CONCRETE WORK SAFETY PROCEDURE

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 All previous issues are hereby superseded and are to be destroyed.

						DOC. CLASS	T/1
						DIST. CODE	18/ 19
0	25 Jun 10	Approved for Construction	C Wardman	DY Kim	J Brand	M.Heo	
A	15 Jun 10	Issued for Approval	C Wardman	DY Kim	J Brand	M.Heo	
REV	**DATE**	**REASON FOR ISSUE**	**PREP**	**CHKD**	**REVD**	**APP'D**	**COMPANY**
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
0	Section 3.2	Changed 2 meters to 1.8 meters
0	Section 3.2	Added section on outrigger requirements
0	Section 4.2	Changed 2 meters to 1.8 meters

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Purpose

The purpose of this procedure is to provide a guideline for reducing the risk of incidents during concreting activities the Ruwais Refinery Expansion Project, EPC-4 (Hereafter "PROJECT").

This procedure does not replace any technical concrete procedure and has been developed purely as an HSE guideline during concreting activities. For technical aspects refer to relevant Construction and/ or QA/QC procedures.

1.2 Scope

This procedure is applicable to all concrete activities taking place on the PROJECT including off site works and works in the camp.

2. RESPONSIBILITIES

2.1 Project Manager

Has the final responsibility to ensure that concrete work on the project is done without endangering health and safety in accordance with the local legislation, client's requirements and stipulations laid down in the HSE management system document.

2.2 Civil Manager

- Carries out checks and inspections to ensure that delivered goods are of good quality in respect of health and safety.
- Reviews and approves procurement requisitions.
- Ensure that incidents are reported, investigated and that corrective and preventive measures are taken: joins the incident investigation team.
- Will ensure that work under his authority is suspended if it has a negative impact on the health, safety or environmental grounds until effective measures have been taken.
- Has the power to remove personnel, including sub-contractor's personnel from the project site if, despite repeated warnings (including written warning) if they work in a manner which endangers health or safety.

2.3 HSE Manager

- Shall coordinate with Section Managers to ensure suitable arrangements, including subcontractors, are in place to conduct concreting works safely.
- Shall assign HSE personnel to monitor the activities, and advise site personnel on subjects concerning health, safety and environment.

2.4 Supervisors

- Ensure that work on the project site is carried out without endangering health and safety of personnel in accordance with the HSE plan and procedures.
- Gives persons under his supervision information and instructions on the subject of health, safety and environment.
- Conducts inspections on plant and equipment prior to commencement of work.
- Ensures that all employees receive PPE and sees to it that they use it where necessary, and maintain it correctly.
- Makes inventory of potential hazards, takes corrective and preventive actions, and ensures that all personnel follow it strictly.
- Is authorized, if he is of the opinion that there is a threat of immediate and serious danger to the personnel and property, stop any activity under his authority from being carried out and/or stop the use of plant and equipment, machinery, etc. until effective measures have been taken.
- Ensure that the safe work procedure for concrete is followed strictly.
- Must conduct a tool box meeting with his crews about concrete work, related hazards and control measures before the start of the day's work.
- Housekeeping is done at the end of the concrete work and the waste to be disposed in line with "Environmental Management Procedure (Doc. No. 5578-E4-HSE-HU-00005)".

3. CONCRETE REQUIREMENTS

3.1 Reinforcement and formwork placement

- Vertical reinforcement such as walls and piers, which might collapse, must be guyed to prevent such a collapse.
- Vertical reinforcement, which poses an impairment hazard to employees, must be properly guarded to eliminate this hazard with appropriate re-bar caps.
- Formwork and shoring shall be designed and erected under the supervision of competent persons.

3.2 Concrete Placement

- Scaffolding platforms on concrete forms shall comply with the CONTRACTOR's RRE Project Scaffolding Procedure and Fall Prevention & Protection Procedure.
- Employees working one point eight (1.8) meters above ground or adjacent surface on forms shall wear and use a full body harness for fall protection if necessary and should wear all required PPE for concrete operation, such as rubber gloves & safety rubber boots during concrete pouring.
- Employees shall not ride on concrete buckets and buckets shall not be hoisted over employees.
- When discharging on a slope, the wheels of ready-mix trucks shall be blocked and the brakes set to prevent movement.
- Ready-mix trucks shall not be allowed to travel through a jobsite with the chutes extended.
- Powered concrete trowels shall be equipped with dead man type controls switch.
- A competent person shall inspect all concrete pump trucks prior to any pour requiring this type of equipment.
- Concrete pumping operations shall immediately be suspended if blockages occur and cleared in safe manner before continuing
- Frequent inspections of concrete pump trucks elephant trunks and fittings
- Concrete wash down requirements to be followed after each pour in line with the "Environmental Management Procedure (Doc. No. 5578-E4-HSE-HU-00005)".
- Concrete pump must have all outriggers fully extended & supported on pads at least 1.5 times the dimensions of the outrigger pads.

All personnel are to be made aware of the hazards involved in handling wet cement and concrete. Skin and eyes that come into contact with concrete can easily be burnt due to the chemical reaction between the skin and the highly caustic hydroxides in wet cement.

4. CONCRETE OPERATIONS

4.1 General

This section provides guidelines to CONTRACTOR and Subcontractor for the protection of personnel engaged in concrete operations.

4.2 Requirements

- No loads will be placed on a concrete structure or portion of a concrete structure unless, based on information received from a qualified person that the structure or portion of the structure is capable of supporting the loads.
- All protruding reinforcing steel onto and into which employees could fall shall be guarded or capped to eliminate the hazard of impalement.
- No employee shall be permitted to ride concrete buckets, nor work under concrete buckets while buckets are being elevated or lowered into position.
- Employees will be required to wear proper PPE, boots, gloves, hard hat and safety glasses to prevent cement burns.
- Employees applying cement, sand and water mixtures through a pneumatic hose will wear face protection in addition to safety glasses.
- No employee shall be permitted to place or tie reinforcing steel more than 1.8 meters above any adjacent working surface unless the employee is protected by the use of a safety harness or equivalent fall protection.

4.3 Equipment and Tools

- Storage bins, silos and containers must be equipped with conical or tapered bottoms, and have mechanical or pneumatic control to pour the material.
- Power and rotating type concrete throwing machines that are manually guided shall be equipped with a control switch that will automatically shut off the power whenever the hands of the operator are removed from the equipment handles.
- Positive safety latches or similar safety devices shall be installed on all hydraulic or pneumatic gates of concrete buckets to prevent premature or accidental dumping.
- Buckets will be suspended from shackles or approved safety-type hooks.
- All pipe supports of concrete pumping system will be designed for 100 percent overload.
- Compressed air hoses will utilize only fail-safe joint connectors (whip checks) to prevent separation of sections when pressurized.
- Tremies, elephant trunks, etc., sections will be secured with fail-safe chain or wire rope in addition to regular couplings or connections.

- Concrete buggies (Georgia buggy) handles will not extend beyond the wheels on either side of the buggy. Where there is a possibility of contact with energized electrical conductors, handles on bull floats will be constructed of non-conductive material or insulated with non-conductive sheath.
- Blades of masonry saws must be covered with a semicircular enclosure to retain blade fragments. A method for retaining blade fragments shall be incorporated in the design of the semicircular enclosure.
- Mixers with 0.76 cubic meter or larger loading skips shall be equipped with a mechanical device to clear the skip of materials. And guardrails installed on each side of the skip.

NOTE: All potentially hazardous energy sources must be locked out and tagged out before performing maintenance or repair on equipment as per the CONTRACTOR's RRE Project "Electrical Safety & Energy Isolation Procedure (Doc. No. 5578-E4-HSE-HU-00034)".

4.4 Formwork/ Shoring

- Formwork and shoring will be designed, erected, supported, braced and maintained so as to safely support any and all vertical and lateral loads that may be imposed upon it during placement of concrete.
- Drawings of plans showing the jack layout, formwork, shoring, working decks and scaffolding will be available at the job site.
- All shoring equipment will be inspected prior to erection to determine that it is specified in the shoring layout and that it is not defective.
- Defective or damaged shoring equipment must not be used for shoring under any circumstances.
- Erected shoring equipment will be inspected during and immediately before and after the placement of concrete.
- Damaged or weakened shoring equipment will be immediately reinforced or re-shored.
- All sills for shoring will be sound, rigid and capable of safely carrying all vertical and lateral loads that may be imposed upon them at anytime.
- All base-plates, shore heads, extension devices and adjustment screws will be in firm contact with the footing sill and the form material.
- Eccentric loads on shore heads and similar members must be designed for such loading.
- Shoring for tiered single post shores and erected shoring must be designed and inspected by an engineer qualified in structural design.
- Single post shores must be vertically aligned, spliced to prevent misalignment, and adequately braced in two mutually perpendicular directions at the splice level. Each tier must be diagonally braced in the same two directions.
- Single post shores should not be adjusted after the placement of concrete.
- The spacing between towers and cross-brace spacing in erected shoring will not exceed that shown on the layout, and all locking devices will be in the closed position.

- All shoring will be laterally supported by attachment to the structure.
- Freestanding masonry walls will be braced and supported to provide lateral stability against wind or other forces.
- Re-shoring must be erected, as original forms and shores are removed, whenever the concrete is required to support loads in excess of its capacity.
- Forms and shores (except those used for slabs on grade and slip forms) must not be removed until the concrete gains sufficient strength to support its weight and superimposed loads.
- Compliance with the plans and specifications for removal of forms and shores, and proper testing with an appropriate standard test method can help determine if the concrete has gained sufficient strength.