64084.1	137124
H2 ,#/HR	0	0	0	0	10838	26553.2	37391.2
C1 ,#/HR	0	0	0	0	0	24091.3	24091.3
H2S ,#/HR	0	0	0	0	0	4779.19	4779.19
C2= ,#/HR	0	0	0	0	0	22386.3	22386.3
C3= ,#/HR	0	32321.6	0	0	0	33861.8	66183.4
C4= ,#/HR	0	61336.6	17337.1	0	0	19291.4	97965.1
TOTAL ,#/HR	8.2088E-06	216522	76213.1	0	10838	319677	623251
BPCD (FOE)	6.54099E-07	17285.4	6104.45	0	2501.41	29623.5	55714.8

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	448883	5.49906E+06
BUTANE	2739.39	22545.2
TOTAL	451622	5.52161E+06

*** PRODUCT ***

FUEL GAS (FOE)	29823.5	319677
MOTOR GASOLINE	170711	1.79565E+06
AVIATION TURBO FUELS	23902	283433
DISTILLATES	122466	1.52852E+06
HEAVY FUEL OIL	33274	506189
OTHER PRODUCTS	72399	913584
H2 TO DESULFURIZERS (FOE)	2501.41	10838
COKE (FOE)	8733.2	163973
TOTAL	463810	5.52186E+06

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REFINERY SIMULATION PROGRAM

CASE:ONTBAS21 REGION:ONTARIO

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	49	219204
CANDNH	9.2	41156.6
SYNCRUDE	30.8	137785
CONDENSA	11	49209

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				447354	5.48034E+06	26434.1
Average		.84098	36.7562	.482344			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	447354	5.48034E+06	60	1300	.840981	36.7559	.482344	26434.1
	*** PRODUCT ***								
2	OVERHEAD	54104.9	505276	60	169.671	.641094	89.2166	.0289442	146.248
28	LSR	40750.4	396654	60	169.671	.668205	80.2614	.0368478	146.158
3	NAPHTHA	82150.8	901149	169.671	320.999	.753034	56.4065	.0268073	241.574
4	KEROSENE	108444	1.31671E+06	320.999	560	.833519	38.2622	.106685	1404.74
5	LGO	48125.5	619169	560	660	.88321	28.711	.312237	1933.28
1	REDUCED CRUDE	154529	2.13803E+06	660	1300	.949805	17.478	1.06211	22708.3

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	154529	2.13803E+06	660	1300	.949805	17.478	1.06211	22708.3
	*** PRODUCT ***								
6	HVGO	123825	1.66507E+06	660	1050	.923111	21.786	.618341	10295.8
7	RESIDUUM	30704.2	472968	1050	1300	1.05746	2.31122	2.62443	12412.7

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	30166.7	388116	560	660	.88321	28.711	.312237	1211.84
64	HVGO	97658.3	1.31321E+06	660	1050	.923111	21.786	.618341	8120.1
	*** TOTAL FEED ***								
8	FCCU FEED	127825	1.70132E+06	560	1050	.913694	23.3658	.548511	9331.94
	*** PRODUCT ***								
12	LCO	20452	287353	430	650	.964518	15.2054	.949253	2727.71
13	HCO	5113	80243.7	650	736.426	1.07737	-.161636	1.49982	1203.51
14	CRACKED GAS	72994.8	796888			.749437	57.3084	.0538959	429.49
39	C3/C4 -FCCU	20096.3	164969			.56353	119.596	0	0

*** PRODUCT ***
< 18 > LE FROM CAT CRACKER (FOE)= 18970
AVAILABLE C3/C4 OLEFINS= 31869.9
CONVERSION Wt%= 78.3935 CONVERSION Vol %= 80
COKE, WT% 9.58333
COKE ,#/HR 163127 Sulfur in Flue Gas,Lbs/hr= 498.938

CAT POLY UNIT
*** FEED ***

< 10 > CAT POLY FEED= 1E-06
*** PRODUCT ***
< 15 > POLYMER= 4.08505E-07
< 16 > LE FROM POLY (FOE)= 3.12905E-07

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 29101.3
< 62 > C3/C4 TO ALKYL= 20096.3
< 20 > I-C4 FR. GAS PLANT= 6054.18
< 21 > I-C4 IMPORTED= 2950.81
*** PRODUCT ***
< 50 > ALKYLATE= 20810.5
< 63 > LE FROM ALKYL (FOE)= 2447.11

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	62000	680106	169.671	320.999	.753034	56.4065	0	0
	*** PRODUCT ***								
17	REFORMATE	50681.5	591459			.801134	45.1247	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 10212.8
CONVERSION(LV%)= 81.7444 Severity (RON Clear)= 96.5 FEED KW= 11.8546

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 54104.9
< 57 > LE FROM REFORMER (FOE)= 10212.8
< 18 > LE FROM CAT CRACKER (FOE)= 18970
< 16 > LE FROM POLY (FOE)= 3.12905E-07
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 28292.2
< 20 > I-C4 FR. GAS PLANT= 6054.18
< 49 > REF C4 TO BLENDING = 8911.99
< 69 > LSR= 40279.9

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 40279.9
*** PRODUCT ***
< 29 > LSR+ISO= 39893.2

*** BY-PASS= 40 % ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 39893.2
< 26 > REFORMATE= 28100.5
< 50 > ALKYLATE= 20810.5
< 15 > POLYMER= 4.08505E-07
< 14 > CRACKED GAS= 72994.8
< 49 > REF C4 TO BLENDING = 8911.99
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 17058
< 23 > UNLEADED REGULAR= 138179
< 24 > UNLEADED PREMIUM= 15348

< 25 > AVIATION GASOLINE= 126

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.379995	.241797	0	0
CRACKED GAS	.571433	.43	.249564	0
REFORMATE	0	.15045	.476381	0
POLYMER	0	2.95634E-12	0	0
ALKYLATE	0	.126387	.21	.9786
C4	.0485718	.0513659	.0640553	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 470.47
< 58 > NAPHTHA= 4865.84
< 59 > KEROSENE= 18565.7
*** PRODUCT ***
< 42 > JET FUEL B= 4277
< 43 > JET FUEL A= 19625

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.11	0
NAPHTHA	.61	.115
KEROSENE	.28	.885

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 89878.1
< 40 > LGO= 17802
< 38 > LCO= 14786
*** PRODUCT ***
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.7	.790804
LCO	0	.1	.172322
LGO	0	.2	.0368739

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 156.828
< 35 > LCO= 5666
< 13 > HCO= 5113
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 22338.2
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 33274

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 22581
< 36 > HVGO TO LUBE OIL= 10882
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	108444	108444	1.31671E+06	.106685	0	5.33966E-03
LGO	17958.8	17958.8	231053	.312237	0	.0313117
LCO	20452	18406.8	258618	.949253	10	.181756
HCO	5113	0	0	1.49982	100	1.49982
VAC RESIDUUM	22338.2	0	0	2.62443	100	2.62443

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	4277	19625	2264	38243	81959	33274
S.G.	.766239	.824263	.833519	.857925	.856557	1.04387
ASTM 10%	206.4	344.538	384.031	391.458	395.328	
ASTM 20%	223.604	368.009	398.975	412.733	420.458	
ASTM 50%	272.98	432.28	447.782	470.686	489.531	
ASTM 90%	467.934	516.901	519.505	547.623	599.329	
RVP,psia	2.74264					
Sulfur Wt %	.0212301	7.59024E-03	5.33423E-03	.0402247	.0303816	2.05118
Flash Point,F	64.215	133.529	144.199	148.109	150.195	
Pour Point,F	-95.841	-50.3346	-44.7752	-52.6559	-37.9934	
Cetane No.					41.5134	
Visc @100F,cs	.771726	1.61362	1.82358	2.101	2.3679	1846.55
Visc @122F,cs	.680849	1.37593	1.54427	1.75914	1.97162	645.218
Watsons K	11.8236	11.64	11.5968	11.346	11.4454	10.774
MeABP	283.616	423.199	443.16	462.321	482.252	962.67

GASOLINE

LEADED REGULAR,BPCD	17058
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	89.2106 / 81.4978 / 85.3542
RON / MON / (R+M)/2	93.9873 / 85.6665 / 89.8269
RVP,psia	11.9474

MMT Addition,mg/l: 18	
UNLEADED REGULAR,BPCD	138179
RON / MON / (R+M)/2	93.1016 / 84.8249 / 88.9633
RVP,psia	11.1446

UNLEADED PREMIUM,BPCD	15348
RON / MON / (R+M)/2	96.1999 / 87.3995 / 91.7997
RVP,psia	9.77122

AVIATION GASOLINE,BPCD	126
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 447354
< 1 > REDUCED CRUDE= 154529
< 2 > OVERHEAD= 54104.9
< 3 > NAPHTHA= 82150.8
< 4 > KEROSENE= 108444
< 5 > LGO= 48125.5
< 6 > HVGO= 123825
< 7 > RESIDUUM= 30704.2
< 8 > FCCU FEED= 127825
< 9 > REFORMER FEED= 62000
< 10 > CAT POLY FEED= 1E-06
< 11 > ALKYLATION FEED= 29101.3
< 12 > LCO= 20452
< 13 > HCO= 5113
< 14 > CRACKED GAS= 72994.8
< 15 > POLYMER= 4.08505E-07
< 16 > LE FROM POLY (FOE)= 3.12905E-07
< 17 > REFORMATE= 50681.5
< 18 > LE FROM CAT CRACKER (FOE)= 18970
< 19 > FUEL GAS (FOE)= 28292.2
< 20 > I-C4 FR. GAS PLANT= 6054.18
< 21 > I-C4 IMPORTED= 2950.81
< 22 > LEADED REGULAR= 17058
< 23 > UNLEADED REGULAR= 138179
< 24 > UNLEADED PREMIUM= 15348
< 25 > AVIATION GASOLINE= 126
< 26 > REFORMATE= 28100.5
< 27 > NAPHTHA SPECIALTIES= 22581
< 28 > LSR= 40750.4
< 29 > LSR+ISO= 39893.2
< 30 > LSR= 470.47
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 154529
< 33 > VAC RESID TO ASPHALT PLANT= 8366
< 34 > VAC RESIDUUM= 22338.2
< 35 > LCO= 5666
< 36 > HVGO TO LUBE OIL= 10882
< 37 > HVGO= 0
< 38 > LCO= 14786
< 39 > C3/C4 -FCCU= 20096.3
< 40 > LGO= 17802
< 41 > LGO= 156.828
< 42 > JET FUEL B= 4277
< 43 > JET FUEL A= 19625
< 44 > STOVE OIL= 2264
< 45 > LIGHT FUEL OIL= 38243
< 46 > DIESEL FUEL= 81959
< 47 > HEAVY FUEL OIL= 33274
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 8911.99
< 50 > ALKYLATE= 20810.5
< 51 > CRUDE LIGHT ENDS= 2.98522
< 52 > TOTAL PRODUCT= 422752
< 53 > C2 % IN CRUDE FEED= .08668
< 54 > C3 % IN CRUDE FEED= .69156
< 55 > I-C4 % IN CRUDE FEED= .36344
< 56 > N-C4 % IN CRUDE FEED= 1.84354
< 57 > LE FROM REFORMER (FOE)= 10212.8
< 58 > NAPHTHA= 4865.84
< 59 > KEROSENE= 18565.7
< 60 > KEROSENE= 89878.1
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20096.3
< 63 > LE FROM ALKYL (FOE)= 2447.11
< 64 > HVGO= 97658.3
< 65 > LGO = 30166.7
< 66 > NAPHTHA PETROCHEMICAL FEED= 15285
< 67 > VGO PETROCHEMICAL FEED= 15285
< 68 > IMPORTED C4= 0
< 69 > LSR= 40279.9

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2033.45	7650.11	36494.7	0	0	0	46178.3
C3 ,#/HR	22893.6	20892.6	27724.5	0	14685.1	894.214	87090
IC4 ,#/HR	13380.9	13358.4	65284.2	0	0	1591.22	93614.7
NC4 ,#/HR	70282.3	19495.2	24514.1	0	15457.9	4531.01	134281
H2 ,#/HR	0	19600.1	14852.4	0	0	0	34452.5
C1 ,#/HR	0	7650.11	15131.9	0	0	0	22782
H2S ,#/HR	0	0	4751.81	0	0	0	4751.81
C2= ,#/HR	0	0	22252.9	0	0	0	22252.9
C3= ,#/HR	0	0	65681.1	0	0	0	65681.1
C4= ,#/HR	0	0	97300.2	0	0	0	97300.2
TOTAL ,#/HR	108590	88646.5	373988	3.87675E-06	30143	7016.44	608384
BPCD (FOE)	8780.77	10212.8	32051.1	3.12906E-07	2447.1	565.919	54057.7

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	46178.3	46178.3
C3 ,#/HR	0	14685.2	0	0	0	72404.9	87090
IC4 ,#/HR	0	90992.4	1271.47	0	0	1350.88	93614.7
NC4 ,#/HR	0	15457.9	57610.8	0	0	61211.8	134281
H2 ,#/HR	0	0	0	0	10861	23591.5	34452.5
C1 ,#/HR	0	0	0	0	0	22782	22782
H2S ,#/HR	0	0	0	0	0	4751.81	4751.81
C2= ,#/HR	0	0	0	0	0	22252.9	22252.9
C3= ,#/HR	0	32305	0	0	0	33376.1	65681.1
C4= ,#/HR	0	61354.9	17428	0	0	18517.3	97300.2
TOTAL ,#/HR	8.20895E-06	214795	76310.3	0	10861	306417	608384
BPCD (FOE)	6.5411E-07	17146.7	6112.1	0	2506.71	28292.2	54057.7

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	447354	5.48034E+06
BUTANE	2950.81	24285.2
TOTAL	450305	5.50463E+06

*** PRODUCT ***

FUEL GAS (FOE)	28292.2	306417
MOTOR GASOLINE	170711	1.79513E+06
AVIATION TURBO FUELS	23902	283377
DISTILLATES	122466	1.52807E+06
HEAVY FUEL OIL	33274	505966
OTHER PRODUCTS	72399	911928
H2 TO DESULFURIZERS (FOE)	2506.71	10861
COKE (FOE)	8688.14	163127
TOTAL	462239	5.50487E+06

TIME:01.17.58 DATE:TUEJUN 51984157 61
REFINERY SIMULATION PROGRAM

CASE:WESBAS20 REGION:WESTERN

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	65.1	322977
SYNCRUDE	31.5	156279
CONDENSA	3.4	16868.2

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				496125	6.10068E+06	18985.4
Average		.844145	36.1252	.311201			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	496124	6.10068E+06	60	1240	.844147	36.1249	.311201	18985.4
	*** PRODUCT ***								
2	OVERHEAD	49358.2	457533	60	170.082	.636346	90.8635	.0147232	67.3633
28	LSR	33837.2	332355	60	170.082	.674275	78.355	.0202679	67.3613
3	NAPHTHA	85501.1	941604	170.082	320.151	.756008	55.6674	.014829	139.63
4	KEROSENE	129566	1.57161E+06	320.151	560	.832693	38.4306	.0620516	975.212
5	LGO	56593.9	726285	560	660	.880983	29.116	.219173	1591.82
1	REDUCED CRUDE	175106	2.40364E+06	660	1240	.942321	18.6611	.67445	16211.4

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	175106	2.40364E+06	660	1240	.942321	18.6611	.67445	16211.4
	*** PRODUCT ***								
6	HVGO	143362	1.91986E+06	660	1050	.919318	22.4184	.412657	7922.44
7	RESIDUUM	31744	483783	1050	1240	1.04621	3.75011	1.7133	8288.65

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	11990.4	153876	560	660	.880983	29.116	.219173	337.255
64	HVGO	137890	1.84658E+06	660	1050	.919318	22.4184	.412657	7620.05
	*** TOTAL FEED ***								
8	FCCU FEED	149880	2.00045E+06	560	1050	.916251	22.9337	.397775	7957.31
	*** PRODUCT ***								
12	LCO	26019.2	366513	430	650	.966998	14.8292	.648417	2376.53
13	HCO	6504.79	101856	650	743.652	1.07494	.135254	1.0245	1043.52
14	CRACKED GAS	83438.1	910133			.748808	57.467	.0411306	374.343
39	C3/C4 -FCCU	35715.3	293317			.563784	119.483	0	0

*** PRODUCT ***
< 18 > LE FROM CAT CRACKER (FOE)= 13376.5
AVAILABLE C3/C4 OLEFINS= 36159.9
CONVERSION Wt%= 76.5869 CONVERSION Vol %= 78.3
COKE, WT% 9.81573
COKE ,#/HR 196460 Sulfur in Flue Gas,Lbs/hr= 411.674

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 15000

*** PRODUCT ***
< 15 > POLYMER= 6122.88
< 16 > LE FROM POLY (FOE)= 4702.11

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 30000
< 62 > C3/C4 TO ALKYL= 20715.3
< 20 > I-C4 FR. GAS PLANT= 7796.22
< 21 > I-C4 IMPORTED= 1488.53
*** PRODUCT ***
< 50 > ALKYLATE= 21428.3
< 63 > LE FROM ALKYL (FOE)= 2548.97

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	70750	779153	170.082	320.151	.756008	55.6674	0	0
	*** PRODUCT ***								
17	REFORMATE	56077	662667			.811223	42.928	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 13575.5
CONVERSION(LV%)= 79.2608 Severity (RON Clear)= 99 FEED KW= 11.8164

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 49358.2
< 57 > LE FROM REFORMER (FOE)= 13575.5
< 18 > LE FROM CAT CRACKER (FOE)= 13376.5
< 16 > LE FROM POLY (FOE)= 4702.11
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 27380.7
< 20 > I-C4 FR. GAS PLANT= 7796.22
< 49 > REF C4 TO BLENDING = 12023.4
< 69 > LSR= 31122.4

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 31122.4
*** PRODUCT ***
< 29 > LSR+ISO= 31122.4

*** BY-PASS= 100 % ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 31122.4
< 26 > REFORMATE= 49095
< 50 > ALKYLATE= 21428.3
< 15 > POLYMER= 6122.88
< 14 > CRACKED GAS= 83438.1
< 49 > REF C4 TO BLENDING = 12023.4
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 60195
< 23 > UNLEADED REGULAR= 126555
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.214887	.143711	0	0
CRACKED GAS	.71002	.29	.287564	0
REFORMATE	.013643	.33331	.438222	0
POLYMER	0	.0483811	0	0
ALKYLATE	0	.126302	.21	.9786
C4	.06145	.0582967	.0642135	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 2714.79
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 20903.2
*** PRODUCT ***
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.13	0
NAPHTHA	.59	.12
KEROSENE	.28	.88

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 108662
< 40 > LGO= 44245.3
< 38 > LCO= 24219.2
*** PRODUCT ***
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.63	.248203
LCO	0	.1	.629763
LGO	0	.27	.122035

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 358.178
< 35 > LCO= 1800
< 13 > HCO= 6504.79
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 15679
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 24342

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 6982
< 36 > HVGO TO LUBE OIL= 5472
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREA
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	129566	129566	1.57161E+06	.0620516	0	3.10441E-03
LGO	44603.5	44603.5	572409	.219173	0	.0219606
LCO	26019.2	13009.6	183257	.648417	50	.357673
HCO	6504.79	0	0	1.0245	100	1.0245
VAC RESIDUUM	15679	0	0	1.7133	100	1.7133

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	20883	17109	5913	13398	157816	24342
S.G.	.766854	.823491	.832693	.923166	.859162	1.04559
ASTM 10%	198.051	339.391	384.638	458.664	399.209	
ASTM 20%	218.84	365.061	399.164	477.486	427.011	
ASTM 50%	272.828	430.592	446.843	530.622	503.754	
ASTM 90%	467.306	516.734	519.432	607.25	607.405	
RVP,psia	2.58136					
Sulfur Wt %	.0118854	4.39444E-03	3.10258E-03	.238502	.0481014	1.41032
Flash Point,F	59.5294	130.673	144.53	185.138	152.324	
Pour Point,F	-98.4946	-51.0597	-44.1994	-67.2957	-33.0154	
Cetane No.					42.7199	
Visc @100F,cs	.761928	1.59415	1.82011	3.49346	2.5412	1804.67
Visc @122F,cs	.672455	1.3602	1.54168	2.7966	2.10725	630.48
Watsons K	11.7988	11.6419	11.6076	10.7782	11.454	10.7511
MeABP	280.728	421.145	442.989	525.107	493.005	960.62

GASOLINE

LEADED REGULAR,BPCD	60195
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	90.1453 / 81.1836 / 85.6645
RON / MON / (R+M)/2	94.7716 / 85.1769 / 89.9743
RVP,psia	10.3302

MMT Addition,mg/l: 0	
UNLEADED REGULAR,BPCD	126555
RON / MON / (R+M)/2	93.25 / 84.8549 / 89.0525
RVP,psia	10.1255

UNLEADED PREMIUM,BPCD	13901
RON / MON / (R+M)/2	96.0298 / 87.5878 / 91.8088
RVP,psia	9.76283

AVIATION GASOLINE,BPCD	2579
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 496124
< 1 > REDUCED CRUDE= 175106
< 2 > OVERHEAD= 49358.2
< 3 > NAPHTHA= 85501.1
< 4 > KEROSENE= 129566
< 5 > LGO= 56593.9
< 6 > HVGO= 143362
< 7 > RESIDUUM= 31744
< 8 > FCCU FEED= 149880
< 9 > REFORMER FEED= 70750
< 10 > CAT POLY FEED= 15000
< 11 > ALKYLATION FEED= 30000
< 12 > LCO= 26019.2
< 13 > HCO= 6504.79
< 14 > CRACKED GAS= 83438.1
< 15 > POLYMER= 6122.88
< 16 > LE FROM POLY (FOE)= 4702.11
< 17 > REFORMATE= 56077
< 18 > LE FROM CAT CRACKER (FOE)= 13376.5
< 19 > FUEL GAS (FOE)= 27380.7
< 20 > I-C4 FR. GAS PLANT= 7796.22
< 21 > I-C4 IMPORTED= 1488.53
< 22 > LEADED REGULAR= 60195
< 23 > UNLEADED REGULAR= 126555
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579
< 26 > REFORMATE= 49095
< 27 > NAPHTHA SPECIALTIES= 6982
< 28 > LSR= 33837.2
< 29 > LSR+ISO= 31122.4
< 30 > LSR= 2714.79
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 175106
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 34 > VAC RESIDUUM= 15679
< 35 > LCO= 1800
< 36 > HVGO TO LUBE OIL= 5472
< 37 > HVGO= 0
< 38 > LCO= 24219.2
< 39 > C3/C4 -FCCU= 35715.3
< 40 > LGO= 44245.3
< 41 > LGO= 358.178
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816
< 47 > HEAVY FUEL OIL= 24342
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 12023.4
< 50 > ALKYLATE= 21428.3
< 51 > CRUDE LIGHT ENDS= 3.12845
< 52 > TOTAL PRODUCT= 471587
< 53 > C2 % IN CRUDE FEED= .10416
< 54 > C3 % IN CRUDE FEED= .87234
< 55 > I-C4 % IN CRUDE FEED= .41795
< 56 > N-C4 % IN CRUDE FEED= 1.734
< 57 > LE FROM REFORMER (FOE)= 13575.5
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 20903.2
< 60 > KEROSENE= 108662
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20715.3
< 63 > LE FROM ALKYL (FOE)= 2548.97
< 64 > HVGO= 137890
< 65 > LGO = 11990.4
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0
< 69 > LSR= 31122.4

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2709.91	10603.5	42600.5	0	0	0	55913.9
C3 ,#/HR	32026.4	27937.1	31503.1	13441.1	15159.9	0	120068
IC4 ,#/HR	17065.3	16511.9	73746.8	33055.7	0	0	140380
NC4 ,#/HR	73313	24097.4	28348.4	11759.6	16240.2	0	153759
H2 ,#/HR	0	26733.3	17429.2	0	0	0	44162.5
C1 ,#/HR	0	10603.5	17663.6	0	0	0	28267.1
H2S ,#/HR	0	0	3985.69	0	0	0	3985.69
C2= ,#/HR	0	0	25975.9	0	0	0	25975.9
C3= ,#/HR	0	0	73392.9	0	0	0	73392.9
C4= ,#/HR	0	0	111164	0	0	0	111164
TOTAL ,#/HR	125115	116487	425810	58256.4	31400.1	0	757068
BPCD (FOE)	10125.4	13575.4	36694.8	4702.11	2548.98	0	67646.7

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	55913.9	55913.9
C3 ,#/HR	10977.3	15159.9	0	0	0	93930.4	120068
IC4 ,#/HR	30592	106411	2649.64	0	0	727.11	140380
NC4 ,#/HR	11759.6	16240.2	98672.1	0	0	27086.6	153759
H2 ,#/HR	0	0	0	0	15151.8	29010.7	44162.5
C1 ,#/HR	0	0	0	0	0	28267.1	28267.1
H2S ,#/HR	0	0	0	0	0	3985.69	3985.69
C2= ,#/HR	0	0	0	0	0	25975.9	25975.9
C3= ,#/HR	23747.2	32795.4	0	0	0	16850.3	73392.9
C4= ,#/HR	46113.5	63683.7	1072.63	0	0	294.167	111164
TOTAL ,#/HR	123190	234290	102394	0	15151.8	282042	757068
BPCD (FOE)	9815.93	18708.9	8244.16	0	3497.03	27380.7	67646.7

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	496124	6.10068E+06
BUTANE	1488.53	12250.6
TOTAL	497613	6.11293E+06

*** PRODUCT ***

FUEL GAS (FOE)	27380.7	282042
MOTOR GASOLINE	203230	2.17845E+06
AVIATION TURBO FUELS	37992	438515
DISTILLATES	177127	2.22703E+06
HEAVY FUEL OIL	24342	370756
OTHER PRODUCTS	28896	404771
H2 TO DESULFURIZERS (FOE)	3497.03	15151.8
COKE (FOE)	10463.5	196460
TOTAL	512928	6.11317E+06

TIME:01.48.39 DATE:SUNJUN101984162 66
REFINERY SIMULATION PROGRAM

CASE:WESBAS21 REGION:WESTERN

**** FEED BLEND ****

CRUDE ORIGIN	LV %	BPCD
CANDNL	65.1	322079
SYNCRUDE	31.5	155845
CONDENSA	3.4	16821.4

No. MBP	LV %	S.G.	API	SULFUR WT%	BPCD	Lbs/hr FEED	Lbs/hr SULFUR
Total	100				494746	6.08372E+06	18932.6
Average		.844146	36.1252	.311201			

**** MATERIAL BALANCE ****

CRUDE UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
0	CRUDE FEED	494746	6.08372E+06	60	1240	.844145	36.1253	.311201	18932.6
	*** PRODUCT ***								
2	OVERHEAD	49692.6	461217	60	171.04	.637153	90.5818	.014725	67.9141
28	LSR	34214.7	336377	60	171.04	.674906	78.1588	.020189	67.9111
3	NAPHTHA	86951.1	958859	171.04	323.921	.757024	55.4161	.0149314	143.171
4	KEROSENE	127046	1.54242E+06	323.921	560	.833434	38.2795	.0627476	967.831
5	LGO	56436.6	724267	560	660	.880983	29.116	.219173	1587.4
1	REDUCED CRUDE	174619	2.39696E+06	660	1240	.942321	18.6611	.67445	16166.3

VACUUM UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
32	REDUCED CRUDE	174619	2.39696E+06	660	1240	.942321	18.6611	.67445	16166.3
	*** PRODUCT ***								
6	HVGO	142965	1.91455E+06	660	1050	.919318	22.4184	.412657	7900.5
7	RESIDUUM	31653.8	482408	1050	1240	1.04621	3.75011	1.7133	8265.1

CAT CRACKER

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
65	LGO	4986.8	63997	560	660	.880983	29.116	.219173	140.264
64	HVGO	137493	1.84127E+06	660	1050	.919318	22.4184	.412657	7598.11
	*** TOTAL FEED ***								
8	FCCU FEED	142480	1.90526E+06	560	1050	.917976	22.6435	.406158	7738.38
	*** PRODUCT ***								
12	LCO	22796.8	322836	430	650	.972161	14.052	.701512	2264.73
13	HCO	5699.2	89785.6	650	736.628	1.08149	-.661987	1.10839	995.174
14	CRACKED GAS	80075.6	875636			.750677	56.9965	.0406731	356.148
39	C3/C4 -FCCU	35235.5	289494			.564012	119.381	0	0

*** PRODUCT ***
< 18 > LE FROM CAT CRACKER (FOE)= 13241.7
AVAILABLE C3/C4 OLEFINS= 35244.4
CONVERSION Wt%= 78.3431 CONVERSION Vol %= 80
COKE, WT% 10.3762
COKE ,#/HR 197796 Sulfur in Flue Gas,Lbs/hr= 413.735

CAT POLY UNIT
*** FEED ***
< 10 > CAT POLY FEED= 15000

*** PRODUCT ***
< 15 > POLYMER= 6115.17
< 16 > LE FROM POLY (FOE)= 4712.82

ALKYLATION UNIT
*** FEED ***
< 11 > ALKYLATION FEED= 29290
< 62 > C3/C4 TO ALKYL= 20235.5
< 20 > I-C4 FR. GAS PLANT= 7531.38
< 21 > I-C4 IMPORTED= 1523.13
*** PRODUCT ***
< 50 > ALKYLATE= 20899.2
< 63 > LE FROM ALKYL (FOE)= 2511.98

CATALYTIC REFORMER UNIT

No.	Name	BPCD	Lbs/hr	IBP	EBP	S.G.	API	SULFUR WT%	Lbs/hr Su
	*** FEED ***								
9	REFORMER FEED	72200	796190	171.04	323.921	.757024	55.4161	0	0
	*** PRODUCT ***								
17	REFORMATE	59418.6	696151			.804287	44.4322	0	0

*** PRODUCT ***
< 57 > LE FROM REFORMER (FOE)= 11501.9
CONVERSION(LV%)= 82.2972 Severity (RON Clear)= 96.5 FEED KW= 11.8127

GAS PLANT
*** FEED ***
< 2 > OVERHEAD= 49692.6
< 57 > LE FROM REFORMER (FOE)= 11501.9
< 18 > LE FROM CAT CRACKER (FOE)= 13241.7
< 16 > LE FROM POLY (FOE)= 4712.82
*** PRODUCT ***
< 19 > FUEL GAS (FOE)= 25149.4
< 20 > I-C4 FR. GAS PLANT= 7531.38
< 49 > REF C4 TO BLENDING = 11994.6
< 69 > LSR= 31708.8

ISOMERIZATION UNIT (ONCE THRU)
*** FEED ***
< 69 > LSR= 31708.8
*** PRODUCT ***
< 29 > LSR+ISO= 31708.8

*** BY-PASS= 100 % ***

GASOLINE BLENDING
*** FEED ***
< 29 > LSR+ISO= 31708.8
< 26 > REFORMATE= 52436.6
< 50 > ALKYLATE= 20899.2
< 15 > POLYMER= 6115.17
< 14 > CRACKED GAS= 80075.6
< 49 > REF C4 TO BLENDING = 11994.6
< 68 > IMPORTED C4= 0
*** PRODUCT ***
< 22 > LEADED REGULAR= 20065
< 23 > UNLEADED REGULAR= 166685
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579

*** GASOLINE COMPOSITION ***

	LR	UR	UP	AV
LSR	.35043	.148048	0	0
CRACKED GAS	.198776	.45	.0776153	0
REFORMATE	.401572	.219212	.563968	0
POLYMER	0	.036687	0	0
ALKYLATE	0	.0852142	.3	.9786
C4	.0492225	.0608386	.0584166	.0214

TURBO FUEL BLENDING
*** FEED ***
< 30 > LSR= 2505.96
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 21112
*** PRODUCT ***
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109

*** TURBO FUEL COMPOSITION ***

	NAPHTHA BASE	KEROSENE BASE
LSR	.12	0
NAPHTHA	.59	.12
KEROSENE	.29	.88

DISTILLATE BLENDING
*** FEED ***
< 60 > KEROSENE= 105934
< 40 > LGO= 50985.8
< 38 > LCO= 20206.8
*** PRODUCT ***
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816

*** DISTILLATE COMPOSITION ***

	STOVE OIL	DIESEL FUEL	LFO
KEROSENE	1	.63	.0445808
LCO	0	.1	.330288
LGO	0	.27	.625131

HEAVY FUEL OIL BLENDING
*** FEED ***
< 41 > LGO= 464.003
< 35 > LCO= 2590
< 13 > HCO= 5699.2
< 37 > HVGO= 0
< 31 > REDUCED CRUDE= 0
< 34 > VAC RESIDUUM= 15588.8
*** PRODUCT ***
< 47 > HEAVY FUEL OIL= 24342

OTHER PRODUCTS
< 27 > NAPHTHA SPECIALTIES= 6982
< 36 > HVGO TO LUBE OIL= 5472
< 48 > RESID TO COKING= 0
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0

DISTILLATE DESULFURIZATION

STREAM	TOTAL	FEED TO DDS				FINAL STREAM
	BPCD	BPCD	Lbs/hr	SULFUR WT%	% BYPASS	SULFUR WT%
KEROSENE	127046	127046	1.54242E+06	.0627476	0	3.13925E-03
LGO	51449.8	51449.8	660270	.219173	0	.0219606
LCO	22796.8	11398.4	161418	.701512	50	.387053
HCO	5699.2	0	0	1.10839	100	1.10839
VAC RESIDUUM	15588.8	0	0	1.7133	100	1.7133

PRODUCT SLATES & SPECIFICATIONS

	JET FUEL B	JET FUEL A	STOVE OIL	LFO	DIESEL FUEL	HFO
BPCD	20883	17109	5913	13398	157816	24342
S.G.	.769329	.824265	.833434	.908978	.860145	1.04344
ASTM 10%	205.002	342.441	388.134	507.878	402.791	
ASTM 20%	224.516	368.197	402.306	542.228	429.779	
ASTM 50%	277.878	432.846	448.885	590.66	504.574	
ASTM 90%	471.958	517.081	519.8	625.739	607.354	
RVP,psia	2.39383					
Sulfur Wt %	.0117796	4.43721E-03	3.13738E-03	.149701	.051584	1.40769
Flash Point,F	63.3984	132.379	146.399	213.232	154.254	
Pour Point,F	-96.4694	-50.2323	-43.3879	-18.9906	-32.8446	
Cetane No.					42.4668	
Visc @100F,cs	.783705	1.61501	1.84423	4.93206	2.56878	1435.35
Visc @122F,cs	.690917	1.37706	1.56099	3.88126	2.12847	523.066
Watsons K	11.7925	11.6406	11.6065	11.1332	11.4468	10.7516
MeABP	286.713	423.355	445.139	576.4	494.492	952.07

GASOLINE

LEADED REGULAR,BPCD	20065
TEL Addition,cc/IG: 1.24	
RON / MON / (R+M)/2 (Clear)	88.5954 / 80.7836 / 84.6895
RON / MON / (R+M)/2	93.8905 / 85.6688 / 89.7797
RVP,psia	10.5314

MMT Addition,mg/l: 18	
UNLEADED REGULAR,BPCD	166685
RON / MON / (R+M)/2	93.634 / 84.5859 / 89.11
RVP,psia	10.1193

UNLEADED PREMIUM,BPCD	13901
RON / MON / (R+M)/2	96.1298 / 87.8493 / 91.9895
RVP,psia	9.74624

AVIATION GASOLINE,BPCD	2579
RON / MON / (R+M)/2	93 / 90.8 / 91.9
RVP,psia	10

STREAMS

< 0 > CRUDE FEED= 494746
< 1 > REDUCED CRUDE= 174619
< 2 > OVERHEAD= 49692.6
< 3 > NAPHTHA= 86951.1
< 4 > KEROSENE= 127046
< 5 > LGO= 56436.6
< 6 > HVGO= 142965
< 7 > RESIDUUM= 31653.8
< 8 > FCCU FEED= 142480
< 9 > REFORMER FEED= 72200
< 10 > CAT POLY FEED= 15000
< 11 > ALKYLATION FEED= 29290
< 12 > LCO= 22796.8
< 13 > HCO= 5699.2
< 14 > CRACKED GAS= 80075.6
< 15 > POLYMER= 6115.17
< 16 > LE FROM POLY (FOE)= 4712.82
< 17 > REFORMATE= 59418.6
< 18 > LE FROM CAT CRACKER (FOE)= 13241.7
< 19 > FUEL GAS (FOE)= 25149.4
< 20 > I-C4 FR. GAS PLANT= 7531.38
< 21 > I-C4 IMPORTED= 1523.13
< 22 > LEADED REGULAR= 20065
< 23 > UNLEADED REGULAR= 166685
< 24 > UNLEADED PREMIUM= 13901
< 25 > AVIATION GASOLINE= 2579
< 26 > REFORMATE= 52436.6
< 27 > NAPHTHA SPECIALTIES= 6982
< 28 > LSR= 34214.7
< 29 > LSR+ISO= 31708.8
< 30 > LSR= 2505.96
< 31 > REDUCED CRUDE= 0
< 32 > REDUCED CRUDE= 174619
< 33 > VAC RESID TO ASPHALT PLANT= 16065
< 34 > VAC RESIDUUM= 15588.8
< 35 > LCO= 2590
< 36 > HVGO TO LUBE OIL= 5472
< 37 > HVGO= 0
< 38 > LCO= 20206.8
< 39 > C3/C4 -FCCU= 35235.5
< 40 > LGO= 50985.8
< 41 > LGO= 464.003
< 42 > JET FUEL B= 20883
< 43 > JET FUEL A= 17109
< 44 > STOVE OIL= 5913
< 45 > LIGHT FUEL OIL= 13398
< 46 > DIESEL FUEL= 157816
< 47 > HEAVY FUEL OIL= 24342
< 48 > RESID TO COKING= 0
< 49 > REF C4 TO BLENDING = 11994.6
< 50 > ALKYLATE= 20899.2
< 51 > CRUDE LIGHT ENDS= 3.12845
< 52 > TOTAL PRODUCT= 471587
< 53 > C2 % IN CRUDE FEED= .10416
< 54 > C3 % IN CRUDE FEED= .87234
< 55 > I-C4 % IN CRUDE FEED= .41795
< 56 > N-C4 % IN CRUDE FEED= 1.734
< 57 > LE FROM REFORMER (FOE)= 11501.9
< 58 > NAPHTHA= 14374
< 59 > KEROSENE= 21112
< 60 > KEROSENE= 105934
< 61 > OLEFIN PETROCHEMICAL FEED= 0
< 62 > C3/C4 TO ALKYL= 20235.5
< 63 > LE FROM ALKYL (FOE)= 2511.98
< 64 > HVGO= 137493
< 65 > LGO = 4986.8
< 66 > NAPHTHA PETROCHEMICAL FEED= 377
< 67 > VGO PETROCHEMICAL FEED= 0
< 68 > IMPORTED C4= 0
< 69 > LSR= 31708.8

LIGHT ENDS BALANCE

*** FROM ***

	CRUDE UNIT	REFORMER	CAT CRACKER	POLY	ALKYL	ISO	TOTAL
C2 ,#/HR	2702.38	8537.46	43393.5	0	0	0	54633.3
C3 ,#/HR	31937.4	23548.2	30903.1	13512.7	14904.1	0	114806
IC4 ,#/HR	17017.9	15224.9	71710.3	32984.6	0	0	136938
NC4 ,#/HR	73109.3	22219.2	27938.5	11890.6	16040.9	0	151199
H2 ,#/HR	0	21972.2	17760.7	0	0	0	39732.9
C1 ,#/HR	0	8537.46	17992.4	0	0	0	26529.9
H2S ,#/HR	0	0	3940.37	0	0	0	3940.37
C2= ,#/HR	0	0	26459.5	0	0	0	26459.5
C3= ,#/HR	0	0	70319.6	0	0	0	70319.6
C4= ,#/HR	0	0	109110	0	0	0	109110
TOTAL ,#/HR	124767	100039	419528	58387.9	30945	0	733667
BPCD (FOE)	10097.3	11501.9	36255.9	4712.81	2511.98	0	65079.9

*** TO ***

	POLY	ALKY	GAS BLEND	PC FEED	DDS	FUEL GAS	TOTAL
C2 ,#/HR	0	0	0	0	0	54633.3	54633.3
C3 ,#/HR	11048	14904.1	0	0	0	88853.5	114806
IC4 ,#/HR	30519.9	103156	2632.5	0	0	629.75	136938
NC4 ,#/HR	11890.6	16040.8	99470.5	0	0	23796.6	151199
H2 ,#/HR	0	0	0	0	15861.9	23871	39732.9
C1 ,#/HR	0	0	0	0	0	26529.9	26529.9
H2S ,#/HR	0	0	0	0	0	3940.37	3940.37
C2= ,#/HR	0	0	0	0	0	26459.5	26459.5
C3= ,#/HR	23343.8	31491.6	0	0	0	15484.1	70319.6
C4= ,#/HR	46437.2	62645.3	22.229	0	0	5.31397	109110
TOTAL ,#/HR	123239	228237	102125	0	15861.9	264203	733667
BPCD (FOE)	9819.84	18225.2	8224.52	0	3660.93	25149.4	65079.9

**** OVERALL MASS BALANCE ****

*** FEED ***

	BPCD	#/HR
CRUDE	494746	6.08372E+06
BUTANE	1523.13	12535.4
TOTAL	496269	6.09626E+06

*** PRODUCT ***

FUEL GAS (FOE)	25149.4	264203
MOTOR GASOLINE	203230	2.17853E+06
AVIATION TURBO FUELS	37992	439461
DISTILLATES	177127	2.22658E+06
HEAVY FUEL OIL	24342	369993
OTHER PRODUCTS	28896	404071
H2 TO DESULFURIZERS (FOE)	3660.93	15861.9
COKE (FOE)	10534.6	197796
TOTAL	510932	6.0965E+06

"E"

REVISED 16 MARCH 1984
47SS KE145-3-0745
OSS83-00188

STATEMENT OF WORK

Objective: To identify the costs to the petroleum refining industry associated with the removal of MMT (methylcyclopendadienyl manganese tricarbonyl) from gasoline for the year 1990.

Statement of Work:

1) Describe options for the oil refining industry to boost octane without the use of MMT by providing an overview of other additives ([i.e.] methanol) but more specifically by reviewing the alternatives in refinery processing.

2) Identify the capital and operating costs (in 1983 dollars) associated with MMT removal from lead-free gas, assuming the following cases of allowable lead concentrations:

   a) 0.29 g/litre
   b) 0.15 g/litre
   c) 0.0 g/litre

3) Revise model to reflect projected 1990 operations. The projected operations which include product demand, crude supply, refinery processing facilities, etc. will be supplied by EMR from a recently completed study.

4) For each grade of gasoline, analysis will be carried out at two octane levels:

   . minimum RON as per CGSB spec
   . current RON in the market place

5) Constraints to be considered include:

   (a) utilization of the CGSB specification of 18 mg/l. of manganese;
   (b) minimization of operating costs (especially crude oil usage) but describing other capital and operating cost options;
   (c) recognition of regional differences in production where they exist.

6) Discuss in a qualitative sense the cost implication if refineries are limited to one half of the CGSB specification (i.e.) .09 mg/l of manganese.

7) Prepare a draft report in 10 copies by April 15, 1984.

8) Prepare a final report in 25 copies by May 30, 1984.

MINUTES OF MEETING

Location: Place Vincent Massey, Hull, Quebec.

Date: March 14, 1984.

Time: 10:00 a.m.

Present:

Mr. Art Stelzig	EPS	Mr. Hap Lafferty	Monenco
Mr. Joe Labuda	EPS	Mr. Alan O'Brien	Monenco
Mr. Vic Shantora	EPS	Mr. Greg Bourque	Esso
Mr. Fritz Landheer	DOE	Mr. Salil Ray	Gulf
Mr. Jack King	EMR		
Mr. Kim Smith	EMR		
Mr. Dave Black	EMR		

1. Introductory remarks by Vic Shantora and Art Stelzig reviewed the need for the study and the schedule for final submission to the Committee.

2. Monenco presented the approach to the study and reviewed the scope of work and assumptions made.

3. Industry representatives said that the main area of their concern was that the study would miss the mark with respect to the capital cost effect on the refining industry of changing emission standards. However, in view of the regional approach of the model and the study budget, the results would likely reflect the broad base numbers sought for discussion purposes.

   Various scenarios were discussed but the two areas of the study that were felt to be deficient were:

   Using RON as the only octane criteria for the study. It was felt that the R+M/2 specification should be reported.

   Cases under Investigation. Messrs. Bourque and Ray felt the cases under investigation did not accurately reflect the effect on the refining industry of changing emission standards.

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4. Other areas of concern were:

(a) The industry octane numbers (RON) being used for the study were questioned. Monenco replied that the numbers were derived from a survey of refinery operations and were fixed at one value for simplicity in the regional refinery approach to the study. It was agreed that for the purpose of the study, these numbers would be used.

(b) The installed reformer capacities used in the study were considered conservative because of the number of old units in Canada that could not be operated at higher severities. It was decided that industry would provide the capacities to be used in the study by Monday, March 19. Failing that, the study was to proceed on the original basis.

(c) Industry representatives questioned the approach of including hydrocracking capacity with catalytic cracking. Monenco are aware of the problem and are taking action to rectify it.

(d) The approach to capital costs was discussed. Monenco stated that once the additional process unit capacities were identified for each region, capital costs would be developed based on in-house expertise and data plus consultation with licensors and suppliers of major equipment.

5. Monenco were asked by EPS to amend the scope of the study as follows.

1. The following two cases to be studied for each region at the industry octane levels and the government octane levels.

Base:	1990	.29 g/L lead and 18 mg/L Mg	70% unleaded 30% leaded
Case:	1990	.29 g/L lead and 0 MMT	90% unleaded 10% leaded

(This gives a study total of 16 simulations.)

2. Octane criteria to include RON and R+M/2.

Monenco stated that the changes to scope would incur a penalty to the schedule of two weeks provided all outstanding information was received by Monday, March 19. Monenco confirmed that changes to the scope would not affect the final cost.

Messrs. Ray and Bourque will provide the following information by Monday, March 19:

1. Industry values for R+M/2.

2. Installed reformer capacities and limitations on operation.

AO'B/dm

COPY: All present
M.J. Rowsell
J. Scott

Environment Canada   Environnement Canada

CONTRACT FOR SERVICE OR WORK   CONTRAT POUR SERVICE OU TRAVAUX

Contractors Inc.,
Suite 400,
2 St. Claire Avenue East,
Toronto, Ontario
M4T 2J5
Attn: H. Lafferty

RECEIVED
JUN 19 1984
MANAGER
EASTERN DIVISION

CORRESPONDENCE AND INVOICES MUST SHOW THESE NUMBERS Numéros à indiquer sur lettres et factures	Contract No. Numéro du Contrat KE145-4-0162

RESP. CENTER Cent. de resp.	PROG. ACT. Prog./Act.	COST CODE Code du coût	AUTHORITY Autorité	LINE OBJECT Art. d'exéc.
1330	1330	00201	101	1160

GENERAL DESCRIPTION OF WORK OR SERVICE - Description général des travaux ou service

Identify cost of gasoline grade split change to refineries.

I/We hereby offer to supply the materials and perform the work or service referred to hereunder on the convenents and agreements contained hereunder on the attached general terms and conditions sheet.

Par les présentes j'offre (nous offrons) de fournir le matériel et d'exécuter les travaux ou les services mentionnés ci-dessous conformément aux stipulations indiquées aux termes et conditions ci-dessous.

DUTIES:

Provide a report which identifies the capital and operating costs to petroleum refineries as a result of a change in the gasoline grade split as identified in the attached Terms of Reference.

Environment Canada Environnement Canada

JF

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The cost petroleum industry associated with MMT removal and grade split changes of motor gasolines 23485