



# EGYPTIAN GENERAL PETROLEUM COOPERATION

Egyptian Oil strategic use OF better fuel

Egyptian Oil strategic use and better fuel

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Ministry of Petroleum



Egyptian General Petroleum Corporation (EGPC)

32

Joint Venture Companies

35

Investment Law Companies

12

Public Sector Companies



## EGPC Objectives

- Apply the International HSE High Standard Measures.
- Enhance Exploration Activities and Search of Extra Oil Potentialities.
- Optimize Oil Production and Enhance Oil Reserves development.
- Improve and Update Terms of Oil Agreements to Attract Investors.
- Satisfy Local Demands from Petroleum Products.
- Maximize Petroleum Exports Revenues
- Upgrade Oil Refineries Efficiency to Maximize High Quality Petroleum Products.
- Optimize Utilization of the Existing Infrastructure.
- Apply the Latest Technologies in the Oil Industries.



## Introduction

*\* The integrity of the environment is the key element in protecting the wealth of nations and their human and environmental safety reflected positively and negatively on these various forms of wealth*

The burning of fuel products (especially coal and oil), one of the most important sources of air pollution



*In line with world attention to environmental protection in recent years, the Ministry of Petroleum , starting to reduce environmental pollution resulting from the use of fuel and petroleum products through the following means:*



*The international environmental laws, in recent years impose pressure on the sectors of oil in the world to improve the quality of fuel used , special means of transport "light distillate (gasoline) and medium (diesel)" with a view to reducing emissions harmful to the environment in which the nitrogen oxides NOX, hydrocarbons and others CO, carbon dioxide and sulfur oxides and particulates SOX solid and lead.*

*improving the fuel specifications to meet the international standards.*

*build new refineries to produce cleaner fuels  
re-refining used oil in order to avoid the harmful use of the used oil where we established new company to collect the oil from the Egyptian market  
expansion in the use of natural gas as fuel which is environmentally safe instead of diesel and fuel oil.  
supporting the planes of the private sector to establish new refineries with high technology to get products matching with the latest EUROPEAN specification*

**Development of fuel specifications to meet the international standards.**

*In order to reduce environmental pollution a restricted environmental legislation has been stated, which lead to a significant evolution in the standard specifications of the various types of fuel is required with the use of means and better technology to produce cleaner fuels.*

*Tables (1), (2) show specification of the European gasoline, as well as the most important amendments*

Table (2) the most important steps in EU Gasoline fuel spec. development

EURO NO.	Effective date	Properties				
		Lead (mg/L)	Benzene (Vol.%)	Aromatics (Vol.%)	Olefins (Vol.%)	Sulphur (ppm)
EURO 2	1-1996	13 (Max.)	5 (Max.)	Not specified	Not specified	500 (Max.)
EURO 3	1-2000	5 (Max.)	1 (Max.)	42 (Max.)	18 (Max.)	150 (Max.)
EURO 4	1-2005	5 (Max.)	1 (Max.)	35 (Max.)	18 (Max.)	50 (Max.)

Table (1) the specification for European gasoline's. EN 228

		Method	Premium	Regular
Ron	Min.	ISO 5164	95	Specified locally
MON	Min.	ISO 5163	85	Specified locally
Lead	G/L max.	EN 237	0.013	0.013
Benzene	Vol %, max.	EN 238	5	5
Sulphur	% m/m, max.	EN 24 260	0.05	0.05
Existent gum	Mg/100 ml. max.	EN 5	5	5
Copper corrosion	Rating	ISO 2160	CLASS 1	CLASS 1
Oxidation stability	Minutes, min.	ISO 7236	360	360
Density	Kg/m3	ISO 3675	725 – 780	725 – 780
Water tolerance			No segregation	No segregation
Appearance		Visual inspection	Clear and bright	Clear and bright

Table (3) automotive diesel fuel specifications for European (CEN member)

Property	Unit	European (CEN member) countries Limits		EGYPTIAN SPEC. Limits	
		Min.	Max.	Min	Max
Cetane number		51.0	-		
Cetane index		46.0	-	46.0	
Density at 15 °C	Kg/m3	820	845	820	870
Aromatics	Vol %	-	-		
Polycyclic aromatic hydrocarbons	% mass (m/m)	-	11		
Di+		-			
Tri+		-			
Sulphur content	Mg/kg	-	350		10000
Flashpoint	°C	> 55	-		
Carbon Res. (on 10% Dist. Res.)	% mass (m/m)	-	0.03		0.1
Ash content	%mass(m/m)	-	0.01		0.01
Water content	Mg/kg	-	200		0.1
Total contamination	Mg/kg	-	24		
Copper st. corr. (3 h at 50 °C)	Rating	CLASS 1	-		Class 1
Oxidation stability	G/m3	-	75		
Lubricity, corrected wear scar Diameter at 60 °C	Um	-	460		
Viscosity at 40 °C	Mm <sup>2</sup> /s	2	4.5		
% Recovered at 250 °C	% (V/v)	-	< 65		
% Recovered at 350 °C	% (V/v)	85	-	85	
95% point	°C	-	160		

Table (4) the most important steps in EU Diesel fuel spec. development

EURO NO.	Effective date	Properties	
		Sulphur content	Cetane No.
EURO 1	10-1994	0.20 Wt.% (Max.)	49 (Min.)
EURO 2	1-1996	0.05 Wt.% (Max.)	49 (Min.)
EURO 3	1-2000	350 ppm (Max.)	51 (Min.)
EURO 4	1-2005	50 ppm (Max.)	51 (Min.)
EURO 5	1-2009	10 ppm (Max.)	51 (Min.)

## Gasoline

\* At The beginning of 1996 the oil sector has a very important step in this field which is the removal of lead compounds (used as an octane number enhancer ) from gasoline and replacing it by one of the oxygenated compound which is MTBE , because off the dangerous effect of lead compounds on the environment and human health especially on children since the tetra ethyl lead can cause retardness of the children, lead can also cause a harmful effect on catalytic converter In cars.

## Development Of The Egyptian Fuel & Solvent Specifications:

- GASOLINE
- GAS OIL
- LPG
- HEXANE

## Gasoline

\* In line with the global trend to reduce the environmental pollution oxygenated compound has been eliminated from our gasoline, and now our gasoline is free of any additive, this necessitated the upgrading of existing manufacturing units.

EGYPTIAN STANDARD SPECIFICATIONS FOR GASOLINE					
TEST	TEST METHOD	Test limits for unseasoned gasoline			
		80	90	92	95
* RELATIVE DENSITY @ 60/60 °F	ASTM D-129 E.S.S.-49	Reported	Reported	Reported	Reported
COLOR	Visual	Red	Green	Colorless	Colorless
DISTILLED °C max.	ASTM D-36 E.S.S.-77				
10% Distilled Vol.		70	70	70	70
20% Distilled Vol.		105	115	120	120
50% Distilled Vol.		165	170	175	180
Final Boiling Point		190	195	200	200
Low Acid Residue % Vol.		2	2	2	2
R.V.P @ 37.8°C Rd Method	ASTM D-321, E.S.S.-176				
*Winter Kg Butakl ( Kg/cm <sup>3</sup> )		600.7	600.7	600.7	600.7
**Summer Kg Butakl ( Kg/cm <sup>3</sup> )		620.63	620.63	620.63	620.63
Total Sulphur (max)	ASTM D-429 E.S.S.-979	0.05	0.05	0.05	0.05
Olefin (m (monthly) (mm)	ASTM D-2699 E.S.S.-452	80	90	92	95
Lead @ 15°C (m (monthly) (mm)	ASTM D-2237 E.S.S.-663	0.013	0.011	0.013	0.013
Iron Mgms (10ml (mm)	ASTM D-381 E.S.S.-220	2	3	3	3
COPPER ST. CORR. @ 50 °C, (1 HR) (max)	ASTM D-130 E.S.S.-418	1	1	1	1
Oxidation stability (minim) (mm)	E.S.S.-418	400	400	400	400
Decomposed (% WT) (mm)	ASTM D-4953	2.7	2.7	2.7	2.7

EGYPTIAN STANDARD SPECIFICATIONS FOR GAS OIL (16 - 2005)				
TEST	TEST METHOD	RESULTS	RESULTS	
			MIN	MAX
* RELATIVE DENSITY @ 60/60 °F	ASTM D-129, E.S.S.-49	(MIN)	0.820 *	
COLOR (ASTM)	ASTM D-199	(MAX)	4	
FLASH POINT (P.M.C)	ASTM D-93, E.S.S.-177	(MIN)	55	
VISCOSITY KINEMATIC @ 40 °C	ASTM D-445, E.S.S.-1100	(MIN)	1.6	
VISCOSITY R / @ 40 °C	SEC	(MIN)	70	
POUR POINT	ASTM D-97, E.S.S.-79	(MAX)	42	
A FOR DEC, JAN, FEB, MAR		(MAX)	3	
B FOR APR, MAY, OCT, NOV		(MAX)	9	
C FOR JUN, JUL, AUG, SEP		(MAX)	15	
WATER & SEDIMENTS	% VOL	ASTM D-2709, E.S.S.-1598	(MAX)	0.1
ASH CONTENT	% WT	ASTM D-462, E.S.S.-81	(MAX)	0.01
** CONRADSON CARBON	% WT	ASTM D-189, E.S.S.-83	(MAX)	0.10 **
TOTAL SULPHUR	% WT	ASTM D-2622, E.S.S.-178	(MAX)	1
DISTILLED @ 150 °C	% VOL	ASTM D-36, E.S.S.-77	(MIN)	85
INORGANIC ACIDS & BASES		IP-162, E.S.S.-82	(MAX)	NIL
CETANE INDEX		ASTM D-4747	(MIN)	46
COPPER ST. CORR. @ 100 °C, (1 HR)		ASTM D-130, E.S.S.-418	(MAX)	DIV.1
GROSS CALORIFIC VALUE	MJ/KG	ASTM D-4688, E.S.S.-420	(MIN)	44.3
* FOR GUIDANCE ONLY				
** ON 10% RESIDUE AFTER DISTILLATION				

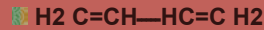
- Diesel fuel
- \* The maximum %wt of sulfur in diesel product about 1% by weight
- \* While the production of modern diesel plants (MIDOR - AMOC) in accordance with European specification (EURO2).
- \* The main challenge which the petroleum sector face is how to reduce the sulphuer in diesel to meet the European specification in spite of the increase in the demand of gas oil at the Egyptian market
- \* Egyptian Standard Specifications For Gas Oil (16 – 2005) table 6

### LPG Or Liquefied Commercial Propane – Butane Mixture

Butadiene is a harmful compound, The present of Butadiene in LPG mixture can depend on the nature of crude and the technology of refining , where reducing the percentage of it is now one of the important target for human sake, as we can see the Egyptian standard specifications of liquefied commercial propane – butane mixture put maximum limits in its spec. 0.5% VOL.

LIQUIFIED COMMERCIAL PROPANE – BUTANE MIXTURE				
TEST		TEST METHOD		RESULTS
* RELATIVE DENSITY @ 60/60 °F		ASTM D-2598	(MAX)	* 0.58
		ASTM D-1267		
VAPOUR PRESSURE @ 50 °C	KG/CM <sup>2</sup> (g)	IP-161	(MAX)	10
COPPER ST. CORR.		ASTM D-1838	(MAX)	No. 1
MERCAPTAN SULFUR	% MASS	IP-272		0.003 – 0.008
HYDROGEN SULPHIDE	% MASS	IP-103		NIL
GROSS CALORIFIC VALUE	K CAL./KG	CALCULATED	(MIN)	11800
FREE WATER		VISUAL		NIL
TEMPERATURE OF				
95% EVAPORATION	°C	ASTM D-1837	(MAX)	MAX 2.2
DIENES CONTENT	VOL%	ASTM D-2163	(MAX)	0.5
* FOR GUIDANCE ONLY.				

## figure out for the Butadiene



1,3-Butadiene is often referred to simply as butadiene. However, the general term butadiene includes both the common industrial chemical 1,3-Butadiene and 1,2-Butadiene, a contaminant in some industrial processes. Physical characteristics of 1,3-Butadiene are shown below.

## figure out for the Butadiene

1,3-Butadiene is a simple **conjugated diene**. It is an important industrial chemical used as a **monomer** in the production of **synthetic rubber**. When the word butadiene is used, most of the time it refers to 1,3-butadiene.

The name butadiene can also refer to the isomer, 1,2-butadiene, which is a **cumulated diene**. However, this **allene** is difficult to prepare and has no industrial significance.

## figure out for the Butadiene

Physical Characteristics of 1,3-Butadiene	
Physical Description	Colorless gas that has a mild gasoline-like odor.
Molecular Weight	54.1
Boiling/Melting Point	24°F / -164°F
Vapor Pressure	@69.8°F: 1,840 mm Hg
Specific Gravity	@68°F: 0.62
Solubility	Soluble in alcohol, ether, acetone, and benzene, not soluble in water.
Flammable	Extreme fire hazard.

## Hazards Of Butadiene:

- The health effects caused by exposure to 1,3-Butadiene can be split into two categories: acute and chronic. Acute exposures can further be split into low and high doses. Acute low exposures may cause irritation to the eyes, throat, nose, and lungs. Frostbite may also occur with skin exposure. Acute high exposures may cause damage to the central nervous system or cause symptoms such as distorted blurred vision, vertigo, general tiredness, decreased blood pressure, headache, nausea, decreased pulse rate, and fainting. Chronic effects caused by exposure to 1,3-Butadiene are controversial. Several human epidemiological studies have shown an increase in cardiovascular diseases and cancer. However, due to the small numbers of cancers and confounding factors such as smoking, and simultaneous exposure to benzene and styrene, a true causal relationship cannot be established.

## Hexane

- $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$
- Hexane is an **alkane hydrocarbon** with the **chemical formula**  $\text{CH}_3(\text{CH}_2)_4\text{CH}_3$  or  $\text{C}_6\text{H}_{14}$ . The "hex" prefix refers to its six carbons, while the "ane" ending indicates that its carbons are connected by single bonds. Hexane **isomers** are largely unreactive, and are frequently used as an inert solvent in organic reactions because they are very non-polar. They are also common constituents of **gasoline** and glues used for shoes, leather products, and roofing. Additionally, it is used in solvents to extract oils for cooking and as a cleansing agent for shoe, furniture and textile manufacturing. In laboratories, hexane is used to extract **oil** and **grease** from water and soil.

## Hazards Of Butadiene

- Experiments involving chronic exposures to mice and rats have shown a strong causal relationship between 1,3-Butadiene exposure and cancer. Animal studies have also shown reproductive and developmental problems. Based on human and animal studies, the EPA has classified 1,3-Butadiene as a known human carcinogen. The American Conference of Governmental Industrial Hygienists (ACGIH) has given 1,3-Butadiene a rating of A2, suspected human carcinogen.

## Hexane

- Hexane has five **isomers**;
- Hexane,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ , a straight chain of six carbon atoms.
- **2-Methylpentane** (Isohexane),  $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_3$ , a five-carbon chain with one methyl branch on the Second.
- **3-Methylpentane**,  $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$ , a five-carbon chain with one methyl branch on the third.
- **2,3-Dimethylbutane**,  $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)\text{CH}_3$ , a four-carbon chain with one methyl branch on the second and third.
- **2,2-Dimethylbutane** (neohexane),  $\text{CH}_3\text{C}(\text{CH}_3)_2\text{CH}_2\text{CH}_3$ , a four-carbon chain with two methyl branches on the second

# Hexane

- Hexane is produced by the **refining of crude oil**. The exact composition of the fraction depends largely on the source of the oil (crude or reformed) and the constraints of the refining. The industrial product (usually around 50% by weight of the straight-chain isomer) is the fraction boiling at **65–70 °C**.
- One of the components of the hexane extracted from crude oil is benzole which has high **carcinogenic effect**, EGPC through its co-operation with The Egyptian General Corporation For Standard And Quality succeeded to decrease the percentage of benzole from **300 PPM** to **50 PPM** in the Egyptian standard spec of Hexane.

## benzole

Benzene, or benzol, is an **organic chemical compound** and a known **carcinogen** with the molecular formula **C<sub>6</sub>H<sub>6</sub>**. It is sometimes abbreviated **Ph-H**. Benzene is a **colorless** and highly **flammable** liquid with a sweet smell and a relatively high melting point. Because it is a known carcinogen, its use as an additive in **gasoline** is now limited, but it is an important industrial **solvent** and precursor in the production of **drugs**, **plastics**, synthetic **rubber**, and **dyes**. Benzene is a natural constituent of **crude oil**, and may be **synthesized** from other compounds present in petroleum

EGYPTIAN STANDARD SPECIFICATIONS FOR  
HEXANE (1515 / 2007)

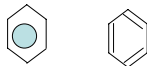
TEST	RESULTS		
DENSITY @ 15°C	GM/ML		0.67 - 0.68
DISTILLATION:			
I.B.P. °C	°C	(MIN)	64
F.B.P. °C	°C	(MAX)	68
RESIDUE AFTER DISTILLATION	MG/100 ML	(MAX)	0.5
ACIDITY OF RESIDUE AFTER DISTILLATION			NEUTRAL
DOCTOR TEST			NEGATIVE
COPPER ST. CORR. @ 50°C, (3 HRS)		(MAX)	DIV.1
AROMATICS	PPM WT.	(MAX)	50
SULPHUR CONTENT	PPM WT.	(MAX)	5
COLOUR SAYBOLT		(MIN)	30
KAURI BUTANOL		(MIN)	25
ULTRA VIOLET ABSORPTION			
@ WAVE LENGTH			
- 280 - 289 NANOMETER			0.03 - 0.04
- 290 - 299 NANOMETER			0.02 - 0.03
- 300 - 359 NANOMETER			0.004 - 0.02
- 360 - 400 NANOMETER			0.004

## Benzole

Benzene is a chemical that is a colorless or light yellow liquid at room temperature. It has a sweet odor and is highly flammable. Benzene evaporates into the air very quickly. Its vapor is heavier than air and may sink into low-lying areas. Benzene dissolves only slightly in water and will float on top of water.

Benzene works by causing cells not to work correctly. For example, it can cause bone marrow not to produce enough red blood cells, which can lead to anemia. Also, it can damage the immune system by changing blood levels of antibodies and causing the loss of white blood cells.

## Physical properties of benzole



Molecular formula	$C_6H_6$
Molar mass	78.11 g mol <sup>-1</sup>
Appearance	Colorless liquid
Density	0.8786 g/cm <sup>3</sup> , liquid
Melting point	5.5 °C, 279 K, 42 °F
Boiling point	80.1 °C, 353 K, 176 °F
Octane no (RON)	120

## Benzole

It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene. The Department of Health and Human Services (DHHS) has determined that benzene causes cancer in humans. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

## Benzole

Eating foods or drinking beverages containing high levels of benzene can cause the following symptoms within minutes to several hours:

Vomiting, Irritation of the stomach, Dizziness, Sleepiness, Convulsions, Rapid or irregular heartbeat, Death (at very high levels). If a person vomits because of swallowing foods or beverages containing benzene, the vomit could be sucked into the lungs and cause breathing problems and coughing. Direct exposure of the eyes, skin, or lungs to benzene can cause tissue injury and irritation. Showing these signs and symptoms does not necessarily mean that a person has been exposed to benzene. Long-term health effects of exposure to benzene. The major effect of benzene from long-term exposure is on the blood. (Long-term exposure means exposure of a year or more.) Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells, leading to anemia.

***THANK  
YOU***