Initial Environmental Examination

Annexes (1 to 3a)
Project Number: 48404-004
July 2020

PAK: Central Asia Regional Economic Cooperation Corridor Development Investment Program (Tranche 2)

Shikarpur–Rajanpur Section of N55

Prepared by the National Highway Authority Pakistan for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 2 June 2020)

Currency unit	–	Pakistan Rupee/s (PRe/PRs)
PRe1.00	=	$0.0061
$1.00	=	PRs164.25

UNIT CONVERSIONS

1 gallon	–	3.785 liter
1 gallon/day	–	0.00455 m^3/day
1 m^3/day	–	0.041 m^3/hour
1 cusec	–	28.31 liters
1 kilometer	–	1,000 meters
1 foot	–	12 inches
1 acre	–	4,046.8 $meter^2$

ABBREVIATIONS

AAD	–	average annual daily
AADT	–	average annual daily traffic
AASHTO	–	American Association of State Highway and Transportation
AASHTO ASM	–	American Association of State Highway and Transportation Officials
ABC	–	aggregate base course
ACBC	–	asphaltic concrete base course
ACW	–	additional carriageway
ACWC	–	asphaltic concrete wearing course
ADB	–	Asian Development Bank
AKM	–	avenue kilometer
APHA	–	American Public Health Association
AP	–	affected person
ASR	–	air sensitive receiver
ASTM	–	American Society of Testing Materials
BDL	–	below detection limit
BHU	–	basic health unit
BOD	–	bio-chemical oxygen demand
BP	–	Bank Policy
^{O}C	–	degree Centigrade/Celsius
CAREC	–	Central Asia Regional Economic Corridor
CC	–	construction contractor
CO	–	carbon monoxide
COD	–	chemical oxygen demand
CSR	–	composite schedule rates

dB (A)	–	decibel
DCR	–	district census report
DC	–	design consultant
DD	–	deputy director
DMC	–	developing member countries
DO	–	dissolved oxygen
EA	–	environmental assessment
EE	–	environmental engineer
EIA	–	environmental impact assessment
EMP	–	environmental management plan
EPA	–	Environment Protection Agency
EPD	–	Environment Protection Department
EPO	–	Environmental Protection Ordinance
ESR	–	Environmental Sensitive Receiver
FCC	–	Forest Conservation Committee
FI	–	financial intermediary
GHG	–	greenhouse gas
GOP	–	Government of Pakistan
GRC	–	grievance redress committee
GRM	–	grievance redress mechanism
HSIP	–	Highway Sector Improvement Program
IEE	–	initial environmental examination
ILO	–	International Labor Organization
km	–	kilometer
kph	–	kilometer per hour
LAC	–	land acquisition collector
LAeq	–	equivalent continuous sound level, 'A weighting' = correction by factors that weight sound to correlate with the sensitivity of the human ear to sounds at different frequencies
m	–	meter
MFF	–	multitranche financing facility
MGDs	–	Millennium Development Goals
MVE	–	motor vehicle examiner
NEQS	–	National Environmental Quality Standards
NESPAK	–	National Engineering Services Pakistan
NGO	–	nongovernment organization
NHA	–	National Highways Authority
NO	–	nitrogen oxide
NOC	–	no-objection certificate
NSL	–	natural surface level
NSR	–	noise sensitive receiver
NTC	–	National Trade Corridor
OP	–	operational policy
OSHA	–	Occupational Safety and Health Administration
PAP	–	project affected person
PEPA	–	Pakistan Environmental Protection Act
PEPC	–	Pakistan Environmental Protection Council
PM	–	particulate matter
PNCS	–	Pakistan National Conservation Strategy
POP	–	persistent organic pollutant

PPAF	–	Pakistan Poverty Alleviation Fund
PPC	–	Pakistan Penal Code
PRC	–	People's Republic of China
RE	–	resident engineer
REA	–	rapid environmental assessment
ROW	–	right-of-way
SC	–	supervision consultant
SMART	–	self-monitoring and reporting tool
SO	–	sulfur oxide
SPS	–	Safeguard Policy Statement
SSEMP	–	site specific environmental management plan
TA	–	technical assistance
TOR	–	terms of reference
TSS	–	total suspended solids
UBC	–	Uniform Building Code
UC	–	Union Council
UNFCCC	–	United Nations Framework Convention on Climate Change
USEPA	–	United States Environmental Protection Agency
WHO	–	World Health Organization

Annex I: IFC Guidelines and NEQS

Table: IFC/WHO standards for Air Quality

Table 1.1.1: WHO Ambient Air Quality Guidelines[7,8]		
	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Source:
https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

Table: IFC/WHO standards for Noise

Table 1.7.1- Noise Level Guidelines[54]		
	One Hour L_{Aeq} (dBA)	
Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[55]	55	45
Industrial; commercial	70	70

Source:
https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

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GOVERNMENT OF THE PUNJAB
LAW AND PARLIAMENTARY AFFAIRS DEPARTMENT

NOTIFICATION
(124 of 2016)

12th August 2016.

The following Notification No. SO(G)/EPD/7-26/2013, dated 05.08.2016 regarding the Punjab Environmental Quality Standards for Drinking Water is published for general information:

DR SYED ABUL HASSAN NAJMEE
Secretary
Government of the Punjab
Law and Parliamentary Affairs
Department

Government of the Punjab
Environment Protection Department

NOTIFICATION: No. SO(G)/EPD/7-26/2013 – In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 1997 (XXXIV of 1997), the Environmental Protection Council has approved the following as the Punjab Environmental Quality Standards for Drinking Water:

Punjab Environmental Quality Standards for Drinking Water

Properties/Parameters	Standard Values	WHO Standards	Remarks
[redacted]			
All water intended for drinking (E. Coli or Thermo-tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12- month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12- month period.	Most Asian countries also follow WHO standards
[redacted]			
Colour	≤15 TCU	≤15 TCU	
Taste	Non objectionable/ Acceptable	Non objectionable/ Acceptable	
Odour	Non objectionable/ Acceptable	Non objectionable/ Acceptable	
Turbidity	<5 NTU	<5 NTU	

Properties/Parameters	Standard Values	WHO Standards	Remarks
Total hardness as $CaCO_3$	< 500 mg/l	---	
TDS	<1000	< 1000	
pH	6.5 – 8.5	6.5 – 8.5	
[redacted]			
Essential Inorganic	mg/Litre	mg/Litre	
Aluminum (Al) mg/l	≤0.2	0.2	
Antimony (Sb)	≤0.005 (P)	0.02	
Arsenic (As)	≤0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium (Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl^-)	<250	250	
Chromium (Cr)	≤0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic	mg/l	mg/l	
Cyanide (CN)	≤0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤1.5	1.5	
Lead (Pb)	≤0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤0.001	0.001	
Nickel (Ni)	≤0.02	0.02	
Nitrate (NO_3)*	≤50	50	
Nitrite (NO_2)*	≤3 (P)	3	
Selenium (Se)	0.01(P)	0.01	

Properties/Parameters	Standard Values	WHO Standards	Remarks
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	-	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries
Organic			
Pesticides mg/l			PSQCA No. 4639- 2004, Page No. 4 Table No. 3 Serial No. 20-58 may be consulted.**
Phenolic compounds (as Phenols) mg/l		[redacted]	
Poly-nuclear aromatic hydrocarbons (as PAHs) g/l		0.01 (By GC/MS method)	
[redacted]			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

* Indicates priority health related inorganic constituents, which need regular monitoring.

** PSQCA: Pakistan Standards Quality Control Authority.

(IQBAL MOHAMMED CHAUHAN)
Secretary, Government of the Punjab
Environment Protection Department

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GOVERNMENT OF THE PUNJAB
LAW AND PARLIAMENTARY AFFAIRS DEPARTMENT

NOTIFICATION
(122 of 2016)

12th August 2016.

The following Notification No. SO(G)/EPD/7-26/2013, dated 05.08.2016 regarding the Punjab Environmental Quality Standards for Ambient Air is published for general information:

DR SYED ABUL HASSAN NAJMEE
Secretary
Government of the Punjab
Law and Parliamentary Affairs
Department

Government of the Punjab
Environment Protection Department

NOTIFICATION: No. SO(G)/EPD/7-24/2013. – In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 1997 (XXXIV of 1997), Environmental Protection Council has approved the following as the Punjab Environmental Quality Standards for Ambient Air:

Punjab Environmental Quality Standards for Ambient Air

Pollutant	Time-weighted average	Concentration in Ambient Air	Method of measurement
Sulfur Dioxide (SO_2)	Annual Average*	80 µg/m^3	Ultraviolet Fluorescence method
	24 hours**	120 µg/m^3	
Oxides of Nitrogen as (NO)	Annual Average*	40 µg/m^3	Gas Phase Chemiluminescence
	24 hours**	40 µg/m^3	
Oxides of Nitrogen as (NO_2)	Annual Average*	40 µg/m^3	Gas Phase Chemiluminescence
	24 hours**	80 µg/m^3	
Ozone (O_3)	1 hour	130µg/m^3	Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	360µg/m^3	High Volume Sampling, (Average flow rate not less than 1.1 m^3/min).
	24 hours**	500µg/m^3	
Respirable Particulate Matter PM_{10}	Annual Average*	120µg/m^3	Preferably β-Ray absorption method
	24 hours**	150µg/m^3	
Respirable Particulate Matter $PM_{2.5}$	Annual Average*	15µg/m^3	Preferably β-Ray absorption method
	24 hours**	35µg/m^3	

Pollutant	Time-weighted average	Concentration in Ambient Air	Method of measurement
	1 hour	15µg/m^3	
Lead (Pb)	Annual Average*	1 µg/m^3	ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	1.5µg/m^3	
Carbon Monoxide (CO)	8 hours**	5 mg/m^3	Non Dispersive Infra Red (NDIR) method
	1 hour	10 mg/m^3	

* Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

** 24 hourly /8 hourly values should be met 98% of the in a year. 2% of the time, it may exceed but not on two consecutive days.

(IQBAL MOHAMMED CHAUHAN)
Secretary, Government of the Punjab
Environment Protection Department

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GOVERNMENT OF THE PUNJAB
LAW AND PARLIAMENTARY AFFAIRS DEPARTMENT

NOTIFICATION
(121 of 2016)

12th August 2016

The following Notification No. SO(G)/EPD/7-26/2013, dated 05.08.2016 regarding the Punjab Environmental Quality Standards for Noise is published for general information:

DR SYED ABUL HASSAN NAJMEE
Secretary
Government of the Punjab
Law and Parliamentary Affairs
Department

Government of the Punjab
Environment Protection Department

NOTIFICATION: No. SO(G)/EPD/ 7-26 **/2013.** In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 1997 (XXXIV of 1997), the Environmental Protection Council has approved the following as the Punjab Environmental Quality Standards for Noise:

Punjab Environment Quality Standards for Noise

No.	Category of Area/Zone	Effective from 1st July, 2010		Effective from 1st July, 2013	
		Limits in dB(A) Leq*			
		Day Time	Night Time	Day Time	Night Time
1	Residential Area (A)	65	50	55	45
2	Commercial Area (B)	70	60	65	55
3	Industrial Area (C)	80	75	75	65
4	Silence Zone (D)	55	45	50	45

Note:

1. Day time hours; 6:00am to 10:00pm.
2. Night Time hours; 10:00 pm to 6:00 am.
3. Silence Zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospital, educational institutions and courts
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority

* dB(A) Leq: Time weighted average of the level of sound in decibel on scale A which is relatable to human hearing.

(IQBAL MOHAMMED CHAUHAN)
Secretary, Government of the Punjab
Environment Protection Department

SEQS, 2016

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KARACHI THURSDAY JANUARY 28, 2016

PART-I

GOVERNMENT OF SINDH
SINDH ENVIRONMENT PROTECTION AGENCY

NOTIFICATION

NO.EPA/TECH/739/2014:- In exercise of the powers conferred under clause (g) of sub-section (1) of section of 6 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Sindh Environmental Protection Council, is pleased to establish the following standards:-

1. (1) These Standards may be called the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Airs, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015.

(2) These Standards shall come into force at once.

2. In these Standards, unless there is anything repugnant in the subject or context –

(a) "Government" means the Government of Sindh;

(b) "Standards" means the Sindh Environmental Quality Standards.

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SINDH ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS (mg/l, UNLESS OTHERWISE DEFINED)

S. No.	Parameter	Standards		
		Into Inland Waters	Into Sewage Treatment [3]	Into Sea [3]
1	2	3	4	5
1.	Temperature 40^{0}C or Temperature Increase *	≤3^{0}C	≤3^{0}C	≤3^{0}C
2.	pH value (H^+)	6-9	6-9	6-9
3.	Biochemical Oxygen Demand (BOD)5 at 20^{0}C [1]	80	250	80**
4.	Chemical Oxygen Demand(COD) [1]	150	400	400
5.	Total Suspended Solids (TSS)	200	400	200
6.	Total Dissolved Solids (TDS)	3500	3500	3500
7.	Oil and Grease	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.3	0.3
9.	Chloride (as Cl^-)	1000	1000	SC***
10.	Fluoride (as F^-)	10	10	10
11.	Cyanide (as CN^-) total	1.0	1.0	1.0
12.	An-ionic detergents (as MBAS)[2]	20	20	20
13.	Sulphate (SO_4^{2-})	600	1000	SC***
14.	Sulphide (S^{2-})	1.0	1.0	1.0
15.	Ammonia (NH_3)	40	40	40
16.	Pesticides [3]	0.15	0.15	0.15
17.	Cadmium [4]	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent [4]	1.0	1.0	1.0
19.	Cooper [4]	1.0	1.0	1.0
20.	Lead [4]	0.5	0.5	0.5
21.	Mercury [4]	0.01	0.01	0.01
22.	Selenium [4]	0.5	0.5	0.5
23.	Nickel [4]	1.0	1.0	1.0
24.	Silver [4]	1.0	1.0	1.0
25.	Total toxic metals	2.0	2.0	2.0
26.	Zinc	5.0	5.0	5.0
27.	Arsenic [4]	1.0	1.0	1.0
28.	Barium [4]	1.5	1.5	1.5
29.	Iron	8.0	8.0	8.0
30.	Manganese	1.5	1.5	1.5
31.	Boron [4]	6.0	6.0	6.0
32.	Chlorine	1.0	1.0	1.0

Explanations:

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Sindh Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.
2. Methylene Blue Active Substances; assuming surfactant as biodegradable.
3. Pesticides include herbicides, fungicides, and insecticides.
4. Subject to total toxic metals discharge should not exceed level given at S. N. 25.
5. Applicable only when and where sewage treatment is operational and BOD5=80mg/l is achieved by the sewage treatment system.
6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.

* The effluent should not result in temperature increase of more than 3^0C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.

** The value for industry is 200 mg/l

*** Discharge concentration at or below sea concentration (SC).

Note: 1. Dilution of liquid effluents to bring them to the STANDARDS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.

2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the STANDARDS limits".

"SINDH ENVIRONMENTAL QUALITY STANDARDS FOR INDUSTRIAL GASEOUS EMISSION (mg/Nm^3, UNLESS OTHERWISE DEFINED)."

S. No.	Parameter	Source of Emission	Standards
1	2	3	4
1.	Smoke	Smoke opacity not to exceed	40% or 2 Ringleman Scale or equivalent smoke number
2.	Particulate matter	(a) Boilers and Furnaces	
	(1)	(i) Oil fired	300
		(ii) Coal fired	500
		(iii) Cement Kilns	300

		(b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.		500
3.	Hydrogen Chloride		Any	400
4.	Chlorine		Any	150
5.	Hydrogen Fluoride		Any	150
6.	Hydrogen Sulphide		Any	10
7.	Sulphur Oxides [2][3]		Sulfuric acid/ Sulphonic acid plants	
			Other Plants except power Plants operating on oil and coal	1700
8.	Carbon Monoxide		Any	800
9.	Lead		Any	50
10.	Mercury		Any	10
11.	Cadmium		Any	20
12.	Arsenic		Any	20
13.	Copper		Any	50
14.	Antimony		Any	20
15.	Zinc		Any	200
16.	Oxides of Nitrogen		Nitric acid Manufacturing unit.	3000
		(3)	Other plants except power plants operating on oil or coal:	
			Gas fired	400
			Oil fired	600
			Coal fired	1200

Explanations:-

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1 percent Sulphur content in fuel oil. Higher content of Sulphur will case standards to be pro-rated.
3. In respect of emissions of Sulphur dioxide and Nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to Standards specified above, comply with the following standards:-

A. **Sulphur Dioxide**

Sulphur Dioxide Background levels Micro-gram per cubic meter (ug/m^3) Standards.

Background Air Quality (SO_2 Basis)	Annual Average	Max. 24-hours Interval	Criterion I Max. SO_2 Emission (Tons per Day Per Plant)	Criterion II Max. ground level increment to ambient (One year Average)
Unpolluted	<50	<200	500	50
Moderately Polluted*				
Low	50	200	500	50
High	100	400	100	10
Very Polluted**	>100	>400	100	10

* For intermediate values between 50 and 100 ug/m^3 linear interpolations should be used.
** No projects with Sulphur dioxide emissions will be recommended.

B. Nitrogen Oxide

Ambient air concentrations of Nitrogen oxides, expressed as NO_x should not be exceed the following:-

Annual Arithmetic Mean $100 ug/m^3$ (0.05 ppm)

Emission level for stationary source discharge before missing with the atmosphere should be maintained as follows:-

For fuel fired steam generators as Nanogram (10^0-gram) per joule of heat input:

Liquid fossil fuel	130
Solid fossil fuel..	300
Lignite fossil fuel	260

Note:- Dilution of gaseous emissions to bring them to the STANDARDS limiting value is not permissible through excess air mixing blowing before emitting into the environment.

Sindh Environmental Quality Standards for Motor Vehicle Exhaust and Noise

(i) **For in-use Vehicles**

S. No.	Parameter	Standards (maximum permissible limit)	Measuring Method	Applicability
1	2	3	4	5
1.	Smoke	40% or on the Ringleman Scale during engine acceleration mode	To be compared with Ringleman Chart at a distance of 6 meters or more.	Immediate effect
2	Carbon Monoxide	6 %	Under idling conditions: Non-dispersive infrared detection through gas analyzer.	
3.	Noise	85 db (A)	Sound-meter at 7.5 meter from the source.	

For new Vehicles

EMISSION STANDARDS FOR DIESEL VEHICLES

(a) For passenger Cars and Light Commercial Vehicles (g/Km)

Type of Vehicle	Category/Class	Tiers	CO	HC+ NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8
Passenger Cars.	M 1: with reference mass (RW).	Pak-II, IDI	1.0	0.7	0.08		All imported and local manufactured
	up to 2500 kg. Cars with RW over 2500 kg. to meet NI Category standards	Pak-II DI	1.0	0.9	0.10	NEDC (ECE 15+ EUDCL)	Diesel vehicles with effect from 01-07-2012
Light Commercial Vehicles	NI-I (RW<1250 Kg)	Pak-II IDI	1.0	0.70	0.08		
		Pak-II DI	1.0	0.90	0.10		
	NI-II(1250kg< RW < 1700 Kg)	Pak-II IDI	1.25	1.0	0.12		
		Pak-II DI	1.25	1.3	0.14		
	NI-III(RW< 1700 Kg)	Pak-II IDI	1.50	1.2	0.17		
		Pak-II DI	1.50	1.6	0.20		

Parameter Standards (maximum permissible limit) Measuring method

Noise	85 db (A)	Sound-meter at 7.5 meters from the source

(b) For Heavy Duty Diesel Engines and Large Goods Vehicles (g/Kwh)

Type of Vehicle	Catogry/ Class	Tiers	CO	HC	NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8	9
Heavy Duty Diesel Engines	Turks and Buses	Pak-II	4.0	1.1	7.0	0.15	ECE-R-49	All Imported and local manufactured diesel vehicles with the effect 1-7-2012
Large goods Vehicles	N2(2000 and up	Pak-II	4.0	7.0	1.10	0.15	EDC	

Parameter Standards (maximum permissible limit) Measuring method

Noise 85 db (A) Sound-meter at 7.5 meters from the Source

Emission Standards for Petrol Vehicles (g/km)

Type of Vehicle	Category/ Class	Tier	Co	HC+ NOx	Measuring Method	Applicability
1	2	3	4	5	6	7
Passenger Cars	M 1; with reference mass (RW), upto 2500 kg. Cars with RW over 2500 kg, to meet N1 Category standards	Pak-II	2.20	0.5	NEDC (ECE 15+ EUDC)	All imported and new models locally manufactured petrol vehicles with effect from 1st July, 2009**

Light Commercial Vehicles	NI-I (RW<1250 kg) NI-NI-II (1250kg> kg RW < 1700 Kg)	Pak-II	2.20	0.5	
		Pak-II	4.0	0.65	
		Pak-II	5.0	0.08	
	NI-III(RW> 1700 kg)				
Motor Rickshaws & Motor Cycles	2,4 strokes < 150 cc	Pak-II	5.5	1.5	ECER 40
	2,4 strokes > 150cc	Pak-II	5.5	1.3	

Parameter Standards (maximum permissible limit) Measuring method

Noise source	85 db (A)	Sound-meter at 7.5 meters from the

Explanations:

DI:	Direct Injection.
IDI:	Indirect Injection.
EUDCL:	Extra Urban Driving Cycle.
NEDC:	New European Driving Cycle.
ECE:	Urban Driving Cycle.
M:	Vehicles designed and constructed for the carriage of passenger and Comprising no more than eight seats in addition to the driver's seat.
N:	Motor vehicles with at least four wheels designed and constructed for the carriage of goods.
*	New model means both model and engine type change.
**	The existing models of petrol driven vehicles locally manufactured will immediately switch over to Pak-II emission standards but no late than 30th June, 2012.

SINDH ENVIRONMENTAL QUALITY STANDARDS FOR AMBIENT AIR

Pollutants	Time-weight average	Concentration in Ambient Air	Method of measurement
Sulphur Dioxide(SO2)	Annual Average*	80 µg/m³	Ultraviolet Fluorescence method
	24 hours**	120 µg/m³	
Oxides of Nitrogen as (NO)	Annual Average*	40 µg/m³	Gas Phase Chemiluminescence
	24 hours**	40 µg/m³	
Oxides of Nitrogen as (NO2)	Annual Average*	40 µg/m³	Gas Phase Chemiluminescence
	24 hours**	80 µg/m³	
O³	1 hour	130 µg/m³	Non dispersive U/V absorption method
Suspended Particulate Matters(SPM)	Annual Average*	360 µg/m³	High Volume Sampling (Average flow rate not less than 1.1 m/minutes)
	24 hours**	500 µg/m³	
Respirable Particulate Matter PM10	Annual Average*	120 µg/m³	ß Ray absorption method
	24 hours**	150 µg/m³	
Respirable Particulate Matter PM2.5	Annual Average*	40 µg/m³***	ß Ray absorption method
	24 hours**	75 µg/m³	
Lead Pb	Annual Average*	1 µg/m³	ASS Method after sampling using EPM 2000 or equivalent filter paper
	24 hours**	1.5 µg/m³	
Carbon Monoxide(CO)	8 hours**	5 mg/m³	Non Dispersive Infra Red(NDIR) method
	1 hours**	10 mg/m³	

*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly and at uniform interval.

** 24 hourly/8 hourly values should be met 98% in a year, 2% of the time. It may exceed but not on two consecutive days.

***Annual Average limit of 40µg/m³ or background annual average concentration plus allowable allowance of 9µg/m³, whichever is lower.

Sindh Standards for Drinking Water Quality

Properties / Parameters	Standard Values for Sindh	WHO Standards	Remarks
Bacterial			
All water intended for drinking (e.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Most Asian countries also follow WHO standards
Physical			
Colour	≤ 15 TCU	≤ 15 TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non	Non	

	objectionable/Acceptable	objectionable/Accep table
Turbidity	(5 NTU	(5 NTU
Total hardness as $CaCO_3$	< 500 mg/l	---
TDS	(1000	(1000
pH	6.5 - 8.5	6.5 - 8.5
Chemical		
Essential Inorganic	***mg/Litre***	***mg/Litre***
Aluminium (Al) mg/l	≤ 0.2	0.2

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Antimony (Sb)	≤ 0.005 (P)	0.02	
Arsenic (As)	≤ 0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium(Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl)	< 250	250	
Chromium (Cr)	≤ 0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic	***mg/Liter***	***mg/Litre***	
Cyanide (CN)	≤ 0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤ 1.5	1.5	
Lead (Pb)	≤ 0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤ 0.001	0.001	
Nickel (Ni)	≤ 0.02	0.02	

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Nitrate (NO_3)	0.50	50	
Nitrite (NO_2)	3 (P)	3	
Selenium (SE)	0.01 (P)	0.01	
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	—	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Organic			
Pesticides mg/L		PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20-58 may be consulted ***	Annex II
Phenolic compounds (as Phenols) mg/L		0.002	
Polynuclear aromatic hydrocarbons (as PAH g/L)		0.01 (By GC/MS method)	
Radioactive			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

*** PSQCA: Pakistan Standards Quality Control Authority

Proviso:

The existing drinking water treatment infrastructure is not adequate to comply with WHO guidelines. The Arsenic concentrations in some parts of Sindh have been found high then Revised WHO guidelines. It will take some time to control arsenic through treatment process. Lead concentration in the proposed standards is higher than WHO Guidelines. As the piping system for supply of drinking water in urban centers are generally old and will take significant resources and time to get them replaced. In the recent past, Lead was completely phased out from petroleum

products to cut down Lead entering into environment. These steps will enable to achieve WHO guidelines for Arsenic, Lead, Cadmium and Zinc. However, for bottled water, WHO limits for Arsenic, Lead, Cadmium and Zinc will be applicable and PSQCA Standards for all the remaining parameters.

Sindh Environmental Quality Standards for Noise

S. No.	Category of Area / Zone	Effective from 1st Jan, 2015		Effective from 1st January, 2015	
		Limit in dB(A) Leq *			
		Day Time	Night Time	Day Time	Night Time
1.	Residential Area (A)	65	50	55	45
2.	Commercial Area (B)	70	60	65	55
3.	Industrial Area (C)	80	75	75	65
4.	Silence Zone (D)	55	45	50	45

Note: 1. Day time hours: 6:00 a.m to 10:00 p.m

2. Night time hours: 10:00 p.m to 6:00 a.m

3. Silence zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts

4. Mixed categories of areas may be declared as one of the four aberve-mentioned categories by the competent authority.

* dB(A) Leq: Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

3. **Repeal and Savings.**

(1) The provisions of the Statutory Notification dated 10th August, 2000 and 18th Octok.r, 2010, issued by the Ministry of Environment, Government of Pakistan, to the extent of the Province of Sindh are hereby repealed.

(2) All actions taken, proceedings initiated shall be deemed to have been taken and initiated validly under the the provisions of these Rules.

DIRECTOR GENERAL,
SINDH ENVIRONMENTAL PROTECTION AGENCY

Karachi: Printed at the Sindh Government Press
28-1-2016

Annex II: Environmental Monitoring Criteria

ENVIRONMENTAL MONITORING CRITERIA

Objectives:

Following are the objectives of the environmental monitoring, sampling and testing:

- Establish baseline environmental conditions of ambient air, noise and water quality in and around the COI of the alignment; and
- This will also provide the basis for impact assessment and compliance monitoring during various phases of the proposed Project.

Environmental Monitoring Criteria:

Following criteria was considered for the selection of environmental monitoring locations along the road alignment:

- Major surface water crossings e.g. canals, distributaries, nullahs, etc. and nearby water ponds along road alignment are considered for selection of surface water sampling locations;
- Nearby sensitive receptors e.g. educational institutions, mosques, health facilities, residential areas, etc. have been given due importance for the selection of ambient air and noise monitoring points; and
- Pumps/hand pumps/tube wells along road alignment being used to fulfil the drinking water requirements of major residential areas, education institutions, mosques, health facilities, etc. have been considered for ground water sampling.

Based on the above criteria, about eight (08) number of surface/wastewater sampling points have been selected whereas about six (06) number of ground water sampling points have been selected. Ambient air and noise monitoring will be conducted at six (06) locations along the road alignment. Tentative monitoring/sampling points along with parameters are provided in below table:

Item	Sampling Parameter
Surface Water	Temperature, pH, TDS, BOD, COD, Phenols, Chloride, Copper, Lead, Manganese, Sulphate, Zinc, Silver, Boron, Barium, Iron
Air Quality	CO, NOx, SOx, $PM_{10,}$
Noise	Equivalent Noise Levels in dB (A)
Drinking Water	Color, pH, Turbidity, Total Hardness, TDS, Antimony, Barium, Chloride, Fluoride, Nitrate, Nitrite, Odor & Taste, Arsenic, Total Coliforms, Fecal Coli forms (E.Coli).

Reasons/criteria for selection of each sampling, monitoring point is provided in below table:

Sampling/Monitoring Point	Reason of Selection	Location
	Surface Water (SW) Sampling	
SW-01	Nullah Crossing	Meeral
SW-02	Begari Canal Crossing	Kandhkot
SW-03	Nearby Water Pond	Kandhkot
SW-04	Nearby Water Pond	Near Bakshapur
SW-05	Pat Feeder Distributary Crossing	Kashmore
SW-06	Pat Feeder Canal Crossing	Kashmore
SW-07	Matwah Distributary Crossing	Near Rojhan
SW-08	Kadra Canal Crossing	Near Kot Mithan
	Ground Water (GW) Sampling	
GW-01	Kundan Mosque & Residential Area	Shikarpur
GW-02	Govt. Higher Secondary School & Residential Area	Khnapur
GW-03	Cadet College	Kandhkot
GW-04	Masjid-e-Bilal & nearby Residential Area	Kashmore
GW-05	Rural Health Centre & Residential Area	Rujhan Chowk
GW-06	Mushtaq Hotel & nearby Residential Area	Rajanpur
	Ambient Air & Noise (A&N) Monitoring	
A&N-01	Residential Area	Shikarpur
A&N-02	Rural Health Centre & Residential Area	Khanpur
A&N-03	Masjid Ali-ul-Murtaza & Residential Area	Kandhkot
A&N-04	Jamia Masjid Qadria & Residential Area	Kashmore
A&N-05	Rural Health Centre & Residential Area	Rojhan
A&N-06	Noorani Masjid & Residential Area	Rajanpur

Map showing ambient air & noise monitoring and surface/ground water sampling points is also provided above.

Annex III. Lab Results

Integrated Environment Laboratory

AMBIENT PARTICULATE MATTERS MONITORING REPORT

Reference Number:	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rojhan, District Rahim Yar Khan
Monitoring Date:	06-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	ACM65, Serial # 1310
Location:	Rojhan, District Rahim Yar Khan		
GPS Coordinates:	28° 42' 54.566" N 69° 54' 2.354" E		

Sr. No.	Time	Parameters	Results (Average 24 Hrs)
	Hours	PM_{10} (µg/m³)	PM_{10} (µg/m³)
25.	11:30 A.M	101.31	104.161
26.	12:30 P.M	105.52	
27.	01:30 P.M	109.31	
28.	02:30 P.M	120.61	
29.	03:30 P.M	124.93	
30.	04:30 PM	119.18	
31.	05:33 PM	120.17	
32.	06:30 PM	122.25	
33.	07:30 PM	109.12	
34.	08:30 PM	102.70	
35.	09:30 PM	101.81	
36.	10:30 PM	102.05	
37.	11:30 PM	99.14	
38.	12:30 AM	98.19	
39.	01:30 AM	97.92	
40.	02:30 AM	93.43	
41.	03:30 AM	89.99	
42.	04:30 AM	88.11	
43.	05:30 AM	87.81	
44.	06:30 A.M	85.97	
45.	07:30 A.M	89.21	
46.	08:30 A.M	108.21	
47.	09:30 A.M	110.52	
48.	10:30 A.M	112.71	
PEQSAA			150 (µg/m³)

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were µg/m³ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature of Analyst:

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS
Creative House, 3rd Floor, Office # 302, Phase II Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: inenvconsultants@yahoo.com www.iec-consultants.com
Environmental Protection Agency (EPA-KPK) Certified

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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Shikarpur
Monitoring Date:	02-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Shikarpur		
GPS Coordinates:	27° 58' 3.920" N 68° 38' 19.672" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	09:00 A.M	1.03	13.34	15.76	16.81
2	10:00 A.M	1.2	13.9	16.12	14.7
3	11:00 A.M	1.18	14.3	16.77	14.05
4	12:00 P.M	1.13	13.61	17.12	15.01
5	01:00 P.M	1.38	15.09	17.6	13.07
6	02:00 P.M	1.26	14.87	17.77	14.45
7	03:00 P.M	1.1	14.63	16.57	12.85
8	04:00 PM	1.15	14.58	16.81	13.7
9	05:00 PM	1.04	14.1	14.1	13.75
10	06:00 PM	1.1	13.41	14.45	13.7
11	07:00 PM	1.12	13.22	15.12	13.78
12	08:00 PM	1.08	13.9	14.88	13.48
13	09:00 PM	1.07	12.91	13.87	14.14
14	10:00 PM	1.06	12.78	13.85	13.74
15	11:00 PM	1.06	13.1	14.1	13.46
16	12:00 AM	1.07	12.88	14.36	13.05
17	01:00 AM	1.06	13.14	14.13	13.45
18	02:00 AM	1.08	14.22	13.88	13.7
19	03:00 AM	1.07	14.1	14.17	12.85
20	04:00 AM	1.06	14	13.68	13.18
21	05:00 AM	1.06	14.44	13.88	12.48
22	06:00 A.M	1.09	13.21	13.74	12.64
23	07:00 A.M	1.1	13.63	13.42	12.85
24	08:00 A.M	1.08	12.1	13.78	13.59
Average Concentration		**1.10**	**13.72**	**14.9**	**13.68**
SEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature of Analyst

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS
Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: inenvconsultants@yahoo.com www. iec-consultants.com
Environmental Protection Agency (EPA-KPK) Certified

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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Khanpur, District Shikarpur
Monitoring Date:	03-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Khanpur, District Shikarpur		
GPS Coordinates:	28° 0' 5.916" N 68° 43' 27.962" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	10:00 A.M	0.74	11.45	14.87	16.32
2	11:00 A.M	0.91	12.01	15.23	14.21
3	12:00 P.M	0.89	12.41	15.88	13.56
4	01:00 P.M	0.84	11.72	16.23	14.52
5	02:00 P.M	1.09	13.2	16.71	12.58
6	03:00 P.M	0.97	12.98	16.88	13.96
7	04:00 PM	0.81	12.74	15.68	12.36
8	05:00 PM	0.86	12.69	15.92	13.21
9	06:00 PM	0.75	12.21	13.21	13.26
10	07:00 PM	0.81	11.52	13.56	13.21
11	08:00 PM	0.83	11.33	14.23	13.29
12	09:00 PM	0.79	12.01	13.99	12.99
13	10:00 PM	0.78	11.02	12.98	13.65
14	11:00 PM	0.77	10.89	12.96	13.25
15	12:00 AM	0.77	11.21	13.21	12.97
16	01:00 AM	0.78	10.99	13.47	12.56
17	02:00 AM	0.77	11.25	13.24	12.96
18	03:00 AM	0.79	12.33	12.99	13.21
19	04:00 AM	0.78	12.21	13.28	12.36
20	05:00 AM	0.77	12.11	12.79	12.69
21	06:00 A.M	0.77	12.55	12.99	11.99
22	07:00 A.M	0.8	11.32	12.85	12.15
23	08:00 A.M	0.81	11.74	12.53	12.36
24	09:00 A.M	0.79	10.21	12.89	13.1
Average Concentration		**0.81**	**11.83**	**14.10**	**13.19**
SEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
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FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: inenvconsultants@yahoo.com www. iec-consultants.com

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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Kashmore, District Kashmore
Monitoring Date:	05-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Kashmore, District Kashmore		
GPS Coordinates:	28° 26' 10.003" N 69° 34' 46.810" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	11:30 A.M	0.91	12.38	15.55	17.15
2	12:30 P.M	1.08	12.94	15.91	15.04
3	01:30 P.M	1.06	13.34	16.56	14.39
4	02:30 P.M	1.01	12.65	16.91	15.35
5	03:30 P.M	1.26	14.13	17.39	13.41
6	04:30 PM	1.14	13.91	17.56	14.79
7	05:33 PM	0.98	13.67	16.36	13.19
8	06:30 PM	1.03	13.62	16.6	14.04
9	07:30 PM	0.92	13.14	13.89	14.09
10	08:30 PM	0.98	12.45	14.24	14.04
11	09:30 PM	1.0	12.26	14.91	14.12
12	10:30 PM	0.96	12.94	14.67	13.82
13	11:30 PM	0.95	11.95	13.66	14.48
14	12:30 AM	0.94	11.82	13.64	14.08
15	01:30 AM	0.94	12.14	13.89	13.8
16	02:30 AM	0.95	11.92	14.15	13.39
17	03:30 AM	0.94	12.18	13.92	13.79
18	04:30 AM	0.96	13.26	13.67	14.04
19	05:30 AM	0.95	13.14	13.96	13.19
20	06:30 A.M	0.94	13.04	13.47	13.52
21	07:30 A.M	0.94	13.48	13.67	12.82
22	08:30 A.M	0.97	12.25	13.53	12.98
23	09:30 A.M	0.98	12.67	13.21	13.19
24	10:30 A.M	0.96	11.14	13.57	13.93
Average Concentration		**0.98**	**12.7**	**14.7**	**14.02**
SEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
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FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: inenvconsultants@yahoo.com www. iec-consultants.com

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AMBIENT GASEOUS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Kund Kot, District Kashmore
Monitoring Date:	04-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Kund Kot, District Kashmore		
GPS Coordinates:	28° 14' 3.525" N 69° 11' 14.139" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	11:00 A.M	1.1	13.12	15.7	17.48
2	12:00 P.M	1.27	13.68	16.06	15.37
3	01:00 P.M	1.25	14.08	16.71	14.72
4	02:00 P.M	1.2	13.39	17.06	15.68
5	03:00 P.M	1.45	14.87	17.54	13.74
6	04:00 PM	1.33	14.65	17.71	15.12
7	05:00 PM	1.17	14.41	16.51	13.52
8	06:00 PM	1.22	14.36	16.75	14.37
9	07:00 PM	1.11	13.88	14.04	14.42
10	08:00 PM	1.17	13.19	14.39	14.37
11	09:00 PM	1.19	13	15.06	14.45
12	10:00 PM	1.15	13.68	14.82	14.15
13	11:00 PM	1.14	12.69	13.81	14.81
14	12:00 AM	1.13	12.56	13.79	14.41
15	01:00 AM	1.13	12.88	14.04	14.13
16	02:00 AM	1.14	12.66	14.3	13.72
17	03:00 AM	1.13	12.92	14.07	14.12
18	04:00 AM	1.15	14	13.82	14.37
19	05:00 AM	1.14	13.88	14.11	13.52
20	06:00 A.M	1.13	13.78	13.62	13.85
21	07:00 A.M	1.13	14.22	13.82	13.15
22	08:00 A.M	1.16	12.99	13.68	13.31
23	09:00 A.M	1.17	13.41	13.36	13.52
24	10:00 A.M	1.15	11.88	13.72	14.26
Average Concentration		**1.17**	**13.5**	**14.9**	**14.35**
SEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

SEQSAA: Sindh Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
- Quality was assured through self calibration of the instrument.
- The values were representing of monitoring conditions prevailing during the monitoring hours.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for court.

Signature of Analyst

FOR ENVIRONMENTAL MONITORING, ANALYSIS & SURVEYS

Creative House, 3rd Floor, Office # 302, Phase III Chowk, Hayatabad, Peshawar, Pakistan
Tel: 091-5852913 Cell: +92 302 8462412 Email: inenvconsultants@yahoo.com www. iec-consultants.com

Environmental Protection Agency (EPA-KPK) Certified

Integrated Environment Laboratory

EPA Accredited

AMBIENT GASEOUS MONITORING REPORT

Reference Number	KS-P/ENV/01-787-2020		
Project Name:	Shikarpur-Rajanpur Road Section Project (N55)	**Site Address:**	Rojhan, District Rahim Yar Khan
Monitoring Date:	06-07-2020	**Reporting Date:**	13-07-2020
Source:	Ambient Air	**Monitoring Instrument:**	AQM65, Serial # 1310
Location:	Rojhan, District Rahim Yar Khan		
GPS Coordinates:	28° 42' 54.555" N 69° 54' 2.354" E		

Sr. No	Time	PARAMETERS			
		CO	NO	NO_2	SO_2
		Units			
	Hours	(mg/m^3)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1	11:30 A.M	1.08	11.98	15.83	17.29
2	12:30 P.M	1.25	12.54	16.19	15.18
3	01:30 P.M	1.23	12.94	16.84	14.53
4	02:30 P.M	1.18	12.25	17.19	15.49
5	03:30 P.M	1.43	13.73	17.67	13.55
6	04:30 PM	1.31	13.51	17.84	14.93
7	05:33 PM	1.15	13.27	16.64	13.33
8	06:30 PM	1.2	13.22	16.88	14.18
9	07:30 PM	1.09	12.74	14.17	14.23
10	08:30 PM	1.15	12.05	14.52	14.18
11	09:30 PM	1.17	11.86	15.19	14.26
12	10:30 PM	1.13	12.54	14.95	13.96
13	11:30 PM	1.12	11.55	13.94	14.62
14	12:30 AM	1.11	11.42	13.92	14.22
15	01:30 AM	1.11	11.74	14.17	13.94
16	02:30 AM	1.12	11.52	14.43	13.53
17	03:30 AM	1.11	11.78	14.2	13.93
18	04:30 AM	1.13	12.86	13.95	14.18
19	05:30 AM	1.12	12.74	14.24	13.33
20	06:30 A.M	1.11	12.64	13.75	13.66
21	07:30 A.M	1.11	13.08	13.95	12.96
22	08:30 A.M	1.14	11.85	13.81	13.12
23	09:30 A.M	1.15	12.27	13.49	13.33
24	10:30 A.M	1.13	10.74	13.85	14.07
Average Concentration		**1.15**	**12.36**	**15.06**	**14.16**
PEQSAA		**05 (08 hr)**	**40 (24 hr)**	**80 (24 hr)**	**120 (24 hr)**

PEQSAA: Punjab Environmental Quality Standards for Ambient Air

Note:

- Selected measurement units were mg/m^3 & $\mu g/m^3$ otherwise stated.
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