

ITEM	13
MANAGER'S REPORT NO.	11
COUNCIL MEETING	1980 02 11

RE: SHELL CANADA LIMITED REFINERY EXPANSION

Following is a report from the Director of Planning on a proposal by Shell Canada Limited to modernize and expand its facilities in Burnaby.

RECOMMENDATION:

1. THAT the report of the Director of Planning be received for information purposes.

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TO: MUNICIPAL MANAGER

1980 FEBRUARY 06

FROM: DIRECTOR OF PLANNING

SUBJECT: SHELL CANADA LIMITED REFINERY EXPANSION

RECOMMENDATION

THAT this report be received for information purposes.

REPORT

At the 1980 January 07 meeting of Council, a series of questions to Municipal staff was presented, pertaining to the current Shellburn Refinery modernization and expansion proposal and certain related atmospheric emission control topics.

The purpose of this report is to provide the answers to these questions, based on staff research and incorporating information supplied by the Air Quality Control section of the Greater Vancouver Regional District and refinery officials where specific technical information from these respective sources was required. At the request of the oil company, the written comments submitted by Shell Canada Limited in response to the questionnaire is attached as Attachment "C".

We trust that these responses provide the information required by Council.

Question 1

Does Shell Canada Limited Refinery Expansion adhere to the same regulations and standards that Chevron Canada Limited had to comply with in 1974 in respect to atmospheric emission controls?

Response

The recent application by Shell Canada Limited to the Director of Pollution Control for an air pollution permit regarding this refinery specifies the level of emission after modernization and expansion project completion. The Regional District staff advise us that the projected emission concentrations are equal to or better than the Level "A" Objectives set out in the "Report on Pollution Control Objectives for the Chemical and Petroleum Industries of British Columbia" and the limits imposed by the existing permit held by Chevron Canada Limited.

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Question 2

What are Level "A" standards for the Pollution Control Objectives for the chemical and petroleum industries of British Columbia?

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Response

The term "Level A Objectives" refers to those limits for specific pollutants set down in the "Report on Pollution Control Objectives for the Chemical and Petroleum Industries in British Columbia" issued by the B.C. Pollution Board on 1974 March 19. The specific numerical limits which are relevant to petroleum refineries are set down in Table I and Table VII of that report (attached as Attachment "A" for reference). It should be noted that these values are not regulatory standards, but rather are objectives or guidelines provided as policy advice to the Director of Pollution Control to assist him in establishing the individual permit requirements for a specific operation.

Question 3

What are the present San Francisco Bay Area Air Pollution Control District Standards?

Response

The Planning Department has copies of the literature containing the past standards of the Bay Area Air Pollution Control District; the following is a tabulation in summary form of the controlled contaminants and maximum permitted emission levels.

<u>PARAMETER (PER STACK)</u>	<u>BAAPCD STANDARD</u>
Particulates	0.150 gr/SCF
SO ₂	300 ppm
Hydrocarbons (calculated as Hexane)	50 ppm
NO _x	300 ppm

However, we have learned that the Bay Area regulations have recently been amended and are now in the process of being reprinted. A copy of the newly-amended standards has been requested, and is expected to be available for perusal within the next two weeks.

According to verbal advice by an official of the San Francisco Bay Area Air Quality Management District, while the application rules have been changed, the numerical values in the emission regulations have not been altered.

Moreover, officials of the GVRD (Air Quality Control) state that the standard of control represented by British Columbia's Level "A" Objectives exceed and are more stringent than the Bay Area standards.

Question 4

What are the National Air Quality Objectives and how are the three levels of air quality objectives (maximum acceptable, maximum desirable and maximum tolerable) defined for each major air contaminant?

Response

A summary of the National Air Quality Objectives dated 1978 March 30 and their definitions, is attached for reference as Attachment "B";

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these objectives are taken from the report entitled "Criteria for National Air Quality Objectives - Sulphur Dioxide, Suspended Particulates, Carbon Monoxide, Oxidants (Ozone) and Nitrogen Dioxide" prepared by the Subcommittee on Air Quality Objectives in 1976 November, and issued under authority of the Minister of Fisheries and the Environment. Additional explanatory material which will assist in understanding the nature of the various contaminants and their known effects on materials, vegetation, and animal life is contained in that report, which is on file and available in the Planning Department.

Question 5

Could staff prepare a summary of records of pollutants relative to Federal air quality objectives recorded in 1975, 1976, 1977, 1978 and 1979 at the Kensington and Confederation Park stations in relation to other stations in the Greater Vancouver Regional District?

Response

The Environmental Health Department has on file a copy of the 1978 report of the Greater Vancouver Regional District which contains summaries of the monitoring records for 1976, 1977, and 1978. It is noted that the records for the Confederation Park station do not cover all of 1976, as monitoring at this station did not commence until early 1977. The data from all stations for 1979 has not yet been compiled and summarized, and so we are unable to supply this part of the information. Due to the length of the document, 84 pages of technical information, we have not attached a copy to this report. Should members of Council desire to review this report we would request that they contact the Environmental Health Department.

GVRD staff, in a letter to the Medical Health Officer dated 1980 January 29, advise as follows:

"We have reviewed our monitoring records as per your request and note that the readings taken at the Kensington and Confederation Park stations are generally similar to the readings from our other stations. Moreover, with the exception of our Ozone measurements, it is also noted that the levels of measured contaminants at our stations are better than the Acceptable National Air Quality Objectives and, in virtually all cases, are also better than the Desirable Objectives or long-term goals for air quality".

Question 6

Is there going to be any extra control action included in the pollution permit for the Shell Refinery given the fact that maximum acceptable levels and maximum desirable levels for ozone (an oxidant linked with cardiac vascular disease) has been exceeded numerous times at the Kensington station during the last four years?

Response

The Regional District in the letter mentioned above advises as follows:

"With regard to Ozone levels in the Regional District, all stations have recorded levels in excess of both the Acceptable and Desirable limits, with the measurements at the Kensington and Confederation Park stations reflecting the typical mean measurement within the District. On the average, however, the Desirable Objective is exceeded less than 2% of the time and the Acceptable Objective, less than 0.5% of the time. For comparison this can be compared to the United States situation where

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the same Acceptable level is exceeded in 103 of the 105 urban areas with a population in excess of 200,000. The viability of this objective is now under question as the United States federal government has recently increased their objective for Ozone to 50% over the Canadian federal limit.

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There are no significant sources of Ozone in the Regional District and the measured levels of Ozone reflect the photochemical production of this compound from other primary pollutants. Mobile sources (aircraft, trains, automobiles, trucks, and buses) are the main cause of these other primary pollutants in the District and not oil refineries. Despite the minor role that the Shell Refinery plays in the generation of Ozone precursors in the District, it is noted, however, that the modernized refinery provides for significant controls in the area of hydrocarbons and nitrogen oxides. Further controls of these contaminants is not anticipated, at this time."

Question 7

What are the present emissions and in what quantities are they? Have these emissions been estimated by Greater Vancouver Regional District Officials or Shell Oil Officials?

Response

Regional staff advise that the best source of information on present levels is provided in the estimates furnished by Shell Canada Limited in its original application for a pollution permit for the existing refinery in April 1976. However, as Shell Canada points out, a refinery's emissions in actual operation will vary throughout the year in response to changing variables which include type of crude oil, market requirements for various end products, and availability of natural gas as a refinery fuel. In recognition of these variations, it is worthwhile to consider maximum and average values for the various contaminants.

The levels estimated by the refinery for their 1976 and current permit applications, in this context, are summarized below.

Parameter (Lbs./Hr.)	April 1976		Dec. 1979*	
	Maximum	Average	Maximum	Average
Sulphur Dioxide	892	318	272	172
Particulates	82.4	27.8	52.8	18.2
Carbon Monoxide	8600	7400	269	211
Hydrocarbons	580	400	100	100
Nitrogen Oxides	163	66.0	145	59

*Emission levels after completion of proposed project.

To assure compliance with the above values, the GVRD is reviewing Shell's designs for appropriate sampling facilities and will require, as a condition of the air emission permit issued to Shellburn, the implementation of an ongoing monitoring program. This program will dictate the frequency of tests, the standard methods, and the equipment to be used as well as requiring that the tests be carried out by an independent body at Shellburn's expense.

Question 8

Why are there differences in the information on present refinery emissions given by Shell Canada Limited in June 1976 compared to information provided in December 1979?

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Response

Shell Canada Limited's reply to this question is contained in their responses as attached (Attachment "C"). It is reproduced here for convenience.

"In April 1976 Shellburn applied to the GVRD as indicated in #7 above. In June 1976 Shellburn responded to the Director of Planning in relation to Council's question "What are Shellburn's present emissions?". We responded in a very literal sense. That is, emission levels were given that represented an actual, low sulphur intake, natural gas fired refinery operation. In reviewing our response we now conclude that confusion might have been avoided if we had responded using the April 1976 application data submitted to GVRD. To assess the effect of the proposed modernization/upgrading project, without introducing confusion it is necessary to compare the emission levels given in both the April 1976 and December 1979 GVRD permit application documents. These data show the following reductions:

SO₂ 46%; NO_x 11%, CO 97%; Particulates 35%; Hydrocarbons 75%."

Question 9

Is the interim stack used to dispose contaminants into the air that Shell constructed in 1978 going to be replaced by a higher stack after expansion?

Response

The new permanent stack that is proposed in the current program is to be the same height (150 feet) as the existing and approved interim stack. Shell advises that the stack design height has been determined by dispersion modelling techniques to ensure that the ground level effects of its emissions will satisfy the Federal Maximum Desirable Ambient Air Guidelines.

Question 10

Has there been a dispersion model for pollutants developed by Shell Canada Limited that takes into account meteorological considerations:

- a) Burrard Inlet Basin's tendency for inversions.
- b) The interaction of the plume with urban heat islands, topographical bluffs, vertical winds, or warm water bodies?

Response

As described at the refinery tour attended by some members of Council on 1980 January 09, Shell Canada Limited has retained Intera Environmental Consultants Limited of Calgary to develop a dispersion model for the Shellburn site, which takes into account the specific area topography and local meteorological factors. Shell's statement is that "the modelling techniques used by Intera are the most up-to-date ones available and are accepted by the major environmental control agencies in both Canada and the United States. In addition, Intera's expertise is recognized throughout North America. The model design addresses all the variables listed in Council's question number 10. Intera's model has been verified by actual ambient air quality analyses."

Question 11 and Question 12

What is the present capacity of the Shell Refinery in relationship to the different product lines? What is the future capacity in the different product lines after modernization?

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Response

Shell Canada Limited has supplied the following figures in reply to these questions. It should be noted that the figures reflect the capacity of the plant for these classes of products; we understand that considerable variation exists in the relative distribution of specific end products within each group of products, dependent on time-specific market demand, inventory, etc.

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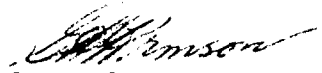
<u>Intake</u>	<u>Present</u> (B/D)	<u>Capacities</u>	<u>After Project</u> (B/D)
Crude Oils	23,500		23,500
Edmonton Product Mix	—		11,000
Total	<u>23,500</u>		<u>34,500</u>

Outturn

LPG, Gasolines, Jet Fuels, Stove, Diesel, Furnace Oils	19,740 (84%)	30,740 (89%)
Asphalt and Bunker Fuels	<u>3,760 (16%)</u>	<u>3,760 (11%)</u>
	<u>23,500 (100%)</u>	<u>34,500 (100%)</u>

Above data assumes continued availability of conventional crude oil for the existing portion of the refinery.

The foregoing is provided for the information of Council.


 G. H. Armson
 CHIEF PUBLIC HEALTH INSPECTOR


 A. L. Parr
 DIRECTOR OF PLANNING

GVH/DGS/ds
 attachments

TABLE I - OBJECTIVES FOR PETROLEUM REFINERY AIR EMISSIONS

<u>SULPHUR PLANT</u>	<u>LEVEL A</u>	<u>LEVEL B</u>	<u>LEVEL C</u>	<u>MONITORING</u>
Sulphur Recovery, % (a)	99 ⁺	99	94	Sulphur balance, continuous stack analyzer
Sulphur Dioxide, mg/M ³ (ppm)	830 (300)	(b)	(b)	Continuous stack analyzer
<u>OVERALL REFINERY</u>				
Sulphur Trioxide, mg/M ³ (gr/SCF)	25 (0.011)	50 (0.022)	100 (0.044)	Quarterly, collection and titration
<u>FCCU REGENERATOR</u>				
Particulate Solids, mg/M ³ (gr/SCF)	115 (0.050)	345 (0.150)	690 (0.300)	Quarterly, collection on filter, gravimetric
Hydrocarbons (as Hexane), mg/M ³ (ppm)	90 (25)	180 (50)	540 (150)	Quarterly, gas chromatograph
lbs/1000 bbls cracking feed	20	40	80	
Carbon Monoxide, mg/M ³ (ppm)	2400 (2000)	2400 (2000)	120,000 (100,000)	Quarterly, continuous, infrared or gas chromatography
Sulphur Dioxide, mg/M ³ (ppm)	830 (300)	1650 (600)	2,800 (1000)	
<u>STEAM PLANT</u>				
Particulate Solids, mg/M ³ (gr/SCF) (c)	150 (0.065)	200 (0.087)	300 (0.130)	Quarterly, collection on filter, gravimetric
Sulphur Dioxide, mg/M ³ (ppm)	830 (300)	1650 (600)	2800 (1000)	Calculated from fuel consumption and S content

(a) Total Sulphur recovered from refinery fuel gases

(b) Emission concentration objectives are not set for Levels B and C, but must be such as to maintain ambient air quality guidelines given in Table VII.

(c) Corrected to 12% carbon dioxide.

ATTACHMENT "A"

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TABLE VII - AMBIENT AIR QUALITY GUIDELINES FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

	<u>LEVEL A</u> (a)	<u>LEVEL B</u> (a)	<u>LEVEL C</u> (a)	<u>MONITORING</u>
<u>Sulphur Dioxide</u>				
1 hour max.	450 (0.17)	900 (0.34)	1300 (0.5)	Continuous
24 hour max.	160 (0.06)	260 (0.10)	360 (0.14)	Continuous
Annual arithmetic mean	25 (0.01)	50 (0.02)	80 (0.03)	Continuous
<u>Hydrogen Sulphide</u>				
1 hour max.	7.5 (0.005)	45 (0.030)	45 (0.030)	Continuous
24 hour max.	-	7.5 (0.005)	7.5 (0.005)	Continuous
<u>Suspended Particulates</u>				
24 hour max.	150	200	260	
Annual geometric mean	60	70	75	
<u>Dustfall</u>				
Residential, tons/sq. mi/mon	15	20	20	Monthly
Other, tons/sq. mi/mon	25	30	35	

(a) Concentrations given in micrograms per cubic metre (20°C, 760 mm Hg, dry basis), and in parentheses, ppm by volume except where noted.

ATTACHMENT "A"

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The maximum tolerable levels are intended to denote concentrations of air contaminants that lead to a substantial threat to public health.

SOURCE: Greater Vancouver Regional District publication entitled Ambient Air Quality Monitoring Data Report, 1978

The Maximum Acceptable Level is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being. It represents the realistic objective today for all parts of Canada. When this level is exceeded, control action by a regulatory agency is indicated.

Clarification. The maximum acceptable level is that which will most directly concern control agencies in their day-to-day operations. When this level is exceeded control action is indicated. This level is intended to provide *adequate* protection for all parts of the environment. It corresponds in concept to the U.S. Federal Secondary Air Quality Standards. It also corresponds in concept to the present Ontario Ambient Air Quality Criteria. In any federal pronouncements or publications on this topic the maximum acceptable level would be given the most prominence.

The Maximum Desirable Level defines the long-term goal for air quality and provides a basis for an antidegradation policy for the unpolluted parts of the country and for the continuing development of control technology.

Clarification. The maximum desirable level is based on a concept which is somewhat unique in the field of air pollution. It has, however, been applied in various ways in the radiation field, in drinking water standards, and by the World Health Organization for health standards. The concept of a long-term goal for air quality provides guidance for land-use planners and for the continuing development of control technology. At levels below the maximum desirable limit there would, in essence, be 'no effect' on any receptor. Persuasion and financial incentives would be the principal methods used to attain this objective.

SOURCE: Criteria for National Air Quality Objectives - Sulphur Dioxide, Suspended Particulates, Carbon Monoxide, Oxidants (Ozone) and Nitrogen Dioxide Prepared by the Subcommittee on Air Quality Objectives November 1976

ATTACHMENT "B"

CANADA
 AMBIENT AIR QUALITY OBJECTIVES*
 (as of January 19, 1978)

Contaminant		Maximum DESIRABLE level	Maximum ACCEPTABLE level	Maximum TOLERABLE level
Sulphur Dioxide	(Annual) (24 hrs.) (1 hour)	30 $\mu\text{g}/\text{m}^3$ (1.1 ppm) 150 $\mu\text{g}/\text{m}^3$ (6 ppm) 450 $\mu\text{g}/\text{m}^3$ (17 ppm)	60 $\mu\text{g}/\text{m}^3$ (2.3 ppm) 300 $\mu\text{g}/\text{m}^3$ (11 ppm) 900 $\mu\text{g}/\text{m}^3$ (34 ppm)	800 $\mu\text{g}/\text{m}^3$ (31 ppm)
Suspended Particulate Matter	(Annual) (24 hrs.)	60 $\mu\text{g}/\text{m}^3$	70 $\mu\text{g}/\text{m}^3$ 120 $\mu\text{g}/\text{m}^3$	400 $\mu\text{g}/\text{m}^3$
Carbon Monoxide	(8 hrs.) (1 hour)	6 mg/m^3 (5 ppm) 15 mg/m^3 (13 ppm)	15 mg/m^3 (13 ppm) 35 mg/m^3 (31 ppm)	20 mg/m^3 (17 ppm)
Oxidants (Ozone)	(Annual) (24 hrs.) (1 hour)	30 $\mu\text{g}/\text{m}^3$ (2 ppm) 100 $\mu\text{g}/\text{m}^3$ (5 ppm)	30 $\mu\text{g}/\text{m}^3$ (1.5 ppm) 50 $\mu\text{g}/\text{m}^3$ (3 ppm) 160 $\mu\text{g}/\text{m}^3$ (8 ppm)	300 $\mu\text{g}/\text{m}^3$ (15 ppm)
Nitrogen Dioxide	(Annual) (24 hrs.) (1 hour)	60 $\mu\text{g}/\text{m}^3$ (3.2 ppm)	100 $\mu\text{g}/\text{m}^3$ (5.3 ppm) 200 $\mu\text{g}/\text{m}^3$ (11 ppm) 400 $\mu\text{g}/\text{m}^3$ (21 ppm)	300 $\mu\text{g}/\text{m}^3$ (16 ppm) 1 000 $\mu\text{g}/\text{m}^3$ (53 ppm)
Hydrogen** Fluoride	(70 days) (30 days) (7 days) (24 hrs.)	.20 $\mu\text{g}/\text{m}^3$ (0.2 ppb) .40 $\mu\text{g}/\text{m}^3$ (0.5 ppb)	.20 $\mu\text{g}/\text{m}^3$ (0.2 ppb) .35 $\mu\text{g}/\text{m}^3$ (0.4 ppb) .55 $\mu\text{g}/\text{m}^3$ (0.7 ppb) .85 $\mu\text{g}/\text{m}^3$ (1.0 ppb)	
Hydrogen** Sulphide	(24 hrs.) (1 hour)	1 $\mu\text{g}/\text{m}^3$ (0.7 ppb)	5 $\mu\text{g}/\text{m}^3$ (3.6 ppb) 15 $\mu\text{g}/\text{m}^3$ (10.8 ppb)	
SO ₂ times** Particulate	(24 hrs.)			125 000 ($\mu\text{g}/\text{m}^3$) ²

* Conditions of 25°C (77°F) and 1013.2 mb (760 mmHg) are used as basis for conversion from $\mu\text{g}/\text{m}^3$ to ppm, pphm, and ppb.
 ** Proposed.

1978-03-30

Pollution Data Analysis Division
 Air Pollution Control Directorate

ATTACHMENT "B"

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SHELLBURN REFINERY
RESPONSES TO COUNCIL QUESTIONS OF
JANUARY 7, 1980

1. The Shellburn Modernization/Upgrading proposal will ensure that the refinery, after project completion, will meet (or be lower than) Level A allowable emission objectives. Further, after project completion, emission concentrations, for each contaminant will meet those levels set down in the Chevron Canada Limited permit issued on August 24/74.
2. Level A objectives are set down in Tables I, II, III, IV, V, VI, VII, VIII and IX of a "Report on Pollution Control Objectives for the Chemical and Petroleum Industries of British Columbia" issued by the B.C. Pollution Control Board March 19/74.
3. We are not in a position to comment on the San Fransico Bay Area Air Pollution Control District Standards.
4. The National Air Quality Objectives and their definitions are set down in a report called "Criteria for National Air Quality Objectives - Sulphur dioxide, Suspended Particulates, Carbon Monoxide, Oxidants (Ozone) and Nitrogen Dioxide" issued by the Federal Minister of Fisheries and the Environment in November 1976.
5. Data relative to ambient air quality at Kensington Park and Confederation Park are tabulated in annual "Ambient Air Quality Monitoring Data Reports" issued by the GVRD.
6. Petroleum refineries do not emit Ozone nor are they viewed as the main source of Ozone precursors. Therefore, the additional controls suggested are inappropriate.
7. Shellburn's emissions vary throughout the year depending on:
 - crude oil types and availability.
 - market requirements for various products.
 - availability of natural gas as a fuel.

Therefore, when discussing emissions, to avoid confusion, one has to consider the maximum and average values instead of the present actual values at any given point in time. In this context Shellburn has applied to the GVRD as follows:

Parameter (Lbs./Hr.)	April 1976		Dec. 1979*	
	Maximum	Average	Maximum	Average
Sulphur Dioxide	892	318	272	172
Particulates	82.4	27.8	52.8	18.2
Carbon Monoxide	8600	7400	269	211
Hydrocarbons	580	400	100	100
Nitrogen Oxides	163	66.0	145	59

*Emission levels after completion of proposed project.

8. In April 1976 Shellburn applied to the GVRD as indicated in #7 above. In June 1976 Shellburn responded to the Director of Planning in relation to Council's question "What are Shellburn's present emissions?" We responded in a very literal sense. That is, emission levels were given that represented an actual, low sulphur intake, natural gas fired refinery operation. In reviewing our response we now conclude that confusion might have been avoided if we had responded using the April 1976 application data submitted to GVRD. To assess the effect of the proposed modernization/upgrading project, without introducing confusion it is necessary to compare the emission levels given in both the April 1976 and December 1979 GVRD permit application documents. These data show the following reductions:

- SO₂ 46%; NO_x 11%; CO 97%; Particulates 35%; Hydrocarbons 75%

9. The permanent stack to be constructed for the Boiler House and Sulphur Plant will be the same height as the existing interim one (i.e. 150 ft.). The height of the new stack has been determined by modern dispersion modelling techniques to insure that the effects of its emissions at ground level will be less than the Federal Maximum Desirable Ambient Air Guidelines.

10. Shell Canada has retained Intera Environmental Consultants Ltd. of Calgary to develop a dispersion model that is site specific to Shellburn in terms of topography and meteorology. The modelling techniques used by Intera are the most up-to-date ones available and are accepted by the major environmental control agencies in both Canada and the United States. In addition, Intera's expertise is recognized throughout North America. The model design addresses all the variables listed in Council's question #10. Intera's model has been verified by actual ambient air quality analyzes.
11. The following data is presented in answer to both questions.
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<u>Intake</u>	<u>Capacities</u>	
	<u>Present</u> (B/D)	<u>After Project</u> (B/D)
Crude Oils	23,500	23,500
Edmonton Product Mix	-	11,000
Total	<u>23,500</u>	<u>34,500</u>
 <u>Outturn</u>		
LPG, Gasolines, Jet Fuels, Stove, Diesel, Furnace Oils	19,740 (84%)	30,740 (89%)
Asphalt & Bunker Fuels	<u>3,760 (16%)</u>	<u>3,760 (11%)</u>
Total	<u>23,500 (100%)</u>	<u>34,500 (100%)</u>

Above data assumes continued availability of conventional crude oil for the existing portion of the refinery.

