A File Report

The Properties, Processing & Pollution Control of MTBE

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Table of Contents

1 Introduction

Ecofuel is proposing to install a 700,000 tonnes per year MTBE plant on a site provided by the Prince Rupert Port Corporation on South Kaien Island, British Columbia. Before committing funds for a $5 million feasibility study, Ecofuel requested confirmation from B.C. Environment that the technology which they intended to use for this project, would be environmentally acceptable in the province.

This brief report attempts to collect relevant information regarding the process technology as well as pollution control status for this production proposal. With the operation of the first MTBE plant in Alberta, technical staff from our Prairie & Northern Regional office supplied some process and pollution control technical knowledge gained from site visits to an Alberta plant. By combining the collected information in both offices, this brief report will form the basis of reviewing water and air pollution control for this production process.

2 MTBE the Chemical Compound

The exact chemical terminology for MTBE is methyl tertiary-butyl ether. It is an aliphatic ether with structural formula CH3OC(CH3)3, with CAS Registry Number 1634-04-4. It is a volatile, clear, flammable, colourless liquid at room temperature, and has a terpene-like odour. MTBE is miscible in gasoline and soluble in water, alcohol, and ether. It has a relatively high vapour pressure (3.35×10^4 Pa at 25 C), a high water solubility (4.8×10^4 mg/L at 20 C) and a low log octanol/water partition coefficient (1.3).

MTBE is generally produced by reacting isobutylene with methanol over an acid catalyst. Common analytical methods used to quantify MTBE include gas chromatography with mass spectromatry, flame ionization, or an oxygen specific response flame ionization detector.

Physical Properties

solubility:	Moderately soluble in water, 4.8 g/100g
appearance:	clear liquid
boiling point:	55 C at 760 mm Hg
melting point:	-110 C
evaporation:	NDA (No Data Available)
specific gravity:	0.74 at 20 C
vapour pressure:	245 mm Hg at 25 C
percent volatile (Vol. %):	NA (Not Available)
vapour density (air=1):	3.0
viscosity:	NDA (No Data Available)

Product Toxicology Data

eye irritation:	slight irritation clearing in 7 days or less
skin irritation:	no irritation at 72 hours
dermal toxicity:	the dermal LD50 in rabbits is greater than 10.0 g/kg
respiratory/inhalation:	the 4-hour inhalation LC50 in rats is 23,500 ppm
ingestion:	the oral LDF50 in rats is 2.8 g/kg

Exposure Standards, Limits and Composition

(1) MTBE is the fifth of 44 substances originally included on the CEPA (Canadian Environmental Protection Act) Priority Substances List (PSL). An assessment report released on February 1, 1993 by Environment Canada concluded that MTBE is not toxic, as defined under section 11 of the CEPA.

(2) All the components of this material are on the Toxic Substance

Control Act Chemical Substance Inventory.

(3) The American Industrial Hygiene Association's recommended Workplace Exposure Level (WEL) for 8-hour TWA is 100 ppm.

(4) U.S. CAS1634044, a toxic chemical substance subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Effect on the Environment

The concentration of MTBE in surface water predicted under a worst-case scenario (6 ng/L) is $1.12x10^8$ times lower than the 96-hour LC50 for the fathead minow (672 mg/L).

The highest predicted airborne concentration of MTBE, 75 ng/m3, is 3.9x107 times lower than the lowest reported effect level in a subchronic inhalation study in rats (2915 mg/m3).

Given the low predicted concentrations of MTBE in the environment and the lack of bioaccumulation, concentrations in food for wildlife are expected to be at least several orders of magnitude lower than those causing acute toxicity. In addition, given the low toxicity of MTBE to aquatic organisms, wildlife food sources are not expected to be at risk due to environmental concentrations of MTBE.

Therefore, on the basis of available data, MTBE is not considered to be "toxic" as defined under Paragraph 11 (c) of CEPA.

Effect on the Environment on which Human Life Depends

Due to its low rate of release and its short persistence in the atmosphere, MTBE is not expected to be involved in global warming or in the depletion of stratospheric ozone. The contribution of MTBE to the formation of ozone in the lower atmosphere is believed to be relatively small because of its low predicted atmospheric concentrations.

Effect on Human Health

It is difficult to estimate exposure of the Canadian population owing to the lack of data on concentrations of MTBE in ambient and indoor air, drinking water, or food. Based on fugacity modelling and limited information on concentrations in shellfish, it is estimated that the average daily intake of MTBE for the age group of the Canadian population most exposed on a body weight basis (i.e., 5-to 11-year-olds) is 0.67 ng.(kg b.w..day). Although not based on actual data on concentrations in air, water, or food, this estimated average daily intake is considerably less (by approximately 45 000 times) than the Tolerable Daily Intake derived.

The U.S. Environmental Protection Agency (EPA) recently issued a report on the health effects of MTBE. Its study, coordinated with the Centres for Disease Control (Atlanta, Ga.) and fuel manufacturers, was initiated after studies in Alaska and New Jersey, linked use of fuel blended with MTBE to such health symptoms as headaches, nausea and dizziness. EPA concluded that the additive poses no health threat to humans in almost all situations, but plans to conduct further research on the effects of exposure to MTBE under extreme cold conditions.

Production and Use

The first plant to produce MTBE in Canada began operating in 1992 in an industrialized area of Edmonton, Alberta. The plant is to produce an estimated 530,000 tonnes of MTBE per year or 12,500 BPCD, most of which is intended for export to the United States.

From 1986 to 1990, Canada imported between 7000 and 25,000 tonnes/year of MTBE for the purpose of blending as an octane enhancer in unleaded gasoline. Most of the imports entered Ontario and Quebec, and a smaller amount went to Alberta and British Columbia. Assuming that Canada's overall consumption of gasoline will not change appreciably over the next few years, it is estimated that MTBE-blended gasoline will continue to account for approximately 2% of the total unleaded gasoline in Canada. The average concentrations of MTBE in these blended gasoline stocks range from 6.5 to 9.6% by volume.

With the introduction of reformulated gasoline in the US and may be later

in Canada to meet tighter emission standards and reduce benzene/aromatic uses, the use of oxygenates is expected to increase. At present time, MTBE is one of the better choices in price and in oxygen contents.

Antiknock Performance

The major attraction of oxygenates to the refiner is their octane blending value. Each volume percent of an oxygenate added to a typical unleaded gasoline with 87 (R+M)/2 octane increases blend octane between 0.1 and 0.3 numbers. The incremental gains decreases as gasoline composition changes and the octane increases. Methanol and ethanol are about equal as octane boosters and offer the highest blending octane values of the EPA-allowed oxygenates. Due to the concentration limits established by EPA, the largest increases in octane in the US are obtainable with 10% of volume ethanol or with 11% by volume MTBE.

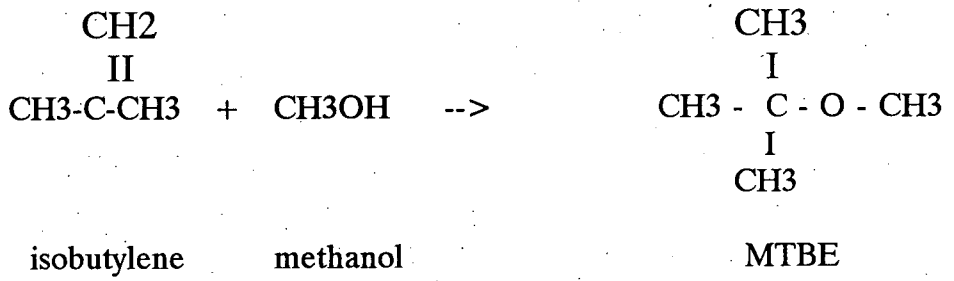
Octane Boost for Selected Oxygenates

Oxygenate	Concentration Limit (Volume %)	Basis of Limit	Typical Blending Value (R+M)/2	Boost at Concentration Limit
Ethanol	10.0	Gasohol Waiver (79)	113	2.6
Methanol	0.3	Substantially Similar	116	0.1
Methanol/ GTBA	9.4	ARCO Waiver	107	1.9
MTBE	11.0	Sustantially Similar	110	2.2

3 Selected Processes of Production

Arco Technology Inc.

The reaction between methanol and isobutylene occurs in the liquid phase when passed through a fixed bed of ion exchange resin-type catalyst. The reaction is very selective since methanol reacts preferentially with the tertiary olefin. The reaction is depicted as follows:



Isobutylene contained in a mixed C4 stream and methanol are fed at a controlled ratio into the reactor. Since the reaction is exothermic, the reactor is provided with cooling for temperature control. The methanol to isobutylene ratio and the reactor temperature are selected to minimize the side reaction that forms diisobutylene. Water in the feeds should be minimized to reduce tertiary butyl alcohol (TBA) formation. Nevertheless, these byproducts are not detrimental to product quality because they are not high-octane gasoline components.

The reactor effluent is sent to a debutanizer tower where the C4s and unreacted methanol are separated from the MTBE product. The bottoms from this tower is high purity MTBE requiring no further purification. The overhead from the debutanizer is normal butylenes containing some methanol.

Methanol is readily separated from the normal butylene so that methanol

content is less than 10 ppm. Recovered methanol is recycled to the reactor.

Isobutylene conversion can range from 90% to above 99%, according to design conditions. MTBE purity is 99+% and contains small quantities of diisobutylene and TBA.

A 200,000 tpy MTBE plant started up in December 1979, for Arco Chemical Co. at Channelview, Texas.

New Arco Process

Methanol or ethanol and hydrocarbon streams containing tertiary olefins such as isobutylene and isoamylene. The process can be designed to handle feedstocks form steam crackers, catalytic crackers, isobutane dehydrogenation, n-butene or amylene isomerization.

The hydrocarbon stream is preheated to remove trace contaminants, It is then combined with the methanol or ethanol and reacted over the ion exchange resin in two fixed-bed adiabatic reactors. The reactive olefin concentrations that can be handled range from 8% to 95%; designs have been licensed over this full range. The temperature of both reactors is automatically controlled to optimize catalyst life and olefin conversions. Alcohol use is minimized by a preprogrammed computer control feed system that has evolved through 15 years of plant operation.

MTBE, TAME or other ethers are separated form the nonreactive hydrocarbons and unreacted alcohol in a distillation column. MTBE is recovered at high purity, from the bottom of the column. The excess alcohol is removed in the overhead stream. It is recovered in an optimized water wash system consisting of a small extractor, alcohol stripper and is recycled.

The process has been optimized through many design upgrades and offers the most reliable and flexible ethers process in the industry. ARCO Chemical is the world's largest producer of MTBE and ETBE with four plants in the U.S. and two plants in Europe and 27 additional licensed units worldwide, resulting in a total ethers capacity of over 140,000 bpsd.

Phillip Petroleum Co

Isobutene concentrate with fresh and recycled methanol are fed to reactors containing an ion exchange resin. The isobutene concentrate can be mixed olefins from an FCCU or steam cracker operation, as well as on-purpose isobutene form an isobutane dehydrogenation process. The reactor operates in the liquid phase under mild temperature and pressure. High-purity MTBE (99 wt %) is removed as a bottom product form the MTBE fractionator. Overhead principally nonreactive linear butenes, isobutane, normal butane and unreacted methanol, flows to a methanol extractor where excess methanol is recovered and recycled. A methanol fractionator ensures high recovery. All unreacted methanol is fractionated away from the MTBE bottoms, saving substantial steam. Process uniquely provides residual butene stream suitable without further treatment to charge directly to an alkylation or polymerization unit.

Phillips etherification process has achieved high conversion rates of isobutene and reactive isoamylene (99+%, respectively) for easy conversion to MTBE and TAME. Both process versions, standard low conversion process and the newer high conversion process, use the same liquid-phase fixed-bed reactors.

There are seven licensed plants, plus an installation at Phillips refinery, Sweeney, Texas.

CDTECH Process

The C4 feed and methanol is fed to the boiling point reactor. This is a fixed-bed downflow adiabatic reactor, in which the liquid is heated to its boiling point by the heat of reaction, and limited vaporization occurs. The system pressure is controlled by setting the boiling point of the reactor contents and hence, the maximum temperature. This provides far superior control than systems that transfer heat by convection of conduction. The equilibrium -converted reactor effluent flows to the CD reaction where the reaction is continued, and concurrently MTBE is separated from unreacted C4s as the bottom product. The CD reaction column eliminates a second fixed bed reactor to provide isobutene conversions up to 99.8%. The heat input to the column is reduced due to the heat produced in the reaction zone. With time the boiling point reactor catalyst loses activity. As the

boiling point reactor conversion decreases, the CD reaction column recovers lost conversion so that high overall conversion is sustained. CD column overhead is washed in an extraction column with countercurrent water stream to extract methanol recovery column for recovery of both methanol and water for recycle.

Feed from an ethylene unit could require a feed water wash step. A well-designed feed water wash to remove catalyst poisons, if needed, is essential for economic catalyst life and MTBE production.

The information is for 99% isobutylene conversion. For ETBE, the conversion is slightly less than for MTBE. For TAME and TAEE, isoamylene conversions of 95+% are achievable. Twenty-three units are in operation using catalytic distillation to produce MTBE or TAME. An additional 12 units are expected to come on-line in 1993. More than 80 ether projects have been awarded to CDTECH since the first unit came onstream in 1981.

UOP Ethermax Process

The Ethermax process combines isobutylene and methanol to form MTBE; it combines isobutylene and ethanol to form ETBE; or it combines reactive isoamylenes and methanol to form TAME. The majority of the etherification reaction is carried out in a simple fixed-bed adiabatic reactor. The adiabatic rector effluent feeds to RWD reaction with distillation column, where the ethers are separated from unreacted feed components. The catalytic section of the RWD column used the Koch Engineering Costumes packing, a highly efficient catalyst containing structured packing, to overcome reaction equilibrium constraints by continuously fractionating the ether product from untreated feed components. The U.S. Gulf Coast unit producing 2000 bpsd of MTBE from an FCC C4 feed. Sixteen Huls MTBE process units are in operation, and an additional six are in design or construction.

4 The Ecofuel Process

The Ecofuel process is also called Snamprogetti/Yarsintez FBD4 process. The process contains two process units.

(a) Isobutane Dehydrogenation
(b) MTBE Synthesis

Dehydrogenation

Isobutane is fed to the dehydrogenation unit to convert isobutane to isobutylene in a continuous operation. The unit utilizes a fluidized bed reactor system using alumina support chromium catalyst made up of reactor and regenerator sections.

The catalyst continuously flows from the reactor to the regenerator in a closed loop. In the regenerator section, coke deposited on the catalyst is burned to regenerate the catalyst. The resulting flue gases are filtered to reduce the particulate content to 0.045 mg/m3 before being released to the atmosphere.

The product stream from the reactor is compressed (after heat recovery and condensate separation), dehydrated, and then routed to a product separator. Here the light components (basically hydrogen) are separated from the effluent by means of a pressure swing absorption (PSA) unit.

The product effluent is further stabilized in a depropanizer column (where the fuel gas stream containing light components is rejected overhead) and then sent to an intermediate isobutylene product storage.

MTBE Synthesis

The stabilized dehydrogenation reaction product isobutylene is fed to the MTBE synthesis unit where the etherification reaction with methanol occurs. Produced MTBE is separated from the unreacted materials. Any

unreacted materials are washed with water in an extraction column in order to recover methanol before being recycled to the dehydrogenation section of the facility. The MTBE product in turn is sent to appropriate storage facilities.

Pollution Control

This design will consume raw materials in the form of fuel, water and catalyst, and will produce MTBE and a small amount of emissions. Emissions of interest are from the Regenerator Exhaust stage and are contained in the particulate portion of the discharge. Expected limits are:

Source and Contaminants	guaranteed concentration mg/m3	ug/m3	kg/y	expected concentration mg/m3	kg/y
stack emission					
PM10	2.47	--	1290	0.045	23.48
Cr3 (Cr2O3)	--	--	360	--	6.4
Cr3	--	--	246	--	4.4
Cr6 (K2Cr4)	--	--	288	--	0.53
Cr6	--	--	8	--	0.14
ambient					
Cr3 (Cr2O3)	0.06				
Cr6 (K2CrO4)	--				
Cr6	0.001				

The design will be a closed loop facility, that is, process liquid effluent will not be discharged to the environment. The types of wastewater effluent that will be generated at the facility include sanitary sewage, surface water run-off and boiler blowdown. The disposal of these wastewaters will meet applicable provincial and federal legislative requirements.

5 MTBE Plant in Alberta

Plant Site

In early 1992, Alberta Envirofuels Inc. began operation of Canada's first MTBE manufacturing facility. This plant came on stream at a time when global demand was increasing for MTBE as an octane-enhancing, environmentally progressive blending component for gasoline.

This plant is located just east of Edmonton in the County of Strathcona. Alberta's rich fields of oil and gas provided the raw materials for the feedstocks for MTBE production

Alberta Envirofuels is an equal joint venture partnership between Neste Canada Inc. and Chevron Standard Limited. Neste Canada is a wholly-owned subsidiary of Neste Oy, the national oil and chemical company of Finland. Chevron Standard is a wholly-owned subsidiary of Chevron Corporation of San Francisco, California. Operator of the plant is Chevron Canada Limited, another subsidiary of Chevron Standard.

Cost to build	$360 Million
Production capacity	530,000 tonnes/year
Employee	100
Markets	Western Canada, U.S., and international
Feedstocks	methanol from natural gas field butane

Process

Field butane entres the first column, called the DIB (deisobutanizer) column, where n-butane is separated. The n-butane is heated, then sent

through the isomerization unit, to produce isobutane, which is converted to isobutylene in the dehydrogenation (Oleflex) unit. Isobutylene and methanol are reacted to produce MTBE. The methanol is produced from natural gas at a nearby petrochemical plant and transported by pipeline to Alberta Envirofuels.

Alberta Licence

The Alberta Air Licence No. 91-AL-393 was issued on December 11, 1991 and was amended on July 28, 1993. Permit includes the operations of a deisobutanizer, an isomerization unit, a dehydrogenation unit, a MTBE synthesis unit, an oxygenate removal unit, a complete saturation unit and associated storage, utilities and administration facilities. The plant shall be operated that the emissions and concentrations in Column 2 of Schedule 1 do not exceed the corresponding limits set out in Column 3 of Schedule 1:

Schedule 1

Column 1 Source of Effluent Stream	Column 2 Regulated Air Contaminant in Effluent Stream	Column 3 Max. Rate of Emission or Concentration of Air Contaminant
Disobutanizer (DIB) Isomerization unit a. isomerization regenerant superheater stack	Oxides of Nitrogen (expressed as Equivalent NO2)	150 ppmv
	Total Hydrocarbons	20 ppmv
Dehydrogenation Unit a. reactor effluent drier regeneration heater stack	Oxide of Nitrogen (expressed as equivalent NO2)	150 ppmv
	Total Hydrocarbons	20 ppmv
b. reactor charge interheater No. 1 and 2 stack	Oxides of Nitrogen (equivalent NO2)	150 ppmv
c. continuous catalyst regeneration (CCR) offgas scrubber vent	Total Hydrocarbons	20 ppmv
	Chlorine & Hydrogen Chloride (combined)	100 ppmv
Oxygenate Removal Unit a. ORU regenerant superheater	Oxides of Nitrogen (equivalent NO2)	150 ppmv
	Total Hydrocarbons	20 ppmv
Utility Unit a. utility boiler stacks	Oxides of Nitrogen (equivalent NO2)	150 ppmv
	Total Hydrocarbons	20 ppmv

The Alberta Water Licence No. 91-WL-189 was issued on December 23, 1991 and was amended on June 30, 1993. Wastewater are allowed to discharge to municipal sewer to comply with discharge limit for the sewer by-law. Stormwater are allowed to discharge to surrounding watershed, if these limits are met:

Substance	MTBE Tank (mg/L)	Methanol Tank (mg/L)
COD	50	50
TSS	25	25
pH	6.5 - 9.0	6.5 - 9.0
O&G	no visible sheen	no visible sheen
methanol	--	5
MTBE	5	--

6 MTBE Plant in Texas

The Texas Air Control Board (TACB) issued a permit on November 19, 1991 for the operation of the MTBE Plant operated by Oxyfuel Corporation. This plant is located at Vidor, Orange County, Texas. This permit prescribes emission limits for NOx, CO, SO2, CH4, VOC, and PM10, from regenerator, steam boiler, flare, isobutane dehydrogenation, MTBE fugitives, and storage tanks. Besides PM10, there is no mention of chromium emissions.

The agency technical review indicated that:

Oxyfuel proposes to construct a grass-roots MTBE plant near Vidor on land leased from Texas Eastern. The process will utilize a isobutane to isobutylene fluid bed reactor with chromium catalyst. The reaction of isobutylene and methanol to produce MTBE will be by fixed bed reactor followed by fractionation. The light ends by-product (mostly hydrogen) will be sold via pipeline. The heavier by-product will be recycled in the process. Oxyfuel will use adjacent Texas Eastern for final product storage and loading as well as wastewater treatment. Texas Eastern has been notified by TACB in the deficiency letter for renewal of Texas Eastern's R-4036A that MTBE loading may require vapour recovery. The permit fee was $50,000.

Oxyfuel has done a number of thing to apply BACT (Best Available Control Technology). The fluid bed reactor will have internal cyclones followed by an external bag house with spare bag filter. In addition there will be a dual stage scrubbing system with sodium thioslulfate as the scrubbing medium for use in case the bag house is off line for maintenance or process reasons. Sodium thiosulfate converts hexavalent chromium to trivalent. The fluid bed is similar to a FCCU but operates at a lower temperature and with less pressure and pressure drop. CO production is limited because the catalyst acts as a catalyst for CO oxidation. Oxyfuel is asking that this be accepted as a Testing of a similar unit in Russia showed that CO emissions would be less than 35 ppmv in the exhaust gas.

Also, BACT for the MTBE storage tanks will be dual seal IFR (Internal

Floating Roof). A package boiler will have low NOx burners with flue gas recirculation. The NOx emissions rate will be permitted at 0.06 lb NOx/MMBTU. The catalyst transfer vent will exit through the bag filter. This filter with the backup in it should give 99.99% plus removal efficiency of particulate matter. A program will be used to control fugitive VOC emissions and all VOC relief valves will relieve to the flare.

Total emissions form the facility are:

VOC	53.44 tpy
NOx	90.91 tpy
CO	94.64 tpy
PM10	5.85 tpy
SO2	11.29 tpy

Both the regeneration exhaust stack and the boiler stack will be tested. To confirm that the CO emissions from the regenerator do not increase above permitted levels a CEM (Continuous Emission Monitoring) will be required.

Emissions of MTBE were modeled using ISC (Industrial Sources Complex) models. All MTBE sources were modeled as if co-located. This gave 689.8 ug/m3 as a maximum GLC (Ground Level Concentration). EES approved this level. CO and NOx were subjected to full modelling. CO did not exceed the significance level and NOx was below the NAAQS (National Ambient Air Quality Standards) when all area sources were included.

NSPS (New Source Performance Standards) Subpart Kb, VV and NNN apply as the two MTBE tanks are 10,000 bbl. each and there is fractionation of the recycled methanol and isobutylene. There are no NESHAP (National Emission Standard for Hazardous Air Pollutants) chemicals used. PSD (Prevention of Significant Deterioration) and non-attainment do not apply as the total emissions of each pollutant is below 100 tpy.

BACT is applied.

7 Reference

(1) Canadian Environmental Protection Act, Priority Substances List Assessment Report No. 5: Methyl tertiary-butyl Ether, Government of Canada, Environment Canada, Health and Welfare Canada, 1992

(2) Hydrocarbon Processing, March, 1993 pp. 193-195

(3) Ecofuel's MTBE Project, Prince Rupert, B.C., Technical Overview, April, 1993

(4) Alberta Environment, Licence to Operate or Use 91-AL-393A, July, 1993

(5) Alberta Environment, Licence to Operate or Use 91-WL-189A, June, 1993

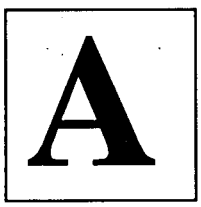
(6) New/Modified Source Technical Review, TNRCC, Texas

(7) Chemical Engineering, January, 1994, pp 61-63 and p.46.

(8) Alberta Envirofuels Inc. brochure "Canada's First Manufacturing Facility".

(9) Oil Week, Aug. 17, 92, pp.13-23.

(10) Ahcohols and Ethers, API Publication 4261, 2nd Edition, 1988



Appendix A: Alberta Plant Licences

Alberta

ENVIRONMENT

LICENCE TO OPERATE OR USE

LICENSE NO. 91-AL-393A

PERMIT NO. 93-SA-473

FILE NO. ..

TO Alberta Envirofuels Inc.
P.O. Bag 2424
EDMONTON, Alberta
T6J 4R3

Pursuant to section 4 of the Clean Air Act, Revised Statutes of Alberta 1980, a licence to operate or use

the Edmonton chemical (MTBE) manufacturing plant

is hereby issued subject to the terms, conditions and requirements attached hereto.

Edmonton July 28, 1993

for Director of Standards and Approvals

LICENCE No.
91-AL-393A (93)

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

Department of Environmental Protection Clean Air Act Licence to Operate or Use No. 91-AL-393 is hereby amended as follows:

1 Section 11 is repealed and the following substituted:

11 The licensee shall conduct ambient monitoring for concentrations of MTBE, methanol, butane and isobutylene at a frequency of twice a year at the two control sites, and a frequency of four times a year at six other sites, at the locations and using analytical methodology acceptable to the Director of Standards and Approvals.

2 Section 9 is amended by:

a) amending subsection (a) by adding after "once in 1992" the following:

"and once in 1995 before the expiry of this licence,";

b) amending subsection (b) by striking out "per calendar year", and, adding "and once in 1995 before the expiry of this licence," after "1992"; and

c) repealing subsection (c).

DATED July 28, 1993

J.C. LACK, DIRECTOR

Alberta

ENVIRONMENT

LICENCE TO OPERATE OR USE

LICENSE NO. 91-AL-393

PERMIT NO. .....

FILE NO. 91-SA-587

TO .....Alberta Envirofuels Inc.
9511 - 17 Street
EDMONTON, Alberta
T8A 2A7

Pursuant to section 4 of the Clean Air Act, Revised Statutes of Alberta 1980, a licence to operate or use

the Edmonton chemical (MTBE) manufacturing plant

is hereby issued subject to the terms, conditions and requirements attached hereto.

Edmonton ..... December 11 ..., 19 91

Director of Standards and Approvals

LICENCE NO.
91-AL-393

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

DEFINITIONS

1 In this licence

(a) "air contaminant" has the same meaning that it has in the Clean Air Act;

(b) "application" means all submissions by the licensee to the Director of Standards and Approvals for this licence or any amendments thereto under the Clean Air Act;

(c) "effluent stream" has the same meaning that it has in the Clean Air (Maximum Levels) Regulation;

(d) "fugitive emissions" means air contaminant emissions to the atmosphere originating from a plant source other than a flue or stack but does not include sources which may occur due to breaks or ruptures in process equipment;

(e) "licensee" means Alberta Envirofuels Inc.; and

(f) "plant" means the lands known and described as the Southwest Quarter of Section 32, Township 52, Range 23, West of the 4th Meridian, and all buildings, structures, process and pollution abatement equipment and storage facilities used in and for the manufacturing of chemical products (Methyl Tertiary Butyl Ether), located thereon.

2 The nominal capacity of the plant is 500,000 tonnes per year of methyl tertiary butyl ether (MTBE).

3 The plant includes but is not limited to the chemical process units generally described as

(a) a deisobutanizer (DIB) isomerization unit,
(b) a dehydrogenation unit,
(c) a MTBE synthesis unit,
(d) an oxygenate removal unit (ORU) and complete saturation unit (CSU), and
(e) associated storage, utilities and administration facilities.

EMISSION AND OPERATING REQUIREMENTS

4 The plant shall be started up, shut down and operated such that the effluent streams emitted to the atmosphere shall be restricted to the following sources:

(a) the DIB isomerization unit regenerant superheater stack,

(b) the dehydrogenation unit reactor effluent drier regeneration heater stack,

LICENCE NO.
91-AL-393

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(c) the dehydrogenation unit reactor charge interheater No. 1 and 2 stack,

(d) the ORU regenerant superheater stack,

(e) the dehydrogenation unit continuous catalyst regeneration (CCR) offgas scrubber vent,

(f) the two utility boiler exhaust stacks,

(g) the emergency flare stack,

(h) the compressor vents,

(i) the steam and nitrogen vents,

(j) the storage tank vents, and

(k) the building ventilation and laboratory hood vents.

5 The plant shall be operated such that for the effluent streams set out in Column 1 of Schedule 1, the emissions and concentrations of air contaminants in Column 2 of Schedule 1 do not exceed the corresponding limits set out in Column 3 of Schedule 1.

6 Except as expressly provided for by the Director of Standards and Approvals in writing, the licensee shall control fugitive emissions in accordance with section 18 of this licence.

7 The licensee shall immediately upon discovery of an emission in excess of a licence limit take steps to reduce the excessive emission.

8 The plant shall be operated such that

(a) for the flare system,

(i) all process safety valve discharges are vented to the flare system for combustion,

(ii) the flare stack shall be equipped with a suitable wind guard, continuously burning pilot lights and electric ignitors to ensure combustion of any gases released to the flare stack,

(iii) the maximum visible emissions do not exceed an opacity of 40% averaged over a period of six consecutive minutes during normal operations, except as provided in subclause (iv),

(iv) the maximum visible emissions may exceed an opacity of 40% for an aggregate period of not more than six minutes in any period of 60 consecutive minutes, for start-up or shutdown of plant processes,

LICENCE NO.
91-AL-393

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(b) the vent gases from the dehydrogenation/CCR reactor section are combusted in the dehydrogenation unit reactor charge interheater No. 1 and 2, and

(c) the offgas from the CCR reactor shall be treated in a wash tower scrubber before being emitted to the atmosphere.

MONITORING

9 In a manner approved or specified by the Director of Standards and Approvals:

(a) the two utility boiler stacks shall each be surveyed once in 1992 to determine:

(i) the concentration and mass flow rate of carbon monoxide, total hydrocarbons and oxides of nitrogen, and

(ii) the total effluent stream volume flow rate and temperature;

(b) the dehydrogenation unit reactor charge interheater No. 1 and 2 stack shall be surveyed once per calendar year beginning in 1992 to determine:

(i) the concentration and mass flow rate of carbon monoxide, total hydrocarbons and oxides of nitrogen, and

(ii) the total effluent stream volume flow rate and temperature; and

(c) the dehydrogenation unit CCR offgas scrubber vent shall be surveyed once per calendar year beginning in 1992, to determine the concentration and mass flow rate of chlorine, hydrogen chloride and total hydrocarbons.

10 Unless otherwise approved, all manual stack sampling facilities, manual compliance survey methods, and ambient monitoring methods shall comply with the applicable requirements described in the documents titled "Stack Sampling Code (SSC-1/76)", and "Methods Manual for Chemical Analysis of Atmospheric Pollutants" as amended from time to time and issued by the Department of the Environment.

11 The licensee shall

(a) submit to the Director of Standards and Approvals the details of the proposed ambient air quality monitoring programs for concentrations of total hydrocarbons, MTBE and other volatile organic compounds, by February 1, 1992, the proposal for the ambient air quality monitoring program shall include but not be limited to sampling locations, frequency, analytical methodology, quality assurance and quality control; and

LICENCE NO.
91-AL-393

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(b) conduct the ambient air quality monitoring program in a manner satisfactory to the Director of Standards and Approvals, commencing no later than April 1, 1992.

REPORTING

12 The licensee shall, in a manner satisfactory to the Director of Standards and Approvals, by December 31, 1993, conduct and submit a report on a comprehensive air emissions audit which will determine the total emissions of nitrogen oxides, carbon monoxide, total hydrocarbons, MTBE, chlorine and hydrogen chloride from all sources in the plant and fugitive hydrocarbon emissions from storage tanks and process equipment.

13 The licensee shall advise the Director of Pollution Control of all intended plant turnarounds and stack surveys no later than two weeks prior to the date of their respective commencements.

14 Source survey information collected in accordance with the requirements of this licence shall be tabulated and summarized in the form of a report in accordance with "Air Monitoring Directive" issued by the Department of the Environment and forwarded to the Director of Standards and Approvals by the end of the month following the month in which the measurements were made.

15 The licensee shall submit monthly reports on the results of the ambient air quality monitoring program to the Director of Standards and Approvals in a manner satisfactory to the Director.

16 An annual summary and evaluation report containing information related to the plant operation, the performance of air pollution control equipment and air contaminant emissions shall be submitted in a manner prescribed by the Director of Standards and Approvals.

GENERAL

17 Those portions of the plant equipped with pollution abatement facilities shall be operated such that:

(a) the abatement equipment is in effective operation when the associated process equipment is operational, and

(b) the proper operational procedures are followed to ensure efficient performance of the abatement equipment.

18 Save and except as expressly permitted by the terms and conditions of this licence, the licensee shall not emit an air contaminant or cause to be emitted an air contaminant that causes or may cause:

(a) the impairment, degradation, or alteration of the quality of natural resources;

LICENCE NO.
91-AL-393

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(b) material discomfort, harm or adversely affect the well-being or health of a person; or

(c) harm to property or to plant or animal life.

19 The mention of trade names, commercial products or named technology in this licence does not constitute an endorsement or recommendation by the Division of Standards and Approvals for general use.

20 This licence shall expire on December 1, 1995.

DATED December 11, 1991

J.C. LACK, DIRECTOR

SCHEDULE 1

COLUMN 1 SOURCE OF EFFLUENT STREAM	COLUMN 2 REGULATED AIR CONTAMINANT IN EFFLUENT STREAM	COLUMN 3 MAXIMUM RATE OF EMISSION OR CONCENTRATION OF AIR CONTAMINANT
Deisobutanizer (DIB) Isomerization Unit a. isomerization regenerant superheater stack	Oxides of nitrogen (expressed as equivalent NO_2) Total Hydrocarbons	150 ppmv* 20 ppmv
Dehydrogenation Unit a. reactor effluent drier regeneration heater stack	Oxides of nitrogen (expressed as equivalent NO_2) Total Hydrocarbons	150 ppmv* 20 ppmv
b. reactor charge interheater No. 1 and 2 stack	Oxides of nitrogen (expressed as equivalent NO_2)	150 ppmv*
c. continuous catalyst regeneration (CCR) offgas scrubber vent	Total Hydrocarbons Chlorine and Hydrogen Chloride (combined)	20 ppmv 100 ppmv
Oxygenate Removal Unit (ORU) a. ORU regenerant superheater stack	Oxides of nitrogen (expressed as equivalent NO_2) Total Hydrocarbons	150 ppmv* 20 ppmv
Utility Unit a. utility boiler stacks	Oxides of nitrogen (expressed as equivalent NO_2) Total Hydrocarbons	150 ppmv* 20 ppmv

* At 3% excess oxygen and dry basis.

Alberta

ENVIRONMENT

LICENCE TO OPERATE OR USE

LICENSE NO. 91-WL-189B

PERMIT NO. .....

FILE NO. 93-SA-413

TO Alberta Envirofuels Inc.
P.O. Bag 2424
EDMONTON, Alberta
T5J 4R3

Pursuant to section 4 of the Clean Water Act, Revised Statutes of Alberta 1980
a licence to operate or use

the methyl tertiary butyl ether (MTBE) chemical manufacturing plant

is hereby issued subject to the terms, conditions and requirements attached hereto.

Edmonton June 30, 19 93

Director of Standards and Approvals

LICENCE No.
91-WL-189B

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

Department of Environmental Protection Clean Water Act Licence to Operate or Use No. 91-WL-189 is hereby further amended.

1 Subsection 6.1 is repealed and the following is substituted:

6.1 The licensee shall, commencing on the date of issue of this amendment, collect a representative water sample from each of the groundwater observation wells at the plant, and have each of the samples analyzed for the water contaminants or parameters specified in Appendix A, at the frequency specified.

Note: Appropriate purging and sampling procedures shall be used for all samples collected.

2 Subsection 6.2 is repealed.

3 Subsection 6.3 is renumbered as 6.2.

4 Appendix A is repealed and the following is substituted.

APPENDIX A

GROUNDWATER MONITORING PARAMETERS

SAMPLING PERIOD	INDICATOR SCHEME	MAIN ORGANICS	MAIN METALS
	Conductance, pH, turbidity TOC, (lab determinations) Conductance, pH, temperature (field determinations)	MTBE, MeOH (all wells) C2Cl4: (wells 14,20,21)[1] DMDS: (wells 15,16,21,22)	Al, Ba, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Ag, Na, Ti, V, Zn
Spring (April)	Indicator Scheme	Main Organics	–
Summer (July)	Indicator Scheme	–	–
Fall (October)	Indicator Scheme	Main Organics	Main Metals
Winter (Jan)	Indicator Scheme	–	–

LICENCE No.
91-WL-189B

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

Note: 1) Monitoring for CCl4 shall continue until April 1994.

2) The licensee shall monitor the groundwater observation wells as specified in this Appendix, or as may otherwise be required by the Director of Standards and Approvals.

DATED June 30, 1993

J.C. LACK, DIRECTOR

Alberta

ENVIRONMENT

LICENCE TO OPERATE OR USE

LICENSE NO. 91-WL-189

PERMIT NO.

FILE NO. 91-SA-587

TO Alberta Envirofuels Inc.
P.O. Bag 4800
SHERWOOD PARK, Alberta
T8A 2A7

Pursuant to section 4 of the Clean Water Act, Revised Statutes of Alberta 1980
a licence to operate or use

the methyl tertiary butyl ether (MTBE) chemical manufacturing plant

is hereby issued subject to the terms, conditions and requirements attached hereto.

Edmonton December 23 19 91

David Spink
for Director of Standards and Approvals

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION ONE: DEFINITIONS

1.1 In this licence

(a) "applications" means the application submissions by the licensee to the Director of Standards and Approvals for licences and permits for the plant under the Clean Water Act;

(b) "approved landfill" means a landfill licenced under the Clean Water Act or the Public Health Act;

(c) "boiler blowdown" means wastewater resulting from the purging of dissolved solids and waste materials from the boilers;

(d) "contaminant" has the same meaning as it has in the Clean Water (General) Regulations;

(e) "daily determination of concentration" means the determination of the concentration of a water contaminant in any sample by procedures approved in this licence (In the event where more than one sample is collected and analyzed per day, the arithmetic average of their analytical results shall be considered as the daily determination of concentration.);

(f) "day" means any consecutive 24-hour sampling period that reasonably represents a calendar day;

(g) "discharge" means any release of liquid material;

(h) "grab" means an individual sample collected in less than 15 minutes and which is representative of the stream sampled;

(i) "hazardous wastes" means waste materials listed in or defined by criteria in Table 1 of the Schedule to the Hazardous Waste Regulation;

(j) "licensee" means Alberta Envirofuels Inc.;

(k) "month" means calendar month;

(l) "plant" means all buildings, structures, storage facilities, process equipment, and lands used by the licensee for the manufacture of methyl tertiary butyl ether (MTBE) and resultant handling of wastes:

(i) located on the Southwest Quarter of Section 32, Township 52, Range 23, West of the 4th Meridian, and

(ii) as described in the applications;

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(m) "plant developed area" means the areas of the plant used for the storage, processing, or handling of raw material, intermediate product, by-product, finished product, process chemicals, or waste material;

(n) "process wastewater" means any water, which during the plant operations, processing, or manufacture of products, comes into direct contact with or results from the production of or use of any raw material, intermediate product, finished product, by-product, or waste product, and includes, but is not limited to, wastewater which may result from the draining, flushing, or steaming out of process vessels or piping;

(o) "sanitary sewage" means any wastewater generated in the kitchen, privy, or lavatory facilities of the plant;

(p) "solid wastes" means any discarded materials resulting from plant operations, including solid, semi-solid, and contained gaseous materials, but does not include hazardous wastes;

(q) "stream" means any liquid flow and includes any discharge;

(r) "surface runoff" means any precipitation that falls on or traverses the plant;

(s) "water contaminant" has the same meaning as it has in the Clean Water Act;

(t) "week" means calendar week; and

(u) "year" means calendar year.

1.2 Unless otherwise specified below all abbreviations used in this licence follow those given in "Units of Expression for Wastewater Management" Manual of Practice No. 6 (1982), published by the Water Pollution Control Federation, or "Standard Methods for the Examination of Water and Wastewater" 17th edition (1989), published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation. In the event of a conflict between the use of the abbreviations in the above references, the former reference shall take precedence over the latter.

1.3 Unless otherwise specified within this licence, reference to specific apparatus, procedure or area of the plant has the same meaning as used in the applications.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION TWO: GENERAL

2.1 Save and except as expressly permitted by the terms and conditions of this licence, the licensee shall not deposit, discharge, emit, permit to be deposited, permit to be discharged, or permit to be emitted from the plant any water contaminant:

(a) in a watercourse;

(b) in surface water;

(c) in underground fresh water; or

(d) in any place under any condition where that water contaminant or any other contaminant that results from the deposit of the water contaminant may enter any watercourse, surface water or underground fresh water,

if it degrades, alters or forms part of or is likely to degrade, alter or form part of the process of degradation or alteration of the chemical or biological quality of water, so that the water in the watercourse, surface water or underground fresh water is or is likely to be rendered harmful to human health or life, fish, wildlife, livestock or plants.

2.2 The licensee shall not alter, add to, or in any other manner change the design or construction of the plant from the plans and specifications in the applications and authorized by permits or approvals issued by the Director of Standards and Approvals without the prior written authorization of the Director of Standards and Approvals. All changes, additions and alterations must be submitted in written form to the Director of Standards and Approvals for approval prior to construction. This section does not apply to adjustments, repairs, replacements or maintenance made in the course of normal operations.

2.3 The licensee shall make available and submit upon request design plans and specifications certified for construction by a professional engineer for the construction of each component of the plant prior to the construction of each component.

2.4 The approval by the Director of Standards and Approvals of any design or specification of the plant shall not constitute or be interpreted as constituting a waiver of any term or condition of this licence or any amendment thereto, including the discharge standards established by this licence or any amendment thereto, nor shall such approval otherwise relieve the licensee from full compliance with the terms and conditions of this licence.

2.5 The issuance of this licence does not convey any property rights in either real or personal property, or any exclusive privileges.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

2.6 The terms and conditions of this licence are severable. If any term or condition of this licence, or the application of any term or condition to any circumstances is held invalid, the application of such term or condition to other circumstances and the remainder of this licence shall not be affected thereby.

2.7 Nothing in this licence shall be construed to relieve the licensee from civil or criminal penalties.

2.8 It shall not be a defense for the licensee in an enforcement action that it would have been necessary to halt or reduce production in order to maintain compliance with the terms or conditions of this licence.

2.9 The licensee shall furnish to the Director of Pollution Control or the Director of Standards and Approvals, within a reasonable time period specified by the Director of Pollution Control or the Director of Standards and Approvals, any information which may be requested to assess compliance with this licence, or the Clean Water Act or its Regulations.

2.10 The Director of Standards and Approvals or the Director of Pollution Control or any employee or agent of the respective Director may, without prior notice, and without incurring liability for so doing, enter the plant or premises of the licensee for the purpose of determining if the terms and conditions contained within this licence have been complied with. In any inspection to determine if the terms and conditions contained within this licence have been complied with, the Director or his employee or agent may carry out tests at the plant site, may examine, make copies of or take extracts of any records of the plant site.

2.11 If the licensee monitors for any water contaminants, which are subject to discharge limitations, more frequently than is required and using procedures approved in this licence, the results of such monitoring shall be provided as an addendum to the reports required under this licence.

2.12 All applications, reports, or information submitted to the Director of Standards and Approvals or the Director of Pollution Control shall be signed and certified by a principal executive officer of the licensee who shall make the following certification:

> "I certify that this document and all attachments were prepared under my direction or supervision to assure that qualified personnel properly gathered and evaluated the information submitted in accordance with the terms and conditions of Clean Water Act Licence to Operate or Use No. 91-WL-189 and amendments, and in accordance with sound engineering and environmental practices. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete."

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

For the purpose of this section, a person is a principal executive officer of the licensee if that person occupies a position at the level of Vice-President or has been duly authorized by a person of at least the level of Vice-President of the licensee, and occupies a position having responsibility of the overall environmental operation of the plant.

2.13 All records and information resulting from the monitoring required by this licence, including records of analyses performed, calibration and maintenance of monitoring equipment, and recordings from continuous monitoring equipment, shall be retained for a minimum of five years, or longer if requested by the Director of Pollution Control.

2.14 Notwithstanding any terms, conditions or requirements of this licence, all terms and provisions of the Clean Water Act and its regulations as amended from time to time must be complied with by the licensee at all times.

SECTION THREE: DISCHARGE - MONITORING AND STANDARDS

3.1 Process wastewaters consisting of those streams listed below are authorized to be discharging to the wastewater ponds A and B with subsequent discharge to the sewer flowing to the City of Edmonton Gold Bar sewage treatment plant in accordance with the agreement between the licensee and the City of Edmonton;

(a) regeneration wastewater from boiler feedwater;

(b) utility boiler blowdown and dehydrogenation steam generator blowdown;

(c) methanol extraction column blowdown;

(d) neutralized spent caustic from the wet gas scrubber wastewater;

(e) continuous catalyst recovery vent gas scrubber wastewater;

(f) compressor and maintenance shop building wash water (oil removed);

(g) utility wash water (process areas) and boiler blowdown quench water;

(h) ion exchange backwash water; and

(i) surface runoff from the plant developed area designated as having a high potential for contamination.

3.2 The discharge of any process wastewaters specified in subsection 3.1 directly to the surrounding watershed is prohibited.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

3.3 Surface runoff from the plant developed area designated as having a low potential for contamination is authorized for collection in the plant's stormwater pond with subsequent discharge to the surrounding watershed in accordance with Table 1 requirements. Surface runoff qualifying for discharge under this subsection includes the following sources:

(a) runoff from roadways;
(b) building roofs;
(c) parking lot;
(d) non-contact process areas; and
(e) open areas and accumulated runoff from the methanol and MTBE storage tank dyked areas not exceeding the substance concentration specified in Table 1 below.

TABLE 1

	MAXIMUM CONCENTRATION (mg/L)	
SUBSTANCE (Contaminant/Parameter)	MTBE TANK DYKE RUNOFF	METHANOL TANK DYKE RUNOFF
Chemical Oxygen Demand	50	50
Total Suspended Solids	25	25
pH	6.5 - 9.0 pH Units	
Oil and Grease	No Visible Sheen	
Methanol	—	5
MTBE	5	—

3.4 Any surface runoff discharged to the surrounding watershed from the stormwater pond shall not exceed the limits specified in Table 1. The licensee shall obtain representative grab samples at least once per each discharge period for the spring, summer and fall of 1992 to monitor the effectiveness of the plant's precipitation runoff management design to adequately segregate uncontaminated runoff.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

3.5 Plant undeveloped area runoff is authorized to follow natural drainage courses. No containment or monitoring is required.

3.6 The licensee shall ensure that any stormwater discharges from the plant:

(a) do not contain floating solids or visible foam in other than trace amounts; and

(b) do not contain oil or other substances in amounts sufficient to create a visible film or sheen.

3.7 Sanitary sewage is authorized to be discharged to the sanitary sewer discharging to the City of Edmonton Gold Bar sewage treatment plant.

3.8 The licensee shall, at all times, properly operate and maintain all treatment facilities or pollution control devices. Proper operation and maintenance includes, but is not limited to, effective performance, adequate funding, trained operators, regular inspections, and adequate laboratory and process controls, including appropriate quality assurance procedures.

3.9 In order to maintain compliance with the terms and conditions of this licence the licensee shall:

(a) provide an alternative power source sufficient to operate all the treatment or pollution control facilities; or

(b) halt, reduce, or otherwise control production and/or all discharges from the wastewater holding ponds A or B upon the reduction, loss, or failure of the primary source of power to the treatment or pollution control facilities.

3.10 The Director of Standards and Approvals may, on his own initiative and where he considers it appropriate to do so, amend, add to, or delete from Table 1 if an adverse effect that was unanticipated by the Director of Standards and Approvals at the time this licence was issued, occurs or may occur.

3.11 Effective December 23, 1991, for each measurement taken or sample collected in accordance with SECTION THREE, the licensee shall record the following information:

(a) the exact place and time of sampling;
(b) the type of sample;
(c) the person who collected the sample;
(d) the dates the analyses were performed;
(e) the laboratory and person who performed the analyses;
(f) the analytical techniques, procedures, or methods used; and
(g) the results of the analyses.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION FOUR: DRINKING WATER - MONITORING AND STANDARDS

4.1 Nil. Monitoring is not required as the licensee obtains drinking water from the City of Edmonton.

SECTION FIVE: RECEIVING WATER - MONITORING AND STANDARDS

5.1 Nil. No discharges are made to a receiving watercourse.

SECTION SIX: GROUNDWATER MONITORING

6.1 The licensee shall, commencing from the effective date of this licence collect a sample from each of the groundwater observation wells at the plant at least once every three months, and have each of the samples analyzed for the water contaminants in APPENDIX A.

6.2 The samples collected from groundwater observation wells shall be collected in a manner which ensures that a representative sample is obtained. Appropriate purging and sampling procedures shall be used.

6.3 For each of the samples collected in accordance with SECTION SIX, the licensee shall record the following information:

(a) the static elevations, above sea level, of liquid phases in the observation well prior to purging;

(b) the exact place, date, and time of sampling, and a description of the purging and sampling procedures;

(c) the temperature, pH, and specific conductance of each sample at the time of sampling;

(d) the person who collected the sample;

(e) the dates the analyses were performed;

(f) the person and laboratory who performed the analyses;

(g) the analytical techniques, methods, or procedures used in the analyses, and a description of the Quality Assurance/Quality Control procedures and results; and

(h) the results of the analyses.

SECTION SEVEN: SOIL MONITORING

7.1 The licensee shall, prior to commencing any additional soil sampling, submit a proposal to the Director of Standards and Approvals by January 1, 1992 which outlines the proposed sampling locations on a topographical map and which includes the proposed sampling and analytical methodology. The licensee must receive written authorization from the Director of Standards and Approvals to proceed with the soil sampling which must be completed prior to January 15, 1992.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

7.2 After the submission and acceptance of the proposal referred to in subsection 7.1 by the Director of Standards and Approvals, the licensee shall collect soil samples from locations representative of the plant including, but not limited to, process areas, chemical unloading areas, maintenance shop(s), sludge and solid waste storage sites, suspected contamination areas, transportation corridors, storage tanks, and pipeline junctions.

7.3 Each soil sampling site shall consist of samples collected from various depths of overburden. Sampling shall be by depth increment: 0-10, 10-20, 20-50, and 50-100 cm. Within a depth each sample shall be composed of not less than 4 sub-samples drawn to be representative of the sampling site.

7.4 Each individual soil sample shall be analyzed separately for the contaminants and parameters listed in APPENDIX B.

7.5 The licensee shall submit two copies of a written report to the Director of Standards and Approvals by March 1, 1992 which details the sampling method used, the exact locations from which the samples were collected including elevations, the results of analyses, and an interpretation of the test results and proposed remedial measures for any clean up that may be required. Results of soil sampling and analyses shall be evaluated first by reference to Alberta Tier I Guidelines for Assessment and Remediation of Contaminated Soils. Alternative soil maintenance targets may be acceptable when accompanied by a risk-based analysis.

SECTION EIGHT: HAZARDOUS AND SOLID WASTE

8.1 The licensee shall dispose of solid wastes at an approved landfill licenced under either the Clean Water Act or the Public Health Act to accept such wastes.

8.2 The licensee may store hazardous waste at the plant in excess of 10 tonnes as per Section 14(3) of Hazardous Waste Regulation, Alberta Regulation 505/87.

8.3 Hazardous waste shall be disposed of to a facility authorized to accept that type of waste or otherwise disposed of as approved, in writing, by the Director of Standards and Approvals.

8.4 Notwithstanding subsections 8.1 and 8.3, empty hazardous chemical containers may be returned to the chemical supplier.

8.5 The licensee shall maintain records of the amount, type, source and disposal location of all industrial wastes generated at the plant.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION NINE: ANALYTICAL PROCEDURES

9.1 The preservation, storage, and handling of all samples collected at the sampling locations identified in this licence shall be in such a manner that the validity of the samples is not compromised. The analysis of samples shall be in a laboratory with documented quality assurance and quality control programs, including participation in interlaboratory studies.

9.2 Analysis of samples collected under this licence shall be in accordance with the procedures described in:

(a) the latest edition of "Standard Methods for the Examination of Water and Wastewater" published jointly be the American Water and Wastewater Association, American Water Works Association, and the Water Pollution Control Federation; or

(b) the latest edition of "Methods Manual for Chemical Analysis of Water and Wastes" published by Alberta Environment.

The licensee may use equivalent methods of analysis to those referenced above provided that prior written approval has been obtained from the Director of Standards and Approvals.

9.3 The analysis of soil samples shall be conducted in accordance with "Manual on Soil Sampling and Methods of Analysis", 2nd edition; Canadian Society of Soil Science, McKeague, J.A. (ed), 1978, or the latest edition, as amended from time to time;

SECTION TEN: REPORTING REQUIREMENTS

10.1 In addition to the reporting requirements set out in the Clean Water (General) Regulations, the licensee shall report by telephone any contravention of the terms or conditions of this licence to the Director of Pollution Control immediately upon discovery of the contravention.

10.2 Within 72 hours of a contravention reported in accordance with subsection 10.1, the licensee shall notify the Director of Pollution Control of the contravention in writing. The notification shall include in addition to that required under the Clean Water (General) Regulations the following information:

(a) the date and time of the contravention;

(b) the nature of the contravention;

(c) any factors which tend to explain or mitigate the contravention;

(d) the steps taken to correct the contravention; and

(e) the steps that will be taken to prevent similar future instances of contravention.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

The licensee shall maintain on file, for a minimum of five years, the names and addresses of all persons involved in the discovery of the contravention and the corrective measures taken.

10.3 The licensee shall within 30 days of the end of each month submit to the Director of Standards and Approvals a written report for that month which includes:

(a) the analytical results of the surface runoff samples collected in accordance with subsection 3.3, including an assessment of the data relative to the limitations specified in Table 1;

(b) an assessment of the performance of the wastewater treatment and holding facilities, the runoff collection facilities and pollution control equipment; and

(c) any other information the Director of Standards and Approvals may require.

10.4 Within 60 days of the end of each of the months that the licensee samples the groundwater observation wells in accordance with Section Six, the licensee shall submit a written report to the Director of Standards and Approvals which includes the analytical results of all groundwater samples.

10.5 The licensee shall, by March 31 of each year, submit an annual written report to the Director of Standards and Approvals containing for the past year:

(a) an overview of the operation and performance of the runoff control, wastewater treatment and pollution control facilities, including any equipment replacements or changes;

(b) an assessment of the data relative to the limitations specified in Table 1;

(c) the types and amounts of solid wastes generated by plant operations and the landfills where those wastes were disposed of;

(d) the types and amounts of hazardous wastes generated by plant operations, how those wastes were/are handled and stored, and how and where those wastes were disposed of;

(e) a list of the quantities of controlled products under the Hazardous Products Act (Canada) or its Regulations which have been added to or consumed in the plant's industrial process in addition to those identified in the applications; and

(f) any other information the Director of Standards and Approvals may require.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

10.6 The licensee shall submit an annual groundwater monitoring report to the Director of Standards and Approvals, by April 14th of each year, summarizing the results of monitoring conducted in accordance with Section Six of this licence. The report shall include the following:

(a) analytical data and information recorded in accordance with subsection 6.3,

(b) interpretation of liquid elevation and a summary of groundwater flow patterns,

(c) interpretation of the analytical results indicating whether any contamination has been detected, and the probable sources of the contamination,

(d) interpretation of the data collected since the start of the groundwater monitoring program at the plant using control charts, which indicate trends in the analytical results, trends in the amount of groundwater contamination present, and the movement of contaminants,

(e) recommendations on any changes that need to be made to the groundwater program to make it more effective, and a sampling schedule for the following year, and

(f) a description of any contaminated groundwater remediation techniques that were or are being used, and a summary of the effectiveness of these activities.

10.7 To comply with reporting deadlines stipulated in this licence, a telecopier facsimile may be submitted as a written report on or before the deadline provided that the original is received by the Director of Standards and Approvals or the Director of Pollution Control no later than 10 days after the reporting deadline.

SECTION ELEVEN: SPECIAL CONDITIONS

11.1 The licensee shall develop and implement a Best Management Practices (BMP) plan which prevents or minimizes the potential for the release of contaminants to any watercourse or groundwater aquifer from plant activities, including, but not limited to, material storage areas, in-plant transfer areas, process and material handling procedures, loading and unloading operations, waste disposal sites and surface runoff from plant property. The licensee shall use as the basis for the BMP plan the manual "Best Management Practices Guidance Document", available from the Director of Standards and Approvals. The BMP plan shall be submitted in writing to the Director of Standards and Approvals by June 30, 1992 and implemented as soon as possible, but no later than January 1, 1993. The plan is subject to the review of the Director of Standards and Approvals.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

11.2 The use, by the licensee, of chlorophenolic biocides or herbicide products containing chlorophenols is prohibited.

11.3 The installation of any underground storage tanks without prior written approval of the Director of Standards and Approvals is prohibited.

11.4 The licensee must submit to the Director of Standards and Approvals a satisfactory Emergency Spill Response Plan for the plant by June 30, 1992. The plan shall be implemented immediately upon written authorization from the Director to the licensee.

The plan must include information and procedures for the remediation of spills and unplanned discharges of any substance, including but not limited to:

(a) a description of the reporting system which will be used to alert responsible managers, and legal authorities;

(b) a description of preventative measures and facilities (including an overall plant site layout) which prevent, contain, or treat spills;

(c) a list of all materials used, processed, or stored at the plant which could be spilled; and

(d) a plant site layout showing all surface drainage routes.

The Emergency Spill Response Plan shall be reviewed and amended, as necessary, by the licensee annually. The amended plan shall be submitted to the the Director of Standards and Approvals by December 31 of each year.

SECTION TWELVE: DECOMMISSIONING

12.1 The Director of Standards and Approvals considers the plant to be a source of water pollution, therefore the licensee must maintain a Licence to Operate under the Clean Water Act until the plant and the plant site have been decommissioned to the satisfaction of the Director of Standards and Approvals.

12.2 In the event that the licensee decides to terminate operation or use of those facilities approved by this licence, the licensee shall submit and implement, subject to the approval of the Director of Standards and Approvals, a plan for decommissioning of the facilities and site.

12.3 Prior to commencing decommissioning of the plant, the licensee shall submit to the Director of Standards and Approvals Division of Alberta Environment for review, a decommissioning plan, consisting of:

(a) a decommissioning schedule;

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(b) plans and diagrams of the plant before and after decommissioning, which includes property boundaries and land use of the area, location and types of all buildings, and waste management facilities, and a piping diagram which shows the location of all piping and underground storage tanks;

(c) a site assessment and proposed mitigative actions to ensure the site is suitable for future uses; and

(d) any other information the Director of Standards and Approvals Division may require.

SECTION THIRTEEN: LICENCE EFFECTIVE AND EXPIRY DATES

13.1 This licence shall become effective on December 23, 1991.

13.2 This licence shall expire on December 1, 1996.

DATED December 23, 1991

David Smith

for J.C. LACK, DIRECTOR

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

A P P E N D I X A

GROUNDWATER MONITORING PARAMETERS

(The licensee shall submit a proposal to the Director of Standards and Approvals for the monitoring parameters proposed for the entire plant by February 14, 1992 for review and evaluation.)

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

A P P E N D I X B

SOILS MONITORING PARAMETERS

The following list constitutes the soil contaminants and parameters to be analyzed once during the term of this licence:

Major Extractable Ions
Sodium Adsorption Ratio
Total Organic Carbon
pH (0.01m $CaCl_2$ test method)
Texture
Conductivity
Heavy Metals

B

Appendix B: Texas Plant Permit

TEXAS AIR CONTROL BOARD

A PERMIT
IS HEREBY ISSUED TO
OXYFUEL CORPORATION

AUTHORIZING THE CONSTRUCTION AND OPERATION OF

MTBE Complex

TO BE LOCATED AT
Vidor, Orange County, Texas
Lat. 30°02'29" Long. 094°01'14"

and which is to be constructed and operated in accordance with and subject to the Texas Clean Air Act (Texas Health and Safety Code, Chapter 382) and all Rules, Regulations and Orders of the Texas Air Control Board. Said permit is subject to any additional or amended Rules, Regulations and Orders of the Board adopted pursuant to the Act and to all of the following conditions:

1. This permit may not be transferred, assigned or conveyed by the holder, and applies only to the location specified herein.

2. This permit is automatically void upon the occurrence of any of the following:
   a. Failure to begin construction within eighteen months of the date of issuance.
   b. Discontinuance of construction prior to completion for a period of eighteen consecutive months or more.
   c. Failure to complete construction within a reasonable time.

3. The facilities covered by this permit shall be constructed and operated as specified in the application for the permit.

4. All representations regarding construction plans and operation procedures contained in the permit application, unless specifically changed in the application for this permit, become conditions upon which this permit is issued. It shall be unlawful for any person to vary from such representation if the change will cause a change in the method of control of emissions, the character of the emissions or will result in an increase in the discharge of the various emissions, unless he first makes application to the Executive Director to amend this permit in that regard and such amendment is approved.

5. The Board shall be notified prior to the start-up of the facilities authorized by this permit in such a manner that a representative of the Texas Air Control Board may be present at the time of start-up.

6. The Board shall be notified prior to the start of any required sampling and/or monitoring of the facilities authorized by this permit in such a manner that a representative of the Texas Air Control Board may be present during the required sampling and/or monitoring. Upon request by the Executive Director, the holder of this permit shall make sufficient stack sampling analyses, or other tests, to prove satisfactory equipment performance. All sampling and testing procedures shall be approved by the Executive Director and coordinated with the regional representatives of the Texas Air Control Board.

7. This permit does not absolve the holder from the responsibility for the consequences of noncompliance with all Rules, Regulations and Orders of the Texas Air Control Board or with the requirements of the Texas Clean Air Act.

8. The facilities covered by this permit shall not be operated unless all associated air pollution abatement equipment is maintained in good working order and operating properly during normal facility operations.

9. Emissions from this facility must not cause or contribute to a condition of 'air pollution' as defined in Section 382.003(2) of the Texas Clean Air Act or violate Section 382.085 of the Texas Clean Air Act. If the Executive Director determines that such a condition or violation occurs, the holder shall implement additional abatement measures as necessary to control or prevent the condition or violation.

10. Provisions: See attachments labeled "General Provisions 20971," 1-9, and "Special Provisions 20971," 1-16.

Acceptance of the permit constitutes an acknowledgement and agreement that the holder will comply with all Rules, Regulations and Orders of the Board issued in conformity with the Act and the conditions precedent to the granting of this permit. Failure to comply with all conditions and special provisions of this permit will subject the holder to the enforcement provisions of the Texas Clean Air Act.

This permit expires 15 years from date of issuance unless renewed as defined in Section 382.055 of the Texas Clean Air Act.

PERMIT NO. 20971 DATE 11/19/91

EXECUTIVE DIRECTOR
TEXAS AIR CONTROL BOARD

GENERAL PROVISIONS

20971

1. Equivalency of Methods - It shall be the responsibility of the holder of this permit to demonstrate or otherwise justify the equivalency of emission control methods, sampling or other emission testing methods and monitoring methods proposed as alternatives to methods indicated in the provisions of this permit. Alternative methods shall be applied for in writing and shall be reviewed and approved by the Executive Director prior to their use in fulfilling any requirements of this permit.

2. Sampling Requirements - If sampling of stacks or process vents is required, the holder of this permit must contact the Quality Assurance Division of the Texas Air Control Board (TACB) prior to sampling to obtain the proper data forms and procedures. The holder of this permit is also responsible for providing sampling facilities and conducting the sampling operations at his own expense.

3. Appeal - This permit may be appealed pursuant to Rule 103.81 of the Procedural Rules of the TACB and Section 382.032 of the Texas Clean Air Act. Failure to take such appeal constitutes acceptance by the applicant of all terms of the permit.

4. Construction Progress - Start of construction, construction interruptions exceeding 45 days and completion of construction shall be reported to the appropriate regional office of the TACB not later than 10 working days after occurrence of the event.

5. Recordkeeping - Information and data concerning production, operating hours, sampling and monitoring data, if applicable, fuel type and fuel sulfur content, if applicable, shall be maintained in a file at the plant site and made available at the request of personnel from the TACB or any local air pollution control program having jurisdiction. The file shall be retained for at least two years following the date that the information or data is obtained.

6. Maintenance of Emission Control - The facilities covered by this permit shall not be operated unless all air pollution emission capture equipment and abatement equipment are maintained in good working order and operating properly during normal facility operations.

7. Piping, Valves, Flanges, Pumps and Compressors in Volatile Organic Compound (VOC) Service

A. These provisions shall not apply (1) where the VOC has an aggregate partial pressure or vapor pressure of less than 0.5 psia at 100°F or at maximum process operating temperature if less than 100°F or (2) to piping and valves two inches nominal size and smaller or (3) where the operating pressure is at least 5 kilopascals (0.725 psi) below ambient pressure.

B. Construction of new and reworked piping, valves and pump and compressor systems shall conform to applicable ANSI, API, ASME or equivalent codes.

C. New and reworked underground process pipelines shall contain no buried valves such that fugitive emission monitoring is rendered impractical.

D. To the extent that good engineering practice will permit, new and reworked valves and piping connections shall be so located to be reasonably accessible for leak-checking during plant operation. Non-accessible valves shall be identified in a list to be made available upon request.

E. New and reworked piping connections shall be welded or flanged. Screwed connections are permissible only on piping smaller than two-inch diameter. No later than the next scheduled quarterly monitoring period after initial installation or replacement, all new or reworked connections shall be gas tested or hydraulically tested at no less than normal operating pressure and adjustments made as necessary to obtain leak-free performance. Flanges shall be inspected by visual, audible and/or olfactory means at least weekly by operating personnel walk-through.

Each open-ended valve or line shall be equipped with a cap, blind flange, plug or a second valve.

F. Accessible valves shall be monitored by leak-checking for fugitive emissions at least quarterly using an approved gas analyzer. Sealless/leakless valves (including but not limited to bellows and diaphragm valves) and relief valves equipped with

a rupture disc upstream or venting to a control device are not required to be monitored. For valves equipped with rupture discs, a pressure gauge shall be installed between the relief valve and rupture disc to monitor disc integrity. All leaking discs shall be replaced at the earliest opportunity but no later than the next process shutdown.

G. Except as may be provided for in the special provisions of this permit, all pump and compressor seals shall be monitored with an approved gas analyzer at least quarterly or be equipped with a shaft sealing system that prevents or detects emissions of VOC from the seal. Seal systems designed and operated to prevent emissions or seals equipped with an automatic seal failure detection and alarm system need not be monitored. Seal systems that prevent emissions may include (but are not limited to) dual pump seals with barrier fluid at higher pressure than process pressure or seals degassing to vent control systems kept in good working order.

Submerged pumps or sealless pumps (including but not limited to diaphragm, canned or magnetic driven pumps) may be used to satisfy the requirements of this provision and need not be monitored.

H. Damaged or leaking valves, flanges, compressor seals and pump seals found to be emitting VOC in excess of 10,000 ppmv or found by visual inspection to be leaking (e.g. dripping liquids) shall be tagged and replaced or repaired. Every reasonable effort shall be made to repair a leaking component, as specified in this paragraph, within 15 days after the leak is found. If the repair of a component would require a unit shutdown, the repair may be delayed until the next scheduled shutdown. All leaking components which cannot be repaired until a scheduled shutdown shall be identified for such repair by tagging. The Executive Director, at his discretion, may require early unit shutdown or other appropriate action based on the number and severity of tagged leaks awaiting shutdown.

I. The results of the required fugitive monitoring and maintenance program shall be made available to the Executive Director or his designated representative upon request. Records shall indicate appropriate dates, test methods, instrument readings, repair results and corrective actions taken. Records of flange inspections are not required unless a leak is detected.

J. Fugitive emission monitoring required by TACB Regulation V, an applicable New Source Performance Standard (NSPS), Title 40 Code of Federal Regulations Part 60 (40 CFR 60) or an applicable National Emission Standard for Hazardous Air Pollutants (NESHAPS) 40 CFR 61 may be used in lieu of Items F through I of this provision.

Compliance with the requirements of this provision does not assure compliance with requirements of TACB Regulation V, NSPS or NESHAPS and does not constitute approval of alternative standards for these regulations.

8. Storage and Loading of VOC

A. These provisions shall not apply (1) where the VOC has an aggregate partial pressure of less than 0.5 psia at the maximum expected operating temperature or (2) to storage tanks smaller than 25,000 gallons.

B. An internal floating roof or equivalent control shall be installed on all tanks.

C. An open top tank containing a floating roof which uses double seal or secondary seal technology shall be an approved control alternative to an internal floating roof tank provided the primary seal consists of either a mechanical shoe seal or a liquid-mounted seal and the secondary seal is rim-mounted. A weathershield is not approvable as a secondary seal unless specifically reviewed and determined to be vapor-tight.

D. For any tank equipped with a floating roof, the integrity of the floating roof seals shall be verified annually and records maintained to describe dates, seal integrity and corrective actions taken.

E. The floating roof design shall incorporate sufficient flotation to conform to the requirements of API Code 650, Appendix C or an equivalent degree of flotation, except that an internal floating cover need not be designed to meet rainfall support requirements.

F. Uninsulated tank exterior surfaces exposed to the sun shall be white.

G. For purposes of assuring compliance with VOC emission limitations, the holder of this permit shall maintain a monthly emissions record which describes calculated emissions of VOC from all storage tanks and loading operations. The record shall include tank or loading point identification number, control method used, tank or vessel capacity in gallons, name of the material stored or loaded, VOC molecular weight, VOC monthly average temperature in degrees Fahrenheit, VOC vapor pressure at the monthly average material temperature in psia, VOC throughput for the previous month and year-to-date in gallons and total tons of emissions including controls for the previous month and year-to-date. This record shall be maintained at the plant site for at least two years and be made available to representatives of the TACB upon request.

H. Emissions for tanks and loading operations shall be calculated using the edition of AP-42, "Compilation of Air Pollutant Emission Factors," in effect on the date this permit was issued (or the edition in effect on the last date the permit was amended if the permit has been amended).

I. Controlled and uncontrolled emissions of VOC shall be calculated for storage tanks using the following meteorological data as monthly average values:

	Monthly Average
Daily temperature change, °F	19.7
Wind speed, mph	10.2
Station pressure, psia	14.7

9. Carbon Compound Waste Gas Streams

A. Except as may be provided for in the special provisions of this permit, all waste gas from point sources containing VOC and/or other organic compounds (hydrocarbons and/or hydrocarbon derivatives excluding carbon dioxide) shall be routed to a flare. The flare shall operate with no less than 98 percent efficiency in disposing of the carbon compounds captured by the collection system. The waste gas streams shall include process vents, relief valves, analyzer vents, steam jet exhausts, upset emissions, start-up and shutdown-related emissions or purges, blowdowns or other system emissions of waste gas. Storage tank vents, cooling tower exhaust and process fugitive emissions are excluded from this requirement. Any other exception to this provision requires prior review and approval by the Executive Director and such exceptions may be subject to strict monitoring requirements.

B. VOC associated with cooling tower water shall be monitored monthly with an approved air stripping system or equivalent. The appropriate equipment shall be maintained so as to minimize fugitive VOC emissions from the cooling tower. Faulty equipment shall be repaired at the earliest opportunity, but no later than the next scheduled shutdown of the process unit in which the leak occurs. The results of the monitoring and maintenance efforts shall be recorded and such records shall be maintained for a period of two years. The records shall be made available to the Executive Director upon request.

SPECIAL PROVISIONS

20971

1. The total emissions of air contaminants from any of the sources shall not exceed the values stated on the attached table entitled "Emission Sources - Maximum Allowable Emission Rates."

2. These facilities shall comply with all requirements of Environmental Protection Agency (EPA) Regulations on Standards of Performance for New Stationary Sources promulgated for Volatile Organic Liquid Storage Vessels in 40 CFR 60, Subparts A and Kb.

3. These facilities shall comply with all requirements of EPA Regulations on Standards of Performance for New Stationary Sources promulgated for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry in 40 CFR 60, Subparts A and VV.

4. These facilities shall comply with all requirements of EPA Regulations on Standards of Performance for New Stationary Sources promulgated for VOC Emissions from SCOMI Distillation Operations in 40 CFR 60, Subparts A and NNN.

5. Flares shall be designed and operated in accordance with 40 CFR 60.18 including specifications of minimum heating value of the waste gas, maximum tip velocity and pilot flame monitoring. If necessary to insure adequate combustion, sufficient fuel gas shall be added to make the gases combustible. An infrared monitor is considered equivalent to a thermocouple for flame monitoring purposes.

6. The holder of this permit shall perform stack sampling and other testing as required to establish the actual pattern and quantities of air contaminants being emitted into the atmosphere from the Regenerator Exhaust Stack (Emission Point Number [EPN] 1) and the Steam Boiler Stack (EPN 2). The holder of this permit is responsible for providing sampling and testing facilities and conducting the sampling and testing operations at his expense.

   A. The appropriate TACB Regional Office in the region where the source is located shall be contacted as soon as testing is scheduled but not less than 45 days prior to sampling to schedule a pretest meeting.

The notice shall include:

1. Date for pretest meeting.
2. Date sampling will occur.
3. Name of firm conducting sampling.
4. Type of sampling equipment to be used.
5. Method or procedure to be used in sampling.

The purpose of the pretest meeting is to review the necessary sampling and testing procedures, to provide the proper data forms for recording pertinent data and to review the format procedures for submitting the test reports.

A written proposed description of any deviation from sampling procedures specified in permit provisions or TACB or EPA sampling procedures shall be made available to the TACB prior to the pretest meeting. The Regional Director or the Director of the Quality Assurance Division shall approve or disapprove of any deviation from specified sampling procedures.

Requests to waive testing for any pollutant specified in B of this provision shall be submitted to the TACB Permits Program. Test waivers and alternate/equivalent procedure proposals for NSPS testing which must have EPA approval shall be submitted to the TACB Quality Assurance Division in Austin.

B. Air contaminants emitted from the Regenerator Exhaust Stack to be tested for include (but are not limited to) nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter and non-methane hydrocarbons. Air contaminants emitted from the steam boiler to be tested for include (but are not limited to) NO_x and CO.

C. Sampling shall occur within 60 days after initial start-up of the facilities and at such other times as may be required by the Executive Director of the TACB. Requests for additional time to perform sampling shall be submitted to the regional office.

Additional time to comply with the applicable requirements of 40 CFR 60 and 40 CFR 61 requires EPA approval and requests shall be submitted to the TACB Quality Assurance Division in Austin.

D. The plant shall operate at maximum production rates during stack emission testing. Primary operating parameters that enable determination of production rate shall be monitored and recorded during the stack test. These parameters are to be determined at the pretest meeting. If the plant is unable to operate at maximum rates during testing, then future production rates may be limited to the rates established during testing. Additional stack testing may be required when higher production rates are achieved.

E. Two copies of the final sampling report shall be forwarded to the TACB within 30 days after sampling is completed. Sampling reports shall comply with the attached provisions of Chapter 14 of the TACB Sampling Procedures Manual. The reports shall be distributed as follows:

One copy to the Beaumont TACB Regional Office.
One copy to the Quality Assurance Division, TACB, Austin Office.

7. The holder of this permit shall install, calibrate and maintain a continuous emission monitoring system (CEMS) to measure and record the in-stack concentration of CO and the opacity from the Regenerator Exhaust Stack (EPN 1).

A. The CEMS shall meet the design and performance specifications, pass the field tests and meet the installation requirements and the data analysis and reporting requirements specified in the applicable Performance Specifications No. 1 through 6, 40 CFR 60, Appendix B. If there are no applicable performance specifications in 40 CFR 60, Appendix B, contact the TACB in Austin for requirements to be met.

B. The system shall be zeroed and spanned daily and corrective action taken when the 24-hour span drift exceeds two times the amounts specified in 40 CFR

60, Appendix B or as specified by the TACB if not specified in Appendix B. Zero and span is not required on weekends and plant holidays if instrument technicians are not normally scheduled on those days, unless the monitor is required by a subpart of NSPS or NESHAPS, in which case zero and span shall be done daily without exception.

Each monitor shall be quality assured at least quarterly in accordance with 40 CFR 60, Appendix F, Procedure 1, Section 5.1.2. For non-NSPS sources, an equivalent method approved by the TACB may be used.

C. The monitoring data for CO shall be reduced to hourly average concentrations at least once every day, using a minimum of four equally spaced data points from each one-hour period. The individual average concentrations shall be reduced to units of the permit allowable emission rate in pounds per hour at least once every week. The opacity measurements shall be expressed in percent opacity.

D. All monitoring data and quality assurance data shall be maintained by the source for a period of two years and shall be made available to the Executive Director or his designated representatives upon request. The data from the CEMS may, at the discretion of the TACB, be used to determine compliance with the provisions of this permit.

E. All cylinder gas audit exceedances of ± 15 percent accuracy and any CEMS downtime shall be reported to the appropriate Regional Director and necessary corrective action shall be taken. Supplemental stack concentration measurements may be required at the discretion of the appropriate Regional Director.

F. For NSPS sources subject to Appendix F, the appropriate TACB Regional Office shall be notified at least 30 days prior to each annual relative accuracy testing audit in order to provide them the opportunity to observe the testing.

8. Opacity of emissions from the regenerator exhaust stack shall not exceed 10 percent averaged over a 6-minute period except for periods of time allowed by Rule 111.111 (a)(1)(E) of Regulation I.

9. The annual methyl tertiary butyl ether (MTBE) production rate shall not exceed 1,347,375,600 pounds per year. Records of the production rate shall be maintained and made available to the Executive Director or his representatives upon request.

10. The annual firing rate of fuel to the steam boiler shall not exceed 1,944,720 million BTU (HHV) per year. Records of fuel firing shall be maintained and made available to the Executive Director or his representatives upon request.

11. The floating roof seals must be properly maintained at all times to minimize vapor loss. Those seals on tanks storing MTBE shall be visually inspected through manholes and roof hatches no less than every 6 months. Records of inspection shall be maintained and made available to the Executive Director or his representatives upon request.

12. Records shall be maintained of those times the regenerator exhaust gases are not flowing through the filter modules. These records shall be made available to the Executive Director or his representatives upon request.

13. No vent gas containing catalyst shall be vented to the atmosphere without first passing through the filter modules associated with the regenerator exhaust.

14. Catalyst unloading shall be monitored by an operator in visual contact with the unloading system at all times. Any release of catalyst to the atmosphere shall be recorded and records maintained. These records shall be made available to the Executive Director or his representative upon request.

15. The emissions record required by General Provision No. 8 shall be calculated at least once per calendar year.

16. Within 60 days of the start of operations, the holder of this permit shall submit to the TACB Regional Director or his representatives documentation which demonstrates that the holder is achieving compliance with all the provisions of this permit. This documentation shall consist of a statement explaining how each requirement in a provision is being met. It will include a sample of each record sheet required to be maintained by any provision and a listing of all testing required with test dates.

EMISSION SOURCES - MAXIMUM ALLOWABLE EMISSION RATES

20971

This table lists the maximum allowable emission rates and all sources of air contaminants on the applicant's property covered by this permit. The emission rates shown are those derived from information submitted as part of the application for permit and are the maximum rates allowed for these facilities. Any proposed increase in emission rates may require an application for a modification of the facilities covered by this permit.

AIR CONTAMINANTS DATA

Emission Point No. (1)	Source Name (2)	Air Contaminant Name (3)	Emission Rates* #/hr	Emission Rates* TPY
1	Regenerator Exhaust (Normal Operation)	NOx	7.38	32.32
		CO	4.49	19.67
		SO2	2.34	10.25
		CH4	15.18	66.49
		VOC	3.73	16.34
		PM10	0.23	1.01
1	Regenerator Exhaust (Start-up Operation)	NOx	11.60	0.12
		CO	2.90	0.03
		SO2	4.18	0.03
		VOC	0.12	0.00
		PM10	9.89	0.07
2	Steam Boiler	NOx	13.32	58.34
		CO	16.65	72.93
		SO2	0.15	0.66
		VOC	0.61	2.67
		PM10	1.09	4.77
3	Flare	NOx	0.03	0.13
		CO	0.46	2.01
		SO2	0.08	0.35
		VOC	0.41	1.80
4	TK-101	MTBE	0.97	3.33
5	TK-102	MTBE	0.97	3.33
6	Isobutane Dehydrogeneration Fugitives (4)	VOC	1.82	7.97
7	MTBE Fugitives (4)	VOC	2.93	12.83
8	Cooling Tower	VOC	1.18	5.17

EMISSION SOURCES - MAXIMUM ALLOWABLE EMISSION RATES

(1) Emission point identification - either specific equipment designation or emission point number from plot plan.

(2) Specific point source name. For fugitive sources use area name or fugitive source name.

(3) VOC - volatile organic compounds as defined in General Rule 101.1
NOx - total oxides of nitrogen
SO2 - sulfur dioxide
CO - carbon monoxide
CH4 - methane
PM10 - particulate matter <10 microns in diameter
MTBE - methyl tertiary butyl ether

(4) Fugitive emissions are an estimate only and should not be considered as a maximum allowable emission rate.

* Emission rates are based on and the facilities are limited by the following maximum operating schedule:

Hrs/day 24 Days/week 7 Weeks/year 52 or Hrs/year _____

C

Appendix C: Technical Report by Daniel Woo

cc

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

EP/WOO/8031/nt

TO FILE

Security Classification - Classification de sécurité
Our File - Notre référence 4075-78/MTBE
Your File - Votre référence
Date September 20, 1993

Senior Facilities Engineer
Scientific Programs Branch
EP, Western & Northern Region
C & P, Edmonton

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TRIP REPORT - ALBERTA ENVIROFUELS INC. - SEPTEMBER 24, 1992

In preparation for a study on the Methyl Tertiary Butyl Ether (MTBE) industry, I revisited the field notes I made on the technical tour of Alberta Envirofuels Inc (AEI) last year. They are revised and written below.

The tour was part of Alberta Environment/Environment Canada's arrangements to fulfil a request from officials of the Environmental Protection Agency of Norway to witness first-hand world scale chemical operations. EP, ADO participated in the program review meeting on September 23, 1992 but due to other commitments was not able to take in the plant tour.

1. Participants

AEI - Risto Nasi, Technical and Environmental Manager;
Alta. Environment - 5 representatives including Chow-Seng Liu of the Standards & Approvals Division;
Environment Canada - John Prinsen, IPB, EP, Ottawa. D. Woo. EP - W & N Region;
Norweign officials - Ms. Kolstad, Ms. Sandgrind.

2. Tour Introduction

- AEI's MTBE plant is located in the County of Strathcona east of the Edmonton City Limits;
- Our group was the first official visitors to AEI;
- AEI's plant officially opened on September 9/92;
- Norweign officials wanted to gain operational experience before setting discharge limits for a MTBE plant in 1995 (and a Methanol plant in 1996);
- AEI is owned 50% by Chevron USA, 50% Neste Canada, a subsidiary of Neste Oy, the national oil and chemicals company in Finland;
- Due to flash hazard, no cameras were allowed inside the plant.

3. AEI Operations

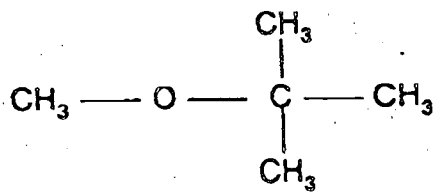
- It is the only MTBE plant in Canada.
- AEI's operation is world scale. It produces 530,000 t/year or 12,500 BPD.
- Product (MTBE) is shipped by rail from Edmonton to Kitimat, B.C. and moved by ship tankers to California.
- The partners of AEI supply feedstocks for the plant and share the MTBE produced.

Canada

- Startup operations commenced on March 15, 1992 (note official opening was September 9/92).
- First ship loaded in Kitimat on May 14, 1992.
- Performance runs (gurantees) were run and accepted on July 12/92 (only 6 days were required before AEI accepted the gurantees.
- In July/92, 100,000 t (846Mbbls) were produced.
- 108% capacity was run on August 12/92.
- The MTBE plant was first conceived in 1987 by Neste. Not long after Celanese pulled out with PetroCanada to follow in 1989.
- Construction started in April/90.
- In the whole month of August 1992, 100% of capacity was achieved.
- The General Manager and the functional managers in AEI were all seconded from parent companies on a rotational basis. AEI operates in self-directed teams (i.e. 1 team consists of engineers, technicians, operators, maintenance workers. There would be no "bosses" on the team).
- AEI has 89 employees

4. Conversion details/MTBE Benefits

- Feed stocks are FC4 (from Rimbey terminal) and methanol (Celanese);
- Product (MTBE) is sent to Gibson;
- MTBE's structural formula is represented as:



- Some characteristics of methanol, ethanol, MTBE and gasoline were discussed. They are tabulated below.

		MeOH	EtOH	MTBE	GASOLINE
BP° C				55	22-275
RVP	Pure	4.6	2.3	7.8	
	Blended			6-10	8-15
MON		93-95	86-97	98-110	80-88

- Benefits of reformulated gasoline include less CO, less HC and less O3.
- Alberta was chosen for the plant due to local FC_4 and methanol supplies;
- Alkylate from refineries is good for gasoline but lacks in Oxygen when compared with MTBE;
- 10% to 15% MTBE blending should have no problem;

- MMT's disadvantage is that it has no O2 element. Refineries in Canada now use it likely due to existing hardware availability;
- MTBE is mandated in some US States;
- MTBE prices are in direct proportion (up or down) to the price of gasoline;
- AEI sent letters to all contractors to minimize fugitive emissions. AEI studies various valves/flanges to select best hardware for fugitive emission controls. Fluor Daniel was asked to ensure that the best valves/flanges were used;
- AEI has 2 stormwater ponds which are discharged to river when full. Two years already passed and no discharge had occurred - (evaporation probably was the reason).
- AEI has 1 wastewater pond containing wastewater and salty water from BFW operation which discharges intermittently at nights via sewer to the Goldbar STP. Weekly samples are picked up at Goldbar STP;
- Oil collected from wastewater are collected and sent to recyclers or waste handlers;
- Burners on site are low NO_x burners;
- Flare is about 100m high;
- Wastewater pond is plastic-lined, not concrete-lined;
- MTBE world-wide capacity was 10 million t/y in 1992;
- The ARCO, Texas, USA operation produced 1.5 million t/y in 1992;
- Another 35 small MTBE operations existed in 1992;
- Replacing methanol in MTBE with ethanol might be a good alternative for some U.S. States with tight vapour pressure control. ETBE has lower vapour pressure than MTBE.

5. Further Plan

- The current plant was designed to handle future expansions. The design incorporated expansions of doubling the capacity. Process units, wastewater treatment facilities and power supply were sized to handle the expanded demands.

6. Attachments

- A brochure entitled Canada's First MTBE Manufacturing Facility was given during the tour and is attached.
- A copy of an article describing the AEI facility from the august 17, 1992 issue of the Oilweek is attached.
- A 20ml sample of MTBE (white color, fairly strong aromatic smell) was given to all participants.

Daniel Woo

attachments

cc: for information with attachment
Bryan Armstrong - ADO
David Poon - P & Y Region
Art Stelzig - IPB, HQ
Barry Munson/then dossier

MTBE (methyl tertiary butyl ether) is gaining worldwide recognition and demand as a clean burning, high-octane blending component of environmentally progressive gasolines for vehicles. The benefits of MTBE include:

- Enhanced gasoline octane — with governments all over the world legislating the removal of lead from gasoline, alternative octane boosters are in high demand.
- Reduced automobile emissions — since MTBE contains oxygen, gasolines using this component burn more cleanly and efficiently, reducing tailpipe emissions of both carbon monoxide and unburned hydrocarbons.
- Reduced evaporative emissions — MTBE's low vapour pressure means that gasolines blended with this product have fewer evaporative emissions, a major component of smog.

While other blending components for cleaner burning gasolines are available, MTBE is unsurpassed in reducing both tailpipe and evaporative emissions while improving engine performance. The unique benefits of MTBE make it the fastest growing gasoline blending component in the world today.

ALBERTA ENVIROfuels INC.

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Canada's First MTBE Manufacturing Facility

ALBERTA ENVIROfuels INC.

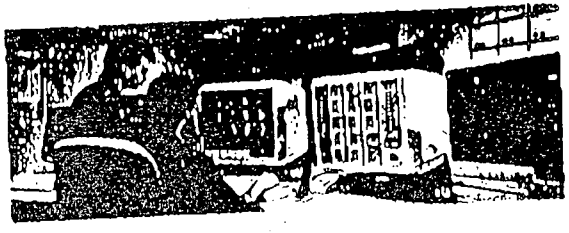
In early 1992, Alberta Envirofuels Inc. began operation of Canada's first MTBE (methyl tertiary butyl ether) manufacturing facility. This plant comes on stream at a time when global demand is increasing for MTBE as an octane-enhancing, environmentally progressive blending component for gasolines.

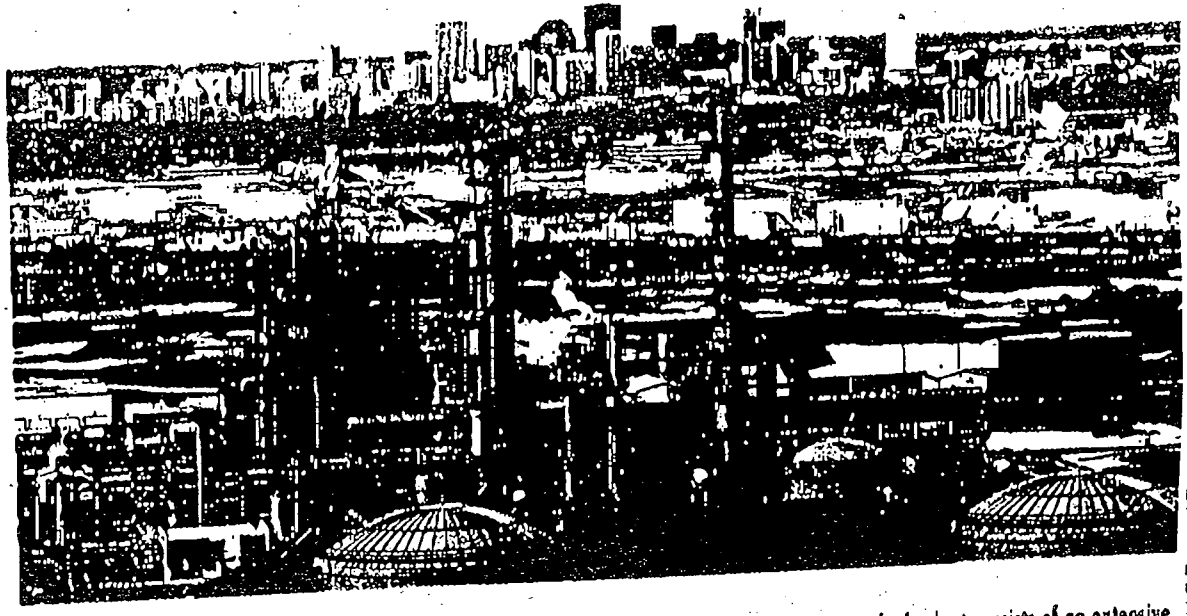
Alberta Envirofuels, a world scale MTBE plant, is located just east of Edmonton in the County of Strathcona. Alberta's rich fields of oil and gas provide the raw materials for the feedstocks for MTBE production.

Alberta Envirofuels is an equal joint venture partnership between Neste Canada Inc. and Chevron Standard Limited. Neste Canada is a wholly-owned subsidiary of Neste Oy, the national oil and chemicals company of Finland. Chevron Standard is a wholly-owned subsidiary of Chevron Corporation of San Francisco, California. Chevron Canada Limited, another subsidiary of Chevron Corporation, manages Chevron Standard's interest in Alberta Envirofuels.

Envirofuel Facts

Cost to build the plant	$360 million
Production capacity	530,000 tonnes/year
Employees	100
Markets for product	• western Canada • west coast United States • international





The two primary ingredients of MTBE are:

- Methanol — produced from natural gas at a nearby petrochemical plant and transported by pipeline to Alberta Envirofuels
- Field butane — converted to isobutylene at the Alberta Envirofuels plant

The MTBE Process

Field butane enters the first column, called the DIB (deisobutanizer) column, where *n-butane* is separated. The n-butane is heated, then sent through the isomerization (Butamer) unit, to produce *isobutane*, which is converted to *isobutylene* in the dehydrogenation (Oleflex) unit. Isobutylene and methanol are reacted to produce MTBE.

The Alberta Envirofuels plant consists of an extensive array of pipes, columns, heaters, air coolers, valves, a storage tanks. The production process is monitored an regulated by eight operators from a central control room, using state-of-the-art process control systems.

The plant is highly energy efficient, with byproducts from one step being used to fuel other steps in the process. Catalysts are recovered and reused. The oper tion complies totally with Alberta's Clean Air and Cle Water Acts and there are no hazardous wastes produ