



USAID
FROM THE AMERICAN PEOPLE



USAID ENERGY POLICY PROGRAM

QUALITY ASSURANCE REVIEW OF EETPL LNG TERMINAL PROJECT DOCUMENTS

GAP ANALYSIS OF SUBMITTED DOCUMENTS
AGAINST PIANC CODES TEMPLATE

January 2015

This program is made possible by the support of the American people through the United States Agency for International Development (USAID)

USAID ENERGY POLICY PROGRAM

QUALITY ASSURANCE REVIEW OF EETPL LNG TERMINAL PROJECT DOCUMENTS

GAP ANALYSIS OF SUBMITTED DOCUMENTS AGAINST PIANC CODES TEMPLATE

Contract No: AID-EPP-I-00-03-00004

Order No: AID-391-TO-12-00002

©USAID Energy Policy Program
House 4, Street 88, Sector G-6/3
Ataturk Avenue, Islamabad, Pakistan
Tel: +92 (51) 835 7072, Fax: +92 (51) 835 7071

DISCLAIMER

The contents of this document are the sole responsibility of Advanced Engineering Associates International, Inc. (AEAI) and do not necessarily reflect the views of USAID or the United States Government.



QUALITY ASSURANCE REVIEW OF EETPL LNG TERMINAL PROJECT DOCUMENTS

GAP ANALYSIS OF SUBMITTED DOCUMENTS AGAINST PIANC CODES TEMPLATE

1.0 General

The documents in the below listed inventory were received from PQA through AEAI and ECIL for our review and assessment, as part of Quality Assurance Process, for compliance of the EETPL LNG Terminal Project with all the International Codes, Guidelines, Regulations as well as the Industry Best Practices stipulated under the Pakistan LNG Policy 2011 that governs the Implementation of LNG Projects in Pakistan. The reports (released by LRS) and subsequent letters from EETPL claim compliance of the Terminal design, construction and operation with SIGTTO and other Standards stipulated in the Pakistan LNG Policy 2011. The LR Report concludes that “the EVTL’s FSRU based LNG Terminal is adequately safe for other than normal/usual Risk and Hazards for Operability”. The gaps noted between the claimed and actual level of compliance with the PIANC standards and recommendations are identified and shown in the appended Gap Study which is confined to PIANC codes and recommendations. Additional Gap Studies are being conducted to evaluate the contents of the documents against the requirements of the SIGTTO and NFPA codes and are being forwarded separately.

The documents were supplied by the PQA progressively. Some documents appear to be incomplete since the attachments / appendices were not annexed to main document. In some case, drawings and sketches also appear to be missing. It is evident that Data Collection Campaign for wind, wave, tide, temperature, swell, security and mishaps was not carried out hence these information remained unavailable. We have sent requests for the missing information and are still awaiting response from the PQA. However, the documents received were examined and compared with the prescribed Standard and Codes and the best practice. The main documents so received are listed as under:-

2.0 The Document Inventory

REF. #	DOCUMENT DESCRIPTION
1.	<p>QRA REPORT.....April 2011</p> <p>This was a 260 pages generic QRA Report - issued by Lloyd’s Register of Shipping in April, 2011 - of three possible sites identified by Engro – VOPAK for an LNG Terminal. The report included results of Hazard Identification Study, Risk Assessment Study and Maneuvering Simulation Study for the three identified possible sites.</p>
2.	<p>HAZID/HAZOP STUDY.....March 2014</p> <p>This was a part of 74 – Page documents dated March 14, 2014 with a cover letter Ref. PQA/DGM (PSP)/253/2007 dated March 24, 2014 From ENGRO ELENGY TERMINAL PRIVATE LIMITED along with the following attachments:</p> <ul style="list-style-type: none"> • Attachment 1: Letter ref: TK/EVTL/March/01 issued by Lloyd’s Register of Shipping dated March 19, 2014 summarizing the findings on Consequential analysis Report Doc. No: OLG/DA/10080 Rev.1 • Attachment 2: Letter from SEPA dated March 20th, 2014 approving the orientation of the proposed Jetty of the new LNG Terminal from perpendicular to parallel to the main channel of Port Qasim subject to a number of conditions. • Attachment 3: <u>HAZID/HAZOP STUDY</u> – Ref: OGL/DA/10078 dated March, 2014 issued by Lloyd’s Register of Shipping.
3.	<p>UPDATED QRA REPORT. ....31st March 2014</p> <p>5- Page letter titled <u>Updated QRA for proposed ETPL Project Site</u> from ENGRO ELENGY TERMINAL PRIVATE LTD. dated March 31, 2014</p>



- 4. COSEQUENCE ANALYSIS REPORT.....22nd Feb. 2014
43 Pages document with a one page cover letter from ENGRO ELENGY TERMINAL PRIVATE LTD. And the attached **Consequence Analysis Report** dated February 22, 2014 issued by Lloyd’s Register under Reference # OGL/DA/10080

- 5. UPDATE ON HAZID/HAZOP STUDY RECOMMENDATIONS.26th Dec. 2014
Two Excel Work Sheets giving **update on the HAZID – HAZOP Recommendations** received from PQA through ECIL on December 26, 2014. Most of the open items on the work sheets are claimed to have been closed. The Operability S.O.Ps. are still not finalized. Target date for closing a number items was December 15, 2014. Current status of these items is not known at this time. Annex C was not received.

- 6. NAVIGATION SIMULATION MODEL TEST.....Dec. 2014
37 Pages document entitled **Mooring Layout Verification and Mathematical Mooring Model** prepared and issued by Artelia Eau and Environment Consultants for CHEC on December 01, 2014 and received from PQA through ECIL on December 26, 2014. The basis of Model Test was verbal information given by two witness Pilots only. The result involves conditions for Q_{Flex} only and prohibits Q_{Max} .

- 7. EXCELERATE SECURITY ASSESSMENT REPORT (SAR).....Dec. 2014
13 - Page document issued by Excelerate Energy on December 17, 2014 and received from PQA through ECIL on December 26, 2014. The report reveals insufficient security and incapability of PQA on a number of security issues. It recommends deployment of a lot of security equipment and personnel/training.

3.0 The Industry Best Practices: PIANC

The PIANC template inter-alia covers following aspects which must be ensured in taking up implementation of the LNG terminal:

Planning & Design: Collection of Site Specific Data on Natural environment such as wind, current, waves, Hydromet data, LNG terminal Site Selection Aspects, Safe Navigability of LNGC carriers in and out of Port Qasim channel, computational numerical model studies, Fast time and Full Bridge simulation based on flow models, Terminal Planning Layout and Design considerations, need for a well laid out design criteria, requirements for Navigational Channel and approaches, Harbor and service crafts, Hard arms and Quick Release Hooks, LNG Spill rates, Ship mooring Considerations, Air dispersion studies, Ignition zones and source identification, Emergency Release System (ERS), Firefighting Facilities, LNG Cargo Operations, Surge pressure and load monitoring systems, Risk Management, Check on hosting port (Port Qasim) Controls on traffic and operability limits, Terminal Security, Procedures and operating guidelines for LNG terminal, Groundings and Collision Risk Assessment etc.

4.0 Development of PIANC Template

To assess suitability of work done so far on the Port Qasim LNG project, the PIANCWG 116 STANDARDS were condensed to arrive at due diligence queries which could be applied on available document collection and gaps identified. These gaps may either be rectified by developers by providing sufficient design information to satisfy the template order, or gaps pertaining to un-attended work be taken up on a fast track basis by a third party so as to conform to these requirements in as far as possible. A template or list of queries for due diligence was evolved such conformity can be contemplated by applying the same to available references.

5.0 Conformance Coding System

We encountered multiple versions of the reference documents which were provided to us during various stages of the evaluation. Furthermore, at the time of report writing the LNG project continues to be in final state of implementation. As such it was considered essential to develop a conformity coding system where current status of each activity could be marked out giving subject-wise status of project element / component reviewed such that corresponding inferences can be drawn. Rationale adapted in achieving the coding method is explained at beginning of template.

6.0 Application of Template on Documents

The template was applied on the references together with citations to the PIANC standard clauses. The “gaps” identified were remarked in a manner that inferences can be drawn in a collective manner. Based on these findings specific recommendations can be drawn for scoping the outstanding work such that the gaps on conformity are rectified.

7.0 Summary of Findings

Principal Areas of partial / non-conformance observed in the referenced documents were site selection considerations, location of jetty, approaches and navigation channel, collection and use of site specific data, computational hydrodynamic models.

It seems EVTL considers it sufficient that since some studies have been carried out, the LNGCs Operations may commence without implementing the recommendations of the studies and those of the subsequent Gap Analysis carried out on these studies. Functioning of LNG Terminal is highly sensitive engineering operation at Sea and Land, which depends on strict adherence to the safety standards during the planning, construction and operational phases of the project. Therefore, compliance of the Standards / Codes, Regulations and Industry Best Practice which is also stipulated in the Pakistan LNG Policy 2011, is extremely essential. From the information available to us we notice that PQA and EVTL have so far not implemented Conditions and Recommendations conveyed to them by the LRS during the HAZID-HAZOP exercise and SEPA. It is very difficult to understand that in the absence of crucial information that remains to be obtained through the remaining studies and implementation of their own recommendations, how LR have gone ahead and declared the Project to have acceptable risk level and permitted the developers to proceed with the construction of the Terminal. Obviously, functioning of the LNG Terminal under these conditions raises concerns about the safety of the Terminal operations. It is therefore recommended that prior to commencement of LNGC’s Operation the identified Gaps be addressed satisfactorily. It may be recalled that almost all the documents (listed above) are either incomplete for compliance to the stipulated conditions or for want of further studies as identified below:

1. Climate, Wind & Wave Study.	This study was recommended in the Hazid/Hazop Study by LRS.
2. Operability Analysis.	Do -
3. Updated Data	Do -
4. Navigation Simulation .	Do -
5. Mooring Simulation.	Do -
6. Ship Compatibility Study	Do -
7. Bathymetric Study	Do -
8. Hydro-Meteorological Study.	This study was recommended in the Navigation Simulation Model Test Report.
9. More detailed Vertical Ship Motion Study	Do -
10. Combined Wave and Tidal Study.	Do -

In addition to above, following basic studies are also essential before finalizing the Operability Analysis.

- a. Met-Ocean Data Collection Campaign
- b. Port Operations Study.
- c. Ship Mooring Study with site specific Met-Ocean Data
- d. PQA Channel improvements and Navigational Studies with VTMS.

8.0 Conclusions & Way Forward

- i. Apropos to due diligence exercise on design and project documents actually made available to us, it can be inferred that following studies, if conducted alongside the on-going implementation process of the Terminal construction, would significantly help the process of resolving the gaps identified. These studies were recommended vide letter dated 18 Dec 2014 and are as follows:
 - 1. Met-Ocean Data Collection Campaign
 - 2. PQA Channel Improvement & Navigational Studies with VTMS
 - 3. Port Operations Study
 - 4. Ship Mooring Studies
- ii. In initial review it was strongly recommended that above studies identified by Gap analysis be carried out in parallel to LNG terminal implementation and permanent project record for the LNG Project (the first of its kind in Pakistan) is formulated and kept in par as regards to compliance with international planning, safety, and operability standards.
- iii. Consequently as a way forward it is recommended that firstly, any pending or withheld design documents are provided to us and secondly, the above studies be commissioned forthwith and executed in tandem with terminal implementation to avail the current ongoing NE monsoon season and also to cover the upcoming SW Monsoon season. Based on these studies the designs prepared should be revisited and validated in light of factual data. Improvements / modifications wherever possible, may still be carried out on permanent construction works that have not been completed thus far. Inferences drawn can nonetheless be applied into improving operating procedures and establishing permanent project records which may be required to be kept in case of an unforeseen incident or safety breach.
- iv. The data gathered and studies updated in light of environmental information should be used to complete the conformity requirements of not only the PIANC but also other standards (SIGTTO, NFPA 59A) which have been used to assess compliance. It must be kept in mind that there is no substitute of site-specific information and data which is used to base fundamental studies. Given the sensitive nature of this LNG project and accompanying risks involved, the need for having a permanent project design record and data base of information cannot be overemphasized.



- v. Possibility of infringement on safety envelopes and operations on other terminals and operators in the vicinity is a liability which not only ENGRO is to carry but also Port Qasim, as hosting port, will have to deal with the same. Impact of ENGRO LNG Terminal on nearby terminals and industrial installations, populations must therefore be carefully re-evaluated with factual information and realistic mitigations implemented.
- vi. Channel width and depth of the channel and at the Terminal site has been examined in light of PIANC standards and comments are given below in the gap study matrix. Work done by designers needs to account for the SIGTTO requirements and PIANC standards as regards to minimum width of channel and other parameters especially with regards to safe navigability of LNGC carriers throughout entire Port Qasim's channel reaches. Any constraints in Port Qasim channel to be dealt with in a satisfactory manner for safe transiting of LNGC carriers. Navigability and safe passage requirements that are laid out in above standards and guidelines should be met as a minimum requirement.
- vii. A satisfactory campaign to properly conduct & document Hydraulic & Hydrodynamic conditions of ENGRO site and approach channel, covering both summer (SW Monsoons) and winter monsoons (NE Monsoon) and in particular wet seasons not seen. This data essentially required in all computational numerical models, fast time simulation, full bridge simulation, siltation assessment computation etc. and to serve as well document project record.
- viii. Port Qasim or Karachi for that matter falls under moderate seismic zone and effect of seismic events in both planning and operability of terminal cannot be ruled out. Impact of seismic forces on terminal installations and all gas transfer equipment must be well documented in a report. LNG Terminal is prone to operational risks and cutting corners on this aspect will compromise ability of professional engineers to make informed technical decisions and draw correct inferences in evolving a complying and safe design of the LNG facility.
- ix. Lastly, the LNG terminal by ENGRO is first of its kind being implemented in Pakistan and this project must set the correct pace and precedence for other LNG terminals to follow. As such it should meet or exceed international best practices and conform to industry codes and standards available as of date.

Glossary / Abbreviation, to indicate the level of CONFORMANCE & REFERENCES:

OK	The item has been adequately addressed as per practice and SIGTTO Standard.
TEA	To elaborate and /or Add to fully comply the SIGTTO Standard.
NC	Not Considered. Not Addressed. The item has been either ignored or inadequately addressed.
NR	Not Required or Not Relevant.
IC	Incomplete or needs adjustments to comply the SIGTTO Standard..
NK	Not Known. No information available, viz a viz the study recommendation present / latest state.
SC	Study completed and verified. Acquired data is available and utilized in QRA
SNA	Study not available. Data used in QRA is not verifiable or source of data unknown
SM	Missing study which needs to be carried out and data required to authenticate the QRA assumptions
SE	Essential Study to be carried out that has been ignored so far.....
	<u>REFERENCES</u>
1.	QRA REPORT..... April 2011
2.	HAZID/HAZOP STUDY.....March 2014
3.	UPDATED QRA REPORT. ....31 st March 2014
4.	COSEQUENCE ANALYSIS REPORT.....22 nd Feb. 2014
5.	WORK SHEET / UPDATE FOR HAZID/HAZOP STUDY RECOMMENDATIONS. ....26 th Dec. 2014
6.	NAVIGATION SIMULATION MODEL TEST.....Oct. 2014
7.	EXCELERATE SECURITY ASSESSMENT REPORT (SAR).....Dec. 2014

TEMPLATE BASED ON PIANCWG 116 STANDARDS FOR Safety Aspects Affecting Berthing Operations of Tankers to Oil and Gas Terminals

NOTE: The **Line of DOTS** is not a place to be filled in. The Line of dots is to indicate the corresponding Answer or Comment on a question or sentence from where the line of dots starts.

Sr. No.	THE PIANC STANDARDS/CLAUSES FOR THE BEST PRACTICE VIZ A VIZ ACTIONED STATUS	CONSOLIDATED LEVEL OF RESPONSE FOR RESPECTIVE CLAUSE	REMARKS	REFERENCE
1	2	3	4	5
1.	<p>NOTE: 1). COLUMN 2 & 3 MAY BE TAKEN FOR RED VS RED. 2). IN THIS COLUMN THE ABBREVIATIONS ARE : NO = NO WORK / NOT TAKEN INTO ACCOUNT / NOT CONSIDERED. IC = INCOMPLETE WORK / WORK WITHOUT BASIS OR DATA NK = NOT KNOWN AND OK = ACCOUNTED FOR (MAY OR MAY NOT BE TO THE REQUIREMENT).</p> <p>PIANC WG116 Cl. No. 5.2 Data Gathering under Risk Assessment System.....</p> <p>a. Under the 5 part risk assessment process in support of Hazard identification and Risk analysis process has 'Data gathering' for understanding and evaluation of current Port Qasim conditions been made with particular emphasis on:.....</p> <ul style="list-style-type: none"> ▪ Topography of the port and its approaches ?.....NO. ▪ Metocean data currents, tides, climate and local met conditions?.....NO. ▪ Marine Traffic flows and cargoes handled?.....NO. ▪ Port facilities, including VTS, Pilotage, tug services?.....NO. ▪ Existing policies and procedures ?.....NO. 	<p>.....</p> <p>NC/SNA/SM</p>	<p>.....</p> <p>Data not collected neither available. Based on ASSUMPTION & Pilot's information.</p>	<p>1,2,3,4 & 6.</p>

<p>2.</p> <p>3.</p>	<p>▪ Organizational structure of Port Qasim ?.....NO</p> <p>b. Has questionnaires and interviews conducted with PQA port management, harbour masters and other port operations officers, pilots, other port employees, contractors and representative port users, and environmental Groups ?.....NK.</p> <p>c. Has auditing of marine and safety procedures been made?.....NO.</p> <p>PIANC WG116 Cl. No. 5.3 Risk Assessment to Port Transit, Towage, Pilotage and Passage Planning.....</p> <p>a. Has risk assessment taken into account following:.....</p> <ul style="list-style-type: none"> ▪ Features of PQA Channel such as extent of navigable waters, bends in the channel, obstructions and isolated dangers, nature of the seabed?.....NO. ▪ Water Factors – tidal range, tidal streams and currents?.....NO. ▪ Environmental Factors, such as the incidence of poor visibility, strong winds,swell?.....NO. ▪ Traffic density and likely encounters with other ships?.....NO. ▪ Existing Navigation Aids and safety systems within PQA?.....NO. <p>PIANC WG116 Cl. No. 5.4 Towage.....</p> <p>a. In assessing LNG Towage capability with PQA has following factors been</p>	<p>NC/TEA</p> <p>NC/SNA</p> <p>TEA/NC/SE</p>	<p>Existing capabilities,</p>	<p>1,2,3,4,6.</p> <p>1,2,3,4,6.</p>
---------------------	---	--	-------------------------------	-------------------------------------

<p>4.</p>	<p>considered:.....</p> <ul style="list-style-type: none"> ▪ Port and approaches constraints?.....NO. ▪ Size, type and maneuverability of ships concerned ?..... IC. ▪ Weather and tidal factors and limits including wave heights and time periods ?.....IC. ▪ Current capability PQA tugs (tug made fast to the vessel) or passive (running close but not made fast) escorting ?.....NO. ▪ Need for tugs need to facilitate maneuvers (turning, unberthing, etc.) ? IC ▪ Procedures for restricted visibility ?.....NO. ▪ Training requirements for tug crews (e.g. simulation, training with pilots, etc.) ?.....NO. <p>PIANC WG116 Cl. No. 5.5</p> <p>Pilotage.....</p> <ul style="list-style-type: none"> a. Has provision of Pilotage Service by PQA been assessed?.....NO. b. Need for additional Pilots and Boarding and Landing of Pilots?.....NO. c. Has Pilotage Directions, Regulations and procedures at PQA been reviewed?.....NO. d. Has PQA’s Navigational Information been examined to be supplied to incoming LNGC (Port Passage Plan)?.....NO. e. Is Navigational Information complete with following information:.....IC <ul style="list-style-type: none"> ▪ Principal channels, depths, under keel 	<p>TEA/NC/SM/SE</p> <p>.....</p> <p>NC/SM</p> <p>NC/SNA/SM</p> <p>NC/TEA/SNA</p> <p>NC/IC/SM</p> <p>NC/IC/SM</p>	<p>Regulations, Aids to Navigation and Traffic etc. has not been considered and are not to meet the requirement.</p> <p>.....</p>	<p>1,2,3</p>
-----------	---	--	---	---------------------

	clearance?.....NO ▪ Tidal streams, heights?.....NO ▪ Principal navigational marks, leading lines?.....NO ▪ Dangers and clearing lines ?.....IC ▪ Maximum speeds, avoidance of wash, areas where squat is a concern?..... NO			
5.	<u>PIANC WG116 Cl. No. 5.6</u> Passage Planning a. Has passage planning procedures within PQA been evaluated?.....NO. b. Has Position Monitoring practices within PQA been examined?.....NO. c. Has Aids to Navigation available within Port Qasim been evaluated for LNG vessels?.....NO.	..... NC/SM/SE NC/SNA NC/SNA/SE NC/TEA/SNA.....	..... VTS not available.	1,2,3,4 1,2,3,4
6.	<u>PIANC WG116 Cl. No. 6</u> Evaluation of Environmental Conditions (within Port Qasim).....IC.	.....	.....	1,2,3,4
7.	<u>PIANC WG116 Cl. No. 6.1</u> Location Planning a. Does location planning account for:.....OK. ▪ Suitable turning/maneuvering areas near the LNG berth ?.....NO. ▪ Suitable anchorage areas ?.....NO ▪ Adequate navigation aids, VTS, tugs and pilots ?.....NO. ▪ Available depths at the Terminal for safe mooring and transfer of LNG cargo?.....IC. ▪ Nature of the seabed and requirements for capital and maintenance	TEA/SE		

8.	<p>dredging ?.....NO.</p> <ul style="list-style-type: none"> ▪ Tidal range, Prevailing current, sea and weather conditions and the orientation of berths ?.....IC. ▪ Effect of Passing ships on moored FSRU and Supply LNGC?.....IC ▪ Impact/conflict with other port traffic ?.....NO. ▪ Security and unauthorized crafts in area?.....NO. ▪ Proximity to population centers ?.....IC. ▪ Environmental impact issues ?.....IC. ▪ Hazardous zones analysis ?.....IC. ▪ Impact /disruption on existing adjacent facilities to LNG terminal? ▪ Same as above but for operational restrictions, construction restrictions and simultaneous operational issues?.....NO. <p>PIANC WG116 Cl. No. 6.2 Essential Project Data Collection Requirements.....</p> <p>a. Has sufficient data been collected regarding site natural environmental conditions ?.....NO.</p> <p>b. Has site specific and factual data been taken into /applied onto planning of the LNG terminal?..... NK.</p> <p>c. Has site data been used in all numerical and physical modeling (FBSS)?.....NK.</p> <p>d. Has following particular data been acquired for the LNG marine facility site and approaches:.....NK.</p> <ul style="list-style-type: none"> ▪ Basis of design for LNG facility?.....NK ▪ Identification of design ships, level of operability required, specific owner/operator requirements?.....OK ▪ Up to date Bathymetric Charts, maps for terminal and approached from outer sea?.....NO 	<p>.....</p> <p>NC/SNA/SM</p> <p>NC/SNA/SE</p> <p>TEA/IC/SE</p> <p>TEA/SNA</p>	<p>.....</p>	<p>1,2,3,4,6.</p>
----	--	--	--------------	--------------------------

<p>9.</p>	<p>e. Has offshore wind data been acquired from wind casting agencies?....NK.</p> <p>PIANC WG116 Cl. No. 6.8 Current Data and its Effects on Terminal.....</p> <p>a. Has Tidal level and current measurements been taken over sufficient time windows to establish profiles for use in terminal design, mooring analysis (OPTIMOOR) and calibration/validation of computational numerical flow models?.....IC.</p> <p>b. Has effect of tidal currents on ship maneuvering, berthing and mooring been evaluated?.....IC.</p> <p>c. Has effect of currents on set and momentum of vessel and its maneuverability been assessed?.....NK.</p> <p>d. For FSRU and LNGC has effect of current on area of hull exposed been seen and drift of ship down current been checked?.....NK.</p> <p>e. Has increased swept path for LNGC ship been worked out?.....NO.</p> <p>f. In Port Qasim creek and at bends has impact of current on siltation or erosion been worked out?.....NO.</p> <p>g. Has current flows which are not well aligned with LNGC berths been examined for hampering berthing and unberthing maneuvers and avoidance of hazardous situations?.....NO.</p> <p>h. Has current flows been accounted for in planning orientation of LNG berths in relation to current flow?.....NK.</p> <p>i. Has effect of fresh water (fluvial) flows mix with tidal flows (density currents) identified and consideration in design and hydrodynamic of flows?.....NK</p> <p>j. Has likelihood of stratified flows where the fresh water flow direction is different to the salt water flow been examined using ADCP profiler data?.....NK.</p> <p>k. Has local long term ADCP measurements been taken at site?.....NK.</p> <p>l. Has Computational flow modeling been done duly validated and</p>	<p>TEA/SNA</p> <p>.....</p> <p>NC/SNA</p> <p>IC/SNA/SE</p> <p>IC/SNA/SE</p> <p>NC/SM/SE</p> <p>NC/SE</p> <p>NC/SNA/SE</p> <p>NC/SE</p> <p>NC/SE</p> <p>NC/TEA/SNA</p> <p>NC/SM</p> <p>NC/SM</p> <p>TEA/SNA</p>	<p>.....</p>	<p>1,2,3,4</p>
-----------	--	--	--------------	----------------

	calibrated by measured current data?..... NK. m. Has Visibility data been acquired?..... NO.	NC/TEA/SNA		
10.	<p>PIANC WG116 Cl. No. 6.4 Geology and Geotechnical Data collection.....</p> <p>a. Has Geological, seismic and geotechnical data been obtained for use in design of foundation works and analysis of dredged material?.....NO b. Has coastal dynamics been evaluated for LNG terminal including longshore drift sources of sedimentation and erosion including effects of nearby dredging or channel deepening in future?.....NO. c. Has seismic assessment been made?.....NK. d. Has EIA and other permit requirements been met?.....OK.</p>	TEA/SNA NC/SE NC/SM TEA	..... ..... ..... .....	1,2,3,6
11.	<p>PIANC WG116 Cl. No. 6.6 Water Levels and Tidal Range.....</p> <p>a. LNGC dynamic behavior when maneuvering and when moored with particular reference to smaller drift anglers in shallow water and larger turn diameter, higher steady state speed?.....NO. b. Has decrease in stopping times and distances in shallow water been considered?.....NO. c. Has under keel clearance and vessel squat been computed?.....NO.</p>	IC/SE NC/SE NC/SE	..... ..... .....	1,2,3,6
12.	<p>PIANC WG116 Cl. No. 6.7 Design Life.....</p> <p>a. In preparing Environmental Design Conditions has design life and return periods for structural design been computed?.....NK. b. Has operational assessments for 1 in 1 year or number of times per year conditions been examined?.....NK.</p>	NC/SE NC/SM NC/SE/SNA	..... ..... .....	1,3

13.	<p>c. Has operational downtime been worked out?.....NK</p>	NC/SNA	.....	1,2,3,4,6
	<p>PIANC WG116 Cl. No. 6.9</p>			
	<p>Wind data and its Effects on Terminal.....</p>	NC/SNA		
	<p>a. Has Wind measurements been taken over an adequate period of time to define return periods and has it been converted to appropriate reference height and duration?.....NO.</p>	IC/TEA/SNA		
	<p>b. Has effect of winds on ship maneuvering and ship mooring been evaluated in terms of overall windage of the FSRU and LNGC moored ship?.....IC.</p>	IC/TEA/SE		
	<p>c. Has downwind maximum wind forces acting on beam winds and drift evaluated?.....NO</p>	IC/SNA/TEA		
	<p>d. Has variable consideration for windage been made for LNG carriers with spherical containment system (MossRosenberg) or prismatic/membrane containment system and vessels in ballast ?.....IC</p>	IC/SNA/TEA		
	<p>e. Has wind conditions effect on efficiency of support vessels, such as tugs and mooring line boats been evaluated?.....IC</p>	IC/SNA/TEA		
	<p>f. Has wind instruments measured and analyzing data taken at 10 m above ground level standard?.....IC</p>	IC/SE/TEA		
	<p>g. Has short duration periods of high wind speeds (squalls, anabatic and katabatic winds) extracted from wind records been accounted for in designs?</p>			
14.	.....		.....	1,2,3,4
	<p>PIANC WG116 Cl. No. 6.10</p>			
	<p>Wave and its Effects on Terminal.....</p>	TEA/SNA		
	<p>a. Has Wave measurements been taken and wave spectrum determined for LNG terminal site location for use in mooring response analysis and wave forces acting on permanent moored vessels? NO.</p>	TEA/SNA		
	<p>b. Has potential harbour resonances and the impact of long waves been assesses for marine terminal especially for permanent moored FSRU and</p>	IC/SNA		

15.	<p>supply vessels?.....NO.</p> <p>c. Has impact of wave conditions on LNGC and FSRU moored ship maneuvering and mooring been analyzed using computer based dynamic mooring evaluation tool (OPTIMOOR or Portmoor) ?.....NO.</p> <p>d. In PQA channel has SW and NE Monsoon based locally wind generated (wind) waves and longer period (T=0.5 min to few minutes) swell wave conditions from more distant disturbances or monsoons originated and weather systems been indentified and analyzed (spectrums) from wave data collected?.....IC.</p> <p>e. Has waves from passing ships (pressure field effect) been examined?...IC</p> <p>f. Has wave resonance effects (oscillation), mooring breakout hazard at antinodal points been analyzed using Mooring analysis programs?.....NO.</p> <p>g. Effect of short and long period wave activity on FSRU and LNGC ships drift downwave , pitch and/or roll effects, likelihood of ship hull contacting seabed?.....NO.</p> <p>h. Analysis of wave resonance and elasticity of overall mooring system and interaction of local wave conditions?.....NO.</p> <p>i. Has occurrence of tidal bores been ruled out? .....NK.</p> <p>j. Effect of wave and flowing current combination induced rolling wave or wave train at flood tide?.....NK.</p>	<p>IC/TEA/SNA</p> <p>NC/SE</p> <p>NC/SE</p> <p>IC/TEA/SM</p> <p>NC/SM</p> <p>TEA/SNA</p> <p>NC/TEA/SM</p> <p>NC/TEA/SM</p>		1,2,3,4
16.	<p>PIANC WG116 Cl. No. 6.11 Visibility and its Effects on Terminal.....</p> <p>a. Has local measurements for visibility been made?.....NK</p> <p>b. Has consideration of visibility made in design of review of aids to navigation (such as range marks, lights, etc.)?.....NK.</p> <p>PIANC WG116 Cl. No. 7 Approach from Open Sea & PIANC WG116 Cl. No. 7.1 Requirements for the</p>	<p>NC/SE</p> <p>NC/SNA</p>		1,2,3,4,6

17.	<p>Approach Channel.....</p> <p>a. As LNG terminal near EVTL site will be sharing channel with other vessels, has suitable risk assessments undertaken and measures taken to mitigate any significant risks associated with managing the marine traffic ?.....IC</p> <p>b. Has design considerations for approach channels in compliance with PIANC WG 49 standard?..... NK.</p>	<p>TEA/SNA</p> <p>NK.</p>		
18.	<p>PIANC WG116 Cl. No. 7.2 <u>Has Tug Assistance been reviewed in light of findings of navigation based risk assessment?</u>.....OK.</p>	<p>NC/SNA/SE</p> <p>.....</p>	<p>.....</p> <p>.....</p>	<p>1,2,3,4,6</p> <p>1,2,3,4,6</p>
19.	<p>PIANC WG116 Cl. No. 7.3 <u>Has Channel Dimensions in terms of its width, depth, layout, orientation been verified in accordance with standards laid out in WG 49 standard?</u></p> <p>a. Has detailed design stage staged considered results of ship navigation simulation in finalizing channel width, layout and orientation requirements?.....NO.</p> <p>b. In Navsim studies, has normal operations of arrivals and departures examined for a range of metocean conditions comprising of wind, waves and currents?.....NO.</p> <p>c. Has emergency scenarios been simulated such as effect of credible equipment failures to include Ship steering gear failure, ship main engine failure, blackout onboard ship, impact of squalls etc.?.....IC</p>	<p>NC/SE</p> <p>NC/SNA/SE</p> <p>NC/SNA/SE</p>	<p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>1,2,3,4</p>
	<p>PIANC WG116 Cl. No. 7.4 <u>Berth Depth and Under keel clearance</u>.....</p> <p>a. In assessing channel depth for design vessel, has required under keel clearance (UKC) requirement been fully accounted for per PIANC WG</p>	<p>TEA/SE</p>	<p>.....</p>	<p>.....</p>

<p>49?..NO</p> <p>20.</p> <p>21.</p> <p>22.</p> <p>23.</p>	<p>b. Has UKC requirements, design criteria verified and optimized through simulation?.....NO.</p> <p>c. Has emergency egress and ship evacuation from berth considered during emergency?.....IC</p> <p>PIANC WG116 Cl. No. 7.6 Anchoring Areas Assessment.....</p> <p>a. Has LNG terminal design assessed suitability of anchorage areas considering navigational hazards, traffic density, environmental conditions, seabed conditions?.....NO.</p> <p>PIANC WG116 Cl. No. 7.7 Places of Refuge Assessment.....</p> <p>a. Has places of refuge been selected while satisfying IMO Resolution A.949(23)?.....NO.</p> <p>PIANC WG116 Cl. No. 7.8 Rules on Passing and Overtaking in Channels.....</p> <p>a. Does passing procedures taken into account under navigation risk assessment and has VTMS system proposed ? VTMS proposed, passing, NO.</p> <p>b. Do these procedures account for Vessel sizes, maneuverability as per environmental data collected,.....IC</p> <p>c. Channel dimensions, exclusion zones as per risk assessment?.....OK</p>	<p>NC/SE</p> <p>NC/SM/SE</p> <p>NC/SNA</p> <p>NC/SNA</p> <p>TEA/SNA</p> <p>NC/SNA/SE</p> <p>IC/TEA/SNA/SE</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>-</p> <p>No data collected</p>	<p>1,2,3,4.</p> <p>1,2,3,4</p> <p>1,2,3,4</p>
--	--	---	---	--

	<p>PIANC WG116 Cl. No. 7.9 Maneuvering/Turning Areas Assessment.....</p> <p>a. Has PQA channel been examined for maneuvering and turning areas requirements as per PIANC WG 49 ?.....NK.</p> <p>b. Do turning areas account for longest LOA, predominant wind & current condition, space required for tugs to operate and optimized in real time navigation simulation studies?.....NK.</p> <p>PIANC WG116 Cl. No. 8 Berthing, Mooring and Monitoring Systems.....</p> <p>PIANC WG116 Cl. No. 8.1 Mooring System.....</p> <p>a. Has mooring system designed to suit the true on site environmental conditions and on basis of site specific metocean data ?..... IC.</p> <p>b. Has OCIMF ‘Mooring Equipment Guidelines’ been considered?.....NK.</p> <p>c. Have mooring fittings such as quick release hooks (QRHs) been considered in design?.....OK</p> <p>d. Have Safe Working Loads (SWL) and Displacement to SWL been considered?.....OK</p> <p>PIANC WG116 Cl. No. 8.2 Fendering System for LNG Terminal.....</p>	<p>.....</p> <p>IC/TEA/SM</p> <p>IC/SNA/SE</p> <p>TEA/MS</p> <p>.....</p> <p>IC/TEA/SNA/SE</p> <p>NC</p> <p>OK/TEA</p> <p>TEA</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>1,2,3,4,5,6</p> <p>1,2,3,5,6</p> <p>1,3</p> <p>1,2,3,5</p>
--	--	---	---	---

<p>27.</p> <p>28.</p> <p>29.</p>	<p>a. Does proposed Fendering system satisfy design requirements such as PIANC’s ‘Guidelines for the Design of Fender Systems’?.....TEA</p> <p>PIANC WG116 Cl. No. 8.3 Vessel Docking Aid Systems.....</p> <p>a. Has a proper Docking aid systems been considered for the LNG berths? .....OK</p> <p>b. Has sufficient Ship to shore links been built into the communication system design?.....OK</p> <p>c. For the LNG terminals are the emergency shutdown (ESD) valves interlinked between ship and shore by cables? .....OK.</p> <p>PIANC WG116 Cl. No. 9 Required Space for Safe Berthing.....</p> <p>a. Have safety distances been considered for following conditions:.....IC</p> <ul style="list-style-type: none"> ▪ Clearance between vessels moored at adjacent berth or maneuvering onto berths ?.....OK ▪ Distance between navigational channel and moored FSRU and LNGC vessels?.....IC ▪ Safety zone around manifolds of berths and LNGC?.....OK/TEA ▪ Navigational and ship maneuvering parameters ?.....OK/TEA ▪ Availability and experience of pilots for types of vessels to be handled?.....NK ▪ Passing traffic including the behavior of moored ships from passing ship effects ?.....IC/TEA ▪ Fire regulations, hazardous cargo zones ?.....IC/TEA ▪ Proximity to population centers ?.....IC/TEA ▪ Metoccean considerations. current/tide, wave, swell, wind?.....IC/TEA ▪ Emergency Release Systems (ERS) and Emergency Shutdown Systems (ESDs)?.....OK 	<p>NC/SM/SE</p> <p>.....</p> <p>TEA/SE</p> <p>TEA/SE</p> <p>OK/TEA</p> <p>.....</p> <p>TEA/SNA</p>	<p>.....</p> <p>.....</p> <p>-</p>	<p>1,2,3,5</p> <p>1,2,3,4,6</p>
----------------------------------	---	--	------------------------------------	---------------------------------

	PIANC WG116 Cl. No. 10			1,2,3,4,6
	Calculation of Environmental Forces		-	
	a. Have sufficient metocean (environmental) data been collected at the Engro LNG terminal site and for its approaches?.....NO	NC/SM		
	b. Have environmental forces consisting of wind, current and waves acting on a vessel been computed on basis of the metocean data?.....NO	NC/SM/SE		
	c. Has Environmental forces reaffirmed using numerical and physical modeling ?.....NO.	NC/SNA		
30.				1,2,3,4,6
	PIANC WG116 Cl. No. 10.1			
	a. Has Wind Forces been computed in accordance with computational procedures given under this PIANC section?.....NO.	NC/SM		
31.				1,2,3,4,6
	PIANC WG116 Cl. No. 10.2			
	a. Has impact of current forces on vessel been computed on basis of OCIMF and this PIANC standard?.....NO.	NC/SNA/SE		
32.				1,2,3,4,6
	PIANC WG116 Cl. No. 10.3			
	a. Have wave forces acting on vessel been computed on methods listed under this PIANC section?.....NO.	NC/SNA/SE/SM	-	
33.				1,2,3,4,5,6
	PIANC WG116 Cl. No. 11			
	Acceptable Metocean Conditions for Safe berthing and unberthing			
	a. Has limiting environmental criteria for operations been developed in light	NC/SM		

34.	of data collected and computational modeling ?.....NO.	NC/SNA/SM/SE		
	b. Has design phase taken into account site specific metocean conditions in optimizing layout of berth and terminal as a whole?.....NK	NC/SNA		
	c. Has environmental forces acting on ships berthing, unberthing and alongside taken into account during associated mooring analysis in both static and dynamic modes to determine limiting conditions ?.....NK			
	PIANC WG116 Cl. No. 12 Operational Safety during Berthing.....	.....	.....	1,2,3,4,5,
	a. Has a plan for berthing of vessels been prepared which includes provision of pilotages, tugs and environmental limits for safe operations?.IC.	IC/SM	-	
	b. Has necessary tug capacity in terms of effective bollard pull determined to overcome maximum wind, wave and/or current forces generated on vessel?.....OK	OK		
	c. Has OCIMF, SIGTTO, Spanish Standard ROM methods used to compute necessary tug assistance ?.....OK	OK		
	d. Has following type of Navigation Simulation Studies been undertaken:..OK.	OK		
	<ul style="list-style-type: none"> ▪ Full Bridge simulation?..... OK ▪ Workstation based real-time simulators?..... OK ▪ Workstation based fast time simulations ?..... OK 	NC/SM/SE	Assumed Met-Ocean Data Utilized	
	e. Has fatigue in Mooring Lines been worked out?.....NO.	NC/SM/SE		
	f. Has fender pressures on Tanker hull been worked out?.....OK			

35.	<p>g. Has consideration for passing ship speeds and separation distances on moored FSRU and LNGC been made in assessing channel design and safety clearances?.....IC.</p> <p>h. Has surge been estimated on moored FSRU and LNG to prevent damage to fenders, loading arms and moorings?.....NK.</p> <p>PIANC WG116 Cl. No. 13</p> <p>a. Has sufficient Nautical Port Information been published for incoming LNGC's?.....NK.</p>	<p>NC/SNA</p> <p>NC/SNA</p> <p>NK</p>		
-----	--	---------------------------------------	--	--

www.ep-ep.com.pk
info@ep-ep.com.pk