

WORKINGPAPER

**NATIONAL ENVIRONMENTAL QUALITY
STANDARDS FOR MOTOR VEHICULAR EXHAUST AND NOISE**

Emissions from new and in-use vehicles are controlled through standards. Pakistan Environmental Protection Agency (Pak-EPA) under clause (e) of section 6(1) of the Pakistan Environmental Protection Act, 1997, and with the approval of the Pakistan Environmental Protection Council, established National Environmental Quality Standards (NEQS), inter alia, for motor vehicle exhaust and noise vide S. R. O. 742 (I)/93 dated August 29, 1993, as follows;

S.No	Parameter	Standards (maximum permissible limit)	Measuring method
1	Smoke	40% or 2 on the Ringlemann Scale during engine acceleration mode.	To be compared with Ringlemann Chart at a distance of 6 meters or more.
2	Carbon Monoxide.	<u>Emission Standards :</u> New Vehicles. Used Vehicles. 4.5 % 6 %	Under idling conditions: Non-dispersive infrared detection through gas analyzer.
3	Noise.	85 db (A).	Sound-meter at 7.5 meters from the source.

2. Generally for the protection of human health and environment, emissions standards for vehicles are fixed for different parameters like, carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), smoke and particulate matter (PM) which are emitted from vehicles and also for secondary pollutants (by-products) such as ozone. Because of the growing vehicle population and high emission rates from the vehicles, serious air pollution problem in the urban area is emerging out. Formation of haze and smog in winter season in cities is very common phenomena leading to respiratory diseases and loss to economy due to cancellation of flights and temporary suspension of traffic on highways.

3. In the existing NEQS related to vehicle emissions only three parameters viz. smoke, carbon monoxide (CO) and noise, have been included that too are very relaxed. It is, therefore, necessary to review and revise the existing exhaust standards both for new and in-use motor vehicles and bring them at par with the standards of the countries of this region.

4. There are three main international approaches in setting up vehicle emission standards viz. European, American and Japanese. Most countries in the Asian region have tended toward the European standards for new cars and trucks, relying largely on the UN Economic Commission for Europe (ECE). With regard to motorcycles and scooters, however, the standards adopted by India, Thailand and Taipei, China are most advanced.

5. The European Union (EU) adopted catalyst-forcing standards for new gasoline-fuelled cars in the early 1990s (so called Euro 1 standards) and have gradually tightened them over the years Euro 2 in 1996, Euro 3 in 2000 and Euro 4 in 2005. Similar approach was adopted for diesel cars and light and heavy commercial vehicles. In conjunction with the tightening of vehicle standards, fuel quality was also improved, as the better fuel quality is necessary to control emission. For example, adoption of Euro 1 standards for gasoline vehicles requires the use of unleaded gasoline. The adoption of Euro 2 standards for diesel vehicles will require the use of diesel with sulfur levels lower than 500 parts per million (ppm). Further reductions in sulfur levels in both gasoline and petrol and diesel fuel are Euro 3, 4 and, for diesel trucks, Euro 5 standards. In setting new vehicle standards, there is a close linkage between vehicle standards and the resulting technologies and availability of appropriate fuel quality throughout the country when the Euro standards are introduced.

6. The majority of countries in Asia have adopted the Euro emissions standards for new gasoline and diesel vehicles (**Annex 1**). The gasoline and diesel fuel standards required for adoption of Euro Standards are as follows: -

Proposed Euro Emission Standards

Proposed time frame for implementation

Vehicle Categories	2006	2007	2010	2013
Cars	Euro I (Pak Stage I)	Euro II (Pak Stage II)	Euro III (Pak Stage III)	Euro IV (Pak Stage IV)
LCV (Light commercial vehicles)	Euro I (Pak Stage I)	Euro II (Pak Stage II)	Euro III (Pak Stage III)	Euro IV (Pak Stage IV)
HDV (Heavy Duty Vehicles)	Euro I (Pak Stage I)	Euro II (Pak Stage III)	Euro III (Pak Stage III)	Euro IV (Pak Stage IV)

Emission Limits for Gasoline Cars (g/km)^a

Gasoline	As from ^b	CO	HC	NO _x
Euro 1	1/7/2006	4.05	0.66	0.49
Euro 2	1/7/2007	3.28	0.34	0.25
Euro 3	1/7/2010	2.30	0.20	0.15
Euro 4	1/7/2013	1.00	0.10	0.08

CO = carbon monoxide, g/km = gram per kilometer, HC = hydrocarbons, NO_x = nitrogen oxides

a “Euro 3 and 4” Standards also apply to light commercial vehicles (<1305 kg)

bThe above dates refer to new vehicle types; dates for new vehicles are one year later

Emission Limits for Diesel Cars (g/km)^a

Diesel	As from ^b	CO	HC	NO _x	PM
Euro 1	1/7/2006	2.88	0.20	0.78	0.140
Euro 2	1/7/2007	1.06	0.19	0.73	0.100
Euro 3	1/7/2010	0.64	0.06	0.50	0.050
Euro 4	1/7/2013	0.50	0.05	0.25	0.025

CO = carbon monoxide, g/km = gram per kilometer, HC = hydrocarbons, NO_x = nitrogen oxides, PM = particulate matter

a “Euro 3 and 4” (Directive 98/69/EC): Standards also apply to light commercial vehicles (<1305 kg)

b The above dates refer to new vehicle types; dates for new vehicles are one year later

Emission limits for light commercial vehicles (Classes N1, N2 and N3)

Light Commercial Vehicles N1 Class (<1350 kg) Emission Limits (g/km)

N1	As from	Fuel type	CO	HC	NO _x	HC +NO _x	PM
Euro 1	1/7/2006	All	2.72	-	-	0.97	0.140
Euro 2	1/7/2007	Gasoline	2.20	-	-	0.50	-
		Diesel	1.00	-	-	0.60	0.100
Euro 3	1/7/2010	Gasoline	2.30	0.20	0.15	-	-

		Diesel	0.64	-	0.50	0.56	0.050
Euro 4	1/7/2013	Gasoline	1.00	0.10	0.08	-	-
		Diesel	0.50	-	0.25	0.30	0.025

CO = carbon monoxide, g/km = gram per kilometer, HC = hydrocarbons, NO_x = nitrogen oxides, PM = particulate matter

a For Euro 1 and 2 the weight classes were N1 (<1250 kg), N2 (1250-1700 kg) and N3 (>1700 kg)

Light Commercial Vehicles N2 Class (1305-1760 kg) Emission Limits (g/km)

N2	As from	Fuel type	CO	HC	NO _x	HC +NO _x	PM
Euro 1	1/7/2006	All	5.17	-	-	1.40	0.19
Euro 2	1/7/2007	Gasoline	4.00	-	-	0.65	-
		Diesel	1.20	-	-	1.10	0.15
Euro 3	1/7/2010	Gasoline	4.17	0.25	0.18	-	-
		Diesel	0.80	-	0.65	0.72	0.07
Euro 4	1/7/2013	Gasoline	1.81	0.13	0.1	-	-
		Diesel	0.63	-	0.33	0.39	0.04

CO = carbon monoxide, g/km = gram per kilometer, HC = hydrocarbons, NO_x = nitrogen oxides, PM = particulate matter

a For Euro 1 and 2 the weight classes were N1 (<1250 kg), N2 (1250-1700 kg) and N3 (>1700 kg)

Light Commercial Vehicles N3 Class (>1760 kg) Emission Limits (g/km)

N3	As from	Fuel type	CO	HC	NO _x	HC +NO _x	PM
Euro 1	1/10/1994	All	6.90	-	-	1.70	0.25
Euro 2	1/1/1998	Gasoline	5.00	-	-	0.80	-
		Diesel	1.35	-	-	1.30	0.20
Euro 3	1/12/2002	Gasoline	5.22	0.29	0.21	-	-
		Diesel	0.95	-	0.78	0.86	0.10
Euro 4	1/1/2006	Gasoline	2.27	0.16	0.11	-	-
		Diesel	0.74	-	0.39	0.46	0.06

CO = carbon monoxide, g/km = gram per kilometer, HC = hydrocarbons, NO_x = nitrogen oxides, PM = particulate matter

a For Euro 1 and 2 the weight classes were N1 (<1250 kg), N2 (1250-1700 kg) and N3 (>1700 kg)

Emission Limits for Heavy Duty Vehicles (g/kWh)

	As from	Test cycle	CO	Total HC	Non-Methane HC	NO _x	Particulate Matter
Euro 1	1/10/1993	13-mode	4.5	1.10	-	8.0	0.612 <85kW 0.36 >85kW
Euro 2	1/10/1996	13-mode	4.0	1.10	-	7.0	0.15 ^a
Euro 3	1/1/2000	ESC ^c ETC ^d	2.1 5.5	0.66 0.78	- 1.6	5.0 5.0	0.10 0.13 ^b 0.16 0.21 ^b
Euro 4	1/10/2005	ESC ^c ETC ^d	1.5 4.0	0.46 0.55	- 1.1	3.5 3.5	0.02 0.03
Euro 5	1/10/2008	ESC ^c ETC ^d	1.5 4.0	0.46 0.55	- 1.1	2.0 2.0	0.02 0.03

Note: "Euro 1 and 2": Directive 91/542/EEC; "Euro 3, 4 and 5": Council position December 1998 and agreed with the European Parliament

CO = carbon monoxide, HC = hydrocarbons, g/kWh= gram per kilowatt-hour, NO_x = nitrogen oxides

a Until 30/11/1998 the particulate limit for engines <700 cc per cylinder and with a rated power speed of more than

3000 rpm was 0.25 g/kWh

b For engines <750 cc per cylinder and with a rated power speed greater than 3000 rpm

Standard	Gasoline		Diesel
	Lead	Sulfur (ppm)	Sulfur (ppm)
Euro 1	0	NA	NA
Euro 2	0	500	500
Euro 3	0	150	350
Euro 4	0	50 ^a	50 ^a
Euro 5 ^b	NA	NA	50 ^a

ppm = parts per million, NA = not applicable

a : 10 PPM is in the late stages of Adoption by the European Union

b : Heavy Duty Diesel Engines Only

Recommendation:

7. Since the proposed revised standards for new vehicles require improvement in engine technology/specifications and quality of fuels, is required to be built on the lead tune required to improve fuel and technology. It proposed to agree the schedule mentioned above.

8. After reaching to a consensus the proposed standards shall be published in the national newspapers as required by the PEPA 1997 and approval of the PEPC shall be sought.

Emissions Standards for New Vehicles (Light Duty)

Country	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
European Union	Euro 1		Euro 2			Euro 3				Euro 4			Euro 5				
Hong Kong, China		Euro 1		Euro 2			Euro 3				Euro 4						
India^a								Euro 1			Euro 2			Euro 3			
India^b						Euro 1	Euro 2				Euro 3						
Malaysia			Euro 1			Euro 2											
Nepal						Euro 1											
Philippines								Euro 1									
PRC							Euro 1		Euro 2								
Singapore	Euro 1						Euro 2										
Sri Lanka								Euro 1									
Taipei, China						US Tier 1						US Tier 2 for diesel ^c					
Thailand	Euro 1					Euro 2			Euro 3				Euro 4				
Viet Nam^d						Euro 1					Euro 4 (under consideration)						
Viet Nam^e												Euro 1	Euro 2	Euro 3	Euro 4		

a Entire country

b Delhi and other cities; Euro 2 introduced in Mumbai, Kolkata and Chennai in 2001; Euro 2

in Bangalore, Hyderabad, Kanpur, Pune and Ahmedabad in 2003; Euro 3 to be introduced

in Delhi, Mumbai, Kolkata, Chennai, Bangalore, Hyderabad and Ahmedabad in 2005

c Gasoline vehicles under consideration

d For gasoline vehicles

e For diesel vehicles