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MANAGING ASSET INTEGRITY AND SAFE OPERATIONS AT THE BAHRAIN PETROLEUM COMPANY - OPERATIONAL ASSETS IN UNFENCED/ UNMANNED AREAS

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ABSTRACT

INTRODUCTION: *Managing operational assets outside the Refinery, in unfenced/ unmanned areas is of paramount importance for the successful and safe operations of the company. Operational assets include gas, oil and utility pipelines, distribution and metering stations, valve stations, power distribution cables and such other assets. These assets are 'on land' inside populated urban areas, desert locations and sub-sea installations. Primarily, company's operational assets are protected by constant patrolling by the nation's public security agencies and also by the company security department. However risks to the company's operational assets arise from Contractors engaged by the company to perform any work on the asset or near the asset or other agencies including ministries or utility companies or authorities engaging their Contractors in carrying out new installation or maintenance work of their own assets located in and around company assets. In the context of Bahrain as a nation, the oil and gas industry contributes substantially to the economy and hence it is very important that all necessary processes are established to protect operational assets. When work is performed by Contractors not directly within operational control i.e. taking place in remote, normally unmanned or minimally manned facilities the inherent risk is high and has to be managed through legally mandated processes.*

SITUATIONAL ANALYSIS: *Bapco has an established 'Process Safety Management' (PSM) system accepted and implemented in the company. The 'Safe Work Permit' system is a very critical control system/measure to ensure Contractor compliance when performing any work. Coupled with the effectiveness of PSM and Contractor Safety process the Government of Bahrain mandated legally binding process of the 'Wayleave' system along with other processes such as Planning Permission, helps in enforcing control of company's operational assets in company's unfenced or remote areas with minimal or no manning. A procedure for 'Processing of Planning Permissions and Wayleave pertaining to BAPCO's Unfenced Areas' has been developed based on engineering design requirements basis international design codes and best professional practices. Details of these practices will be described and illustrated in the detailed presentation.*

PRESENTATION/CONCLUSION: *Bapco has over the past years developed procedures and processes to manage operational assets/ areas within the Oil and Gas Fields, Oil transmission pipelines and the 'Right-of-Way', Gas Distribution Network and the 'Right-of-Way', Refinery, Tank Farms and its own Shipping Wharf Operations in keeping with the highest engineering standards, safety and quality requirements. Purpose of this presentation is to list and explain the adaptation of these procedures and processes coupled with pragmatic solutions that forms the basic architecture that aids in controlling the safety and operability of assets in 'Unfenced/ unmanned Operating Areas'. This ensures generating positive economics and aiding in the growth of the nation's economy.*

NOMENCLATURE

Bapco	Bahrain Petroleum Company
BSDI	Bahrain Spatial Data Infrastructure
CPO	Central Planning Office
RAMS	Risk Assessment & Method Statement
MoW	Ministry of Works
GDN	Gas Distribution Network
PED	Plant Engineering Department
PSM	Process Safety Management
SPOC	Single Point of Contact within Bapco

1. INTRODUCTION

The history of Bapco dates back to the establishment of the company in 1929. This followed by the spudding of the first oil well in Bahrain in 1932, the first oil well in the middle east and this part of the world. Following this historical milestone, the various related developments in the region took fruition and CALTEX formed the Bahrain Refinery which commenced production in 1936.

Bapco was an integrated Oil & Gas Company at the turn of this millennium but the upstream and downstream operations were demerged towards the end of the first decade to form two companies, i.e. Tatweer Petroleum to manage and operate the upstream functions and Bapco to manage and operate the downstream functions.

Bapco currently manages the import of crude oil from Saudi Arabia through pipelines called the Abquaiq- Bahrain Pipelines, transfer of crude oil from the Bahrain oil fields, refining of crude oil, international marketing of refined products from the refinery and sale of crude oil from the offshore Abu Safa oil fields, supply and sale of aviation fuel at the Bahrain International Airport transferred through the Jet A1 Pipeline from Bapco's tank farm in Sitra to the Arad Depot and the local distribution and marketing of petroleum products. Till the year 2018 Bapco were also responsible for the supply of gas to the electric power generating plants and other gas consuming industries which include one of the biggest aluminum smelters in the world.

It is worth noting that the operation of refinery involves very large scale transfer of incoming crude oil and gas through pipelines and controlled by a series of valve stations, the transfer of refined products from the refinery to storage tank terminals for local distribution and export through Bapco's shipping wharf which serve large vessels, also through a large network of pipelines and valve stations.

Apart from the above mentioned pipelines which include oil and gas pipelines, Bapco used to manage the Gas Distribution Network for Bahrain currently with Tatweer Petroleum, a very large network of 'ring main' based gas pipelines with a number of unmanned/ sparingly manned distribution and metering stations all over the country serving very critical national infrastructure and industries that drive the economy.

Apart from the mentioned oil and gas pipelines of interest to this paper would be the utilities infrastructure for Bapco's township and office areas which include water supply pipeline and power cables.

All the above mentioned operational assets of Bapco crisscross the country in a maze of other national infrastructure required to support the nation's economy and well-being.

Managing the integrity of these assets and ensuring their safe operations is paramount for the viable operations of Bapco and the health of the nation's economy.

The following pages detail the various elements and links of the process that ensure Bapco's asset integrity and safe operations. It is the process and the human element involved in implementation that aid the end result i.e. the business operation.

2. PLANNING PERMISSION/ WAYLEAVE

The Ministry of Works, Power & Water- Wayleave Committee of the Government of Bahrain introduced a circulatory approval procedure in 1982/83 which detailed the various stages of approval required before any work commences.

Large/medium projects are initiated through a Planning Permission application, followed by Wayleave Approval nearer the commencement of the work. Small projects are initiated directly through e-Wayleave Approval and for very minor work there is a separate service notification procedure. There is also a specified procedure of the Ministry of Works requiring that an application be filled-in seeking permission to cut prescribed roads/footpaths for any works affecting the said areas.

The basic purpose of these procedures is to ensure that for any new installation in a certain area, approvals shall be obtained from all those agencies, which are affected in that area.

The Planning Permission and Wayleave procedures will:

1. Safeguard the integrity of existing installation.

2. Reconsider/revise the proposals for installation of new facilities or services in terms of location and/or time to ensure that there are no conflicts with the existing facilities.

3. Ensure safe working methods are followed during installation of the new facility.

All applications are coordinated through the Central Planning Office and their relevant Procedure Manual.

Currently, Pre-Planning Permission, Planning Permissions, Consultation Letter/ Application for land sub-division requests follow the standard paper form as issued by the Central Planning Office – Ministry of Works. The basic approval process will be discussed in this Section.

The Wayleave has progressed from the standard paper form to an e-Wayleave administered by the Central Informatics Organization under the Bahrain Spatial Data Infrastructure and will be discussed in detail. [4]

2.1 PLANNING PERMISSION PROCESS

The Planning Permission is a document issued by the Central Planning Office (CPO) of the Ministry of Works (MoW) on behalf of the requesting stake holders for projects within the Kingdom and is a circulating paper form processed at the design stage of medium or large projects to ensure that comments are obtained from all agencies who have services at common location so that the specific requirements of each agency are taken care of.

The Planning Permission document is routed by the CPO to Bapco SPOC for processing within the company. The SPOCs study the document and make requisite checks on the proposed project and its implications on Bapco Leased Areas, assets including operational aspects, then seek advice and support from other departments as deemed necessary and then process the document to other Owner Departments 'if required' for their advice and approval.

If the project, for which the Planning Permission document is generated, falls within Bapco Operating Areas then the document is returned by the SPOC with comments being, "obtain Bapco Management Approval"

The process of sub-lease/ relinquishment will also follow the requirements as specified.

On receipt of the letter from the requesting stake holder of the project for which the Planning Permission was generated by the CPO a review of the request will be done.

Following completion of review of the request letter a decision will be made by the Chief Executive to either accept or reject the request. Basis the decision, if the decision is made to reject the request, a letter will be sent from the Office of the Chief Executive or his nominee conveying the decision to the stake holder of the project.

If the decision is to accept the request, this will be followed-up by preparing documentation for placing the request before the forthcoming meeting of the company's 'Board of Directors' who will in-turn provide approval for sub-lease/ relinquishment of the requested land parcel vide a Board Resolution.

Basis the Board Resolution the company's Legal Advisor will prepare documentation as appropriate and necessary to complete the formalities of sub-lease/ relinquishment of the requested land parcel.

Following completion of formalities of sub-lease/relinquishment of the requested land parcel, the Board Resolution along with the referenced drawings shall be transmitted to the Head Land Surveyor to record the same on the official Bapco Leased Area drawings with notes for easy reference. The Head Land Surveyor shall maintain/ update records of the Bapco Operating Area drawings by plotting all sub-lease/ relinquishments as and when approvals are made and within a period of not more than 90 days from the date of approval.

The Legal Advisor will then liaise with the stake holder of the project and obtain necessary signatures on the documentation prepared to complete the process of sub-lease/ relinquishment of the requested land parcel. [4]

2.2 ONLINE e- WAYLEAVE

The online e-Wayleave system is an Automated System replacement of the manual Wayleave Procedure in practice earlier. The new system takes care of all requirements of the manual procedures and associated issues. This system has been developed and is operated by Bahrain Spatial Data Infrastructure under the Central Informatics Organization an agency of the Government of Bahrain.

The online e-Wayleave system is designed to create the required information, distribute and monitor the system.

The online e-Wayleave system supports the following activities to be performed to complete the process of e-Wayleave approval.

1) Digital data distribution.
2) Online creation of Wayleave.
3) Online response to Wayleave.
4) Online verification to stake-holders data at any time
5) Online submission of planned data.
6) Support multiple project types
7) Support upload and download of Wayleave data/ design files.
8) Incorporate new functionality.
9) Fine tune old procedures.
10) Auto approval, understudy and resubmit options for processing of e-Wayleave by the Stake Holders.

The Stake Holders of the e-Wayleave System are;
1) Electricity & Water Authority which includes Electricity Distribution Directorate (EDD)/ Electricity Transmission Directorate, Water Distribution Directorate (WDD), PSDW, PSDE.
2) Ministry of Works – Roads Directorate, SEPPD, TSE.
3) Telecom Regulatory Authority – BATELCO, MENA, ZAIN (telecom companies)
4) Ministry of Housing.
5) Municipality
6) Bapco
7) Tatweer
8) Stake Holders of the Central Planning Office (CPO) [4]

2.3 FUNCTIONALITY OF e-WAYLEAVE SYSTEM

The e-Wayleave application has an initial approval period of a maximum of ten working days from the creation/ submission of

the e-Wayleave application with an initial approval period of five days extendable by an additional five days as being 'under-study'.
The e-Wayleave system will automatically increase the period required for approval from five days to ten days for e-Wayleaves submitted without planning permission serial number, when the status on the system is shown as 'pending'.

The e-Wayleave system will automatically submit a 'cleared for approval' status for e-Wayleave applications submitted with planning permission serial number when the status on the system is shown as 'pending' after five days.

e-Wayleave applications when created will be sent to all parties/ stake holders involved/ of interest in the process at the same time based on the 'fencing' details (digital maps/ footprints) of the property/ asset provided to the CPO by the stake holders.

In situations, when the e-Wayleave is to be resubmitted then the status will be shown as 'On-hold'.

Approvals of e-Wayleave applications for which work has not commenced within three months, will automatically expire. If the work is not completed in the specified period then the CPO is required to approve the continuation of work. If CPO rejects the extension of work period the work has to be stopped and e-Wayleave to be re-submitted seeking approval. [4]

2.4 THE e-WAYLEAVE APPLICATION/ APPROVAL PROCESS

The SPOC (Single Point Of Contact) is the person designated by the Government Agency/ Ministry/ stake holder (such as Bapco) as the contact person to raise e-Wayleave applications and to provide decisions/ solutions for all e-Wayleave applications submitted/ referred to that Agency/ Ministry/ Stake Holder by the e-Wayleave system. The SPOC is assisted by the Sub-SPOC's in assessing the submitted e-Wayleave and to advise/ approve them for further processing. The e-Wayleave is transmitted to Sub-SPOCs by the SPOC when it is ascertained by him that the e-Wayleave requires input from the Sub-SPOC's in order to process the application. Following receipt of input from the Sub-SPOCs, the application is processed/ returned with the necessary comments/ approval. [4]

3. PROCEDURE FOR APPROVAL OF PLANNING PERMISSION AND e- WAYLEAVE WITHIN BAPCO

3.1 GENERAL

All Planning Permissions and Wayleave Applications for outside Agencies are coordinated through the Ministry of Works, Central Planning Office (CPO) and circulated to Bapco Plant Engineering Department/ Gas Distribution & Sales Department which shall process these on behalf of the Company and return to the CPO. The process of distribution from the CPO is fully described in the Procedures Manual of CPO - MoW.

Each Wayleave Application or Planning Permission relates to one Agency and one project only and the Eng. Technical Liaison/ assigned person shall arrange to meet the given contact at site to discuss/clarify the project.

The project shall then be discussed with the concerned Bapco Owner Department and approval/comments given with any observations and/or special conditions stated on a covering letter and the application returned to the CPO. There shall be joint meetings in the office of the Eng. Technical Liaison / Bapco Owner Departments/ the Planning Permission/ e-Wayleave Applicant and on the work site, prior to providing requisite approvals. The concerned Bapco Owner Department shall receive a copy of the processed Planning Permission or Wayleave Application. [4]

3.2 LIABILITY AND INDEMNITY

Bapco requires all outside Agencies, or their Contractors, working inside Company reservation areas to obtain requisite indemnity/ liability coverage and to adhere to Bapco safety regulations and practices. The amount of indemnity to be specified for damage to pipelines and consequential loss due to interruption in refinery production or loss of facility, depends on the particular area. Refer sub-sections below. The third party liability shall indemnify, protect, defend and hold harmless the Company and its affiliated or associated Companies from and against any and all claims. demands, actions and proceedings of third persons, for bodily injury or death or property damage caused by any negligent act or omission, of the outside Agency and/or its Contractor or its employees arising out of our connection with the performance of the work. It shall also indemnify, protect, defend and hold harmless the Company and affiliated or associated Companies from and against any and all claims for injury, loss or damage suffered by the Company or by its servants, agents or employees caused by any negligent act or omission of the outside Agency and/or its Contractor or its employees arising out of or in connection with the performance of the work.

All Bapco Reservation Areas have been identified and formal drawings issued to the Central Planning Office which are updated in the BSDI system. The separate conditions that prevail in each area are given in the detailed procedure and are the conditions that should accompany Bapco's approval of a Planning Permission or Wayleave Application, together with any specific conditions considered necessary at the time. Also refer to Section 6 and other sections/ sub-section for general list of additional conditions, which shall be added to the conditions as necessary. [4]

3.3 ENFORCEMENT OF PERMIT TO WORK SYSTEM

The application of the permit to work when an e-Wayleave application is submitted by Outside Agency/ Contractor, for work to be carried-out in the affected corridor of 20 meters on either side of Bapco property/ facilities, will be based on review of the detailed Risk Assessment and Method Statement using the Bapco Risk Assessment template, submitted along with the permit to work application, as requested by Bapco in the response to the e-Wayleave application. The permit to work application shall have as attachment, Risk Assessment and Method Statement (RAMS) with the list of all activities indicating the Hazards levels along with the control measures. All works within a corridor of 5 meters on either side of Bapco property/ facilities shall be executed only by Bapco Approved Contractors. [1][3][4]

4 THE PROCESS

As is evident from the title of this paper and the abstract the process adopted requires the enforcement of a system by and through the government ministries and agencies within the broad legal framework.

Coupled with the governmental regulations and processes Bapco has developed very clear procedures and guidelines for all work within defined Bapco reservation areas (on-shore) and Prohibited Anchorage Zones (off-shore). The growing congestion of the existing over-ground and underground services network throughout Bahrain has necessitated the introduction of a detailed procedure to address internal and governmental requirements. [4]

4.1 The procedure covers the following;

a) Provides details of the e-Wayleave process and the responsibilities of the Single Point Of Contact – SPOC.
b) Identify responsibility based on areas of work and the work to be executed. Roles of various Bapco personnel in approval/ issue of 'permit to work'.
c) Lists Bapco Owned Areas to enable identifying of responsibilities and permit requirements
d) Insurance cover requirement for various Bapco Owned/ reserved Areas.
e) Provides guidelines to outside agencies regarding allowable distances above and below Bapco installations for pipeline/ power/ telephone cable crossings. A detail for typical type/ angle of crossings (pipelines, power/ telephone cables, civil construction, road works etc.) to Bapco installations mentions minimum design requirements/ standards to be followed.
f) The requirements of Gas Distribution Network (GDN) are included with standard requirements.
g) Lists down requirements including the requirement of trial pits on either side of Bapco installations as required from outside agency/ Ministry/ Contractor by Bapco when preparing Method Statements and Risk Assessments to be submitted for Bapco approvals of the Way Leave/ Planning Permission and subsequent 'permit to work' approvals.
h) Provides references applicable drawings, Bapco Procedures and Standards.
i) Flow charts are attached as and when necessary to illustrate the procedure.
j) Addresses requirements when work is being carried-out by outside agencies during emergencies.
k) Advises changes in the enforcement of the permit to work system (Safe Work Permit System) when e-Wayleave application is submitted by Outside Agency/ Contractor, for work to be carried-out in the affected corridor of 20 meters on either side of Bapco property/ facilities basis the detailed Risk Assessment and Method Statement (RAMS) submitted along with the application. [1][4]

4.2 PROCESS ELEMENTS

a) Owner Department

This is the Bapco Department responsible for the area in which the work is located outside fenced areas. Ownership is detailed in Bapco's Procedure QS/600/GN/009/BU Issue Status 01, 18th August 2014 - Ownership of Company Property, current revisions will apply.

b) Third Party Insurance Indemnity

This covers the liability as per law of the insured party to persons who are not parties to any insurance cover.

c) Plant Engineering Department

Plant Engineering Department of Bapco is responsible for all outside communications both written and verbal and for coordinating Bapco's response to all applications pertaining to Bapco Operating Areas and Refinery assets and their timely circulation and return to the Wayleave Coordinator, Central Planning Office - (CPO) of the Ministry of Works.

Furthermore, Plant Engineering Department shall ensure that all work within Bapco's reservation areas is carried out in accordance with Bapco's Health, Safety & Environment regulations and 'permit to work' requirements. [4] All engineering drawings shall be reviewed by Plant Engineering Department to ensure that there are no adverse effects on Bapco's facilities. Plant Engineering is also responsible for approval and issue of permit to work in Bapco's Non-Operating Areas. [1] The nominated SPOC for Plant Engineering Department is the Senior Engineer - Technical Liaison.

d) Gas Distribution & Sales Department

Gas Distribution & Sales Department (now under Tatweer Petroleum) shall be responsible for all outside communications both written and verbal and for coordinating Bapco's response

to all applications pertaining to the Gas Distribution Network (GDN) assets and their timely circulation and return to the Wayleave Coordinator, Central Planning Office - (CPO) of the Ministry of Works.

Furthermore, Gas Distribution & Sales Department shall ensure that all work within Bapco's reservation areas is carried out in accordance with Bapco's Health, Safety & Environment (HSE) regulations and permit to work requirements. [2][4] All engineering drawings shall be reviewed by Plant Engineering Department to ensure that there are no adverse effects on Bapco's facilities.

Gas Distribution & Sales Department is also responsible for approval and issue of permit to work in Bapco's GDN Areas. [1]

The nominated SPOC for Gas Distribution & Sales Department is Superintendent – Gas Distribution. [4]

4.3 PROCESS FLOW

Bapco Owner Department shall appraise all applications and technical enquiries together with Plant Engineering Department representative and shall advise any special conditions required for approval and the involvement of other Departments whenever required.

Once the Wavleave Approval has been granted to the Outside Agency or his contractor, the concerned party shall present his insurance certificate to Bapco Plant Engineering Department Representative/ Eng. Technical Liaison or Gas Distribution & Sales Department/ Superintendent – Gas Distribution for approval, after which he can apply to the designated Bapco Owner Owner Department/Section for work permits before commencing work.

A 'permit to work' shall be issued by the Owner Department upon confirmation that all special conditions including the insurance indemnity and the required level of supervision have been met. [4]

5 REQUIREMENTS FOR PARTICULAR Bapco ASSETS

Among the Bapco assets in unfenced areas, requirements that are specified for one asset i.e. the Abquaiq-Bahrain (A/B) crude oil pipeline are listed below as an example due to restriction in the length of the paper.

5.1 A/B PIPELINES FROM ZALLAQ TO THE REFINERY (ON-SHORE)

This asset runs from Abquaiq through the eastern province of Saudi Arabia (on-shore) then into the off-shore portion of Saudi Arabia, crosses the maritime border of Saudi Arabia and Bahrain and comes out at the landfall, at Zallaq in Bahrain.

To ensure the continued integrity of our operating systems and to protect against accidental damage or interruption to those facilities, for any Outside Agency and/or their Contractor requiring to work within a distance of 20 meters on either side of the A/B pipelines, the following conditions shall be observed:

a) All excavations adjacent to the pipelines shall be only by 'hand-excavation'. Machine excavation is permitted only outside a limit of 5 meters from either side of the pipeline, unless scope of work has been clearly defined with an approved Risk Assessment and Method Statement (RAMS), level of indemnity, and agreed level of supervision.

b) All construction work in the A/B Pipeline corridor shall be performed with a spacing of at least 5 meters from the outer edge of outermost pipeline. Care should be taken in case of excavation that the edge of the excavation shall be 5 meter away from outer edge or the nearest pipeline. Any engineering deviation to this requirement has to be approved by Plant Engineering Department and the Owner Department and only Bapco Approved Contractors shall be used for any works within the 5 meter corridor either side of the nearest pipeline.

c) During machine excavation a series of temporary timbers spaced at 10 meter interval, shall be placed 5 meters from the pipeline to ensure compliance with 6.5.3.2 above.

d) Application for permission to work within the Company reservation area must be submitted to Superintendent Refinery Tanks at least 48 hours prior to the scheduled start of work.

Permits to work shall only be issued if the indemnity and level of supervision requirements have been approved, and recoverable expenses agreed.

e) The Contractor shall indemnify Bapco for an amount of BD. 1,200,000 (Bahraini Dinars One Million Two Hundred Thousand) or less, depending upon the scope of work to be executed and level of supervision agreed, against any claim or liability arising during the period of work.

The Contractor shall produce a Certificate of Insurance satisfactory to Bapco before work commences. [4]

5.2 A/B PIPELINES (OFF-SHORE)

In addition to the above requirements all work to be carried out off-shore, within the assigned Prohibited Anchorage zone, shall be subject to the conditions laid down in Oil Storage & Export Department document reference SS/363/MO/202/OP, Issue Status 03, 4th December 2013 – Marine Operations –

Conditions/ precautions for working in close proximity to submerged pipelines and Section 5.3. [4]

5.3 GENERAL LIST OF CONDITIONS FOR WORK AROUND SITRA WHARF TERMINAL AND A/B PIPELINES

Listed below are the recommended guidelines for work which includes amongst others Bathymetric/hydro-graphic survey around Sitra Wharf (primarily OS&E Departments requirements) when conducting such survey within immediate areas of Sitra Wharf and A/B pipelines;

1. Every vessel(s) whilst navigating within Bapco's compulsory pilotage district or part thereof shall, at all time adhere to Bapco's safety standards as stipulated within relevant quality document(s), which includes but are not limited to the following:

a. Bapco permit to work system applies to this task.

b. The contractor's marine vessel must be inspected by Superintendent Marine Operations Section or his delegate for the purpose of verifying the competency of the captain and the crew on board and to determine the suitability of the vessel(s) primarily from a safety point of view.

c. Bapco would stress the importance of the competency of the boat captain who must be fully aware of the tidal state when commencing the survey and locations of the sea lines.

d. The contractor to provide relevant paperwork for marine vessel(s) (commercial registration, boat captain's license, first aid certificates for boat crew and/or passengers. etc.).

e. The contractor shall only consider the employment of vessel(s) which have valid statutory certificates from her classification society or flag state.

f. It is extremely important to understand that general vessel traffic in/out of Sitra Wharf shall not be impeded.

g. The proposed area of survey is in close proximity to Bapco's owned sea lines, hence, no anchoring activities will be allowed in the area, however, due to the availabilities of sufficient depth of navigable water, the survey vessel(s) will have no issues on crossing over the sea lines.

h. As per Bapco applicable rules, all diving activity must be carried-out under the permit to work system (i.e. pre-qualified). Hence, contractor must hire a Bapco approved contractor to conduct the diving activities or be pre-qualified to dive within Sitra Terminal and A/B pipeline areas. Plant Maint - District C Section Superintendent to discuss and execute the Diving Certificate permit and/or Divers Pre-Qualification process.

i. Permit to work would be required for any cameras and/or communication devices used in the area. Hence, contractor to provide details of cameras, communications devices, and other equipment to be used for permit to work application purposes.

j. Contractor to provide details & type of equipment to be used to obtain the sea current and tide.

k. If any boreholes investigation activities are to be carried out, contractors must provide details and locations of the proposed boreholes.

l. Method of conducting sea bed investigation and sedimentation studies to be identified.

m. A contingency plan shall be provided by the contractor, for different scenarios i.e. the environmental conditions become unfavorable to perform the tasks.

2. A comprehensive risk assessment and method statement (RAMS) for the survey to be provided. This includes the following:

a. Method of transferring personnel and assets from and to the site.

b. The emergency contact list has to be included within the Method Statement. i.e. Bapco contact numbers and other regulatory authorities.

c. Attending vessel's name and call sign has to be clearly identified within the Method Statement.

d. The applicable mandatory certificates have to be included within the Method Statement i.e. boat(s) registry certificate, captain(s) certificate, boat(s) navigational permit and first aid certificate for the crew and passengers.

e. The exact area of the survey needs to be superimposed on a nautical chart.

f. Survey timing to be included within the Method Statement. It should be noted that navigation during day-light hours are only permitted.

g. The safety of the personnel on board (passenger & crew) has to be identified.

h. Copy of vessel(s) insurance certificate and/or (document confirming P&I cover if any) for the boat(s) engaged in the survey.

3. Bahrain coastguard (BCG) requirement:

a. It is mandatory for all ships of less than 150MT flying the national ensign to comply with the Bahrain coastguard ministerial decree (13) 2007 and shall, in accordance with the provision of the said decree, hold the ship's owner responsible for the assignment of seafarers for services in their ships in accordance with the provision of the present decree, and shall ensure that the following statutory certificates are obtained:

- Coxswain Navigation License.
- Certificate of Registry.
- Ship Station Licence.
- Hull Survey report.
- First Aid certificate for the boat's crew.
- Services Vessel Permit and/or Passenger Boat Permit.

4. Ports and Maritime Affairs (PMA)

a. It is mandatory for all ships of 150MT or more flying the national ensign to comply with (PMA) applicable regulations; and shall hold the ship's owner responsible for the assignment of seafarers for services in their ships in accordance with the provision of relevant IMO Conventions as specified within the IMO summary of status as relevant to the Kingdom of Bahrain, and shall has to undertake to follow the shipping law and Act of the Kingdom of Bahrain.

b. It is mandatory for all ships whether it's less or more than 150MT with foreign registration trading within the Bahraini waters, to comply with (PMA) applicable regulations, with respect to the following:

- Standards of watch keeping certificates 1995 (STCW95) as amended for all officers.
- All statutory certifications issued by the ship's administration shall be presented by contractor including the Safe manning certificate.
- Navigational permit for foreign flagged ship.
- Harbor **d**ues maybe applicable.

As a final comment, it is to be noted that the above requirements are preliminary; it may modified/amended once the method statements and details of the usage/type of equipment for various purposes are provided. [4]

6 GENERAL LIST OF CONDITIONS FOR APPROVAL OF WAYLEAVE/ PLANNING PERMISSION

These conditions are applicable to all Bapco reservation areas and shall vary depending on the nature of work.

a) All excavations under/ over a pipeline shall be made by hand and should be a minimum distance of 2 meters from any pipe support to ensure they are not disturbed. Deep trench excavation shall be shored to the satisfaction of Bapco, to eliminate the possibility of collapse.

b) Where a pipe is routed under a buried pipeline there should be a minimum clearance of 450 mm and the pipe should cross at 90 degrees to the pipeline.

c) Where an electrical cable is routed under a buried pipeline there should be a minimum clearance of 750 mm and the cable should cross at 90 degrees to the pipeline.

d) Where heavy machinery must 'cross-over' pipelines during temporary works a minimum of 600 mm of compacted fill shall be placed over the pipes and road plates (minimum 25 mm thick) placed over the fill with a minimum of 1.5 meter projection past the outer limit of the pipe.

e) Where heavy compaction or paving machinery is required to work adjacent to a pipeline then temporary barriers shall be installed and approved by Bapco.

f) Where the Roads Directorate requires constructing a new road over pipelines, Bapco will be responsible for installing protecting sleeves to the pipes at the concerned Ministry's expense. In addition, the Roads Directorate shall provide a protective concrete slab above the pipes (Fig.3) to give mechanical protection from vehicle loads and install 'Armco'/ 'New Jersey' type crash barriers over the extent of pipelines. Drawings shall be submitted for acceptance by Bapco before approving Wayleave Application. As an alternative, pipe culvert may be constructed at Roads Directorate discretion, subject to the design, method statement and risk assessment of construction being accepted by Bapco.

g) Contractor Job Supervisor on site shall hold a valid Bapco permit to work Receiving Certificate/ Badge for receiving Bapco permit to work. [1] [2]

h) Where Cathodic Protection exists, anodes should not be disturbed.

i) Following the completion of construction work the site must be left, in its original condition and tidy. Any surplus material shall be removed from the site.

j) Notwithstanding the above general conditions. Bapco reserves the right to add, modify amend their conditions as they deemed fit to suit the scope of work.

k) Only Bapco Approved Contractors shall be used when performing 'High Risk' activity assessed based on the 'Risk Matrix'. [2][3][4]

7.1 SCENARIO - EXCAVATION AND LAYING SERVICES UNDER A BAPCO PIPELINE

Guidelines for various scenarios have been explained in the procedure [4] with recommendation/ suggestions for processing

of Wayleave, to be adopted by the SPOC. Two of the scenarios are detailed below. [4]

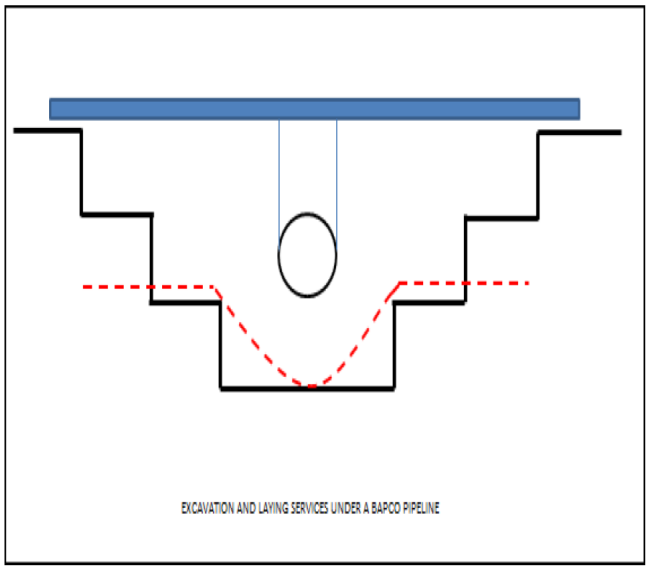

Fig.1 Scenario 7.1 graphic [4]

RECOMMENDED ACTION BY SPOC:

1) As a minimum the separation distance between Bapco Pipeline and intended Third Party installation shall be in excess of the distances mentioned.

2) A RAMS shall be prepared and presented to the respective owner of the Bapco asset.

3) A HAZOP review may be conducted based on the review of RAMS and in the opinion of the Owner Department/ SPOC.

4) The SPOC/ Gas Distribution Wayleave Coordinator or Shift Supervisor shall schedule the permit to work and Approval and Issue of the permit shall be the responsibility of the Owner Department if the Bapco Asset/ pipeline are within 20 meters.

5) Suitable shoring plates and assembly (shoring frames) shall be used and shall go further than the final depth of excavation by 3 meter deep.

6) Shoring plates shall not be driven with Excavator bucket but will have to be driven using a suitable vibro-hammer. Vibration calculations are to be submitted along with RAMS for the Vibro-hammer to be used. A Vibro-recorder shall be installed at a suitable location as agreed with Bapco, to record the vibration. Work shall be stopped if vibration exceeds the indicated particle velocity at the pipeline exceed 75mm/ sec.

7) Width of excavation around Bapco Pipelines shall be indicated in RAMS and approval given for the dimensions and also the protection measures when excavation work is carried out and when Vibro-hammer is used. The suitability of the particular equipment to be used is to be checked with reference to Bapco Engineering Practice and excavation dimensions may have to be increased/ altered.

8) The peak particle velocity at the pipeline shall not exceed 75 mm/s. The contractor shall arrange for vibration monitoring while carrying out the piling and directional drilling work near Bapco pipelines.

9) Encroachment to Bapco Leased Area/ Right-of-Way has to be reviewed by Plant Engineering Department/ Technical Support Section and necessary documentation to be prepared and approval sought from Bapco Management prior to approval of the application.[4]

7.2 SCENARIO, DEEP EXCAVATION IN CLOSE PROXIMITY AND RUNNING PARALLEL TO AN ABOVE GROUND BAPCO PIPELINE

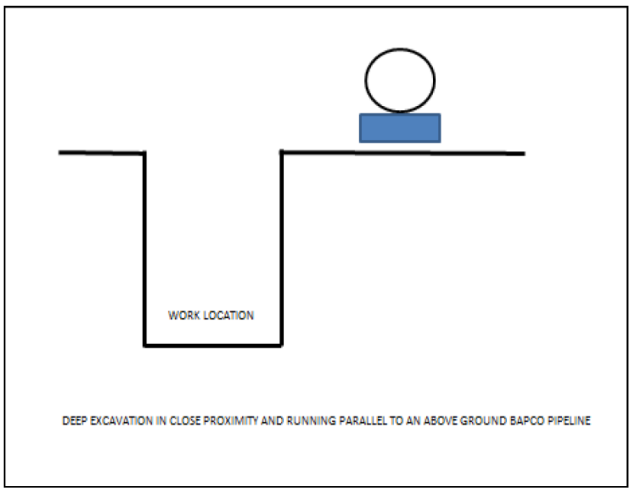

Fig.2 Scenario 7.2 graphic [4]

RECOMMENDED ACTION BY SPOC:

1) Bapco permit to work system shall apply when the deep excavation is within 9 meters of the above ground pipeline.

2) Manual excavation shall be the mode of excavation if work is to be carried out within 5 meters.

3) All safety requirements shall be followed. During machine excavation a series of temporary timbers spaced at 10 meter interval, shall be placed 5 meters from the pipeline to ensure compliance.

4) RAMS shall be prepared by the Department/ Agency carrying-out the operation who shall submit the same to the SPOC who in turn will route it to all concerned departments.

5) It is good engineering practice to keep the excavation outside the zone of pipe support foundation loading (45 degree from outside of outer edge of foundation). Engineering support to be requested.

6) A minimum horizontal clear clearance of 5 meter should be maintained between outer edge of pipe and excavation for any permanent or temporary works related to it.

7) Suitable shoring plates and assembly (shoring frames) shall be used and the shoring plates shall go further than the final depth of excavation by 3 meter.

8) Shore plates shall not be driven with Excavator bucket but will have to use a suitable vibro-hammer. Vibration calculations are to be submitted along with RAMS for the Vibro-hammer to be used. Vibro-recorder shall be installed at the location to record the vibration. Work shall be stopped if vibration exceeds the indicated particle velocity of 75 mm/sec at the pipeline.

9) Width of excavation nearest to Bapco Pipelines shall be indicated in RAMS and approval given for the dimensions and also the protection measures when excavation work is carried out and when Vibro-hammer is used. The feasibility of the particular equipment to be used is to be checked with reference to Bapco Engineering Practice and excavation dimensions may have to be increased/ altered.

10) The peak particle velocity at the pipeline shall not exceed 75 mm/s. The contractor shall arrange for vibration monitoring while carrying out the piling and tunneling work near BAPCO pipelines. Readings are to be submitted at the start and end of each shift to the permit to work Bapco Issuing Authority. Work shall be stopped immediately when the particle velocity exceeds 75 mm/ sec and the same reported to the Bapco permit to work Approving/ Issuing Authority.

11) The SPOC/ Gas Distribution Wayleave Coordinator or Shift Supervisor shall schedule the permit to work and approval and issue of the permit shall be the responsibility of the Owner Department if the BAPCO Asset/ pipeline are within 20 meters.

8 CONCLUSIONS

Attempt has been made in this paper to highlight the processes and provide guidelines to manage integrity of Bapco assets and ensure safe operations in unfenced areas. The processes and guidelines are developed from experience gained in managing these assets amongst various stakeholders i.e. government regulators, ministries, infrastructure authorities, Contractors, etc. and supported by various design codes including ASME.

Though the detailed procedure could not be shared due to limitation in the length of the paper for publication it is hoped that this paper will prove to be useful for professional management of similar assets in other countries.

9 ACKNOWLEDGEMENTS

This paper would not have been possible without the support and help from Bapco Management, Manager – Plant Engineering Department (Mr. Ali Redha Awadh), Deputy General Manager, Engineering Division (Mr. Khalid Hadi) and Bapco's executive management.

BAPCO as a mentor organization has provided me with the training and information through its systems and procedures which made this paper possible.

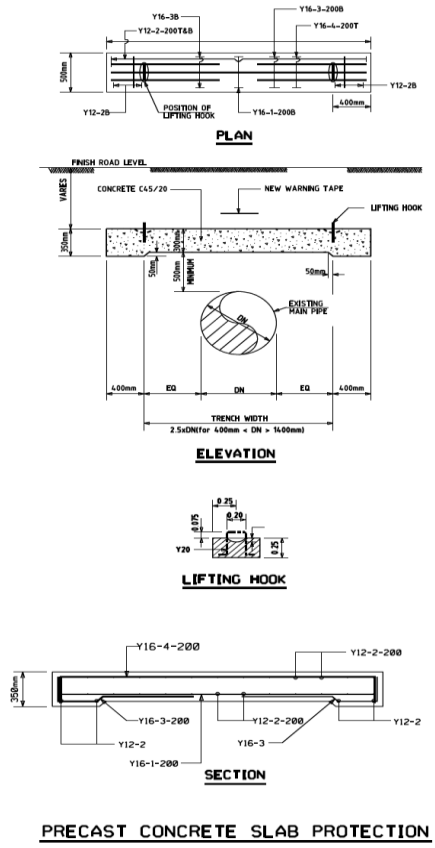

Fig.3 PRECAST CONCRETE SLAB PROTECTION DETAIL [4]

10 REFERENCES

[1] Bapco Procedure, OEMS/SAFE/SWP/PERM/2, Issue 02, 15th November 2015"Safe Work Permit system"

[2] BAPCO, Standard, SS/370/PSM/405/SH, Issue Status 01, 3rd June 2001"Contractor Safety Standard"

[3] BAPCO Procedure, QS/750/ML/029/00, Issue Status Rev 05, 1stJune 2011"Prequalification of Suppliers/ Contractors"

[4] BAPCO Procedure, ENG/PLENG/000/GENE/3, Issue Status 2.0, 22nd May 2018"Procedure for processing of Planning Permission & Wayleave (TASAREEH) pertaining to Bapco unfenced areas"

