TASK BASED RISK ASSESSMENT FOR SINGLE COMPLETION OIL WELLHEAD INSTALLATION

Dissertation work

Submitted in the Partial Fulfillment of the Requirement
For the Award of the Degree of

Master of Technology
in
(Health, Safety and Environment)

Under the Guidance of

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Date: 06/05/2007

CERTIFICATE

This is to certify that the work embodied in this thesis entitled "TASK BASED RISK ASSESSMENT FOR SINGLE COMPLETION OIL WELL HEAD INSTALLATION" submitted by **Mr. Alex C George** to the University of Petroleum & Energy Studies, Dehradun, in partial fulfillment of the requirement for the award of Degree of **Master of Technology** in ***Health, Safety & Environment***, is a bona fide work carried out by him through his own investigations from 20th March, 2007 to 30th April, 2007 under my supervision and guidance. I have been informed by him that he has been registered for M.Tech Degree in Health, Safety & Environment vide University Registration No. R070205002. He has also confirmed to me that this thesis has not been submitted to any other University for any other degree.

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CERTIFICATE

This is to certify that the project work entitled **"Task Based Risk Assessment for Single Completion Oil Wellhead Installation "** submitted by **" Alex C George "** in partial fulfillment of the requirements for the award of the degree of Master of Technology (Health ,Safety & Environment), at College of Engineering Studies, University of Petroleum & Energy Studies, is a bona fide record of the work carried out by him at Alsa Engineering and Construction Co.L.L.C , ADCOs ASAB Oil field, under the guidance of "Mr. Anirudhan K.V (Project Manager), Alsa Engineering and Construction Co. L.L.C" and "Dr Nihal Anwar Siddiqui, Assistant Professor, University of Petroleum & Energy Studies, Dehradun".

To the best of my knowledge, the contents of this project work did not form a basis of the award of any previous degree or published material by any one else.

The work is comprehensive of sufficient standard and here by recommended for the award of the degree of M.Tech in Health, Safety & Environment.

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CONTENTS

1. Executive Summary:

Task Based Risk Assessment study has been performed for the new single completion oil well SB- 90 wellhead piping and instrument control system installation for ALSA Engineering and Construction Company in ADCO's ASAB oil field.

SB-90, the single completion natural well will be handed over to the client (ADCO) by NDC (National Drilling Company) after the completion of drilling and the associated wellhead casing installation. Thus handed over well is then taken over by ALSA for the wellhead piping and other auxiliary instrument control system installation.

The connecting existing flow lines, solar panel, cathodic protection system etc and its auxiliary works are outside the scope of this TBRA study.

For the purpose of the analysis it has been assumed that the wellhead area are within restricted entry open area, which is normally manned by the ALSA employees and the frequently visiting ADCO operations and EMPD teams.

Task Based Risk Assessment (TRA) is the ADNOC specified technique for identifying hazards, assessing risks and determining prevention and control measures for a wide range of occupational and operational activities.

TBRA is an approach, which has some similarities with HAZOP. Both tools provide a way to actively engage the imaginations of those carrying out the assessment to:

- Identify hazards.
- Identify possible initiating causes that might lead to release of a hazard.
- Assess the consequences of those causes.

- Assess the existing control, mitigation and recovery methods.
- Determine whether additional control, mitigation and recovery methods are necessary to reduce the risk associated with the hazards
- Description the risk assessment steps for task activities; defining the work scope, identifying the hazards, assessing the risks, selecting the controls.

HAZOP focuses on the operation of plant, whilst TRA focuses on a sequence of tasks to be carried out by personnel. HAZOP is usually carried out in an office.

TRA is normally carried out at the work-site, so that those carrying out the assessment have first hand experience of the environment where the tasks will be undertaken, including the potential impact from or to other ongoing works in the vicinity

Different types of hazards and the risk associated are being formulated and assessed to find out the hazardous consequences and the remedial measures to be taken to avoid or to reduce the impact of consequences.

The risk was assessed in terms of risk of fatality and risk of injury to determine the impact of the proposed installation task would have on life, property and the surrounding environment.

The wellhead installation major task has been divided into the following tasks, viz

I. Well Head Piping

1. Area Grading and support installation
2. Pipe spool installation and welding
3. Post Weld Heat Treatment
4. NDT (Radiography) on weld joints
5. Hydro test Arrangement and Testing
6. Final Box Up and Painting touch up.

7. Tie in of Wellhead piping with FL.
8. Handover to client (ADCO).

II. Well Head Control Panel:

1. Excavation, laying of tube and WHCP installation
2. Tubing from well head to WHCP
3. Testing and Pre commissioning

Each task has been subjected to the Task Based Risk Assessment technique and conducted the individual study to each task and assessed the various risks and the associated hazards.

The methodology of the performed TBRA is fully based on the work/task to be done:

1. Define work to be done

(Wellhead piping and other auxiliary instrument control system installation)

2. Break work into simple tasks
    I. Wellhead piping
    II. Wellhead instrument control system
3. Select a task.
4. a. Identify hazards.
    b. Determine causes of incidents.
    c. Determine consequences of potential incidents.
    d. Assess control measures and risks.
5. Check the risk tolerability.
6. If yes, introduce various controls and if No, consider the next task.

2. Acronyms and Glossary:

Acronyms:

ALARP	As low as reasonably practicable
ADCO	Abu Dhabi Company for Onshore Oil Operations
EMPD	Egineering and Major Project Division
TBRA	Task Based Risk Assessment
WHCP	Wellhead control Panel
SSV	Surface Safety Valve
SC- SSSV	Self Contained Sub Surface Safety valve
SSSV	Sub Surface Safety Valve
ESD	Emergency Shut Down
LP	Low Pressure
HP	High Pressure
PI	Pressure Indicator
NDT	Non Destructive Testing
PWHT	Post Weld Heat Treatment
RT	Radiography test
P&ID	Piping and Instrument diagram

Glossary:

Hazard	The potential to cause harm
Risk	The combination of frequency and consequences, the chance of an event happening that can cause specific consequences.
Risk Assessment	The systematic study of the probabilities of harm and the severity of the outcome (typically within a work system or organization)
Risk Control	The process of risk assessment coupled to a systematic consideration of potential control measures and a judgment on whether they are reasonably practicable to implement.
Individual Risk	The combined risks to a 'named' individual
Semi Quatitative Risk	Use of matrix or risk calculator. Rank risks according to different areas of matrix (A, B or C) or numbers.
Task-based approach	Follow individuals during their work activities and identify hazards associated with each step of their tasks.
Isolation Point	A point in the process, which can be used to isolate one part of the process from the rest of the system

3. ALSA Engineering and Construction Co. L.L.C

- An Introduction

Specialized Engineering and construction contractor for

- Industrial Civil and Structural works
- Mechanical Works
- Piping and Pipeline Works
- Electrical / Instrumentation Works
- Cathodic Protection Works
- Pipeline Services

ALSA Engineering and Construction Company L. L. C., ALSA, is a professionally managed multi-dimensional engineering and construction project Organization involved in Civil, Mechanical, Electrical, Instrumentation and Cathodic Protection Projects to various sectors in UAE with special focus on Oil and Gas sector. ALSA was formed in the year 2004, as a continuation of the activities which were being carried out by Alsa Technical Services for the last decade.

ALSA has experience in projects related to construction of production facilities and processing facilities in the Oil & Gas sector in projects covering Industrial Civil, Structural, Mechanical, Electrical, Instrumentation and Cathodic Protection, as well as in services such as Coating Services and Pipeline services. The expertise covers experience with different materials like carbon steel, stainless steels including Duplex, Inconel etc and Polymer family materials such as GRE, RTRP, GRP, PVC, HDPE, MDPE pipes etc., erection & commissioning of static and rotary equipments, construction of Oil storage tanks, gathering stations, corrosion protection projects, water injection projects, control and automation systems, etc.

ALSA workforce is multi disciplined, with experience and expertise to meet all of various Project requirements. They have the experience of working in the most difficult terrain and working conditions.

They are trained to meet requirements for working in Abu Dhabi Onshore Oil fields, with special focus on ADNOC Group of companies. They are trained for HSE Related requirements in addition to job specific training given by reputed external agencies.

4. Well head and its auxiliary tubing installation:

Method Description:

This describes the activities that will undertaken in order to complete the installation and welding of new Well head piping from X-mas tree including supports, valves and other fittings up to the midway valve and the WHCP installation along with its auxiliary tubing works.

The main operation is divided into

a) **Wellhead piping installation**
b) **WHCP and its auxiliary tubing installation.**

a). Wellhead piping installation:

Installation of supports:

Survey, area grading & excavation for pipe supports:

A qualified and experienced land surveyor shall undertake this job in order to establish the layout of the WH Piping arrangements for further works like excavation compaction and install foundations, WH Piping – as per the ADCO approved AFC drawings.

Prior to commencement of any Grading works, it shall be confirmed that, there is no under ground services in the grading area. Pipe support excavation near X'mas tree (up to 5 mtr) shall be carried out manually. Excavation area to be barricaded prior to start excavation works. Required shoring shall be provided during the excavation. Excavated material may be stock piled to be reused during backfilling and unwanted excavated material shall be leveled and compacted.

Well head pipe supports area to be compacted well with gatch material layer of 300 mm with proper watering and Plate compactor. Support levels to be checked with the reference of X'mas tree wing valve.

Pipe supports shall be as follows in normal conditions

WPS 1 – For Single well – 1 No /For Dual well	–	2 Nos
WPS 2 - For Single well – 2 No /For Dual well	–	4 Nos
WPS 4 - For Single well – 1 No /For Dual well	–	2 Nos
Drain Support	–	1 Nos
Hurdle supports	–	26 Nos
Anchor supports	–	1 No
Limit support	-	1 No

Installation of WH Piping:

Once piping supports are installed and leveled, piping installation and welding works shall be started. Pre fabricated piping spools shall be installed over Pipe supports as per the drawings.

Spool tag nos. to be checked during installation to avoid the misplacement of spools and weld joint continuation.

Fit up and welding:

Welder's qualification: Welders shall be qualified as per approved WPS by ADCO. Results of all qualification test shall be submitted to ADCO for review and approval.

Fit up and welding: Fit up and welding works shall be carried out by experienced fabricators only. External clamps shall be used for fit up.

If there are any damaged bevels in the pre fabricated spools, damaged bevel ends shall be cut and re beveled for the weld joint, this shall be confirmed by ALSA

QC engineer. All the fit up shall be inspected and recorded by ALSA QC and random joint inspection by ADCO Inspector.

Welding of joints shall be started once fit up is cleared. Pipes shall be properly supported prior to welding. Welding electrodes shall be used as per relevant WPS which should be available at work site. Electrode handling shall be as per approved procedure and the documents shall be maintained as per these procedures. Portable oven at specified temperature shall be used for low hydrogen Electrodes.

Welding machines used for welding works shall be in good condition and with valid calibration certificates.

Welding Operations shall be referred as required to ADCO standards and procedures. ALSA QC engineer/Supervisor shall explain the requirement to the welders prior to start the work.

Once welding is completed, welders number and joint number to be marked very close to the joint. If the joint is welded by 2 welders, it shall be properly identified for Radiographic Testing.

N D T (Non Destructive testing):

NDT for the weld joints shall be carried out by ADCO approved agencies only. Calibration certificates shall be available for all the equipments to be used for NDT works.

I. R T (Radiographic Test): It shall be done on 100% of weld joints as per ADCO approved project specific NDT procedure. For PWHT joints RT shall be carried out after PWHT.

II. MPI shall be carried out for all fillet welds.

III. Hardness Test: One weld in every 5 shall be surface hardness tested using Portable approved equipment. For welds in sour service lines 100% after PWHT

IV. PWHT: All carbon steel pipe works when thickness through a butt weld joint exceeds 19.05 mm. PWHT shall be carried out as per ADCO approved procedures.

Inspection for weld Joints and NDT shall be carried out as per Document 30.99.12.005 part 15 Inspection and Testing of Production welds.

Hydrostatic pressure testing:

Hydro testing shall be carried out as per approved Hydro test procedure. Hydro test shall be done only after the approval of Hydro test pack for individual Well Heads.

- Prior to carrying out any work, the attached check list to be filled and verified to confirm the system readiness for testing.
- Before commencing any testing activities, a 'Test Pack' containing all relevant documentation shall be submitted and approved by ADCO.
- Pressure test instruments like pressure gauge, Recorders etc shall be calibrated prior to use and certificates shall be included in test pack.
- Test package shall be submitted to the client (ADCO) for review and approval at least 2 days in advance of actual test.
    - Test pack shall include the following documents
    - Marked up P & ID
    - Marked up Isometrics showing Test Limit.
    - NDT Records (RT, MT / PT & UT reports etc, if applicable)
    - Weld History Sheets
    - Calibration certificates for test equipment.
    - Testing water shall be tested for the values as per the Project specifications

- Test Manifold shall be of adequate pressure rating for safe working .

Testing of Piping (Carbon Steel)

Hydro testing of Pipeline sections shall be carried out at the ALSA Workshop

Testing Requirements:-

Test Pressure of Pipelines: 145 Psi (g)

Test Medium: Potable Water

Test Duration: 2 Hrs.

Pressure Gauge Range – 220 To 240 Psi (g) – 2 Nos (Calibrated)

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Test Medium: Potable Water

Test Duration: 2 Hrs.

Pressure Gauge Range – 220 To 240 Psi (g) – 2 Nos (Calibrated)

Hydro Testing:

Lines to be tested shall be checked for completion as per Test package limits prior to release. Blinding /Isolation shall be checked prior to test to ensure that the blind flanges are of required rating and safe for test pressure. Pressure gauges shall be located at the test system at low and high points. Gauge ratings shall be from Zero to a minimum of 1.5 times of the test pressure.

Filling shall be done from lowest point. Vent shall be provided at highest point.

Test pressure shall be applied by means of suitable test pump. Pressure shall be slowly raised gradually in steps of 10 % of test pressure and once the pressure attains 50% of the test pressure, further pressurization shall be held for duration of 15 minutes and ensured that there is no leakage from the Flange joints.

Once the above is ensured, pressurization shall be continued till the test pressure is reached and one (1) hour stabilization time is allowed beyond which the test is continued for further two (2) hrs, which is the required holding time. During holding time test pump shall be removed from the Manifold and blinding shall be done.

De-pressurization, Dewatering and Drying:

After satisfactory completion of pressure test, depressurization shall be effected gradually till pressure is reduced to zero.

Dewatering shall be carried out as per advice from ADCO. After dewatering, dry air shall be passed through the entire piping system which is continued for 10 minutes to achieve the required dryness.

Re-instatement of piping:

After dewatering and drying, re-instatement of piping shall be done as per the drawings and specs.

Re-instatement shall include but not limited to:

Removal of all temporary materials like spades, blinds, temporary supports etc

Removal of all temporary gaskets used during testing and providing new gaskets

While doing re-instatement care shall be taken to ensure that no dirt or debris is entering into the system.

Painting works:

Painting works shall be carried out as per ADCO approved Painting procedure. Field joint shall be blasted and painted at site after Hydro testing.

RESOURCES:

Manpower :

Services of following category of manpower are envisaged:

1 Piping Foreman (Job Performer) -1 No.
2. Fabricator - 2 No
3. Welder – 2 Nos.
4. Rigger - 1 No
5. Helpers - 4 Nos.
7. Welding Inspector - 1 No.
8. Blaster / Painter - 3 Nos

Equipment / Tools:

1. Welding Machine - 2 Nos
2. Crane (With Test certificate) – 1 No
3. Hiab (With Test certificate) – 1 No
4. Grinding Machine - 4 Nos.
5. Blasting / Painting unit - 1 No
6. Hand Tools
7. JCB/Shovel – 1 No.
8. Land Cruiser – 1 No
9. Water Tanker – 1 No.
10 6 W Trailer/Tipper – 1 No.

Materials:

- Pipes and Fittings
- Pre-cast Supports /Hurdle supports
- Gatch Material

HSE REQUIREMENTS:

- Necessary work permit shall be obtained prior to commencement of work. Method statement for the work execution shall be attached with the permit.
- All the new members of the team shall undergo a safety induction course in order to be aware of the work.
- HSE Engineer shall be available at site as required
- HSE compliance shall be ensured as per AL HUSAM HSE plan.
- Workmen shall have all relevant PPE as required for the job.
- Only experienced technicians / skilled workmen shall be allowed to undertake the job.
- Necessary fire extinguishers shall be provided in the vicinity.
- A toolbox meeting shall be conducted to brief all concerned about Dos & Don'ts. Special coverage of salient points related to the job undertaken and risk involved, including course of action in case of emergency, shall be ensured during the session.
- After completion of the activities, the area shall be cleared of all equipment, Tools & tackles, surplus materials and debris generated from the works.
- All the equipment should have the valid test certificates and shall be inspected and approved by ADCO HSE Dept.

- All the drivers and Operators should have the training certificates from ADCO approved agencies.

- All the Safety documents and certificates for the Vehicle/Equipment/Operator/Drivers shall be submitted to ADCO for review and approval.

b). Well Head Control Panel and the associated tubing installation:

- Find the prevailing wind direction.
- WHCP shall be located 30 mtrs away from the Well Head X-mas tree in the upwind direction approved by ADCO.
- ESD station shall be located at a safe distance from WHCP, 30 mtrs away from the well head, 1200 mm from ground level and at an easily accessible location approved by ADCO.
- Install the concrete pre-cast foundations for the WHCP & ESD station at the approved locations.

Installation of supports shall be done as per the following procedure:

- Before commencing the grading works it shall be ensured that there is no under ground services in that grading area.
- Excavation shall be carried out manually near (up to 5 mtrs) the X-mas tree.
- Necessary barricading shall be done during the excavation, Installation activities. Excavated material shall be reused for back filling and the remaining excavated material shall be leveled and then compacted.
- Compaction shall be done with proper watering and plate compactor at a layer of 300 mm gatch material.
- Coordination levels shall be identified and checked with reference to the
- X – mas tree and with the WHCP drawings.

Tubing works:

- Excavate 900 mm deep x 500 mm wide tubing trenches
- Fix pre-fabricated bulk head manifold in the well head concrete bund.
- Lay PVC coated SS tubing (3/8" & 1/2" for drain line) between WHCP & bulk head manifold at the X-mas tree and 3/8" tube to the ESD station.
- Make sure that there are no joints in the tubes in trenches.
- Protect the tubings with 150 mm thick layer of soft sand and then place concrete tiles.
- Backfill the trenches with clean sand and lay warning tape 20 cm below ground level.
- Provide concrete route markers at 10 mtr intervals.
- Run tubing from bulk head manifold to the x-mas tree through properly fixed cable tray and then up to the SSV's , SC-SSV's & fusible plugs as mentioned in the manufacturer's schematic drawings.
- Connect the LP fusible plugs in the fusible loop as per drawing.
- Excavate tubing trench from the bulk head manifold to the pressure sensing connection of the flow line string, install the hi-lo pilot sets down steam of the choke valve and lay tube to/from the pilot and for the pilot drain.
- Back fill the trenches by providing tiles & warning tapes as mentioned above.
- Connect the respective valves in the tubing to SSV's , SC-SSV's & pilot sets as mentioned in the manufacturer's drawing.

Tie-ins/ Hook ups:

- Run the above ground tubing to the WHCP through properly fitted cable tray and connect it to the respective tie-in points as per CAC schematic drawings.
- Connect the tubing to the bulkhead manifold near the X-mas tree.

- Connect the tubing from manifold to the isolation valve of SC-SSV's through H P fusible plug.
- Connect the hydraulic supply tube from manifold to the SSV's through the quick exhaust valves. (In case of Self contained SSV's, connect it independently to the flow line as per instruction manual of the SSV and agreed by ADCO without connecting it to the WHCP)
- Connect the LP fusible loop to the manifold.
- Connect the tubes to/from pilots at manifold and pilots.
- Connect the pilot drains and drain lines from Quick exhaust valves to the common return line at the manifold.
- Connect the line to the ESD valve and provide drain connection.

Inspections:

- Visually inspect the WHCP & accessories prior to installation
- Inspect the tubing for external damages prior to laying
- Inspect the trenches for adequate depth & width, free from stones, debris etc prior to tube laying.
- During tube laying inspect the tube ends are properly cut, filed to avoid sharp edges & protected to avoid entry of sand or other materials inside the tubes.
- Inspect the fittings for proper ferrules prior to installation.
- Inspect the valves for proper ratings as per requirements.
- Inspect for proper bending, leveling & supporting of tubes during installation.
- Visual inspection of all tubing, connections, fittings & tie-ins and make sure that all are as per specifications and drawings

Leak Test:

Leak tests shall be done as per the following phases:

(i) Tubing between WHCP & Wellhead @ 4000 Psi

(ii) Tubing between WHCP & ESD Switch @ 4000 Psi

- Fill the hydraulic reservoir with hydraulic fluid (ADNOC H32) until 3/4th full.
- Flush the tubes using Nitrogen.
- Charge the WHCP accumulators with Nitrogen at the required pressure using special charging kits & intensifier.
- Open pump discharge isolation valves in the WHCP
- Place all Wellhead manual control valves in 'close' position.
- Place BV2-1 of WHCP in 'SSV shut down position'.
- Turn HR1-1 (Logic Pressure Regulator) handle & HR2-1 (SSV Pressure Regulator) fully counter clockwise.
- Operate the pneumatic manual pump of the WHCP and charge the system with hydraulic pressure.
- Bleed the tubes and release the trapped air in the tubes and make sure the fluid reaches the whole system.
- Adjust SSV supply regulator to 3,000 psig output & Logic supply regulator to 75 psig.
- Continue Manual pressurization until 3500 psig is attained.
- Check for any leaks inside & outside the WHCP, at all connections, fittings& tie-ins
- In case of any leak rectify it.
- Check for pressure drop in the gauge and make sure that there is no leak in the whole system.
- In case of no visible leaks are found externally in the system and pressure drop is monitored in the gauge, individual tubing to be separately leak tested using hydraulic pump and the defective tube will be replaced & leak tested again.

Functional Test and Commissioning:

Functional Test & commissioning shall be done as per Panel manufacturer's instructions and ADCO operations requirement.

- Make sure that there is no leak at the system.
- Ensure that BV2-1 is in 'SSV shut down position'
- Ensure that Hi-Lo pilots for the well string are not in bypass position.
- Ensure that the manual control ball valves for the SSV & SC-SSV are open for the well string under test.
- Check pressure gauge readings for 'Hydraulic supply pressure' & 'Hydraulic control supply pressure'
- Pull & pin manual valve. This allows logic control pressure to interface valve HV1-1 and thereby opens SC-SSV.
- Check pressure gauge reading on the front panel for 'Hydraulic Supply to SC-SSV.
- Turn valve BV2-1 to 'SSV in service' position. This opens the SSV by the interfacing of logic control pressure with HV1-2.
- Check pressure gauge reading on the front panel for 'Hydraulic Supply to SSV.
- The well is now open.
- Check the pin dropped out for LV1-1, when the flow line pressure is established within the limits.
- To close the well, push the LV1-1. SSV will be closed first and SC-SSV will be closed after 20 seconds.
- The well can be closed by various means like turning the ESD valve to open position.
- If the well opens and closes by the above described operation, then the functional test is complete and the well can be commissioned by re- instating the WHCP in well open position by repeating the above steps.

- The above activities shall be performed after AISA attaining pre-commissioning status. For these listed activities, commissioning assistance shall be provided to ADCO operations, who shall carryout the commissioning of the system including WHCP.

Resources:

Manpower:

- Job Performer / Supervisor,
- Instrument Technician / Fitter,
- Instrument Helpers,
- Excavation Laborers,
- Crane / Hiab operator
- Rigger

Equipments:

- Crane / Hiab / JCB
- Drilling Machine with generator
- Water Tanker
- 4WD Vehicle

Materials:

- WHCP and other accessories,
- Quick exhaust Valves,
- LP & HP fusible plugs,
- Ball valves for SSV, SC-SSV & pilot lines.
- Pre Cast Foundations for WHCP & ESD

4. TASK BASED RISK ASSESSMENT:

An Introduction:

Task Risk Assessment (TRA) is the ADNOC specified technique for identifying hazards, assessing risks and determining prevention and control measures for a wide range of occupational and operational activities.

TRA is an approach, which has some similarities with HAZOP. Both tools provide a way to actively engage the imaginations of those carrying out the assessment to:

- Identify hazards.
- Identify possible initiating causes that might lead to release of a hazard.
- Assess the consequences of those causes.
- Assess the existing control, mitigation and recovery methods.
- Determine whether additional control, mitigation and recovery methods are necessary to reduce the risk associated with the hazards.

HAZOP focuses on the operation of plant, whilst TRA focuses on a sequence of tasks to be carried out by personnel. HAZOP is usually carried out in an office. TRA is normally carried out at the work-site, so that those carrying out the assessment have first hand experience of the environment where the tasks will be undertaken, including the potential impact from or to other ongoing works in the vicinity.

In outline, the procedure takes the task to be accomplished and divides it into sub-tasks of manageable size. Each sub-task is then reviewed against a checklist or a list of guidewords. Team members use the checklist / guidewords list to identify hazards that may be present during performance of each sub-task due to equipment failure, human error, environmental conditions, external effects, process upset or other sources.

The potential effects of the hazard are then assessed against the available protective and preventative systems and a judgment made as to whether it is safe to proceed or, whether further protective or preventative measures are required. On occasion it may be necessary to delay the work whilst a more detailed or rigorous assessment is made, to change the proposed work procedure, or to provide or further evaluate specialized protective systems.

The supervisor responsible for the work must lead the Task Risk Assessment team, which must be made up of people who will be involved in the work. In some cases the Task Risk Assessment team must also include those with relevant specialist knowledge.

All persons involved in TRA must be competent for their role and must receive prior training in TRA at an appropriate level. They must have a practical and theoretical knowledge of the hazards involved, possible effects and preventative measures, together with an awareness of the work and workplace conditions

Where TRA is used it must be carried out according to a formal documented procedure.

The formal procedure must cover:

- Use of an appropriate checklist or guidewords for the task to be reviewed.
- The format for recording the findings and especially any additional precautions that may be required.
- Communication of the results of the TRA to those affected by it, especially if they were not part of the assessment team.
- Interface with the Permit-to-Work System

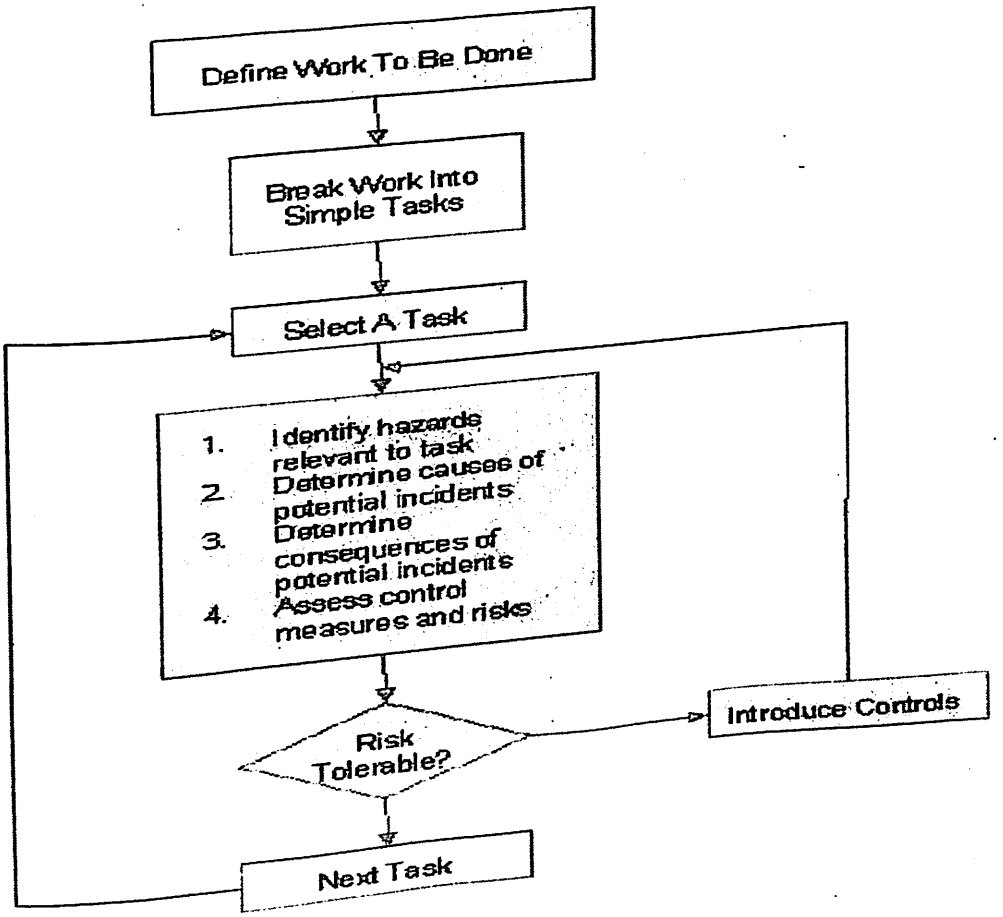
The results of the TRA must, where appropriate, be included in procedures, operating manuals and emergency plans. They must also be communicated during 'tool-box' talks. TRA is an ideal focus for any tasks that require refresher training and 'tool-box' talks before commencing such as:

- Tasks that is relatively complex.
- Tasks that are carried out infrequently.
- Where there are personnel changes.

Typical Activities In Oil Industry which requires Task Based Risk Assessment:

- Lifting and movement of heavy objects over live process equipment
- Machinery breakdown repair / maintenance
- Removing heat exchanger bundle from its shell
- Working inside a process vessel
- Dumping catalyst from a reactor
- Working with equipment where access is restricted
- Chimney (stack)repair
- Cleaning of a hydrocarbon storage tank
- Truck Discharge
- Storage Tanks
- Filling Vehicles
- Storage of Oil
- Storage of Non-Oil Liquids
- Waste Disposal
- Shipping Duties
- Tank Dipping / Temperature / Sampling
- Tank Cleaning / Repair
- Hot Work
- Forklift Operation
- Sampling
- Warehouse Work

TBRA Methodology:



CONCLUSION

ADNOC specified technique for identifying hazards, Task Based Risk Assessment (TBRA) is used to assess the risks and determine the prevention and control measures for a wide range of occupational and operational activities. This defined technique is known to be an effective Semi- Quantitative Risk Assessment Technique or to an extent a Qualitative Risk Assessment. This technique has been used here to assess and qualify the risks and to determine the prevention and control measures.

Different types of hazards and the risk associated are being formulated and assessed to find out the hazardous consequences and the remedial measures to be taken to avoid or to reduce the impact of consequences.

The risk was assessed in terms of risk of fatality and risk of injury and to determine the impact of the proposed installation task would have on life, property and the surrounding environment.

REFERENCE

1. **ADCO HSE Procedure Manual Vol .10**
2. **ADNOC code of practse on control of Major Accident Hazards (COMAH)**
3. **A text book on Safety, Reliability and Risk Management: an integrated approach by Sue Cox and Robin Tait.**
4. **Fundamentals of Risk analysis and Risk Management- by Vlasta Molak**
5. **HSEMS "Awareness" by Environmental Center for Consultancy (ECC), Abu Dhabi**

ANNEXURE 1

Task Based Risk Assessment Worksheets for Well Head Installation

1. Task Based Risk Assessment Performed for ***: Wellhead Piping & supports erection and Installation at ADCOs ASAB Field***

Scope :

The scope of this risk assessment is related to the possible safety hazards likely to be encountered during Piping Erection, material handling, loading, unloading and radiography of full penetration joints.

Hazards Identified:

After the detailed study following hazards were identified and need to be assessed:

Material handling, Loading and unloading	-	Over travel of the main or auxiliary hoist
		- Swiveling action during lifting or lowering.
		- Boom travel, Absence of alarm, Fire due to spark
Lifting accessories		- Breakage of slings / belts / hooks while handling loads.
Operations in Oil & Gas area	-	Possible Oil/Gas leak.

Sl no.	Activity	Hazard The potential to cause harm (Health, injury, Property damage, environmental etc)	Top Event / Consequences (The harm which could possibly occur).	Probability	Initial Risk H /M /L (With no controls in place)	Recommended Consequence Barrier Describe all Recommended / Consequences controls / barriers for each hazard to reduce its severity, probability or both	Residual Risk H M /L with controls in place
1	Material handling, Loading and unloading using equipment like Hiab, mobile crane etc.	Over travel of the main or auxiliary hoist.	Damage to the existing property or personnel working in the area.	Medium	High	i. Only qualified operators to operate the crane. ii. Crane capacity should be sufficient to lift the load. SWL of the crane should be certified and available. iii. Limits of the hoists should be functional and properly set. iv. During lifting operations, no person shall stand under the load. Also no load shall be slewed over any vessel containing hydrocarbons or other flammable or hazardous material. v. No lifting appliance shall be left unattended with a suspended load. vi. The hoisting mechanism on a crane shall only be used for direct raising or lowering operations and never for dragging. vii. Avoid shock loads and jerking. viii. Operator should know the exact weight of the consignment and the place where to be unloaded.	Low
		Swiveling action during lifting or lowering.	Injury to personnel or property.	High	High	. Use proper tie line to arrest the swiveling of the material.	Low
		Boom travel	Damage to the existing property or personnel working in the area.	Medium	High	i. Set the limit of telescopic travel of the boom so that it maintains a clear distance of 3 meter from the overhead utilities like power transmission line or fixed structure.	Low
		Absence of alarm.	Injury to personnel working in the area.	Medium	Medium	Bell or buzzer should be used to warn the approaching crane.	Low

Sl no.	Activity	Hazard The potential to cause harm (Health, injury, Property damage, environmental etc)	Top Event / Consequences (The harm which could possibly occur).	Probability	Initial Risk H /M /L (With no controls in place)	Recommended Consequence Barrier Describe all Recommended / Consequences controls / barriers for each hazard to reduce its severity, probability or both	Residual Risk H M /L with controls in place
		Spark through exhaust pipe	1. Fire and Explosion 2. Damage to property or life.	Medium	Medium	1. Use approved crossings. 2. Use spark arrestor on the exhaust pipe of the vehicles and mobile cranes.	Low
2.	Material Handling (non manual)	1.Unsafe rigging action 2. Use of no certified, color coded lifting tools and tackles 3. Non certified riggers and operators 4. Non compliance of 100% PPE	1. Load Failure 2. Injury to the personal 4. Fatality	Medium	High	1. Exercise safe rigging operation 2. Use only certified tools and tackles 3. Deploy only certified operators and riggers 4. Practice ADCO color coding procedure and use only proper color coded, certified tools and tackles. 5. Keep safe distance from the load, only the concerned riggers are allowed to stand near to the load	Low
	Conclusion:	MATERIAL HANDLING, LOADING AND UNLOADING: i. Only qualified operators to operate the crane. ii. Crane capacity should be sufficient to lift the load. SWL of the crane should be certified and available. iii. Limits of the hoists should be functional and properly set. iv. During lifting operations, no person shall stand under the load. Also no load shall be slewed over any vessel containing hydrocarbons or other flammable or hazardous material. v. No lifting appliance shall be left unattended with a suspended load. vi. The hoisting mechanism on a crane shall only be used for direct raising or lowering operations and never for dragging. vii. Avoid shock loads and jerking. viii. Operator should know the exact weight of the consignment and the place where to be unloaded. ix. Use proper tie line to arrest the swiveling of the material.					
		LIFTING ACCESSORIES: i. Capacity of the lifting tackles should be known and duly certified. ii. Condition should be good without showing any sign of damage.					

	iii. After completing lifting operation, slings shall be hooked back to the hook to avoid catching on obstructions.						
Sl no.	Activity	Hazard The potential to cause harm (Health, injury, Property damage, environmental etc)	Top Event / Consequences (The harm which could possibly occur).	Probability	Initial Risk H /M /L (With no controls in place)	Recommended Consequence Barrier Describe all Recommended / Consequences controls / barriers for each hazard to reduce its severity, probability or both	Residual Risk H M /L with controls in place
5	NDT inspection on piping welded joints	Radiography	1. Inadvertent exposure of radiations to non-radiography personnel when the authenticated NDT technicians have been performing radiography.	High	High	1. An area around the work site need to be vacated of all the personnel. If possible radiography shall be performed outside the normal working hours. 2. Radiography to be performed only by a certified operator. 3. Safety precautions necessitated by the use of radiation, such as the importance of safety ropes, warning signs and lights, and the risk of radiation accident, shall be explained to those staying in the vicinity of the exposure site. 4. Unauthorized persons must be prevented, during the work, from handling the radiography device.When operators leave for a break, the device must be locked in such a way that it cannot be used.	L
	Conclusion	Radiography: 1. An area around the work site need to be vacated of all the personnel. If possible radiography shall be performed outside the normal working hours. 2. Radiography to be performed only by a certified operator. 3. Safety precautions necessitated by the use of radiation, such as the importance of safety ropes, warning signs and lights, and the risk of radiation accident, shall be explained to those staying in the vicinity of the exposure site. 4. Unauthorized persons must be prevented, during the work, from handling the radiography device. When operators leave for a break, the device must be locked in such a way that it cannot be used.					

2. Task Based Risk Assessment Performed for: Tie in (Cold Cutting and Welding/ Flanging) of WH piping with the existing Flowline at ADCOs ASAB Field

Scope :

The scope of this risk assessment is related to the possible safety hazards likely to be encountered during cold cutting of existing service flowline for tie in works on WH piping at ADCOs ASAB field.

Hazards Identified:

After the detailed study following hazards were identified and need to be assessed:

Material handling, Loading and Undloading	- Over travel of the main or auxiliary hoist
	- Swiveling action during lifting or lowering.
	- Boom travel , Absence of alarm, Fire due to spark
Cold Cutting operation:	- Un skilled persons have been deployed.
	- Damaged cutting equipment
Welding/Flashing	- Performing welding operation in a high H2S proximity area, Spillage of Oil
	- Hot welding splashes.
	- Performing welding operation without purging/flushing the line and without closing the line with wet mud pig
	- Body parts in b/w, injury to body parts.
Operations in Oil & Gas area	- Possible presence of Oil/Gas.

Sl no.	Activity	Hazard The potential to cause harm (Health, injury, Property damage, environmental etc)	Top Event / Consequences (The harm which could possibly occur).	Probability	Initial Risk H /M /L (With no controls in place)	Recommended Consequence Barrier Describe all Recommended / Consequences controls / barriers for each hazard to reduce its severity, probability or both	Residual Risk H M /L with controls in place
	Material handling, Loading and unloading using equipment like Hiab, mobile crane etc.	Over travel of the main or auxiliary hoist.	Damage to the existing property or personnel working in the area.	Medium	High	i. Only qualified operators to operate the crane. ii. Crane capacity should be sufficient to lift the load. SWL of the crane should be certified and available. iii. Limits of the hoists should be functional and properly set. iv. During lifting operations, no person shall stand under the load. Also no load shall be slewed over any vessel containing hydrocarbons or other flammable or hazardous material. v. No lifting appliance shall be left unattended with a suspended load. vi. The hoisting mechanism on a crane shall only be used for direct raising or lowering operations and never for dragging. vii. Avoid shock loads and jerking. viii. Operator should know the exact weight of the consignment and the place where to be unloaded.	Low
		Swiveling action during lifting or lowering.	Injury to personnel or property.	High	high	. Use proper tie line to arrest the swiveling of the material.	Low
		Boom travel	Damage to the existing property or personnel working in the area.	Medium	High	i. Set the limit of telescopic travel of the boom so that it maintains a clear distance of 3 meter from the overhead utilities like power transmission line or fixed structure.	Low
		Absence of alarm.	Injury to personnel working in the area.	Medium	Medium	Bell or buzzer should be used to warn the approaching crane.	Low

Sl no.	Activity	Hazard The potential to cause harm (Health, injury, Property damage, environmental etc)	Top Event / Consequences (The harm which could possibly occur).	Probability	Initial Risk H /M /L (With no controls in place)	Recommended Consequence Barrier Describe all Recommended / Consequences controls / barriers for each hazard to reduce its severity, probability or both	Residual Risk H M /L with controls in place
	Lifting accessories	Breakage of slings / belts / hooks while handling loads.	Damage to the material / property or injury to personnel.	High	High	i. Capacity of the lifting tackles should be known and duly certified. ii. Condition should be good without showing any sign of damage. iii. After completing lifting operation, slings shall be hooked back to the hook to avoid catching on obstructions.	Low
	Cold cutting of existing service lines	Flooding of existing line products	Un- Conscious of Personals, Environmental damage, Fire, Chemicals harm to personal	Low	High	- Do not Operate any Existing services without proper Permit. - Tools box talk about the line product. - product to be collected in safe container and dispose in ADCO designated area . - Only experienced workmen should engage for the work. - cutting machine shall be selected and agreed by ADCO EMPD and Operations. - required spade/Blind shall be installed in the cutting line at RDS & Clusters.	Low

3. Task Based Risk Assessment Performed for: Painting works for structural and WH piping at ADCOs ASAB Field

Scope:

The scope of this risk assessment is related to the possible safety hazards likely to be encountered during painting works.

Hazards Identified:

After the detailed study following hazards were identified and need to be assessed:

Grit blasting for surface preparation	- Noise exposure
	- Grit and dust exposure.
	- Inadequate coverage of the operational area.
	- Uncontrolled release from the blasting equipment.
	- Unsafe system of work
Painting	- Unsafe use of stirrer
	- Application of paint
Operations in Oil & Gas area	- Possible presence of Oil/Gas atmosphere.

Sl no.	Activity	Hazard The potential to cause harm (Health, injury, Property damage, environmental etc)	Top Event / Consequences (The harm which could possibly occur).	Probability	Initial Risk H /M /L (With no controls in place)	Recommended Consequence Barrier Describe all Recommended / Consequences controls / barriers for each hazard to reduce its severity, probability or both	Residual Risk H M /L with controls in place
1	Grit blasting for surface preparation	Noise	Personnel can suffer both long and short terms hearing problems through exposure to high levels of noise.	High	High	Where required the supervisors shall carry out a noise assessment of the affected area in order to establish the exact noise level for which personnel are being exposed. If required provide suitable hearing protection aid and ensure that it is worn.	
		Grit and dust.	Injuries to the operator.	High	High	Use proper PPE like masks and respirators, hand gloves, helmets etc. Display and awareness of MSDS	
		Inadequate coverage of the operational area.	Injuries to other personnel and dust spreading to other area.	High	High	Barriers shall be erected around the blasting area to prevent access to unauthorized personnel. Hazard / Warning signs shall be erected.	Low
		Uncontrolled release from the blasting equipment.	Injury due to fall, trips and slips in the event of non-availability of suitable working platforms to operate the blasting equipment	Medium	High	Supervisors shall ensure that suitable access platforms have been provided where grit blasting takes place.	Low
		Unsafe system of work	Equipment failure	Medium	Medium	Supervisor and operators to ensure that regular maintenance of all the equipment is carried out.	Low

Sl no.	Activity	Hazard The potential to cause harm (Health, injury, Property damage, environmental etc)	Top Event / Consequences (The harm which could possibly occur).	Probability	Initial Risk H /M /L (With no controls in place)	Recommended Consequence Barrier Describe all Recommended / Consequences controls / barriers for each hazard to reduce its severity, probability or both	Residual Risk H M /L with controls in place
2	Painting	Unsafe use of stirrer	Power shock, death or injury to person	Medium	High	i. Equipment to be earthed. ii. 220 / 110 V step down transformer to be used. iii. Supervision during operation.	
		Application of paint	-Inhalation may cause irritation of the mucous membrane. - Skin contact may cause irritation with prolonged contact. - Eye irritation - Ingestion may damage lungs.	Medium	Medium	i. PPE to be used. ii. Follow the instructions of the supplier of the paint mentioned in the MSDS.	Low
3	Works in Oil & Gas Area	Possible Oil/Gas Leak	Un- Conscious of Personals, Environmental damage, Fire	Low	High	- Do not Operate any Existing services without proper Permit.. - H2s /Fire evacuation procedures shall be cascaded during tool box meeting. - Unauthorized persons must be prevented to enter the area - Strictly Follow the Safety warnings displayed at site. -Provide flame arrestor for all equipment -No inflammable material in the vicinity	Low

3. Task Based Risk Assessment Performed for: Wellhead Control Panel Installations at ADCO oil Fields (SAS)

Scope:

The scope of this risk assessment is related to the possible safety hazards likely to be encountered during the Well Head Control Panel Installation.

Hazards Identified:

After the detailed study following hazards were identified and need to be assessed:

Excavation of trench	-	Failure of underground services/trench collapse, fall of , fall of persons into the trench.
Lifting accessories	-	Failure of slings and/or other lifting tools and tackles while handling loads.
Oil filling and pressurization	-	Pump and accessories failure.
Operations in Oil & Gas area	-	Possible presence of Oil/Gas atmosphere.

Sl no.	Activity	Hazard The potential to cause harm (Health, injury, Property damage, environmental etc)	Top Event / Consequences (The harm which could possibly occur).	Probability	Initial Risk H /M /L (With no controls in place)	Recommended Consequence Barrier Describe all Recommended / Consequences controls / barriers for each hazard to reduce its severity, probability or both	Residual Risk H M /L with controls in place
1	Excavation of Tube trench	Failure of Underground services/ Trench collapse	Electric shock /possible death Flooding/possible death Toxic efforts and fire/possible death	High	High	iv. Gas test to be done prior to enter into trench v. Proper shoring and shuttering to be done for trench more than 1 meter iii protection to the existing UG services to be done iv work permit with excavation certificate to be obtained	Low
2	Lifting accessories	Breakage of slings / belts / hooks while handling loads.	Damage to the material / property or injury to personnel.	High	High	vi. Capacity of the lifting tackles should be known and duly certified. vii. Condition should be good without showing any sign of damage. viii. After completing lifting operation, slings shall be hooked back to the hook to avoid catching on obstructions.	Low
3	Pressurization and Testing	High pressure Pump and accessories failure	Damage to the material / property or injury to personnel	Medium	High	i. All components to be checked that material as well as rating is as per requirement for safe operation. ii. All instruments used shall be calibrated before use iii. Nearby areas to be barricaded and only authorized personnel shall be allowed to be near the work area. iv. Full time personnel shall be available to note the temperature and pressure gauge readings v. Ensure that pressurization is not done during adverse weather condition.	Low

Sl no.	Activity	Hazard The potential to cause harm (Health, injury, Property damage, environmental etc)	Top Event / Consequences (The harm which could possibly occur).	Probability	Initial Risk H /M /L (With no controls in place)	Recommended Consequence Barrier Describe all Recommended / Consequences controls / barriers for each hazard to reduce its severity, probability or both	Residual Risk H M /L with controls in place
						vi. Proper warning sign boards to be installed and followed. vii. No other activity shall be permitted in the vicinity during hydro test viii. During pressurization, no loosening or tightening of bolts& nuts shall be allowed. Suitable tools for working in oil field area shall be used.	
4	Working in Oil and Gas Facilities. (Wellhead areas)	Possible Oil/Gas Leak	Un-consciousness of Personnel's, Environmental damage, Fire	Low	High	- Do not operate any equipment without proper Permit.. - ADCO Operation Personnel shall be present all the time when testing is carried out. - H_2S /Fire evacuation procedures shall be cascaded during tool box meeting. -Provide spark arrestor for all equipment -No inflammable material shall be kept in the vicinity - Proper PPE shall be used by all the personnel.	Low

Annexure 3: ADCO Risk Matrix

Severity	People	Assets	Environ-ment	Reputa-tion	Probability A: Has occurred in world-wide industry but not in ADNOC	B: Has occurred in other ADNOC Group Company	C: Has occurred in specific ADNOC Group Company	D: Happens several times per year in specific ADNOC Group Company	E: Happens several times per year in same location or operation
5. Catastrophic	Multiple fatalities or permanent total disabilities	Extensive damage	Massive effect	International impact					
4. Severe	single fatality or permanent total disability	Major damage	Major effect	National impact					
3. Critical	Major injury or health effects	Local damage	Localized effect	Considerable impact					
2. Marginal	Minor injury or health effects	Minor damage	Minor effect	Minor impact					
1. Negligible	slight injury or health effects	Slight damage	Slight effect	Slight impact