ABU DHABI OIL REFINING COMPANY (TAKREER)

RUWAIS REFINERY EXPANSION (RRE) PROJECT

PROJECT NO. 5578 / AGREEMENT NO. 09-5578-E-4

EPC PACKAGE - 4 : TANKAGE AND ASSOCIATED INTERCONNECTING PIPING

DOCUMENT / DRAWING COMMENTS SHEET

COMMENTS TO BE RETURNED TO:
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FAX NO.:

BY DATE:

Contractor Transmittal No.	**T-DH-5578-E4-1587**	**Recd. Date**	**29 Oct 2010**
Document No.	**5578-E4-HSE-HU-00030**	**Rev. Date**	**27 Oct 2010**
Document Title	**Job Safety Analisys (JSA)**	**Rev**	**0**

COMMENTS:

By: **Signed** **Date**

Review Code:

1. REJECTED : REVISE AND SUBMIT ☐
2. COMMENTS AS NOTED : WORK MAY PROCEED SUBJECT TO COMPLIANCE WITH AND INCORPORATION OF COMMENTS ☐
3. NO COMMENTS : WORK MAY PROCEED ☐
4. INFORMATION ONLY. : ACCEPTED FOR INFORMATION ONLY ☐

No. of Pages attached to this form :

JOB SAFETY ANALYSIS (JSA)

AGREEMENT NO.	**:**	**09-5578-E-4**
PROJECT NAME	**:**	**Ruwais Refinery Expansion Project EPC-4: Tankage & Associated Interconnecting Piping**
COMPANY	**:**	**Abu Dhabi Oil Refining Company (TAKREER)**
PMC	**:**	**Mott MacDonald Ltd.**
CONTRACTOR	**:**	**Daewoo Engineering & Construction Co., Ltd.**

This page is a record of all revisions of this document. All previous issues are hereby superseded and are to be destroyed.

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DOC. CLASS: T/1

DIST. CODE: 18/19

REV	DATE	REASON FOR ISSUE	PREP	CHKD	REVD	APP'D	COMPANY
0	27 Oct 2010	Approved For Construction	D. Bhandari	A. Mesquita	DY Kim	M Heo	
A	16 August 10	For Review and Comment	C Wardman	DY Kim	J Brand	M Heo	
SIGNED (Initials)							

NOTES:

(a) Revisions are denoted by a vertical line placed in the right-hand margin against the revised text.

(b) PREP = Prepared by, CHKD = Checked by, REVD = Reviewed by, APP'D = Approved by.

(c) In case of conflict between any requirements stipulated in this document with the contractual requirements, the contractual requirements shall prevail.

REVISION INDEX DETAILS

Rev	Location of Change	Brief Description of Change

CONTENTS

1. INTRODUCTION

1.1 Purpose

The purpose of this procedure is to minimize the risk of injury to personnel or damage to equipment during work operations by careful planning of work activities.

1.2 Scope

This procedure covers the analysis of work tasks, the identification and assessment of the hazards involved and the planning of risk prevention.

2. DEFINITIONS AND ABBREVIATIONS

ALARP	As Low As Reasonably Practicable. To reduce a risk to a level, which is "as low as reasonably practicable" involves balancing reduction in risk against the time, trouble, difficulty and cost of achieving it. ALARP represents the point, objectively assessed, at which the time, trouble, difficulty and cost of further reduction measures becomes unreasonably disproportionate to the additional risk reduction achieved.
BAT	Best Available Techniques. Equivalent to ALARP in Pollution, Prevention and Control. BAT minimises the pollution that may be caused to the environment taken as a whole, using best available techniques and having regard to BPEO
BPEO	Best Practicable Environmental Option. Equivalent to ALARP in Pollution Prevention and Control. The outcome of a systematic consultative and decision-making process which emphasises the protection and conservation of the environment across land, air and water. BPEO establishes for a given set of objectives, the option that provides the most benefits or the least damage to the environment, as a whole, at acceptable cost, in the long term as well as in the short term.
CONTRACTOR	Daewoo Engineering & Construction Co., Ltd. or DAEWOO
DEC	Daewoo Engineering and Construction Company Limited
ERA	Environmental Risk Assessment. A method to identify, evaluate and assess significant environmental risks that will form the basis for environmental risk management within the HSE MS.
FAR	Fatal Accident Rate an end point used in safety QRA.
FRA	Fire Risk Assessment. A qualitative method to identify, evaluate and assess significant fire risks that will form the basis for fire risk management within the HSE MS. FRA does not include events with the major accident hazard potential.
Hazard	The potential to harm people and the environment, cause damage or loss of assets, and to adversely impact on TAKREER's reputation.

Health Hazard	The potential to cause harm to health. Health hazards may be biological, chemical, physical, ergonomic or psychological in nature. 'Health hazards' are also known as 'agents hazardous to health' and 'hazardous agents'. These terms are interchangeable.
HRA	Health Risk Assessment. The systematic identification of health hazards in the workplace and subsequent evaluation of health risks. HRA is the primary method for classification of the level of occupational health risk and for setting control implementation priorities.
PLL	Potential Loss of Life an end point used in safety QRA.
PTW	Permit-to-Work
QRA	Quantitative Risk Assessment. A quantitative method to identify, evaluate and assess significant HSE risks that will form the basis for HSE risk management within the HSE MS. QRA shall be used by TAKREER for all events with the major accident hazard potential. QRA is often associated with safety risk assessment but in this guidance a more general description to quantitative HSE risk assessment has been used.
Risk	Combination of the frequency (likelihood) of an event and the severity of the consequences (effects) of that event.
HSE Critical Task	A task with potential to cause major injury or health effects to people, local damage to assets, localized effects to the environment or considerable impact on reputation (see also ADNOC 'Risk Management Guidelines').
Task	A discrete work activity.
TRA	Task Risk Assessment - an accident prevention tool that works by identifying hazards and eliminating or minimizing them before a job is performed, and before they have a chance to become accidents.
Top event	The release of a hazard. The undesired event at the end of the fault tree and at the beginning of the event tree. The centre point in the Bow Tie Diagram.
Residual Risk	An assessment of the worst case risk associated with the hazard or effect (no defences) and an assessment of the risk carried by people and the facility once this risk is defended against is called the residual risk

3. RESPONSIBILITIES

3.1 Project Manager

The Project Manager is responsible for ensuring that the requirements of this procedure are adhered strictly during execution of the project.

3.2 HSE Manager

The HSE Manager is responsible for;

- Identifying, based on the construction planning and schedule, the work tasks requiring the JSA.

- Ensuring that the requirements of this procedure are strictly applied.
- Ensuring that the required records are generated and available for review.
- Ensuring that the proper training and toolbox meeting are conducted.

3.3 Section Manager

Section managers are responsible for the work tasks

3.4 Supervisors

- The Supervisors shall participate in the JSA.
- They shall ensure that all the employees under their charge are fully informed of the methods of working and equipment to be used, the hazards involved, and the safety measures to be implemented.

4. IDENTIFICATION OF ACTIVITIES REQUIRING JSA

Job safety Analysis, (JSA), is appropriate for any task where the hazards and control measures need to be formally assessed. A JSA is to be raised for all activities with a significant risk for which a specific established safety precaution is not in place.

As a minimum a JSA must be raised for:

- Non routine or one-off tasks
- New tasks or tasks requiring new work methods
- Routine tasks that are carried out under unusual circumstances

In general routine tasks should be dealt with by established procedures however a JSA should still be completed for;

- Routine tasks that have the potential for serious incidents
- Routine tasks which have a history of incidents or near-miss.

In all of the above cases the JSA is used to both identify hazards and to establish necessary controls and recovery measures.

5. TEAM MEMBER OF JSA

JSA is normally a team exercise involving three to five people.

The person involved in leading the analysis should have a level of technical competence relevant to the job to be analyzed and be a competent JSA Leader. The composition of the team depends on the individual task being analyzed and front line supervisors and each area of skill should be represented. For simpler tasks, a small team led by the supervisor of the activity should be sufficient. Tasks of greater complexity may involve safety advisers and area supervisor. Larger teams or JSA exercises covering a number of tasks may benefit from use of a facilitator (someone holding JSA skills.)

6. APPLICATION

The JSA for general or low hazard activities may be conducted only once, at the beginning of the work. However, the JSA of routine or low hazard potential activities(Generic JSA) shall be regularly reviewed to ensure that the conditions on which these JSA are based are not changed, e.g., working conditions and equipment.

7. EXECUTION

7.1 JSA Process

The personnel (engineering disciplines, construction and HSE) shall:

1. Review the method statement (working methods, equipment, personnel and area conditions) by breaking down the task into basic steps, describing what is to be done and in what sequence.
2. Identify the hazards associated with the work task, and evaluate the risks arising from those hazards.
3. Identify any employee, group of employees or people who are especially at risk.
4. Identify facilities that are at risk.
5. Evaluate whether existing controls are satisfactory, and if not, what actions need to be taken (e.g. change in design, shield/guard, special equipment and work method, and emergency plans).
6. Identify what information and training are needed for the employees performing the work task or other employees at risk.
7. Evaluate and record the probability or likelihood of an accident occurring as a result of uncontrolled risk. Also record the 'worst case' likely outcome.
8. Record significant findings and any circumstances arising from the assessment where serious or imminent danger could arise.

7.2 Conducting JSA

JSA may be conducted on an existing task, during the planning stage. Three principal ways of conducting JSAs are discussed below:

- Direct observation
- Group discussion
- Recall and check.

7.2.1 Direct observation

In this method the persons doing the analysis actually observe the job being done.

They may observe the process a number of times before they identify the separate steps, estimate the potential incidents and develop controls and recovery measures. In addition, they may observe different employees doing the same job to establish variations in job execution.

The advantages of direct observation are threefold:

- **Recognition**

  Seeing the job being done stimulates recognition of potential incidents more effectively than relying on memory. It also stimulates better solutions.

- **Experience**

  Employees who do a job regularly are a rich source of information about incidents associated with their job; they can be a great help with the JSA. In addition, observing the job gives supervisors an excellent opportunity to exchange safety ideas with operatives.

- **Environment**

  The influence of the environment and interface with other work can be more readily appreciated. A limitation of the observation method is that it cannot be readily applied to new jobs or jobs done infrequently.

7.2.2 Group discussion

A group of people familiar with the job, under the guidance of the supervisor, use their collective experience to identify the job steps, the potential incidents in each and develop good solutions. The participants in the discussion should be those with most knowledge about the job. In either case, the supervisor needs to be competent in JSA group discussion techniques. He should be able to stimulate a group to obtain the maximum contribution from each of its members and guide the discussions down the most productive paths.

7.2.3 Recall and check

The individual supervisor prepares a preliminary version of the JSA on the basis of recall rather than of direct observation of the job. This preliminary version is checked by discussing it with others or by directly observing parts of the job about which there may be doubts.

7.2.4 Outline of JSA Process

Identify task scope and JSA objective

Determine the task to be analyzed, establish the scope of work and the objectives of the exercise. Convene and brief the JSA team.

The scope of work should include the task to be analyzed and the range of operating environments to be considered. Permit to work may be used to specify that a JSA is carried out as part of work preparation.

Break down task into basic steps

Break down the task into its basic steps, describing what is to be done, and in what sequence. This information is often available in a work procedure or method statement.

In defining the steps a balance must be made between too much and too little detail. As a general rule, the demarcation between steps will be marked by some change, either in activity or location that would result in different hazards or exposure. Experience has shown that most tasks that are the subject of JSA can be broken down into ten steps or less. If more than 15 steps are identified and it is not feasible to merge

some steps without losing essential detail, it is recommended that the task itself is split and separate JSA are conducted for each part.

Each step description should:

- Provide a statement of what is to be done, without reference to how it is to be done or who is to do it
- Begin with an action verb (install, remove, assemble etc)
- End with the subject being discussed (pump, valve, hoist etc)
- Omit reference to hazards.

Identify potential hazards

Examine each basic step for hazards that could be present as a result of the task itself or of the work environment. At the same time, consider the departures from expected circumstances that could release or expose the hazard, and the potential incident that could result.

The observation method described earlier provides a good opportunity to assess hazards in the context of the work environment and discuss them with operators.

The key activity in a JSA determines the hazards and potential incidents associated with each particular step. JSA fail or become inefficient when the focus is on overall solutions to the whole job. Structured questions should be applied to each step to stimulate discussion about the various risk factors.

Enumerate possible effects for each

Define control measures and recovery operation

Controls and recovery measures should be developed first of all from an overview of the complete task and the risks involved. If the task as described involves a number of high risks, a change in the entire task may present a better solution than controlling each hazard individually.

If no radical solution presents itself, each hazard and potential incident should be examined and control measures identified. A useful hierarchy of solutions to bear in mind is shown below (ranked broadly in order of effectiveness):

- Eliminating the hazard (e.g. buying ready sawn timber rather than using a circular saw)
- Substitution (using a less hazardous material or process)
- Reducing the frequency of a hazardous task
- Enclosing the hazard
- Guarding / segregating people
- Additional procedures
- Additional supervision
- Additional training
- Instructions/information (handouts/signs)
- Personal protective equipment.

In addition to defining controls, recovery measures should also be developed to take into account the possibility of control failure. Recovery measures consider the following:

- (some) personal protective equipment
- Secondary containment
- Detection and alarm devices
- Escape and rescue equipment
- Emergency procedures.

7.3 Documentation

A copy of the JSA shall be kept at the work location by the supervisor responsible for the activities covered by the JSA.

The JSA documentation register shall be kept by the HSE Manager.

7.4 Review and Approval

The JSA shall be signed by the Section Manager and Supervisors, and issued for approval of the HSE Manager.

7.5 Implementation

Prior to the commencement of the site activity, all personnel involved with the work task shall attend a JSA briefing to be conducted by the Supervisor in charge.

7.6 Audit / Assessment

After the job is performed, the effectiveness of the JSA should be assessed.

- Did the JSA capture all the steps of the job?
- Were potential hazards identified?
- Were potential hazards sufficiently mitigated?

When JSA is reused, they should be reviewed to determine if environmental or operational factors have changed.

JSA audit shall be conducted as a part of site HSE audit by reviewing a random selection of JSA to ensure the effectiveness of JSA.

8. JSA TRAINING

Training courses for supervisors and foremen shall be conducted by the HSE Manager. The content of the training shall cover:

1. How to conduct a JSA.
2. Forms to be used.
3. Key points for breaking down the tasks. Demarcation between steps shall be marked by some changes, either in activity, tools, equipment, personnel or location that would result in different hazards or exposure.
4. Key points for identifying hazards and potential incidents.
    - Strain or overexert.
    - Slip, trip or fall.
    - Be struck or make injurious contact with anything.
    - Caught in, or between anything.
    - Exposed to any injurious conditions (such as gas, heat, fumes, pressure and chemicals).
    - Injure a fellow employee.
    - Damage to equipment occurs.
    - Pollution occurs.
5. How to present/explain the JSA results to the work crew.

9. ATTACHMENT

JSA Form

TAKREER
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Ruwais Refinery Expansion Project EPC-4
JOB SAFETY ANALYSIS FORM

DAEWOO E&C

JSA Number: 5578-E4-JSA-HU-0000x	☒ NEW ☐ REVISED	Page No. 1 to 4

Area of Operation: EPC 4
Job being analysed: Excavation & Backfilling (Earth Works)

Department/Section doing JSA: HSE xxxx		JSA members:	xxxxx
		Job performers:	xxxxx

NORMAL APPROVALS: POSITION	Name	Staff No	Signature	Date	General job requirements / Common PPE
JSA by:	xxxx				
Job Supervisor:	xxxx				
EXTRA ORDINARY APPROVALS (ONLY IN VERY SPECIAL CASES REFERRED BY A JOB SUPERVISOR):					
Discipline Superintendent					
Safety Representative					
Any Other Approving Authority					

Emergency Situation / Evacuation	Gas leak / Fire	In case of Emergency situation all works must be stopped, equipments to be switched off and all personne must report to the nearest muster point considering wind direction.

Note: **1) If any of the tasks involves biological, physical or chemical hazards, then Industrial Hygienist must also sign this Form, against "Any Other Approving Authority" above.**

2) If steps in a job are more than the space provided above, use a photocopy to continue on the next page.

3) Details on safety (PPE, Hazard etc) and environmental requirements can be found in DEC HSE Plan & Manual.

Sequence of Basic Job Steps	Potential Hazards	Hazard Controls