

Clarification #02 - Nashpa LP compressor package

Project Name:	SUPPLY,INSTALLATION AND COMMISSIONING OF ENGINE DRIVEN GAS RECIPROCATING COMPRESSOR PACKAGE FOR NASHPA PLANT											
Tender No.:	PROC-FC/CB/P&P/NASHPA-4900/20											
Customer:	OIL & GAS DEVELOPMENT COMPANY LIMITED											
ITEM	Bidders queries	description of bid clause	OGDCL Response									
1	In bidder experience, it is not necessary for all cylinders to configure with VVCP, it is suggested to configure VVCP according to the actual selection needs	3.4 3.4.1 Variable Volume Pockets on all compressor cylinders	VVCP to be provided, follow tender									
2	It is suggested that customers purchase grouting materials(chemicals/filters/fibres etc.) locally, and the M/S OGDCL carries out construction according to vendor relevant requirements and M/S OGDCL experience. If bidder should in charge of construction of foundations please provide geotechnical investigation report, Installation elevation of equipment and current ground elevation of compressor package installation site for our reference.	3.4. Compressor flow control system: 3.4.1. Variable Volume Pockets on all compressor cylinders 3.14. Installation material: 3.10.18. Grouting material (chemicals / fillers / fibres / bolting etc.) 3.10.19. Earthing material 3.10.20. Material for construction of foundations 3.10.21. Shims for levelling / alignment	Follow tender, soil investigation report already provided in clarification #1. Site visit also allowed as per schedule mentioned in clarification #1. All Material in 3.14 in bidder scope.									
3	In bidder understanding that bidder only provide installation guidance/supervision and M/S OGDCL will in charge of installation work of compressor package at site. Please confirm.	8.3. Levelling & Grouting of the skids: Levelling and grouting of the skids to be Supply, Installation and Commissioning Assistance of Gas Engine Driven LP Gas Reciprocating Compressor for Nashpa Plant 20. Format of financial bid: The following format to be incorporated in the financial bid: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;">Sr.</th> <th style="width: 70%;">Description of equipment / services</th> <th style="width: 25%;">Prices in USD</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>Price of the complete compressor package</td> <td></td> </tr> <tr> <td>B</td> <td>Installation supervision, commissioning, foundation, start-up and on-site training (lump sum prices)</td> <td></td> </tr> </tbody> </table>	Sr.	Description of equipment / services	Prices in USD	A	Price of the complete compressor package		B	Installation supervision, commissioning, foundation, start-up and on-site training (lump sum prices)		Follow the scope as given in tender. Installation and commissioning in bidder scope. Foreign material will be supplied on C&F by sea Karachi basis. After Material inspection, it will be shifted from Karachi to Nashpa by OGDCL. Material will be unloaded at Nashpa by OGDCL. Other scope as per tender in bidder scope.
Sr.	Description of equipment / services	Prices in USD										
A	Price of the complete compressor package											
B	Installation supervision, commissioning, foundation, start-up and on-site training (lump sum prices)											
4	1. As per industry practice, M/S OGDCL should in charge of hazop study of whole plant instead of equipment supplier. Please confirm. 2.The unit is to provide the standby unit for the on-site unit. It is recommended to provide the PID and PFD of the on-site unit. HAZOP is not required for the standby unit, it is suggested that M/S OGDCL makes HAZOP together with the whole station	7.4. The supplier / bidder is required to perform HAZOP Study of the plant during the design phase of the package. 7.5. The HAZOP Study shall be reviewed by 06 Nos (approx.) of OGDCL professionals consisting of Plant Operations, Mechanical, Electrical, Instrumentation and HSEQ Engineers. Bidder to arrange the HAZOP meetings at a suitable venue within Pakistan at its own cost.	HAZOP of Package and its interconnecting will be performed, any change approved during HAZOP within the package will be born by bidder & while in interconnecting piping OGDCL will bear the cost. PFD already shared with clarification # 1, PID's will be shared with successful bidder.									
5	Due to the international epidemic situation, please confirm that bidder can online to attend HAZOP meeting.	7. Progress review,HAZOP Study & Design Review 7.5. The HAZOP Study shall be reviewed by 06 Nos (approx.) of OGDCL professionals consisting of Plant Operations, Mechanical, Electrical, Instrumentation and HSEQ Engineers. Bidder to arrange the HAZOP meetings at a suitable venue within Pakistan at its own cost.	As per tender, HAZOP meeting to be arranged in Pakistan by bidder. (currently no provision for online meeting as per tender at this stage)									
6	Please provide fuel gas pressure,temperature.	N/A	Pressure 90 psig, Temperature minimum 50 F & 100 F max.									
7	There is no description of utility instrument air in this document. Please Provide field utility instrument air parameter including pressure,temperature.	N/A	Startup Air Compressed Dry Air 115 - 125 psig, Instrument Air Compressed Dry Air 125 psig									

ITEM	Bidders queries	description of bid clause	OGDCL Response
8	Compressor bearing temperature by the original of Compressor manufacture, it's RTD type. Engine bearing and cylinder temperatures by the original of engine manufacture, it's k type TC and processed by engine ESM system. so these temperature instrumentation shall be TE, please confirm	5.16. List of Meters and .Alarms required:	Agreed. Compressor bearing RTD should be connected to field mounted temperature transmitter.
9	EWS and OWS are not included in compressor manufacture's scope of supply. all the new LP compressor data will transfer to EWS and OWS via communication links.	All the compressor data along with fire and gas leakage detection data shall be transmitted to new Engineering Workstations (EWS) and Operation workstations (OWS) considered delicately for new LP compressor for monitoring and controlling.	Redundent CPU/Power Supply/Modbus communication is required. OWS & EWS are not required,however bidder will be responsible for HMI development/configuration/programming in existng DCS/Safety manager (ESD). Laptop is required with all latest licensed (lifetime) software. Mentioned cables (SOR-4900) pairs must have 15% spare capacity. Caliberation kits/tools for F&G system to be provided by bidder. DNFT (FLL) should be powered from PLC (Cell powered DNFT is not required). Separate earthing pits to be developed for control and 220/380 volts is manadatory.
10	Instrument SIL rating should be based on the result of HAZOP analysis.Please confirm.	6.3. Instrumentation and Control System: 6.3.1. All field instrumentation shall be supplied to have SIL-3 certification	Both SIL2 and SIL 3 are acceptable
11	The LP compressor package PLC redundant parts only as follow: PLC controller Power supply modules Communication modules Comply with SIL-2 design, please confirm	N/A	Redundent PLC Controller (CPU), Power Supply modules, Communication modules should comply with Both SIL2 and SIL 3 are acceptable
12	3.3 Process Gas System, 1.As per our understanding, only 01 set PSV is required for final outlet and its set point is 725 psig. Please confirm. 2.Please confirm that all PSVs shall be equipped with 02 isolation valves and bypass valves?	3.3.11 Relief Valves (Spring Type, 1st Stage Iniet,Each Stage Outlet and 01 Set PSV with set point of 725 psig, along with 02 Isolating and bypass Valves)	1- No, each stage (Suction & Discharge) must have PSV with isolation valves and bypass valves, in addition to these PSV's 01 PSV is required to be installed at discharge manifold outside skid limits to be at set @ 725 psig for block case. 2- Each PSV to be provided with upstream/downstream isolation valves and bypass valves.
13	3.4 Compressor flow control system 17.Design parameters, Please share the frequency of changes of suction pressure, suction temperature, discharge pressure. Will these parameters changes continuously in short time ? if not, we suggest that VVCP can be used to achieve required flow rate at different suction pressure conditons. Otherwise, suction valve unloader may be used to achieve the target flow, and VVCP will be not required. Please advise. As per our understanding, 5 mmscf capacity shall be achieved at 50 psig suction pressure and 650 psig discharge pressure, pls confirm.	3.4.1 Variable Volume Pockets on all compressor cylinders 17.Design parameters 1.Suction Pressure(psig):50 to 100 2.Suction Temperature(deg.F):80 to 150 3.Final Discharge Pressure(psig):500 to 650	VVCP is required, Minimum capacity is 5 MMSCFD @ 50 psig suction/650 discharge pressure

ITEM	Bidders queries	description of bid clause	OGDCL Response
14	3.9 Gas Engine Start System, 1.Please provide starting gas/air parameters. 2.Please also provide instrument air parameters.	3.9.1 Pneumatic starting motor	1- Dry Compressed Air, Pressure 115 - 125 psig, Dry Compressed Air. 2- 125 psig dry (-40 F) compressed IA
15	3.12 Canopy/Enclosure for Engine & Compressor, Please explain in detail the specific requirements of Canopy/Enclosure design, such as noise reduction value, ventilation requirements, etc.	3.10.13 Complete Canopy/Enclosure for Engine and Compressor incorporating the acoustic, thermal, vibration, health and safety and maintainability considerations in design.	Closed Canopy (Pic shared), Acoustic Enclosure with ventilation. Ref Clarification # 1
16	6.4 HSEQ Requirements, Please provide the file National Environmental Quality Standards of EPA,Pakistan	6.4.2	Doc Attached
17	Please provide the soil test report.	8.1.2 The supplier/bidder to utilize the information provided in the soil test report attached with this document for the design of the foundations of the skids.	Soil Investigation report is already attached in clarification 1, dismantling of existing hard standing (RCC 6" & PCC 4") is also in bidder scope.
18	17.Design parameters, Discharge temperature after cooler should be at least 18°F higher than ambient temperature. Please recheck this clause. And provide reasonable design condition of ambient temperature, or raise discharge temperature.	4.Max discharge temperature: 115(deg.F) 8.The maximum ambient temperature is 122(deg.F)	Pls refer clarification # 1
19	Please confirm the saturation of process gas, in other words, humidity of process gas.	17.1 Gas analysis report for the Process Gas	20 - 40 lbs/MMSCF
20	Please provide fuel gas pressure, temperature and humidity.	17.2 Fuel Gas Specification	Pressure 90 psig, Temperature minimum 50 F & maximum 100 F, 0.01 ppmv
21	Whether the PID on the last page of the file is for reference only. Please confirm.	P&ID	This is typical PID showing minimum requirement but bidder may not be limited to it only.
22	6.2 Electric Design, All motors to be supplied with the package to have standardized frame sizes conforming to IEC, Please confirm it's acceptable or not.	All motors to be supplied with the package to have standardized frame sizes conforming to NEMA.	NEMA to be confirmed for motors. IEC code for other electrical equipments is given in tender.
23	6.3.1 After consulting manufacturers of Rosemount and Honeywell, pressure and temperature transmitters only have SIL2 certification and not SIL3 certification. And other instrument such as level switch, no oil flow switch with the bare compressor etc. have no sil certification. Please confirm whether the above statement is ok. Or indicate the method that satisfies SIL3.	All field instrumentation to be supplied to have SIL-3 certification	Both SIL2 and SIL 3 are acceptable
24	1. According to the requirements of 6.3.2, there are redundant CPU/communication/power supply /Modbus communication modules and non-redundant analogue and digital input /output modules in PLC. So is sil3 in 5.1 for compressor PLC or Workstations PLC? 2. We understand that the EWS&OWS is not included in the scope supply of the compressor package, please confirm.	5.1.The overall control , monitoring and alarm of compressor shall be done by dedicated SIL-3 rated PLC based control system, all the compressor data along with fire and gas leakage detection data shall be transmitted to new Engineering Workstations (EWS) and Operation workstations (OWS) considered delicately for new LP compressor for monitoring and controlling. 6.3.2. The control system shall comprise of on-skid stand-alone cabinets having the following: 6.3.2.1 Redundant PLC controllers 6.3.2.2. Analogue, Digital input /output modules (as per I/O requirements) 6.3.2.3. Redundant communication equipment and cables 6.3.2.4. Redundant power supply unit 6.3.2.5. Input/Output Marshalling 6.3.2.6 Redundant Modbus communication of compressor parameters with existing Plant DCS	Redundant CPU/Power Supply/Modbus communication is required. OWS & EWS are not required, however bidder will be responsible for HMI development/configuration/programming in existing DCS/Safety manager (ESD). Laptop is required with all latest licensed (lifetime) software. Mentioned cables (SOR-4900) pairs must have 15% spare capacity. Calibration kits/tools for F&G system to be provided by bidder. DNFT (FLL) should be powered from PLC (Cell powered DNFT is not required). Separate earthing pits to be developed for control and 220/380 volts is mandatory. Compressor PLC Both SIL2 and SIL 3 are acceptable
25	We consider providing vibration sensors, and then wiring vibration sensors to the compressor PLC system, using the compressor PLC system as the vibration detection system. Please confirm whether it is available.	Machine protection system with complete scope as per API 670, 5th Edition. Bentley Nevada or equivalent make with same input and output ports as of Bentley Nevada.	Yes, confirm.

ITEM	Bidders queries	description of bid clause	OGDCL Response
26	17.1 Gas Analysis report for the Process Gas, This section provides the process gas composition, but the C2 content in process gas is 0, and the C3+ content exceeds 32%, we understand that there should not be so many heavy hydrocarbons in the stabilizer overhead gas, please confirm.		fresh Gas analysis report attached.
27	Please provide the current process gas composition,since the process gas composition at tender document is sample dated 22-Jun-2019 and may have some changes which will influence the compressor model sizing.	N/A	fresh gas analysis report Attached
28	Please clarify wheather no load mechanical running test of compressor package is needed at bidder factory	N/A	No load Mechanical running test to be performed during FAT.
29	Maximum Flow Requirement meter cube per minute		98.39 m ³ /min
30	Discharge Pressure in bar		44.82 barg
31	Suction Pressure		3.45 to 6.9 barg
32	Ambient temp		2 C - 50 C
33	Air / Water cool		Both, Process Gas Cooling & utility cooling by air and engine jacket by coolant
34	Gas to be Compress		Flash Natural Gases.
35	RH or water concentration of gas		Already provided
36	Any treatment system requirement		No
37	Compressor technoloy (Piston/Screw/Dynamic)		Piston
38	Does this compressor request to perform continually?		Yes, confirm.
39	Is this process gas ingredient dirty? or impurity?		gases will be off gases from crude stablization unit and off gases of LP and MP seperation , some small entrainment may be there as it will be off gases.
40	Is there a limited installation area in the plant?		No, ample space is available

Gas Analysis report for the Process Gas of NASHPA

Sr.#	Components	Mole %
1.	Methane C ₁	61.3988
2.	Ethane C ₂	17.3722
3.	Propane C ₃	14.2296
4.	I-Butane nC ₄	1.4174
5.	N-Butane iC ₄	1.9933
6.	I-Pentane iC ₅	0.2869
7.	N-Pentane iC ₅	0.1973
8.	Hexane Plus C ₆₊	0.0648
9.	Carbon Dioxide CO ₂	2.4620
10.	Nitrogen N ₂	0.5777
11.	Hydrogen Sulphide H ₂ S	-
12.	Specific Gravity	0.8668
13.	Calorific Value (BTU/ft³)	1426.7



NASHPA Gas Processing and LPG Recovery Plant

DOCUMENT NO.:
NGP-000-HSE-15.65-0002-00

PHILOSOPHY

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Environmental Design Philosophy

NASHPA Gas Processing and LPG Recovery Plant	
DOC. NO.	NGP-000-HSE-15.65-0002-00
DESCRIPTION	Environmental Design Philosophy
REVISION	01
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REVISION HISTORY

REV.	DATE	REVISION DESCRIPTION
A	22/04/2016	Internal Discipline Check
B	25/04/2016	Issued for Review
C	20/05/2016	Issued for Approval
00	07/06/2016	Approved for Design
01	21/07/2016	Approved for Design

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1.1 Introduction

OIL & GAS Development Company Ltd. (OGDCL) is operating NASHPA Oil & Gas fields in Khyber Pakhtunkhwa of Islamic Republic of Pakistan. OGDCL intends to install LPG Recovery Plant, Compressors & Allied Facilities at this field.

1.2 Scope

This Environmental Design Philosophy concerns the philosophy, regulatory instruments, guidelines and standards that have to be taken into consideration for the design of NASHPA Gas Processing and LPG Recovery Plant with regard to its operating phase in order to:

- develop an industrial process in line with applicable Pakistan environmental legislation and international standards that regulate the environmental protection against emissions and wastes disposal;
- provide adequate control/monitoring systems in order to assure the constant compliance with the regulation requirements.

2.0 ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used in this document:

BOD	Biochemical Oxygen Demand
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
dB(A)	Noise Level in decibel with A-weighting
LPG	Liquefied Petroleum Gas
NEQS	National Environmental Quality Standards (Pakistan Standard for Environment)
NO _x	Oxides of Nitrogen
PM	Respirable Particulate Matter
SO ₂	Sulphur Dioxide
SPM	Suspended Particulate Matter
VOC	Volatile Organic Compound

3.0 REFERENCE

3.1 Codes and Standards

The following local laws and regulations (Pakistan) will be used for the design of the project:

NEQS National Environmental Quality Standards

4.0 PROJECT ENVIRONMENTAL PHILOSOPHY

Project design shall aim to:

- 1) Safeguard the environment, and where possible improve the environmental condition.
- 2) Eliminate the use of hazardous material from the design wherever practicable, and select lower toxicity chemicals over higher toxicity chemicals.
- 3) Minimize energy demand and maximize energy efficiency.
- 4) Avoid waste generation and minimize both the quantities of waste generated and the hazards of the waste.
- 5) Minimize demand and maximize reuse of freshwater.
- 6) Segregate potentially contaminated water and effluents and manage in line with best industry practice.
- 7) Reduce air emissions by process design and through energy optimization.
- 8) Avoid venting of gases, and minimize diffuse gas losses.
- 9) Design process systems to minimize flaring, utilize efficient flare tips.
- 10) Reduce footprint of facilities to minimize impacts on environment and land users.

In particular the design shall reduce the quantities and volumes of air and aqueous emissions to environment and solid waste.

5.0 AIR POLLUTION

5.1 Air Quality standards

The following table shows the air quality standards to be respected as per Pakistan Statutory Notifications issued by Government of Pakistan, Ministry of Environment.

Table 5-1: National Environment Quality Standards for Ambient Air

Pollutants	Time-weighted average	Concentration in Ambient Air		Method of measurement
		Effective from 1st July, 2010	Effective from 1st January, 2013	
Sulphur Dioxide (SO ₂)	Annual Average*	80 µg/m ³	80 µg/m ³	-Ultraviolet
	24 hours**	120 µg/m ³	120 µg/m ³	Fluorescence method
Oxides of Nitrogen as (NO)	Annual Average*	40 µg/m ³	40 µg/m ³	-Gas Phase
	24 hours**	40 µg/m ³	40 µg/m ³	Chemiluminescence
Oxides of Nitrogen as (NO ₂)	Annual Average*	40 µg/m ³	40 µg/m ³	-Gas Phase
	24 hours**	80 µg/m ³	80 µg/m ³	Chemiluminescence
O ₃	1 hour	180 µg/m ³	130 µg/m ³	-Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	400 µg/m ³	360 µg/m ³	-High Volume
	24 hours**	550 µg/m ³	500 µg/m ³	Sampling, (Average flow rate not less than 1.1 in ³ /minute)
Respirable Particulate Matter. PM ₁₀	Annual Average*	200 µg/m ³	120 µg/m ³	-β Ray absorption method
	24 hours**	250 µg/m ³	150 µg/m ³	
Respirable Particulate Matter. PM _{2.5}	Annual Average*	25 µg/m ³	15 µg/m ³	-β Ray absorption method
	24 hours**	40 µg/m ³	35 µg/m ³	
Lead Pb	Annual Average*	1.5 µg/m ³	1 µg/m ³	-ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	2 µg/m ³	1.5 µg/m ³	
Carbon Monoxide (CO)	8 hours**	5 mg/m ³	5 mg/m ³	-Non Dispersive Infra Red (NDIR) method
	1 hour	10 mg/m ³	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.

Project shall prevent or minimize impacts to air quality by ensuring that:

- Emissions do not result in pollutant concentrations that reach or exceed above ambient quality standards.
- Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards.

5.2 Industrial Gaseous Emission Limits

The following table shows the Industrial Gaseous Emission standards to be respected as per Pakistan Statutory Notifications issued by Government of Pakistan, Ministry of Environment, Local Government and Rural Development.

Table 5-2: "National Environmental Quality Standards for Industrial Gaseous Emission (mg/Nm³, Unless Otherwise Defined)."

S. No.	Parameter	Source of Emission	Existing Standards	Revised Standards
1	2	3	4	5
1.	Smoke	Smoke opacity not to exceed	40% or 2 Ringlemann Scale	40% or 2 Ringlemann Scale or equivalent smoke number
2.	Particulate matter	(a) Boilers and Furnaces		
	(1)	(i) Oil fired	300	300
		(ii) Coal fired	500	500
		(iii) Cement Kilns	200	300
		(b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.	500	500
3.	Hydrogen Chloride	Any	400	400
4.	Chlorine	Any	150	150
5.	Hydrogen Fluoride	Any	150	150
6.	Hydrogen Sulphide	Any	10	10
7.	Sulphur Oxides ^{(2) (3)}	Sulfuric acid/Sulphonic acid plants Other Plants except power Plants operating on oil and coal	400	1700
8.	Carbon Monoxide	Any	800	800
9.	Lead	Any	50	50
10.	Mercury	Any	10	10
11.	Cadmium	Any	20	20
12.	Arsenic	Any	20	20
13.	Copper	Any	50	50
14.	Antimony	Any	20	20
15.	Zinc	Any	200	200
16.	Oxides of Nitrogen	Nitric acid manufacturing unit. Other plants except power plants operating on oil or coal:	400	3000
	(3)	Gas fired	400	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 National Environment Quality Standards (NEQS) specified above, comply with the following standards:-

A. Sulphur Dioxide

Sulphur Dioxide Background levels Micro-gram per cubic meter ($\mu\text{g}/\text{m}^3$) 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. Allowable ground level increment to ambient ($\mu\text{g}/\text{m}^3$) (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 $\mu\text{g}/\text{m}^3$ 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 $\mu\text{g}/\text{m}^3$ (0.05ppm)
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Emission level for stationary source discharge before missing with the atmosphere, should be maintained as follows:-

For fuel fired steam generators as Nanogram (10⁰-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 NEQS limiting value is not permissible through excess air mixing blowing before emitting into the environment.

5.3 Process Heaters and Boilers

Low NO_x burners shall be specified on all fired sources as minimum. All equipment Vendors shall be asked to guarantee their air emissions will not exceed the limits shown in Table 5-2.

5.4 Flare

All hydrocarbons (or other environmental hazardous material) gas/vapour discharges from operating process vents and pressure relief devices shall be collected and routed to flare or recycled to process.

Flares must be designed to meet the requirement for destruction efficiency of 98% or greater.

5.5 Fugitive Emissions

Fugitive emissions in petroleum facilities are associated with vents, leaking tubing, valves, connections, flanges, compressor and pump seals, open pits containments and loading / unloading operations of hydrocarbons.

Fugitive emissions may include:

- Hydrogen;
- Methane;
- VOCs (e.g. ethane, ethylene, propane, propylene, butanes, butylenes, pentanes, pentenes, C₆-C₉ alkylate, benzene, toluene, xylenes, phenol, and C₉ aromatics);
- PAHs and other semi volatile organic compounds;
- Inorganic gases such as hydrogen sulphide, carbon dioxide, carbon monoxide, etc.

VOCs can react with NO_x in the presence of sunlight to form low-level atmospheric ozone.

5.5.1 Fugitive emissions control

Fugitive emissions shall be minimized by ensuring both adequate equipment design and by ensuring that fugitive emission monitoring programme is performed during operation of the facility.

Definitions:

VOC Service: equipment handling a fluid that is at least 10 percent VOC by weight.

Light Liquid Service: the vapour pressure of one or more VOC component is greater of 0.3 kPa at 20°C and the concentration of such components is 20% weight or greater.

Heavy Liquid Service: equipment that is not in VOC gas/vapour service or in light liquid service.

Control device: an enclosed combustion device, vapour recovery system, or flare with a destruction/removal efficiency of 95% minimum.

All requirements detailed in following paragraphs are applicable to equipment in VOC service.

5.5.1.1 Pumps

Any pump in light liquid service shall be monitored periodically for seal leaks. A leak is detected by an instrument reading of 2000 ppm hydrocarbon or more.

Pumps with the following requirements (or equivalent):

- a) dual mechanical seal system that includes a barrier fluid system (at higher pressure than process fluid or routed to process or control device) with seal failure detection system, or
- b) no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background and no external shaft penetrating the pump housing, or
- c) closed vent system capable of capturing and transporting any leakage back to the process or to control devices,

are exempt from fugitive emissions monitoring requirements.

5.5.1.2 Valves in gas/vapour service and in light liquid service

All valves shall be designed to perform with no detectable emissions as indicated by an instrument reading of less than 500 ppm hydrocarbon above background where practical. The selection of valves shall also consider future requirements for fugitive emission monitoring as valves which can maintain a leak rate below 500 ppm VOC will ultimately be subject to less frequent monitoring.

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

Each open-ended valve or line equipped with a second valve shall be operated in a manner such that the valve on the process fluid end is closed before the second valve is closed.

5.5.1.3 Compressors

Each compressor in VOC service shall be equipped with a seal system that includes a barrier fluid system (or equivalent system) that prevents leakage of VOC to the atmosphere.

Each compressor equipped with seal system based on the barrier fluid shall comply with requirements below:

- a) Shall be:
 - a. operated with the barrier fluid at a pressure that is greater than the compressor stuffing box pressure; or
 - b. equipped with a barrier fluid system degassing reservoir that is routed to a process or fuel gas system or connected by a closed vent system to a control device; or
 - c. equipped with a system that purges the barrier fluid into a process stream with zero VOC emissions to the atmosphere.
- b) Barrier fluid shall be in heavy liquid service or shall not be in VOC service.
- c) Each barrier fluid system shall be equipped with a sensor that will detect failure of the seal system, barrier fluid system, or both.

A compressor is exempt from the above requirements if:

- a) It is equipped with a closed vent system to capture and transport leakage from the compressor drive shaft back to a process or fuel gas system or to a control device.

- b) Compressor is designated for no detectable emissions, as indicated by an instrument reading of less than 500 ppm above background.

6.0 WATER DISCHARGES

6.1 Municipal and Liquid Industrial Effluents Limits

The following table shows the Municipal and Liquid Industrial Effluents standards to be respected as per Pakistan Statutory Notifications issued by Government of Pakistan, Ministry of Environment, Local Government and Rural Development.

Table 6-1: "National Environment Quality Standards for Municipal and Liquid Industrial Effluents (mg/l, Unless Otherwise Defined)

<u>S. No.</u>	<u>Parameter</u>	Standards	<u>Revised</u>	Into Sewage Treatment ⁽⁵⁾	Into Sea	
			<u>Standards</u>			
1	2	3	Into Inland Waters	4	5	6
1.	Temperature or Temperature Increase*	40°C	≤3°C	≤3°C	≤3°C	≤3°C
2.	pH value (acidity/basicity)	6-10pH	6-9 pH	6-9 pH	6-9 pH	6-9 pH
3.	5-days Biochemical Oxygen Demand (BOD) at 20°C ⁽¹⁾	80 mg/L	80 mg/L	250 mg/L	80 mg/L **	
4.	Chemical Oxygen Demand (COD) ⁽¹⁾	150 mg/L	150 mg/L	400 mg/L	400 mg/L	
5.	Total Suspended Solids	150 mg/L	200 mg/L	400 mg/L	200 mg/L	
6.	Total Dissolved Solids	3500 mg/L	3500	3500	3500	
7.	Oil and Grease	10 mg/L	10 mg/L	10 mg/L	10 mg/L	
8.	Phenolic compounds (as phenol)	0.1 mg/L	0.1 mg/L	0.3 mg/L	0.3 mg/L	
9.	Chloride (as Cl ⁻)	1000 mg/L	1000 mg/L	1000 mg/L	SC***	
10.	Fluoride (as F ⁻)	20 mg/L	10 mg/L	10 mg/L	10 mg/L	
11.	Cyanide (as CN ⁻)	2 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L	
12.	An-ionic detergents (as MBAS) ⁽²⁾	20 mg/L	20 mg/L	20 mg/L	20 mg/L	
13.	Sulphate (SO ₄ ²⁻)	600 mg/L	600 mg/L	1000 mg/L	SC***	
14.	Sulphide (S ²⁻)	1.0 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L	
15.	Ammonia (NH ₃)	40 mg/L	40 mg/L	40 mg/L	40 mg/L	
16.	Pesticides ⁽³⁾	0.15 mg/L	0.15 mg/L	0.15 mg/L	0.15 mg/L	
17.	Cadmium ⁽⁴⁾	0.1 mg/L	0.1 mg/L	0.1 mg/L	0.1 mg/L	
18.	Chromium (trivalent and hexavalent) ⁽⁴⁾	1.0 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L	
19.	Copper ⁽⁴⁾	1.0 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L	
20.	Lead ⁽⁴⁾	0.5 mg/L	0.5 mg/L	0.5 mg/L	0.5 mg/L	
21.	Mercury ⁽⁴⁾	0.01 mg/L	0.01 mg/L	0.01 mg/L	0.01 mg/L	
22.	Selenium ⁽⁴⁾	0.5 mg/L	0.5 mg/L	0.5 mg/L	0.5 mg/L	

<u>S. No.</u>	<u>Parameter</u>	<u>Revised Standards</u>			
		Standards	Into Inland Waters	Into Sewage Treatment ⁽⁵⁾	Into Sea
1	2	3	4	5	6
23.	Nickel ⁽⁴⁾	1.0 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L
24.	Silver ⁽⁴⁾	1.0 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L
25.	Total toxic metals	2.0 mg/L	2.0 mg/L	2.0 mg/L	2.0 mg/L
26.	Zinc	5.0 mg/L	5.0 mg/L	5.0 mg/L	5.0 mg/L
27.	Arsenic ⁽⁴⁾	1.0 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L
28.	Barium ⁽⁴⁾	1.5 mg/L	1.5 mg/L	1.5 mg/L	1.5 mg/L
29.	Iron	2.0 mg/L	8.0 mg/L	8.0 mg/L	8.0 mg/L
30.	Manganese	1.5 mg/L	1.5 mg/L	1.5 mg/L	1.5 mg/L
31.	Boron ⁽⁴⁾	6.0 mg/L	6.0 mg/L	6.0 mg/L	6.0 mg/L
32.	Chlorine	1.0 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L

Explanations:-

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Federal 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 as 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°C 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 NEQS 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 NEQS limits”.

6.2 Produced Water

Oil and gas reservoirs contain water (formation water) that is produced when brought to the surface during hydrocarbon production. The produced water stream can be one of the largest waste products, by volume, managed and disposed of by the onshore oil and gas industry. Produced water contains a complex mixture of inorganic (dissolved salts, trace metals, suspended particles) and organic (dispersed and dissolved hydrocarbons, organic acids) compounds, and in many cases, residual chemical additives (e.g. scale and corrosion inhibitors) that are added into the hydrocarbon production process.

Feasible alternatives for the management and disposal of produced water should be evaluated and integrated into production design.

The main disposal alternatives considered in this project is:

- Produced water is treated in produced water treatment package for oil-water separation. After separation, the treated water is elevated to the produced water storage tank by produced water transfer pumps.

Maximum permissible limits for treated produced water are reported here below:

- Required Oil in Water Outlet Concentration 100 ppm (Max)

The produced water storage tank will be drain into the evaporation pond having the geo membrane to isolate the oily water from soil.



6.3 Sanitary Wastes

Sanitary wastes will be collected to the local septic tanks and then run into soak pits and penetrate into the compatible formation.

7.0 NOISE

The following table shows the noise standards to be respected as per Pakistan Statutory Notifications issued by Government of Pakistan, Ministry of Environment.

Table 7-1: National Environmental Quality Standards for Noise

S. No.	Category of Area / Zone	Effective from 1st July, 2010		Effective from 1st July, 2012	
		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 above-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.