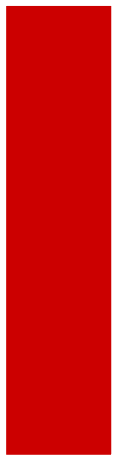




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HEALTH, SAFETY AND ENVIRONMENTAL

REFERENCE GUIDE

HSE INTERVIEW GUIDE -INDEX

SL NO.	ELEMENTS	PAGE NO.
1	INTRODUCTION	2
2	HSE MANAGEMENT SYSTEM, HSE PLAN, HSE TRAINING & DEFENITIONS.	3
3	LIFE SAVING RULES AND LIFE PROTECTION RULES.	10
4	PERMIT TO WORK SYSTEM (PTW).	11
5	RISK ASSESSMENT (RA) & JOB SAFETY ANALYSIS (JSA).	14
6	ENVIRONMENT.	16
7	PERSONAL PROTECTIVE EQUIPMENT.	17
8	GAS TESTING.	21
9	HYDROGEN SULPHIDE (H ₂ S).	22
10	SULPHUR DIOXIDE (SO ₂).	25
11	EMERGENCY RESPONSE PLAN	25
12	INCIDENT,ACCIDENT & NEARMISS	27
13	FIRE & FIRE FIGHTING.	29
14	ROAD SAFETY.	33
15	CHEMICAL HANDLING.	33
16	EXCAVATION.	36
17	CONFINED SPACE.	39
18	LIFTING ACTIVITIES.	41
19	ELECTRICAL SAFETY	46
20	NON DESTRUCTIVE TEST (NDT).	50
21	PRESSURE TESTING.	54
22	HOTWORK ACTIVITIES.	55
23	HOT TAPPING	58
24	WORKING AT HEIGHT.	61
25	CIVIL CONSTRUCTION ACTIVITIES.	68
26	INSULATION ACTIVITIES.	72
27	ABRASIVE BLASTING	73
28	REFRACTORY WORKS.	75
29	MANUAL HANDLING	75
30	HEAT STRESS	77
31	ABBREVIATIONS.	79

1. INTRODUCTION

ABOUT ME:

Let me introduce myself, my name is Muhammed Shafeeq, I am an Indian with 9 years of experience as an HSE Professional in various Oil and Gas field companies (Onshore and Offshore) in the UAE and India. I started my career in 2008 and till its continuing.



I would like to share one of my experiences when I planned to start my career in the UAE, I searched the job as HSE professional and some of the companies invited me to attend the interview, but the interviewers were not satisfied with my presentation during the interview due to lack of knowledge in HSE, ultimately it will affect to find a job. So I planned to gather all the questions what the interviewers asked to me at that time, then I searched answers for those questions, but it was not enough, anyway it was better than before.

I attended different client interviews and company interviews throughout my career, some of the interviews were complicated and some of them are simple, but anyway got approval from various clients. This is one of the reasons to prepare this HSE guide and I tried to include maximum notes which questions are asked to me and some of the questions and notes I collected from my friends. Still, I am studying about and it will be continued. I am not able to offer any job for all, but I can share my knowledge with my HSE friends. *"Nobody wants to fail any interviews or nobody wants to lose their job due to lack of knowledge"*; this is my intention and aim of this HSE guide. So I am dedicating this HSE guide to all my HSE friends. I am requesting you to note this mail id shafeeqtazz@yahoo.com for your feedback or correction or queries.

ABOUT HSE GUIDE:

This HSE guide includes most of the topics according to the requirements of Abudhabi companies such as ADCO, GASCO, ZADCO, EMAL, etc. and Some EPC Company interviews questions,

In this HSE Guide all the sessions are important; it is the basics and its minimum knowledge we should know in HSE profession. Whenever you go for an interview, we should know about the company and what type of projects they are handling and what are the scope of works, then we should prepare ourselves for the interview according to that project scope. Some of the points have been highlighted or underlined for the easiest way of learning. I hope this HSE guide may very help full for my HSE friends and wish you a bright future!!!.

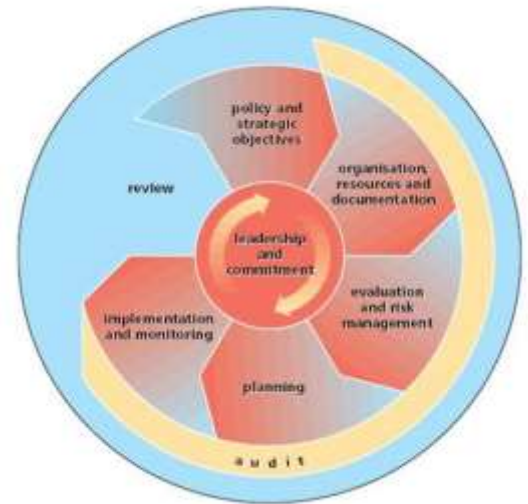
THANKS TO:

- Mr. Wilson Pious. : HSE Manager
- Mr. Saji Kumar Achari : Sr. HSE Engineer.
- Mr. Fiyaz Abudul Rahim : Sr. HSE Officer
- Mr. Ajay Kumar Govinda Pillai : Sr. HSE Officer
- Mr. Hareesh Riceland. : Sr. HSE officer

2. HSE MANAGEMENT SYSTEM, HSE PLAN, HSE TRAINING, HSE RESPONSIBILITIES & DEFINITIONS.

HEALTH, SAFETY & ENVIRONMENT MANAGEMENT SYSTEMS (HSEMS) 8 ELEMENTS: LPORPIAM

1. Leadership & Commitment.
2. Policy & strategic objectives.
3. Organization, resources & Competence.
4. Risk Evaluation & Management.
5. Planning standards & Procedures.
6. Implementation & Monitoring.
7. Audit.
8. Management Review.



1. LEADERSHIP & COMMITMENT:

This HSEMS element addresses the top-down leadership and commitment to create the company culture, necessary for success in the systematic management of HSE.

2. POLICY & STRATEGIC OBJECTIVES:

This HSEMS element addresses corporate intentions, principles of action and aspirators with respect to health, safety and environment and the aim of improved HSE Performance.

HSE Policy in 2 words.

Zero Incident/ Accident (No harm).

3. ORGANIZATION, RESOURCES & COMPETENCE:

This HSEMS element addresses the organization of people, resources and the competence required of sound HSE Performance.

4. RISK EVALUATION & MANAGEMENT:

This HSEMS element addresses the identification, evaluation and management of HSE hazards and evaluation of HSE risks, for all activities, product and services, and the development of measures to reduce these risks.

5. PLANNING, STANDARDS & PROCEDURES:

This HSEMS element addresses the planning of work activities, the standards and procedures along which these shall be executed, specifically the risk reduction measures as selected through the evaluation and risk management process. It includes safe guarding the integrity of assets, managing changes and developing and testing emergency response measures.

6. IMPLEMENTATION & MONITORING:

This HSEMS element addresses the manner in which activities are to be performed, monitored and corrective action to be taken when necessary.

7. AUDIT:

An Audit Program shall be in place to review and verify effectiveness of the management system. It shall include audits by auditors independent of the process or facility audited.

8. MANAGEMENT REVIEW.

Management shall regularly review the suitability and effectiveness of the HSEMS.

IMPORTANT ELEMENTS IN HSEMS:

1. Leadership & Commitment.
2. Risk Evaluation and Management.

KEY ELEMENTS OF SAFETY MANAGEMENT SYSTEM:

Policy, Organizing, Planning & implementing, Evaluation, Action for improvement, Audit and continual Improvement.

HSE PLAN:

It is the systematic procedure which is describe how to carryout work in a safe manner by protecting health safety and environment. HSEMS is the base of HSE plan.

THE CONTENTS ARE THE FOLLOWING:

Project Title, Index, Introduction, scope of work,

Leadership and commitment: Proactive target setting, informed involvement of top management commitment like incentive programs, visibility& site walk through by top management.

Policy & Strategic objectives: HSE Policies, sub policies, Strategic Objective & Targets

Organization, resources & Competence: Organization chart, Resources, Roles and Responsibilities, HSE Competency assurance, contractors & subcontractors and communications.

Risk Evaluation & Management: Identification, Evaluation& Assessment, Controls, ownership & performance in maintaining controls, recovery and Recording & HSE Case.

Planning, standards & Procedures: HSE Plan, Asset integrity, Site basic HSE rules, Standards, procedures & work instructions, HSE Manual- documentation, reference documents, Management of change, & emergency response plan.

Implementation & Monitoring: Implementation, Site inspections, HSE training plans, Non-compliance & corrective action, performance monitoring & records, incident reporting & follow- up.

Audit: Audit plan, Auditor competency& contractor auditing.

Management review and Annexure.

HSE TRAINING:

Ensure ALL Employees receive adequate induction, Orientation and craft specific HSE Training to execute their roles and responsibilities in a safe manner throughout.

1. Competent person(s) shall be selected and nominated to conduct the standards site HSE Orientation General Orientation and visitors Safety Orientation.
2. Delegate(s) Alternate(s) should also be nominated to fulfill the role in the absence of the assigned person(s).
3. Issue induction sticker and HSE passport to attendees after training.

PROVIDE TRAINING FACILITIES:

Contractors shall install, provide and maintain sufficiently large enough facilities located in the contractor's combined Camp / Office/ Medical facility/ Training facility, to conduct training and orientation for their proposed manning levels.

Training facilities shall include the following:

1. Adequate number of seats.
2. Air conditioning.
3. Power outlets & Computer access.
4. Visual aid devices and tools (such as screens and TVs etc.)
5. Address instrument..

**BRIEFING OF HSE INDUCTION INCLUDED BUT NOT LIMITED TO:**

HSE Policy, Emergency preparedness (Moke drill plan, Evacuation Plan, Assembly point, First aid facility, Ambulance, Medical clinic, Emergency contact Numbers.), PTW system of the site, Welfare facilities, work related procedures , Mandatory PPE and Work related PPEs. These are the minimum will be briefed during HSE Induction.

MANDATORY TRAININGS AS PER ADNOC REQUIREMENT.

HSE induction, H2S, First Aid & Fire Fighting trainings (from Approved Institute),

HSE OFFICER RESPONSIBILITIES.

- Conducting HSE induction and other in house HSE training for the employees.
- Ensure that the workforce understands safety requirements, procedures and rules through an onsite orientation.
- Verify the PTW weather it is valid or not, Conduct PTW audit on site.
- Participating in site inspections with high profile tours by management.
- Carryout daily inspections of assigned areas, monitor site conditions, work practices and safety compliance. Ensure that unsafe work condition practices are corrected by supervisor.
- Attending weekly, monthly, and emergency meetings with clients and report on company safety performance.
- Ensure that Tool box talks are conducting on regular basis and ensure they are being done in a professional and capable manner. Maintain record of all training and attendance for audit purpose.
- Issue safety violations notices / memo of dangerous occurrences and practices.
- Make sure the basic welfare facilities at site like; Basic first Aider, Shaded Rest Area, cold water, emergency vehicles, toilet, full PPE, emergency numbers with all work force, and emergency evacuation procedure etc.
- Inspection of light and heavy vehicles, equipment and getting clients approval.
- Inspection of power and hand tools, tackles, lifting equipments and accessories, and material handling machineries, scaffolding etc.
- Inspection of life saving equipments like; Fire extinguishers, Fire Hose Real, H2S monitors, Escape Hoods, General alarm system, Water sprinklers, Heat/Smoke detectors.
- Submitting monthly records HSE activities to the HSE Manager & Clients.
- Accident investigation, reporting and recommendation, follow up procedures and back up training.
- Monitor work permits shall be obtained prior to any work commencing and work shall be carried out in accordance with specific measures itemized on the permit.
- Ensure apposite attitude with all personal to ensure the safety standards are complained with continual improvement.
- To ensure all required sign boards, notices, posters and others safety related literature is properly displayed for employees' information.

HSE DEFINITIONS:

- **HEALTH:**
Absence of disease Or the Protection of people from personal injury resulting from exposure to hazardous substances and material, or physical, mental and social wellbeing of a person.
- **SAFETY:**
Protection of people from personal injury and Property& Environment from damages.
- **ENVIRONMENT:**
Surroundings in which an organization operates, including air, water, land natural resources, flora, fauna, humans and their interrelation.
- **ERGONOMICS:**
The relationship of science between worker, equipment and working environment.
- **WELFARE:**
Looking-after employee's well-being.
- **HSE POLICY:**
It is the overall view of the organization towards HSE, it is a legal requirement, it is top management commitment and it is signed by senior most person of the management.

- **GENERAL STATEMENT OF INTENT:**

The Organization's overall approach to health and safety managements and its aims in terms of performance. It must commit the organization to achieving legal compliance.

- **SOURCES OF INFORMATION:**

- **MSDS** (Material Safety Data Sheet); **Product label**,
- **HSE** (Health Safety Executive) (UK);
- **ACGIH** (American Conference of Government Industrial Hygienic) (**USA**); and
- **EU** (European Union).

- **DIFFERENCE BETWEEN DEVIATION AND CHANGE OF MANAGEMENT:**

- **Deviation** : Temporary, sudden due to practical reasons.
- **Change of Management** : Permanent change to improve efficiency safety process.

- **BENCH MARKING:**

Comparison of an organization's performance with the others in the industry or sector is known as bench marking **OR** Comparison of performance of two similar organizations.

- **4 "C" S IN CRITICAL IN DEVELOPING A POSITIVE SAFETY CULTURE:**

- Competency;
- Control;
- Cooperation; and
- Communication;

- **TYPES OF PROCESS SAFETY CULTURE:**

- Pathological;
- Reactive;
- Calculative;
- Proactive; and
- Generative;

- **DIFFERENCE BETWEEN PRO-ACTIVE MONITORING & REACTIVE MONITORING:**

- **Pro-Active Monitoring:** To ensure that health and safety standards are correct in the workplace before accidents, incidents or ill health are caused. (Safety inspections, sampling, surveys, and safety tours)
- **Reactive Monitoring:** Using accidents, incidents and ill health as indicators of performance to highlight areas to concern.

- **DIFFERENCE BETWEEN CLIENT AND CONTRACTOR:**

- **Client** is organization or individual for whom the construction project is carried out.
- **Contractor** will be pointed with overall responsibility for the construction.

- **SAFE SYSTEM OF WORK (SSOW):**

The Analysis of a task or process which consider the hazards line to be present and details the precautions necessary to avoid or minimize the risk to the health and safety of the individuals.

The SSOW elements are Pre-Planning meeting, **RA**(Risk Assessment).**PTW** (Permit to Work System),Competent Person, Roles and Responsibility allocated, **IT IS** (Instruction, Training, Information and Supervision),Maintenance on equipment, Recovery measures, Emergency Response Plan, **MSDS** (Material Safety Data Sheet), **Control**(Technical, Behavioral and Procedural), **PPE**(Personal Protective Equipment),**TBT**(Toolbox Talk) and Isolation,

- **AUDIT:**

Arrangements must be made for the independent, systematic and critical examination of safety management system to ensure safe working practice in an operation.

- **DIFFERENCE BETWEEN AUDIT & INSPECTION:**

- **If we are saying simply-** Inspection is a “DO” and Audit is a “CHECK”.
- **If it is in explanation-** An inspection is typically something that a site required to do by a compliance obligation, An Audit is a process to checking the compliance obligations are met including required inspection have been done.

- **DOCUMENTS WILL BE CHECKED DURING AN AUDIT:**

Health and Safety Policy, Risk Assessment and Safe system of work, Training Records, Minutes of safety committee meeting, Records of health and safety monitoring activities, Accident investigation reports and near miss reports, Emergency Arrangements, Inspection reports from Insurance companies, Records of worker complaints, etc.

- **METHOD STATEMENT:**

It is a document which describes full details of method of our work, individual responsibilities, working equipment & Working environment which is submitted by contractor to client.

- **HAZARD:**

Something with the potential to cause harm to People, Equipment, Environment and Company Reputation;

- **HEALTH HAZARDS:**

- **Physical Hazard** (Noise, vibration, Electricity, Temperature & Lighting)
- **Chemical Hazard** (Gas, Dust & Smoke),
- **Biological Hazard** (Virus, Bacteria, Fungi & Mold),
- **Psychological Hazard** (Stress & Fatigue),
- **Ergonomically Hazard** (Strain & Work posture),
- **Mechanical Hazard** (**ENTICE:** Entanglement, Trap, Impact, Contact and Ejection).

- **MAIN HAZARDS IN THE SITE:**

Slip/trips/falls, Falling from height, Falling Object, Collision with objects, Trapping /Crushing under or between object(s), Manual Handling, Contact with machinery and Hand tools, Electricity, Transport, Contact with chemicals, Asphyxiation and drowning, Fire and explosion (Consequence of an event), Animal, etc.

- **MAIN HAZARDS IN OIL AND GAS FIELD:**

- H2S Release, Hydrocarbon,
- Working At height,
- Thermal (Temperature),
- Pressure system,
- Noise/Vibration,
- Chemical and Driving.

Pedestrian Hazards:

CASE:

C-Collision, **A**-Air born particles, **S**-Slip and Trip and **E**-Ergonomic;

- **RISK:**

The likelihood that harm will occur and severity of the harm to People, Equipment, Environment & Company Reputation;

- **ACUTE EFFECT:**

When a person exposure to high concentration of Chemical for a short period of time and this effect generate in his body which is reversible;

E.g. Exposure to Ammonia can cause temporary breathing troubles, dizziness, etc.

- **CHRONIC EFFECT:**

When a person exposure to low concentration of chemical for a prolong period of time and this effect generate in his body which may or may not be reversible.

E.g. Exposure to Ammonia on long time basis can cause Asthma, cancer etc.

- **TLV (THRESHOLD LIMIT VALUE):**

The concentration to which it is believed that a person can be exposed continuously for short period of time without suffering from irritation, chronic or irreversible tissue damage and reduce work efficiency.

- **STEL (SHORT TIME EXPOSURE LIMIT):**

The maximum concentration of a chemical to which workers may be exposed continuously for up to 15 minutes without danger to health or work efficiency and safety.

- **OEL (OCCUPATIONAL EXPOSURE LIMIT):**

The maximum allowable concentration of airborne contaminants to which a person may be exposed for certain reference time.

- **CONFINED SPACE:**

Any Enclosed area which has the limited access and egress and it has deficiency and Enrichment of the oxygen and it is not designed for continuous human occupancy. E.g.: Trench, Pit, and Vessel.

- **TOOLBOX TALK:**

These are normally provided by Supervisor or foreman to their Operatives prior to start the work. Specific safety topic shall be discussed about activity, tools & equipment or which is involve in their activity and its safety precautions.

- **TRAINING:**

The process of imparting specific skills and understanding to undertake defined tasks;

- **COMPETENT PERSON:**

A Person who has **SKETL**, Skill, Knowledge, Experience, Training, Limit (A competent Person knows his Limitations).

- **INCIDENT:**

An instance of something happening; an event or occurrence;

- **ACCIDENT:**

An Un wanted, Unforeseen, Unplanned Event which leads to loss of some kind.

- **UNSAFE ACT AND UNSAFE CONDITION:**

- **Unsafe Act** : Any Act doing by person who is not safe or lead to an accident/Near miss.
- **Unsafe Condition** : Any condition where something exists that varies from normal accepted safe Condition and can result accident.

- **NEAR MISS:**

An un-wanted, Unforeseen, Unplanned Event which had the potential to result in a loss of some kind.

- **LOST TIME INJURY (LTI):**

Work related injury or illness that renders the injured person unable to perform any of their duties.

- **RESTRICTED WORK CASE (RWC):**

Any Work Related injury which renders that injured person is temporary unable to perform all, but still some of their normal work on any day after the day on injury occurred.

- **MEDICAL TREATMENT CASE (MTC):**

Any work related injury involves neither Lost Time Injury nor Restricted work case But which is required treatment by a physician or other medical specialists. It does not include First aid.

- **OCCUPATIONAL ILLNESS:**

Any work related abnormal condition or disorder.

- **FIRST AID:**

The purpose of first aid is to preserve the life of an injured person and prevent his condition from worsening until qualified help arrive

- Aim **PPP** (Preserve life. Prevent deterioration. Promote recovery).

- **EXCAVATION:**

Any man made cave-in on the earth.

- **TRENCH:**

Depth is greater than width is called trench, although the width is not greater than 15 feet (4.5 M).

- **NOISE:**

Any unwanted irritated sound is called noise.

- **RADIATION:**

Emission of waves is called radiation.

- **HOT WORK:**

Any work that may produce the heat, Work that involves continues or potential source of ignition.
(E.g. Cutting, Grinding, welding, sandblasting, etc);

- **COLD WORK:**

Any work that may not produce the heat, (E.g. Scaffolding work, Cleaning, Cold cutting, Insulation, painting, etc);

- **ZONE CLASSIFICATION RELATING FLAMMABLE ATMOSPHERE:**

- **ZONE-0:** Explosive gas atmosphere are present **continuously** of present long period.
- **ZONE-1:** Explosive gas atmosphere **likely** to occur normal operation.
- **ZONE-2:** Explosive gas atmosphere **not likely** to occur in normal operation. If it occurs it will only exist for a short time.

- **FLASHBACK ARRESTOR:**

A flashback arrestor is a special gas safety device most commonly used in oxy-fuel welding and cutting to stop the flame or reverse flow of gas back up into the equipment or supply line and it prevents the user and equipment from damage or explosions.

- **CHALWYN VALVE:**

Operating diesel engines in hazardous environments is a serious safety risk. A release of flammable gas or hydrocarbon vapor can occur at any time and be drawn into the engine's air intake. The most effective way of shutting down a runaway diesel engine is with an automatic air intake shutoff valve.

- **SPARK ARRESTOR:**

A spark arrester is any device which prevents the emission of flammable debris from combustion sources, such as internal combustion engines, fireplaces, and wood burning stoves. Spark arresters play a critical role in the prevention of wild land fire and ignition of explosive atmospheres.

- **DERMATITIS:**

Dermatitis, also known as eczema is a group of diseases that results in inflammation of the skin. These diseases are characterized by itchiness, red skin, and a rash. In cases of short duration there may be small blisters while in long-term cases the skin may become thickened. The area of skin involved can vary from small to the entire body.



PIPE LINE PROJECT ACTIVITIES SEQUENCES:

- Transportation of Pipe lines,
- Right of Way (ROW) in sandy Area,
- Stringing, Bending,
- Cutting, grinding, welding,
- Field joint coating,
- Nondestructive test (NDT),
- Pre-padding, post padding,
- Hydro testing,
- De commissioning & de oiling of existing lines; and
- Restoration.

3. LIFE PROTECTION RULES (LPR) AND LIFE SAVING RULES (LSR)

ADCO LIFE PROTECTION RULES (LPR):

1. Follow Transportation safety requirements. (Road safety).
2. Obtain Valid Permit to work before commencing any job that requires PTW and ensure that all workplace hazards are addressed.
3. Conduct gas test whenever required.
4. Verify isolation before work begins and use the specified life protecting equipment. (Isolation verification).
5. Obtain authorization or valid confined space certificate before entering confined space.
6. Use specified fall protection equipment when working at height.
7. Obtain authorization or a valid permit to work and inhibition certificates before overriding or disabling safety critical equipment and systems.
8. Do not walk or stay under the suspended load.
9. Do not use banned or unauthorized tools or equipment.
10. Use mandatory PPE, RPE as per requirement.

GASCO LIFE SAVING RULES (LSR):

1. Protect yourself against a fall when working at height.
2. Conduct atmospheric gas testing when required.
3. Do NOT stand or walk under a suspended load.
4. Carry a Personal Gas Detector and Emergency Escape Breathing Apparatus when entering an H2S Zone.
5. Obtain authorization before entering a confined space.
6. Verify Hazardous energy isolation before working on equipment.
7. Work ONLY with a valid Permit to Work.
8. Obtain authorization before overriding Safety Critical Equipment.
9. Wear a seat belt.
10. Do Not Exceed the Speed Limit.

4. PERMIT TO WORK SYSTEM (PTW).

PERMIT TO WORK:

It is a legal, formal written document which is used to control a certain type of work which is potentially hazardous.

PURPOSE AND SCOPE: (As per ADCO)

The purpose of the permit to work system is to ensure that a safe working environment is achieved by providing management control over the various activities which may have hazardous interactions. The system provides a formal and controlled process that identifies and communicates risk and hazards associated with planned activity and ensure that appropriate precautions and measures are implemented so that the job can proceed and be completed safely. It is important to note that a permit to work is not a permission to carry out a hazardous job, but is an essential part of procedure that provides instruction on how to carry out hazardous job safely and in a managed and controlled way.

- **Area Authority (AA):** An ADCO Grade 11 or above employee who is responsible for the day to day activities and safety of specified work areas. He is authorized in writing by the area manager following satisfactory completion of the PTW certification and Approval Assessment process.
- **Issuing Authority (IA):** An ADCO employee who is a direct subordinate of the Area authority and who is authorized in writing by the Area manager following satisfactory completion of the PTW certification and Approval Assessment process. He authorizes the job to proceed after checking and certifying that the work site is safe. The area authority can sign as both Issuing Authority and Area Authority in his area of responsibility in which case he also assumes all the responsibilities of IA in work site in addition to his responsibilities as AA.
- **Job Originator (JO):** An ADCO employee who is competent in the ADCO PTW system as a job performer (by passing ADCO course entitled "PTW Job performer") and who sign the work permit request confirming the requirement to carry out the work. The job originator approval/ signature on PTW is only required in case JP is a contractor, the JO must be an ADCO supervisor or an ADCO representative (e.g. PMC in projects).
- **Job Performer (JP):** An ADCO employee or Contractor who is authorized in writing by the Area Manager, following satisfactory completion of the PTW Certification course entitled "PTW- Job Performer" and approval assessment process and to whom the PTW/Certificate is issued. The JP is directly responsible for the quality and safety of the work to be performed and for conducting a Toolbox Talk (TBT) immediately before commencing the work.
"The JP cannot be an AA, IA or the gas tester because, he can be manipulates the things for the execution of the work."
- **Authorized Gas Tester (AGT):** An ADCO Employee or Contractor of supervisory level other than the JP, who is authorized in writing by the Area Manager following satisfactory completion of the Gas Test Certification and Approval assessment process. The AGT may also be the AA or IA so long as they are suitably qualified but he cannot be the JP.
- **Isolating / De-Isolating Authority (IDA):** a competent ADCO employee who is authorized in writing by the Area manager and who is responsible for the isolation and de-isolation of plant and equipment in accordance with the Area Authority's request under an Isolation Confirmation Certificate (ICC). His discipline can be safety, mechanical, electrical and process or instrument. In High voltage isolation, for multi discipline work using ICC/HVEC, the electrical IDA must be classified as Authorized Electrical Person (AEP)/ Senior Authorized Electrical person (SAEP).
- **Authorized Electrical Person (AEP):** A competent electrical person who has been formally and practically assessed by a qualified and approved team, as having sufficient technical knowledge and has been authorized by the Area Manager in writing to carry out a specific work on electrical System, apparatus and equipment.

- **Senior Authorized Electrical Person (SAEP):** An ADCO Engineer or supervisor of grade 11 or above, who has sufficient academic qualification, technical knowledge, experience, training and certification to issue and cancel the High Voltage Electrical Certificate (HVEC).
- **Permit Coordinator (PC):** An ADCO employee who is qualified in ADCO PTW system as an Area Authority course entitled "PTW- Area Authority" and who administers the permit. He may or may not be authorized as an AA or IA.
- **Area Safety Officer:** An ADCO employee who provides specialized safety advises guidance and control and who fulfils the role of HSE Team leader, Senior Safety and Loss Prevention Officer (SSLPO) or Safety and Loss Prevention Officer (SLPO) in Operation division and/ or Lead Construction Safety Engineer in Engineering and Major Project Division (EMPD).

AREA CLASSIFICATION:

- Restricted Area.
- Non Restricted Area.
- Open Area.

RESTRICTED AREA:

Any area where there is risk of:

- Electrocutation due to the close proximity of electrical conductors or other electrical apparatus (e.g. transformers, switch gears, substations, etc.)
- Toxic fumes, Hydrogen sulphide or lack of oxygen (e.g. sewers, confined spaces, waste water treatment unit, well head cellars, chemical lab, etc).
- Hazardous Areas- area as defined on the Hazardous Area Classification Drawings as being Class-I, Div.1 (Zone 0 & Zone 1) or Class I, Div.2 (Zone 2).

RESTRICTED AREAS SHALL INCLUDE:

- 30 meter radius of any oil, gas, or water well head irrespective of services.
- 30 meter on either side of any exposed flanges and valves on oil and gas pipelines and 30 meter on either side of any surface/ exposed oil or gas pipeline.
- 10 meter on either side of any surface / exposed water line.
- 30 meter around cold flare tips, vents, burn and oil saver pits, lit flares.
- 30 meter from GASCO company gas facilities.
- 50 meter from ADNOC company oil facilities.
- Any electric generating station or substations.
- Oil lab and chemical store (for non-routine work).
- Sewage plant.
- Control room (due to its impact on operations, for non- routine work).
- Any confined space regardless of location.

NON-RESTRICTED AREA SHALL NORMALLY INCLUDE:

- Shallow water supply wells for domestic purposes.
- Residential areas such as camps.
- Office building or compound.
- Workshop, stores and fire water pumps and fire water tank areas.
- Any area outside of 30 meter radius of any oil, gas or water well head, production equipment, surface oil or gas pipeline(MOL, transfer line or flow line), flare tips, vents, burn, and oil saver pits.
- Buried (not exposed oil/ gas and water pipelines).
- Any area outside of 30 meter of OPCO's pipeline corridor or sister company oil / gas facilities.
- MECO reverse osmosis plant and water tank farms,
- Any other facilities which are not covered by the definition of "Restricted Areas".

NOTE-1: In Non-restricted areas where permits (HWP/CWP), are not required, certificates must still be issued work involving Excavation, Radiography, Mechanical/Electrical/Process/ Control Isolation or Confined Space Entry.

NOTE-2: Hot Work Permit is required for any naked flame or incentive sparing work in Non restricted areas (the only exception is welding workshop).

- **OPEN AREA:**

An area which has been formally handed over using an "Open Area Hand over Certificate" from Operation EMPD, Drilling or another party for Major maintenance or Construction work a non- restricted area. In case of deviation (e.g. interfering with restricted area) written approval of area manager will be obtained after construction with HSE Team Leader in the work area and where the risk.

TYPES OF PERMIT:

- Cold Work Permit.
- Hot Work Permit

- **COLD WORK PERMIT (CWP):**

Any work which does not produce any heat (Scaffolding activity, blinding, etc.) and the permit that must be issued for all work to perform in restricted Areas which does not require Hot Work Permit.

- **HOT WORK PERMIT (HWP):**

The permit which must be issued for all jobs in restricted areas requiring an ignition source(flame- heat-spark). Capable of igniting flammable materials. The use of cameras, non- intrinsically safe equipment (e.g. mobile phones, pagers and personal digital Assistance "PDA") are prohibited in hazardous areas. Vehicle entry in to hazardous areas is also considered a potential source of ignition requiring HWP. In addition, a HWP must be issued for any work that involves naked flames and high energy sparks (high-energy sources of ignition) in ALL areas, including non-restricted areas.

Naked Flame and High Energy Sparks: Work involving burning, flame, and arc cutting/ welding.

TYPES OF CERTIFICATES:

- Radiography Certificate.
- Confined space Entry Certificate (CSEC).
- Excavation Certificate.
- Isolation Confirmation Certificate (ICC).
- High Voltage Electrical Certificate (HVEC).
- Control of Process of Inhibition Certificates (CPIC).
- Lock out Tag out (LOTO)

- **Radiography Certificate:**

The certificate that must be issued, regardless of the location for any radiography work;

- **Confined space Entry Certificate (CSEC):**

The certificate, which must be issued, regardless of the location for any confined space entry;

- **Excavation Certificate:**

The certificate, which must be issued, regardless of the location for any excavation activity;

- **Isolation Confirmation Certificate (ICC):**

The certificate, which must be issued, regardless of the location, when the un expected operation of mechanical/electrical/ process/ control equipment that can be started by automatic, manual or remote control may result in injuries to persons working on the equipment or who are in the vicinity due to release of energy.

- **High Voltage Electrical Certificate (HVEC):**

A form of declaration issued by a Senior Authorized Electrical Person(SAEP) to authorized Electrical Person(AEP) to work on High voltage Equipment, apparatus and system (650 Volts or above)following an assessment of the hazards and risk of the activity. The certificate describes fully and concisely the work to be carried out, the conditions and safety measures applicable, and the time for the work to start and the composition of the crew that can safely carry out the work.

- **HIGH VOLTAGE ELECTRICAL EQUIPMENT:** any electrical equipment which is normally operated at voltage exceeding "650 Volts."
- **MEDIUM VOLTAGE ELECTRICAL EQUIPMENT:** any electrical equipment which is normally operated at voltage between "250 - 650 Volts."

- **LOW VOLTAGE ELECTRICAL EQUIPMENT:** any electrical equipment which is normally operated at voltage not exceeding "250 Volts."

- **Control of Process of Inhibition Certificates (CPIC):**

The isolation of the execution of a proactive system/ safety critical equipments (e.g. Fire/Smoke/gas detection systems, firefighting systems, process alarm or Emergency shutdown and pressure safety valves etc.)

- **Lock Out- Tag Out:**

A mean to partially or entirely isolate a piece of equipment, plant or process to allow work to proceed safely on an alternative section of the equipment, plant or process.

Lock Out...

- Key operated padlocks shall be used,
- All the following sections shall have their own padlocks and keys.
- Each pad lock is to be numbered and color coded as follows:
 - Electrical/ Power system - Red.
 - Mechanical - Blue.
 - Instrument - Green.
 - Production - white.
 - Contractor - Yellow.
- Padlocks and Keys shall be stored so that they are not available to unauthorized personal.
- A master key or second key for each padlock used for lock out purposes shall be kept in secure storage for **emergency use only**.
- Keys for substation doors, electrical rooms and transformer fence doors shall be kept in the custody of ADCO's involved electrical section.
- Only the person to whom they are issued shall use padlock and keys.

5. RISK ASSESSMENT (RA) AND JOB SAFETY ANALYSIS (JSA).

RISK ASSESSMENT:

It is nothing more than a careful examination to what in work could cause to harm.

PURPOSE:

The purpose of the Risk Assessment is to determine whether there is any likelihood of injury, illness or disease associated with the identified hazards by considering the adequate measure to protect health & safety of the people who may be exposed.

- **Risk assessment will include following items at least:**

1. Identification of all the hazards applicable to significant risk activities.
2. Details of measures in place to control the risk.
3. A justification that existing control measures are adequate.

- **A prioritized list of risks for further action should be produced from the analysis process:**

1. Extreme/ Significant Risks - Immediate management action required.
2. Medium or High risks - immediate action required
3. Moderate Risks - Action by due date.
4. Low Risks - Action/ Manage by routine procedure.



					Probability				
					Improbable	Remote	Occasional	Probable	Frequent
Severity	People	Assets	Environment	Reputation	Has occurred in world-wide industry but not in ADNOC	Has Occurred in other ADNOC Group Company	Has Occurred in specific ADNOC Group Company	Happens several times each year in specific ADNOC Group Company	Happens several times each year in same location or operation
5-Catastrophic	Multiple Fatalities	Extensive damage	Massive effect	International Impact	A5	B5	C5	HIGH RISK	
4-Sever	Single fatality or permanent disability	Major damage	Major effect	National Impact	A4	B4	C4		
3-Critical	Major injury or health effects.	Local damage	Localized effect	Considerable Impact	A3	MEDIUM RISK (ALARP)		D3	E3
2-Marginal	Minor injury or health effects	Minor damage	Minor effect	Minor Impact	A2			D2	E2
1-Negligible	Slight injury or health effects	Slight damage	Slight effect	Slight Impact	LOW RISK		C1	D1	E1

Figure: Qualitative Risk Potential Matrix

Hazards and control measures should be identified to reduce the risk to As Low as Reasonably Practicable (ALARP).

If cannot find ALARP for an activity, the control measure shall be under close supervision from higher authority and give more care on that activity more than Normal control measure.

• **RISK MANAGEMENT PROCESS.**

Identify → Evaluate → Manage → Review.

The process of identifying hazards, assessing the risk, taking action to eliminate or reduce the risk, monitoring and review the risk.

• **QUANTITATIVE RISK ASSESSMENT:**

May be the risk will identify the impact/probability by mathematical and simulation tools which could measure affect time/cost.

• **STEPS OF RISK ASSESSMENT:**

(IDERR) **I:** Identify the Hazard, **D:** Decide who might be harmed and how, **E:** Evaluation of the Risk (Estimation of the Risk, Evaluation of the risk & Effectiveness of Control measure), **R:** Record your findings and **R:** Review and Revise.

- **STEPS OF TASK RISK ASSESSMENT (TRA) IN ADCO:**

Serial No. Job Steps, Cause, Consequences, Potential Risk, Existing Barriers/Controls, Recommended controls, Action by, Residual risk, ALARP (Yes/No) and Completion date.

- **TYPE OF RISK WILL IDENTIFY IN THE TRA:**

Potential or initial Risk and Residual Risk.

- **RESIDUAL RISK:**

The Existing risk after implementing the control measure.

- **HIERARCHY OF CONTROL:**

ERICPD, Elimination, Reduction, Isolation or Substitution, Control {Administrative Control (Technical & Behavioral), Engineering Control (Procedural)} **PPE** (Personal Protective Equipment) & **Discipline- IITS**: (Information, Instruction, Training and Supervision).

- **JOB SAFETY ANALYSIS/JOB HAZARD ANALYSIS (JSA/JHA):**

To identify the hazards before they occur. It focuses on the relationship between the workers, the task, the tools and the working environment. Ideally after you identify the controlled hazards, we will take steps to eliminate or reduce them an acceptable risk level.

- **DIFFERENCE BETWEEN RISK ASSESSMENT AND JOB SAFETY ANALYSIS:**

The main difference is that the Job Safety Analysis doesn't have Risk Assessment Matrix and Risk Assessment has the Risk Assessment Matrix.

METHOD STATEMENT:

Documents produced by the appointed person to describe how the work should be carried out including any contingency plan if the operation becomes interrupted.

The typical method statement will contain the following;

- The job to be undertaken.
- The individual activities required to complete the job.
- The individual trades/ disciplines involved in each activity.
- Tools/ equipment to be used in each activity.
- Any substances to be used where and during which activity they will be used.
- The name(s) of the supervisor(s) for each activity.
- The name of the person in overall charge of the job.

6. ENVIRONMENT.

Surroundings in which an organization operates, including air, water, land natural resources, flora, fauna, humans and their inter-relation;

- **Environmental Aspects:** Any elements of company activities, product and services that can interact positively or negatively with the environment.
- **Environmental Impact:** Any change to the environment, weather adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.

POLLUTION:

There are seven general grouping of pollution:

- **Noise**, which is any undesired sound round the area of work;
- **Waste**, which is any scrap material, effluent or un wanted substance that needs to dispose of;
- **Ground Pollution**, which is any spillage or contamination of the ground in the work area;
- **Water Pollution**, which is caused by allowing poisonous, noxious or polluting matter in to water ways or ground water.
- **Air Pollution**, which is any dust, gas, fume, smoke, vapor, smog or spray within the work area;
- **Nuisance**, which can be any act or omission that affects the comfort or quality of life; and
- **Vibration**, which is caused by using plant and equipment that may damage structures, buildings or natural formations.

SEWAGE HANDLING:

Sewage contains chemical and biological agents that are potentially hazardous to human health and the environment. Sewage shall only be handled / disposed of by authorized approved company or personal.

GENERAL WASTE MANAGEMENT:

- All wastes must be managed in a manner that minimizes the potential for adverse impact to the surrounding human and ecological environments.
- All personal must be aware that the liabilities associated with storage, transportation and disposal of wastes are not readily transferred to others.

WASTE MINIMIZATION:

All personal are encouraged to minimize waste disposal through materials management and reuse/recycling practices.

The basic principles of waste management are the **"4 R"s**:

1. **REDUCE** : Generate less waste through careful and continuous review of operating parameters & procedures.
2. **REUSE** : Reuse Material in their original form.
3. **RECYCLE** : Convert waste back to a usable material via an appropriate agency.
4. **RECOVER** : Extract materials or energy from a waste for other uses (Unavoidable Waste residue).

**HOUSEKEEPING, WASTE MANAGEMENT & SEGREGATION:**

Housekeeping is not just a matter of sweeping the floor clean at the end of the day.

Poor housekeeping creates a cluttered workplace and a breeding ground for accidents.

Good housekeeping means organizing your work place so that everything is stored in its proper place.

Housekeeping is everybody's responsibility and you can maintain a good standard of housekeeping in your workplace by:

- Keeping floor and access ways unobstructed.
- Proper storing of tools and equipment.
- Proper stacking and storing of the materials; and
- Regular disposing of rubbish and waste in to the proper bins.
- Reduce, re use and recycle the materials.
- Collect, segregate according to classification, store, manage and remove waste materials.
- Regular cleaning areas irrespective of location, tasks and work schedule for the location.
- Store, use, remove and manage Hazardous Material (HAZMAT) and Hazardous Chemicals (HAZCHEM).

7. PERSONAL PROTECTICE EQUIPMENT (PPE).

IMPORTANTS OF PPE

Making the workplace safe includes providing instructions, procedures, training and supervision to encourage people to work safely and responsibly.

Even where engineering controls and safe systems of work have been applied, some hazards might remain. These include injuries to:

- The lungs, e.g. from breathing in contaminated air
- The head and feet, e.g. from falling materials
- The eyes, e.g. from flying particles or splashes of corrosive liquids
- The skin, e.g. from contact with corrosive materials
- The body, e.g. from extremes of heat or cold.

PPE is needed in these cases to reduce the risk.



ABOUT PPE

- Only use PPE as a last resort and it is the Last line of defense against illness or injury.
- Employers have responsibility concerning the provision and use of personal protective equipment (PPE) at work.
- PPE is equipment that will protect the user against health or safety risks at work. It can include items such as safety helmets, gloves, eye protection, high-visibility clothing, safety footwear and safety harnesses. It also includes respiratory protective equipment (RPE).
- If PPE is still needed after implementing other controls (and there will be circumstances when it is, e.g. head protection on most construction sites), you must provide this for your employees free of charge
- You must choose the equipment carefully (see selection details below) and ensure employees are trained to use it properly, and know how to detect and report any faults.

SELECTION AND USE:

You should ask yourself the following questions:

- Who is exposed and to what?
- How long are they exposed for?
- How much are they exposed to?

WHEN SELECTING AND USING PPE:

- Choose products which are CE marked in accordance with the Personal Protective Equipment.
- Choose equipment that suits the user – consider the size, fit and weight of the PPE. If the users help choose it, they will be more likely to use it
- If more than one item of PPE is worn at the same time, make sure they can be used together, e.g. wearing safety glasses may disturb the seal of a respirator, causing air leaks
- Instruct and train people how to use it, e.g. train people to remove gloves without contaminating their skin. Tell them why it is needed, when to use it and what its limitations are.

OTHER ADVICE ON PPE:

- Never allow exemptions from wearing PPE for those jobs that 'only take a few minutes.
- Check with your supplier on what PPE is appropriate – explain the job to them
- If in doubt, seek further advice from a specialist adviser.

MAINTENANCE:

PPE must be properly looked after and stored when not in use, e.g. in a dry, clean cupboard. If it is reusable it must be cleaned and kept in good condition.

MONITOR AND REVIEW:

- Check regularly that PPE is used. If it isn't, find out why not
- Safety signs can be a useful reminder that PPE should be worn
- Take note of any changes in equipment, materials and methods – you may need to update what you provide.

THINK ABOUT:

- Using the right replacement parts which match the original, e.g. respirator filters
- Keeping replacement PPE available
- Having a supply of appropriate disposable suits which are useful for dirty jobs where laundry costs are high, e.g. for visitors who need protective clothing
- Employees must make proper use of PPE and report its loss or destruction or any fault in it.

TYPES OF PPE CAN BE USED:**EYES:**

- **Hazards**
Chemical or metal splash, dust, projectiles, gas and vapor, radiation
- **Options**
Safety spectacles, goggles, face screens, face shields, visors.
- **Note**
Make sure the eye protection chosen has the right combination of impact/dust/splash/molten metal eye protection for the task and fits the user properly.

HEAD AND NECK:**▪ Hazards**

Impact from falling or flying objects, risk of head bumping, hair getting tangled in machinery, chemical drips or splash, climate or temperature

▪ Options

Industrial safety helmets, bump caps, hairnets and firefighters' helmets

▪ Note

- Some safety helmets incorporate or can be fitted with specially-designed eye or hearing protection.
- Don't forget neck protection, e.g. scarves for use during welding.
- Replace head protection if it is damaged.

EARS:**▪ Hazards**

Noise – a combination of sound level and duration of exposure, very high-level sounds are a hazard even with short duration

▪ Options

Earplugs, earmuffs, semi-insert/canal caps

▪ Note

- Provide the right hearing protectors for the type of work, and make sure workers know how to fit them.
- Choose protectors that reduce noise to an acceptable level, while allowing for safety and communication.

HANDS AND ARMS:**▪ Hazards**

Abrasion, temperature extremes, cuts and punctures, impact, chemicals, electric shock, radiation, vibration, biological agents and prolonged immersion in water

▪ Options

Gloves, gloves with a cuff, gauntlets and sleeve that covers part or all of the arm

▪ Note

- Avoid gloves when operating machines such as bench drills where the gloves might get caught
- Some materials are quickly penetrated by chemicals – take care in selection, see HSE's skin at work website
- Barrier creams are unreliable and are no substitute for proper PPE
- Wearing gloves for long periods can make the skin hot and sweaty, leading to skin problems. Using separate cotton inner gloves can help prevent this.

FEET AND LEGS:**▪ Hazards**

Wet, hot and cold conditions, electrostatic build-up, slipping, cuts and punctures, falling objects, heavy loads, metal and chemical splash, vehicles

▪ Options

Safety boots and shoes with protective toecaps and penetration-resistant, mid-sole wellington boots and specific footwear, e.g. foundry boots and chainsaw boots.

▪ Note

- Footwear can have a variety of sole patterns and materials to help prevent slips in different conditions, including oil - or chemical-resistant soles. It can also be anti-static, electrically conductive or thermally insulating.
- Appropriate footwear should be selected for the risks identified.

LUNGS:**▪ Hazards**

Oxygen-deficient atmospheres, dusts, gases and vapors.

▪ Options – respiratory protective equipment (RPE)

Some respirators rely on filtering contaminants from workplace air. These include simple filtering face pieces and respirators and power-assisted respirators

Make sure it fits properly, e.g. for tight-fitting respirators (filtering face pieces, half and full masks)

There are also types of breathing apparatus which give an independent supply of breathable air, e.g. fresh-air hose, compressed airline and self-contained breathing apparatus.

▪ Note

- The right type of respirator filter must be used as each is effective for only a limited range of substances.
- Filters have only a limited life. Where there is a shortage of oxygen or any danger of losing consciousness due to exposure to high levels of harmful fumes, only use breathing apparatus – never use a filtering cartridge.

- You will need to use breathing apparatus in a confined space or if there is a chance of an oxygen deficiency in the work area.

WHOLE BODY:

Hazards

Heat, chemical or metal splash, spray from pressure leaks or spray guns, contaminated dust, impact or penetration, excessive wear or entanglement of own clothing.

Options

Conventional or disposable overalls, boiler suits, aprons, chemical suits.

Note

- The choice of materials includes flame-retardant, anti-static, chain mail, chemically impermeable, and high-visibility
- Don't forget other protection, like safety harnesses or life jackets.

FALL PROTECTION SYSTEM:

PERSONAL FALL ARREST SYSTEMS:

A personal fall arrest system is a system used to safely stop (arrest) a worker who is falling from a working level. It consists of an anchorage, connectors, and a body harness. It also may include a lanyard, deceleration device, lifeline, or suitable combinations of these. Under Subpart, body belts (safety belts) are prohibited for use as part of a personal fall arrest system.

Note: Know the A, B, C & D s of Personal Fall Arrest Systems are: **Anchorage, Body wear, Connectors** like snap hooks or Dee-rings, connection points, lanyards, lifelines, etc. and **Deceleration device.**

FALL RESTRAINT SYSTEMS WHILE FALL RESTRAINT SYSTEMS:

Fall restraint system as a means of prevention. The system, if properly used, tethers a worker in a manner that will not allow a fall of any distance. This system is comprised of a body belt or body harness, an anchorage, connectors, and other necessary equipment. a lifeline, and other devices for a restraint system to work, the anchorage must be strong enough to prevent the worker from moving past the point where the system is fully extended, including an appropriate safety factor.

EMERGENCY EQUIPMENT:

Careful selection, maintenance and regular and realistic operator training is needed for equipment for use in emergencies, like compressed-air escape breathing apparatus, respirators and safety ropes or harnesses.

BREATHING APPARATUS:

- ✓ **EEBA** (Emergency escape breathing Apparatus) : For evacuation purpose.-15 Minutes of duration.
- ✓ **SCBA** (Self Contained breathing apparatus) : For Rescue operation and confined space workpurpose.-30 Minutes of duration.
- ✓ **CABA** (Continuous Airline Breathing apparatus).

PPE STANDARDS:

- **Safety Helmet** : ANSI Z89.1, EN 166.
- **Safety Goggle** : ANSI Z87.1, EN 397.
- **Ear Protection** : ANSI/ASSE A10.46-2013. (Hearing Loss Prevention for Construction & Demolition Workers). This standard applies to all construction and demolition workers with potential noise exposures (continuous, intermittent and impulse) of 85 dBA and above.
- **Safety shoes** : ANSI Z41.1
- **Safety Harness** : ANSI/ASSE Z359.11-2014, EN 361.



8. GAS TESTING

Gas testing is Mandatory prior to work being undertaken in a process or hydrocarbon area that carries a risk to personnel or equipment from exposure to explosive, flammable, toxic or life threatening vapors. Gas testing shall also be required in any other area where the above risks are considered to exist which is covered by the client Permit to Work System.

TO ENSURE COMPLIANCE TO THIS RULE ALWAYS UNDERTAKE A GAS TEST:

- Prior to entering a confined space
- Before and during normal working in a Process or Hydrocarbon Area
- When breaking containment on a process system
- When hot working in a Process plant or Hydrocarbon Area
- When operating diesel plant in a Process or Hydrocarbon Area
- Before allowing an authorized vehicle to enter a Process Area and during its presence there.
- Whenever the atmosphere could be potentially hazardous or is unknown.
- Where there is a suspected hydrocarbon or toxic gas leak.

WHO MIGHT BE AUTHORIZED GAS TESTER:

- An ADCO Employee or Contractor of supervisory level other than the Job Performer, who is authorized in writing by the Area Manager following satisfactory completion of the Gas Test Certification and Approval assessment process.
- The AGT may also be the Area Authority or Issuing an Authority so long as they are suitably qualified but he cannot be the Job Performer.
- *Job performer cannot be a gas tester even if he completed the course of Authorized gas tester because, he can be manipulates the things for the execution of the work.*

ITEMS WILL SHOW DURING CONDUCT THE GAS TEST:

- Hydrogen Sulphide (H₂S) : (below 10 PPM),
- LEL : (less than 5% for the hydrocarbon),
- Oxygen (O₂) : level (19.5% to 22.5%),
- Carbon monoxide (CO) : (LEL-12.4% & UEL- 74.2%).

EXPLOSIVE RANGE (TLV, STEL & IDLH) FOR DIFFERENT GAS:

GAS	TLV- TWA (PPM)	STEL (PPM)	IDLH (PPM)
Hydrogen Sulphide (H ₂ S)	10	15	100
Sulphur Dioxide (SO ₂)	2	5	100
Ammonia (NH ₃)	25	35	300
Chlorine (Cl ₂)	0.5	1	10
Carbon Monoxide (CO)	25	50	1200



• LEL (Lower Explosive Limit):

It is the lowest concentration of fuel in air that will just support a self-propagating flame.

• UEL (Upper Explosive Limit):

It is the highest concentration of fuel in air that will just support a self-propagating flame.

EXPLOSIVE RANGE (LOWER & UPPER) FOR DIFFERENT GAS:

Flammable GAS	LEL / LFL (by volume in air)	UEL / UFL (by volume in air)	AIT (by volume in air)
Hydrogen Sulphide (H₂S)	4.3%	46%	260 C / 500F
Ammonia (NH₃)	15%	28%	651.57 C / 1204 F
Carbon Monoxide (CO)	12.4%	74.2%	
Hydrogen (H)	4%	75%	
Acetylene (C₂H₂)	2.5%	8%	
Propane (C₃H₈)	2.1%	9.5%	
Methane- CH₄ (Natural Gas)	5%	15%	
Petrol (Gasoline)	1.4%	7.6%	

INERT GAS OR NOBLE GAS:

The **noble gases** (historically also the **inert gases**) make up a group of chemical elements with similar properties; under standard conditions, they are all odorless, colorless, monatomic gases with very low chemical reactivity. The six noble gases that occur naturally are helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), and the radioactive radon (Rn). Oganesson (Og) is variously predicted to be a noble gas as well or to break the trend due to relativistic effects; its chemistry has not yet been investigated.

9. HYDROGEN SULPHIDE (H₂S)

CHARACTERISTICS:

- Heavier than Air, (1.189times).
 - H₂S is accumulated in low areas such as well cellars, open drain ditches and excavations.
- Invisible, colorless, highly flammable, explosive, corrosive, Toxic, poisonous, pyrophoric, soluble in water & oil.
 - When soluble with water it will change to Sulfuric Acid (**H₂SO₄**).
 - When it burns it will change to Sulphur dioxide (**SO₂**).
- Rotten egg smell in low concentration (below 1 PPM) & Deadness sense of smell.
- Attacks the nervous system.
- 100 PPM is the immediate danger to death.
- Second biggest killer gas after carbon monoxide.

OTHER NAMES OF H₂S:

Silent Killer, Sour gas, Rotten egg gas, Acid gas, etc.

SAFETY PRECAUTIONS:

- Carry a H₂S personal monitor & escape mask at every opportunity.
- Know at least 2 Escape routes from your work place.
- Always check wind direction.
- Be aware of updated emergency action drill.
- Notify and prominently display information relating to safety measures and emergency procedures in the site.
- Never go to a low-lying area during H₂S leak.
- Display H₂S warning sign in H₂S prone areas.
- H₂S Safety induction training should be given to all employees.

WHAT ARE PROMINENT H₂S HAZARDS?

- Eyes and respiratory irritation.
- Dizziness, headache, nausea, abdominal pain.
- Loss of consciousness, Brain damage possible, death / fatal.

TREATMENT OF PERSONS AFFECTED BY H₂S:

Positive pressure breathing apparatus must be worn by any persons attempting a rescue.

- The victim must be immediately moved to fresh air, possibly in the upwind direction of the gas leak. The rescuer must be outside the contaminated area before removing his/her personal BA set.
- **If the victim has stopped breathing**, resuscitation must be started immediately, using artificial respiration or a resuscitator if available. Resuscitation must be continued until the victim starts breathing unaided or until qualified medical assistance arrives. Medical help must be summoned as soon as possible.

GLOSSARY & DEFINITIONS:

- **TLV (THRESHOLD LIMIT VALUE):**

The concentration to which it is believed that a person can be exposed continuously for short period of time without suffering from irritation, chronic or irreversible tissue damage and reduce work efficiency.

- **TIME WEIGHTED AVERAGE (TWA):**

Time Weighted Average (TWA) concentration of the contaminant in air over the normal work shift of 8 hours, to which workers can be exposed without respiratory protection in a 40 hour workweek.

- **STEL (SHORT TIME EXPOSURE LIMIT):**

The maximum concentration chemical to which workers may be exposed continuously for up to 15 minutes without danger to health or work efficiency and safety.

Short Term Exposure Limit (STEL) when exposed only for a short period of 15 minutes. This maximum concentration can be allowed to breathe 4 times during 8 hours with minimum 1-hour interval between exposures.

- **OEL (OCCUPATIONAL EXPOSURE LIMIT):**

The maximum allowable concentration of airborne contaminants to which a person may be exposed for certain reference time.

- **IMMEDIATE DANGER TO LIFE AND HEALTH (IDLH):**

An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

- **Threshold Limit Value (TLV)** is 10 PPM for 8 hours.
- **Short Term Exposure Limit (STEL)** is 15PPM. (The concentration which it is believed that a person can be exposed continuously for 15 PPM without any danger to health, irritation and his safety).
- **Lower Exposure Limit (LEL)** is 4.3 % (43000PPM).
- **Upper Exposure Limit (UEL)** is 46 % (460000PPM).
- **Auto ignition temperature** is 500 F (260 c).
- **1% H₂S** is 10000 PPM.

TRAINING REQUIREMENTS:

Basic training of all personnel working in oil and gas field areas shall include the following elements and be completed during the first day on site within the induction training.

- Hazards and characteristics of hydrogen sulfide.
- Safety precautions.
- Operation of safety equipment and life support system.
- Each Divisional Area whose operations contain hydrogen sulfide more than 100 PPM within the system shall additionally comply with the following provisions:
- Personnel not H₂S trained and certified shall not be allowed entry to process facilities.

DEVICES TO IDENTIFY H₂S AT SITE:

- Fixed Detectors, Personal monitors, Multi gas detectors and Wireless detectors.

SAFETY EFFECTS OF H₂S:**• EFFECTS ON METALS:**

H₂S in the presence of free water will be corrosive especially during abnormal situations, such as start-up and shut-down. If carbon dioxide, oxygen, chloride ions, elemental Sulphur is presents either individually or together then severe corrosion may take place within a very short period.

• PYROPHORIC IRON SULPHIDE:

In lines, vessels or equipment carrying gas or liquids which may contain hydrogen sulphide there is a possibility that **pyrophoric iron scale (iron sulphide) may be formed. Pyrophoric iron scale can spontaneously ignite when exposed to air.** When joints have to be broken on pipelines, flow lines, vessels and equipment the exposed metal should be doused with water to render harmless any potential pyrophoric iron scale that may be present. Scale removed from such lines/equipment should be placed in a drum and immediately covered with water.

• OXIDIZATION:

The process of decreasing of weight of a metal after got rust or corrosion is called as oxidization.

PHYSIOLOGICAL EFFECT OF H₂S:

CONCENTRATION IN AIR	EFFECT
< 1 PPM	Odor of rotten eggs can be clearly detected
10 PPM	Unpleasant odor. Possible eye irritation. ACGIH recommended Threshold Limit (TLV-TWA)
15 PPM	TLV - STEL averaged over 15 minutes
20 PPM	Burning sensation in eyes and irritation of the respiratory tract after one hour or more exposure
50 PPM	Loss of sense of smell after about 15 or more minute's exposure. Exposure over one hour may lead to headache, dizziness, and/or staggering. Pulmonary edema reported following extended exposure to greater than 50 PPM. Exposure at 50 PPM or greater can cause serious eye irritation or damage
100 PPM	Coughing, eye irritation, loss of sense of smell after 3 to 15 minutes. Altered respiration, pain in eyes, and drowsiness after 15 to 20 minutes, followed by throat irritation after one hour. Prolonged exposure results in a gradual increase in the severity of these symptoms. Concentration considered immediately dangerous to life or health(IDLH)
200 PPM	The sense of smell will be lost rapidly, and it will irritate the eyes and throat. Prolonged exposure (>20 to 30 minutes) may cause irreversible pulmonary edema, i.e. accumulation of fluid in the lungs.
300 PPM	Marked conjunctivitis and respiratory tract irritation.
500 PPM	Unconsciousness after short exposure, breathing will stop if not treated quickly. Dizziness, loss of sense of reasoning and balance. Victims need prompt artificial ventilation and /or cardiopulmonary resuscitation (CPR) techniques
700 PPM	Unconscious quickly. Breathing will stop and death will result if not rescued promptly. Artificial ventilation and/or cardiopulmonary resuscitation (CPR) is needed immediately
> 1000 PPM	Unconsciousness at once. Permanent brain damage or death may result. Rescue promptly and apply artificial ventilation and/or cardiopulmonary resuscitation (CPR).

10. SULPHUR DIOXIDE (SO₂).

PRODUCTION OF SULPHUR DIOXIDE (SO₂):

SO₂ is one of the products formed when H₂S is burned in the atmosphere and also formed when pyrophoric iron sulphide oxidizes. It is also often present in combination with H₂S.

GENERAL CHARACTERISTICS:

Sulfur dioxide is a heavy, colorless, poisonous, non-flammable gas with a pungent, strong suffocating odor, irritating odor familiar as the smell of a just-struck match.

HEALTH HAZARDS:

It is a respiratory irritant and causes coughing, an increase in sputum production and broncho-constriction (spasm of airways) at low concentrations.

TLV-TWA & STEL:

Threshold Limit Value based on an 8-hour time weighted average (TLV-TWA) is 2 PPM. The 15-minute Short Term Exposure Limit (STEL) is 5 PPM.

11. EMERGENCY RESPONSE PLAN

EMERGENCY PROCEDURE PLAN:

The emergency procedures plan includes, but not limited to, such items as the responsibilities of personnel, the immediate action plan, telephone numbers and communication methods, the location of nearby residences, medical facilities, and emergency response personnel, safety equipment and supplies available, and the evacuation routes. It outlines the immediate steps and actions that would be taken in the event of a major release of toxic material.

This practice applies to all project work, rest and accommodation areas for all Client and Contractor personal. It does not replace client or other emergency services procedures.

CONTINGENCY PLAN:

A site-specific written document that provides an organized plan for alerting and protecting employees and the public within an area of exposure following the accidental release of a potentially hazardous atmospheric concentration of hydrogen sulphide.

PRIORITIES ARE TO:

- Protect life and property.
- Control, decrease and minimize severity of emergency situations.
- Protect the environment.

TRAINING:

Adequate number of personal shall be trained to deal with emergencies likely to occur on the project. Training topics included but not limited to.

- Training activities include:
 - Personal training
 - Firefighting ;
 - Traffic control
 - Evacuation drills.
- Emergency response personal shall be trained as following:
 - Advanced first aid.
 - Confined space and work at height
 - Basic firefighting and containment.
 - Basic HAZMAT and HAZCHEM control, containment and clean up.
 - Rope rescue and extraction.

ORIENTATION AND EDUCATION SESSIONS:

These are regularly scheduled discussion sessions to provide information, questions & answers and identify needs and concerns.

EMERGENCY RESPONSE PLAN:

It included the following;

- Types of Emergency.
- Types of Siren;
- Weekly Testing Plan;
- Emergency Contact Numbers;
- Location of Assembly point;
- Emergency evacuation procedure;
- Emergency drill schedule;
- Emergency Reporting Procedure.

EVACUATION PLAN:

The following must be displayed clearly in the work area and in offices:

- Full plan of the work area showing the safe escape route and location of the assembly points.
- Emergency contact telephone numbers.
- Personal responsible during emergency evacuation.

TYPES OF EMERGENCY DRILLS:

- Walk- through Drills.
- Functional Drills.
- Evacuation Drills.

• Walk- through Drills:

Supervisors and responders actually perform their emergency response functions.

• Functional Drills:

These drills test specific functions such as medical response, emergency notifications, warning and communications procedures and equipment, though not necessarily at the same time. Personal are asked to evaluate the systems and identify the problem areas.

• Evacuation Drills:

Personal walk the evacuation route to designated area where procedures for accounting for personal are tested. Participants are asked to make notes as they go along of what might become a hazard during an emergency, e.g. stairways, cluttered with debris, smoke in the hall ways, Plans are modified accordingly.

POINTS TO NOTES DURING CONDUCT AN EMERGENCY DRILL:

- Time of siren raised;
- Duration of Siren;
- Time of action start by search boy;
- Time of arrival of first person at assembly point,
- Time of completion of head count at the assembly point,
- Time of arrival all search boys at assembly point,
- Time of last person to the assembly point,
- The Number of person at site during emergency,
- Total number of person assembled at the assembly point.

NOTIFICATION:

All employees at work shall be notified of emergency situation by way of raising "Manual Siren" or Whistle by site HSE / construction officers. The employees have a responsibility to know what systems are in place in their work area and the location of assembly point.

TYPES OF EMERGENCY:

- Medical Emergency
- Fire emergency.
- Gas leakage.
- Natural calamities & Mass illness.

EMERGENCY RESPONSE WHILE LISTENING THE SIREN:

- Stop the activity what you are doing;
- Shut off all the equipments; (to avoid any other emergency because of running equipment).
- Use buddy system;
- Watch wind direction and proceed to assembly point by cross wind direction,
- Employees should stay in the group they were working with in order that an accurate head count can be obtained;
- Check the head count and inform as per incident protocol.
 - Monitoring for sign or symptoms of injury;
 - Providing or requesting assistance if needed; and
 - Being prepared to direct employees as to instructions given by senior management.
- **Note:** “**DO NOT** return to the area until the all clear siren has sounded and it is safe to do so.”

EMERGENCY RESPONSE WHILE YOUR PERSONNEL MONITOR GIVING ALARM:

- Stop the activity what you are doing;
- Shut off the equipments; (to avoid any other emergency because of running equipment).
- Hold the breath;
- Don the EEBA(Emergency Escape Breathing Apparatus);
- Watch wind direction;
- Proceed to safe location by cross wind direction;
- Then upwind direction and go to nearest assembly point ,
- Check the roll call/ head count and Inform as per incident protocol.
 - Monitoring for sign or symptoms of exposure;
 - Providing or requesting assistance if needed; and
 - Being prepared to direct employees as to instructions given by senior management.

EMERGENCY RESPONSE DURING FIRE EMERGENCY:

If you discover a fire;

- Stop the work- Make sure all tools placed in a safe manner and equipment and machinery turned off.
- Activate the nearest fire alarm if available or call for help before attempting to extinguish a fire (shout: “Fire” “Fire” “Fire”).
- Notify Fire station if possible
- Attempt to extinguish the fire if the fire is small.
- If the fire is too big to control with the equipment at hand, retreat.
- Proceed to assembly point for head count (name check).

12. INCIDENT, ACCIDENT, NEAR MISS, LTI & FIRST AID

INCIDENT:

An instance of something happening; an event or occurrence.

ACCIDENT:

An un-wanted, Unforeseen, Unplanned Event which leads to loss of some kind.

DIFFERENCE BETWEEN INCIDENT & ACCIDENT:

All accidents can ALSO be described as incidents – but NOT all incidents are accidents.

- E.g. If a drunk driver runs his car into a group of people, that is an **accident** (he did not intend to do it; it was caused by alcohol and chance). It could also be described as an **incident**.
- If three people were arrested after fighting in a bar, that is an **incident** (but not an accident – because the fight was not by chance; they intended to fight).

- **ACCIDENT PRECURSOR:**

An initiating event that could lead to accident conditions;

- **CAUSES OF AN ACCIDENT:**

Unsafe Act and Unsafe Condition.

- **UNSAFE ACT AND UNSAFE CONDITION:**

- **Unsafe Act:** Any Act doing by person who is not safe or lead to an accident/Near miss.
- **Unsafe Condition:** Any condition where something exists that varies from normal accepted safe condition and can result accident.

- **NEAR MISS:**

An Unwanted, Unforeseen, Unplanned Event which had the potential to result in a loss.

- **LOST TIME INJURY (LTI):**

Work related injury or illness that renders the injured person unable to perform any of their duties.

- **LOST TIME INJURY FREQUENCY RATE (LTIFR)**

$$\text{LTIFR} = \frac{\text{NUMBER OF LTI}}{\text{TOTAL MAN HOURS}} \times 1,000,000$$

- **SEVERITY RATE (SR) :**

$$\text{SR} = \frac{\text{DAYS LOST DUE TO LTI}}{\text{TOTAL MAN HOURS}} \times 1,000,000$$

- **RESTRICTED WORK CASE (RWC):**

Any Work Related injury which renders that injured person is temporary unable to perform all, but still some of their normal work on any day after the day on injury occurred.

- **MEDICAL TREATMENT CASE (MTC):**

Any work related injury involves neither Lost Time Injury nor Restricted work case But which is required treatment by a physician or other medical specialists. It does not include First aid.

- **OCCUPATIONAL ILLNESS:**

Any work related abnormal condition or disorder.

ACCIDENT INVESTIGATION PROCEDURE:

1. Gathering information about the event,
2. Analyze that information and draw conclusions about the immediate and route causes.
3. Identify the suitable control measure.
4. Plan the remedial action.

CAUSES OF ACCIDENT INVESTIGATION:

- To identify the immediate cause and root cause of the incident
- To identify the corrective action to prevent the recurrence.
- To identify the management weakness and Risk assessment.
- To record the facts.
- For legal reason.
- For claim management.
- For staff morale.
- For disciplinary purpose.
- To enable the updating of risk assessment.
- To discover the trends of establishments.

HOW TO INVESTIGATE AN ACCIDENT:

- Date and Time of the accident;
- Location of the accident;
- Details of the injured person (Name, Role /Work history);
- Details of Injury Sustained;
- Description of activity;
- Assessment of Immediate and root causes of incident;
- Assessment of any breaches of legislation;
- Details of witness and witness statement; and
- Recommended Corrective action.

FIRST AID:

The purpose of first aid is to preserve the life of an injured person and prevent his condition from worsening until qualified help arrive

Aim **PPP** (Preserve life. Prevent deterioration. Promote recovery).

ESSENTIALS OF FIRST AID:

- Ensure your safety and the patient safety.
- Act quickly and methodically.
- If unconscious, check breath and pulse.
- Start emergency resuscitation if necessary.
- Secure any fractures if.

STEPS IN PRIMARY SURVEY OF FIRST AIDER OR DOCTOR ABCD:

D: - Danger.

R: - Response.

A: - Airway.

B: - Breathing.

C: - Circulation & **D:** - Defibrillation. (Response: - Alert, Voice, Place & Unresponsive).

CAUSES OF UNCONSCIOUSNESS (FISHSHAPED):

F: - Fainting.	I: - Increased body temperature.
S: - Shock.	H: - Head Injury.
S: - Stroke.	H: - Heart attack.
A: - Asphyxia.	P: - Poisoning.
E: - Epilepsy.	D: - Diabetic Emergency.

TYPES OF INJURIES:

Abrasion, Incision, Laceration, Avulsion & Puncture.

13. FIRE AND FIRE FIGHTING

FIRE:

It is an exothermic chemical chain reaction between fuel and oxygen in the presence of requisite amount of heat.



Figure: Fire Tetrahedron.

TYPES OF FIRE: As per KOC

- **Class A** : Ordinary combustible fire (E.g. Wood, paper, cloth etc.)
- **Class B** : Liquid or liquefiable solids (E.g. Petrol, diesel, kerosene etc.).
- **Class C** : Gaseous fire {E.g. LPG (liquefied petroleum gas), H₂S, NG (Natural gas)}.
- **Class D** : Metal fire (E.g. Magnesium, potassium, Zirconium, Titanium, Phosphorous).
- **Class E** : Electrical Fire: Fire involving energized electrical equipment as electrical cable electrical motor etc.

TYPES OF FIRE EXTINGUISHER & THEIR USE: (As per KOC)

Classes of Fire	Types of fire	Type of Fire Extinguisher		
		Water	DCP (Dry Chemical Powder)	CO ₂ (Carbon dioxide)
Class "A"	Ordinary combustible: (wood, rubber, paper, fabric etc.)	Most suitable	May be used	May be used
Class "B"	Liquid (Petrol, oil, thinners etc.)	Not Suitable	Most suitable	May be used
Class "C"	Gaseous: (Acetylene, propane, LPG, Butane etc.)	Not Suitable	Most Suitable	May be used
Class "D"	Metals: (Sodium, potassium, magnesium) require special extinguishing agent	Not Suitable	Only Special DCP	Not Suitable
Class "E"	Electrical: Energized electrical equipment as electrical cable, electrical	Not Suitable	Suitable	Most Suitable

FIRE EXTINGUISHMENT PRINCIPLES:

Fire extinguishment principle involves elimination one or more of the components forming a fire Triangle.

- **Smothering** : The removal of air or oxygen to point the so that combustion ceases. E.g.: fire blanket, foam and sand.
- **Cooling** : Cooling of fuel to the point so that combustion vapors are no longer produced, and temperature is dropped below ignition point. Example: water spray etc
- **Starving** : The removal of fuel to the point so that nothing remains to burn. E.g: turn of valves.
- **Inhibiting the Flame Chain Reaction:** It is represented by fire tetrahedron shown below. In this method by arresting the chemical chain reaction in the flame zone, combustion process is terminated, e.g. introduce a Dry Chemical Extinguisher, inert agent etc.

MAIN CAUSES OF ELECTRICAL FIRE:

- Over load Circuit (Use of multiple socket accepters),
- Inadequate circuits for the current (5amp wiring carrying 13 amp),
- Incorrect fuses,
- Damaged wiring and insulation,
- Loose connections, * Overheating of cables on coil,
- Overheating due to thermal insulation,
- Overheating due to lack of ventilation,
- Flammable materials close to electrical equipment.

PRINCIPLE CAUSES OF THE SPREAD OF FIRE OR TRANSMISSION OF FIRE:

- **Conduction** : The movement of heat through material.
- **Convection** : The movement of hotter gases up through the air.
- **Radiation** : Transfer of heat through the sun glows.
- **Direct burn** : Combustible material is contact with naked flame.

- **CONTENT OF DCP POWDER EXTINGUISHER:**

Sodium bicarbonate, Potassium bicarbonate & Ammonium phosphate.

- **FLASH POINT:**

The lowest temperature at which a substance can produce sufficient vapour to start burning with a flame.

- **FIRE POINT:**

The lowest temperature at which a substance can produce sufficient vapours to start and continue the burning with a flame.

- **IGNITION TEMPERATURE:**

The temperature at which spontaneous ignition can take place.

- **LEL (LOWER EXPLOSIVE LIMIT):**

It is the lowest concentration of fuel in air that will just support a self-propagating flame.

- **UEL (UPPER EXPLOSIVE LIMIT):**

It is the highest concentration of fuel in air that will just support a self-propagating flame.

- **VOLATILE LIQUID:**

Some liquids have low boiling point and thus change from liquid to vapour easily at ordinary temperature.

TYPES OF SOLID FUEL:

- **Tinder** : That can be ignited with a lighted match stick.
- **Kindling** : That cannot be ignited easily by a lighter/match stick but can be ignited by tinder.
- **Bulk fuel** : That cannot be easily ignited with tinder but can be with kindling.

TYPES OF LIQUID FUEL:

- **Combustible** : Those liquids which have flash point above 1500F/65.50C
- **Flammable** : Those liquids which have a flash point between 730F and 1500F (230C-65.50C)
- **Highly Inflammable** : Those liquids which have a flash point below 730F/230C.
- **Incombustible Material** : The material it neither burns nor gives off flammable vapours When heated up to a standard range (7500C generally).

SOURCES OF IGNITION:

- Naked Flames;
- Electricity;
- Smoking materials;
- Hot work;
- Chemical reaction;
- Heating appliances;
- Friction;
- Static electricity; Lightening;
- Improper storage of flammable materials;
- Lack of Inspection and supervision.

HAZARDOUS AREA:

An area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of potential ignition sources by the electrical apparatus contained within hazardous area.

COMBUSTIBLE SUBSTANCES:

Combustible liquids have flash points between 100°F and 200°F (93°C).

FLAMMABLE SUBSTANCES:

Flammable liquids are more dangerous. These are liquids that have flash points below 100°F (37.8°C).

FIRE FIGHTING:

Facilities shall be provided with adequate first-aid, firefighting equipment such as portable fire extinguishers, Fire Hydrants, fire hose etc. and well- trained personal to handle small fire incidents. Any person who directs or uses first aid and firefighting equipment must ensure that the correct type and method of use is

applied. Emergency Response personnel should also be able to mobilize large fire-fighting equipment within reasonable time after the outbreak of a major fire.

In the event of a fire at the facilities, the field/ Terminal Manager, or authorized deputy, shall assume overall command. If available, qualified person will act as Fire commander and take charge of firefighting on behalf of the Manager.

All permanent personal working at the site will be trained in the use of fire-fighting equipment.

Instruction and training shall include, but not be limited to, the following:

- The action to be taken upon discovering a fire.
- The action to be taken upon hearing the fire alarm.
- Raising the alarm, including the location of alarm call points, internal fire alarm, telephone and alarm indicator panels.
- The Correct method of calling the fire brigade.
- The location and use of firefighting equipment.
- Knowledge of escape routes and assembly point.
- Appreciation of the importance of fire doors and use of the need to close all doors and window at the time of fire and on hearing the fire alarm.

1. Fire emergency Procedures:

If you discover a fire;

a) Stop the work- Make sure all tools placed in a safe manner and equipment and machinery turned off.

b) Activate the nearest fire alarm if available or call for help before attempting to extinguish a fire (shout: "Fire" "Fire" "Fire").

c) Notify Fire station if possible

d) Attempt to extinguish the fire if the fire is small.

- If the fire is too big to control with the equipment at hand, retreat.

e) Proceed to assembly point for head count (name check).

NEVER:

- Do not Jump from heights or run.
- Do not hide in excavation, pipes or buildings.
- Do not leave the site without permission
- Do not block the firefighting equipment.

2. Firefighting Equipment:

- All personal shall know the location of firefighting equipment in their work / camp areas;
- Access to firefighting equipment must never be blocked by any material or equipment;
- All firefighting equipment shall be inspected monthly to ensure it is in place, accessible and fully charged. Further inspection and maintenance shall be conducted in accordance with the manufacturer's instruction.
- Fire extinguishers and hoses are to be ready and available in the location of any hot work.
- Never use water on fixtures that contain live electrical outlets, such as an electrical breaker panel.

3. Types of firefighting Equipment:

- Portable first aid & firefighting appliances.
- Fixed installation.
- Mobile equipment.

PORTABLE FIRST AID & FIREFIGHTING APPLIANCES:

All facilities, Rigs and sites will be equipped with portable first aid & firefighting appliances and may be supplemented by the addition of fixed installation systems or mobile equipment depending on the fire risk and size of site.

Types of portable firefighting appliances are:

- Pressurized Water fire extinguishers.
- Foam/AFFF (aqueous film-forming foam) fire extinguishers.
- Dry chemical Powder fire extinguishers.
- Carbon dioxide fire extinguishers;

Note: Halon Portable fire extinguishers are not permitted.

4. Evacuation:

- Assembly areas and alternate assembly shall be identified and signed.
- Learn at least two escape routes, and emergency exits from your area.
- Personal shall move away from any threat or danger.

- All personal shall move to the nominated assembly areas.
- All personal to remain in the assembly point for head count and any further instructions.
- **Fire Regulations shall be clearly and concisely expressed and displayed in prominent positions.**
- **Fire Warden shall be nominated for all premises, depending on size and number of floors.**

14. ROAD SAFETY

"This Road safety questions will ask in ADCO interviews:"

Comply with ADCO corporate procedure No. 10/3 "Land Transportation Safety Manual"

Three important components of Road safety is that: **Road, Vehicle and Driver.**

- All the drivers should be medically fit and certificate shall be submitted To the Client (ADCO).
- All drivers shall attend **ADSD** (ADCO Document for Safe Driving course)/ **Defensive Driving Course (DDC)**-GASCO before driving in the Client (ADCO/GASCO) premises.
- IVMS (In Vehicles Monitoring System) should be installed and report the driving record (RAG Report) to Client (ADCO/GASCO) regularly.
 - Harsh break
 - Harsh Start
 - Seat belt including passenger(s).
 - Over speed (speed limit: below 120 km/h).
- Rollover protection bar with screen.
- Apply journey management system.
 - Logbook
 - Not allow driving after 20:00 at night time, when need to drive after this time required take permission.
- Client (ADCO/GASCO) Vehicle inspection sticker required (Quarterly-ADCO/ Annual- Fire dept.)
- Provide desert safety kit.

OPERATION:

- No speeding.
- Don't use mobile phone during driving.
- Always wear seat belt.
- Daily Checking before driving.

CONTENTS OF DESERT SAFETY KIT:

- Smoke Canister (2).
- Heliograph signal mirror (1)
- Space Blanket (1)
- Light stick (2)
- First aid kit
- Heavy duty jaw rope (steel)
- Tire Pressure gauge.
- Foldable shovel
- Water for 2 days fr
- Flag pole (3 meters)
- Glace Paper role



15. CHEMICAL HANDLING.

- Chemicals are the most common and significant health hazards
- Chemicals can be hazardous for numerous reasons and can combine with other chemicals to make new hazards
- All hazards must be taken into account when using and storing chemicals.

OBJECTIVES:

- To:
 - Recognize chemical hazards commonly encountered in the field

- Explain warning properties of various chemical hazards
- Describe how to evaluate and control these hazards.
- The degree of hazard associated with a particular chemical will depend on:
 - Its physical properties
 - Its toxicity
 - The way it is used
 - The environment in which it is encountered.

CHEMICAL HAZARDS:

- Liquids
- Dust
- Fumes, Mist,
- Vapor & gas.

It is color coded, **Red** for fire, **Blue** for health, **Yellow** for reactivity and **White** for specific hazard like oxidizer, alkali, acid and corrosive etc.

ROUTES OF ENTRY OR MODES OF ENTRY:

- **Inhalation** (through nose);
- **Ingestion** (through mouth);
- **Absorption** (through skin); and
- **Injection** (force full entry of chemical).

TOXICITY

- Ability of the substance to harm the body and the manner in which it harms the body
- Quantity + Duration + Toxicity = Dose
- The dose makes the poison

PHYSICAL CLASSIFICATION:

- Chemicals may be found in solid, liquid, aerosol, or gas and vapor form.
- The degree of danger varies according to the form of the chemical and the factors previously discussed.

HEALTH EFFECT:

- Acute Effect.
- Chronic effect.

ACUTE EFFECT:

When a person exposure to high concentration of Chemical for a short period of time and this effect generate in his body which is reversible.

E.g. Exposure to Ammonia can cause temporary breathing troubles, dizziness, etc.

CHRONIC EFFECT:

When a person exposure to low concentration of chemical for a prolong period of time and this effect generate in his body which may or may not be reversible.

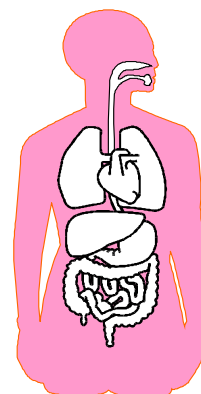
E.g. Exposure to Ammonia on long time basis can cause Asthma, cancer etc.

HEALTH HAZARDS:

- Irritant: Severe Irritation
Irritation
Slight or No effect
- Toxic Effect
- Asphyxiant
- Sensitizer
- Teratogenic (unborn child)
- Mutagenic (Heritable genetic defects)
- Carcinogenic
- Oil Acne (Cutting Oil)
- Particle size (Micron) $\leq 10 \leq 100$
- Photo sensitizer (Irritant or Sensitizer + UV) Coal Tar Pitch.

TARGET ORGANS:

- Central nervous system (CNS).
- Eye.
- Ear.
- Nose.
- Mouth.
- Skin.
- Heart.
- Lungs.
- Liver.
- Digestive tract.
- Reproductive system.
- Kidneys.

**PERSONAL PROTECTIVE EQUIPMENT:**

- PPE for the chemical handling shall be decided as per the instruction of Material Safety Data Sheet.

CONTROL MEASURES:

- Chemical Approval Panel→**MSDS** (Material Safety Data Sheet).
- Elimination, Substitution
- Changed Method of work, Engineering Control (extraction)
- Information, Instruction & Training→**COSHH** (Control of Substances Hazardous to Health).
- Personal Protection Equipment.
- Monitoring.
- Recovery Measures (Emergency Plan)

MSDS (MATERIAL SAFETY DATA SHEET):

The details of following things;

- **Information about chemical:** (Name of the product, Composition, Ingredients, Physical and Chemical Properties, Reactivity /Stability, Manufactures details),
- **Information about hazards:** (Identify the hazard, Health hazard),
- **Information about Precautionary measures:** (First aid Measures, Firefighting technique, Spill control, Exposure controls, Handling/Storage Procedure, PPE),
- **Environmental Impact information:** (Ecological Information, Disposal consideration),
- **Other:** (Regulations, Standards).

BASIC REQUIREMENT OF CHEMICAL STORAGE AREA:

- Label storage areas according to the type of chemical family or hazard classification found there.
- Display MSDS according to the chemical.
- Keep aisles, hallways, doorways, exits, and entryways clear.
- Keep storage areas well lit, appropriately ventilated, and at a consistent, cool temperature.
- Eliminate ignition sources such as open flames, heat sources, or direct sunlight.
- Keep emergency equipment such as fire extinguishers handy and in good working order. .
- Confine chemical storage areas so that leaks or spills are controlled. Prevent chemicals from running down sink, floor, or storm water drains. Clean up spills and drips immediately.

TYPES OF PLASTICS ACCORDING TO DISPOSAL THEORY

- **#1: PETE-** Polyethylene Terephthalate.
- **#2: HDPE-** High Density Polyethylene.
- **#3: PVC-** Poly Vinyl Chloride.
- **#4: LDPE-** Low Density Polyethylene.
- **#5: PP-** Poly Propylene.
- **#6: PS-** Poly Styrene.
- **#7: Other,** Miscellaneous.

16. EXCAVATION.

DEFINITIONS:

- **EXCAVATION:**

Any man made cave-in, leveling, clearing or depression in the earth's surface, including its sides, wall and faces formed by earth removal and producing unsupported earth conditions by reason of the excavation.

- **TYPES OF EXCAVATION:**

- **Manual Excavation:** The excavation without using any powered equipment.
- **Mechanical Excavation:** The excavation work using any electrical or mechanical equipment.

- **TRENCH:**

A narrow excavation made below the surface of the ground. In general, the depth is greater than width is called trench, although the width is not greater than 4.5 Meters (15 feet).

- **PIT:**

An area often sunken or depressed below the adjacent floor area; in general, already built before-existing procedure shall be followed.

- **PROTECTIVE SYSTEMS:**

Methods used to protect employees from cave-ins, from materials that could fall or roll into the excavation onto the workers or from collapse of adjacent structures. Protective systems include supports, sloping and benching, shields and other means to protect workers.

- **SHORING:**

Hydraulic, timber or mechanical systems that support the sides of an excavation, designed to prevent cave-ins.

- **HYDRAULIC SHORING:**

A pre-engineered support system of hydraulic cylinders (cross-braces) used with vertical rods (uprights) or horizontal rods designed specifically to support sidewalls of an excavation to prevent cave-ins.

- **BENCHING:**

A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal steps, with a vertical rise between steps;

- **SLOPING:**

A method of excavating in which the sides of an excavation are laid back to a safe angle to prevent cave-ins. (The safe angle required varies with different types of soil, exposure to the elements and superimposed loads. There is no single angle of repose. Soil classification must be identified to select safe sloping and benching methods).

- **TRENCH BOXES:**

A structure that is able to withstand the forces imposed on it by cave-ins, and in the process, protects employees inside the structure.

- **SOIL TYPES:**

Clay Soil, Loose Soil, Rough Soil & Rock Soil.

- ✓ **Type A:** Compressive strength is 1.5 tons per square foot or more.
- ✓ **Type B:** Compressive strength is in between 1.5 tons and 0.5 ton.
- ✓ **Type C:** Compressive strength is below 0.5 ton.

EXCAVATION HAZARDS:

- Sudden and unexpected collapse of excavation wall (cave in).
- Underground Utilities- Presence of underground electrical cable, telephone cable.
- Flooding of water accumulation.
- Presence of Toxic gas.
- Falling of Person /vehicle.
- Adjacent structures.
- Lack of Oxygen- when we are doing the deep excavation pressure is more than air.
- Access / Egress-for movement of person to excavation.

- Falling of Material on the people who are working in excavation.

EXAVATION CONTROL MEASURES:

- To protect the cave in provide shoring, sloping, shielding, Benching.
- Check the location map, go for the cable detectors, make trial pit to avoid the underground utility.
- De watering to avoid water accumulation.
- Use of gas detectors, forced ventilation and to be provided the respiratory protection to avoid the toxic gases.
- Hard barricading, Flickering light and signages should be provided to prevent of falling of person / vehicle.
- Maintain proper distance from adjacent structure. The foundation should be provided by the shoring or shielding. Upper structure should be supported by under pinning.
- Conduct the gas test to check the presence of oxygen level, use respiratory protection.
- Adequate ladder should be provided for the movement of people and ramps should be installed for the movement of vehicles.
- Store the material should be keep away from the excavation (scaling).
- Adequate Supervision
- Proper PPE.

SAFETY PRECAUTIONS REQUIRED FOR A SAFE EXCAVATION: (Detailed)

- No mechanical excavation closer than **5 meters** to any **hydrocarbon** carrying pipeline.
- No mechanical excavation closer than **3 meter** to a **non-hydrocarbon** carrying pipeline, cables and services.
- For any excavation **deeper than 1m**, ladder must be positioned projecting minimum 1 meter above the edge of the excavations.
- Ladders shall be provided **every 7.5 meters** (25 feet) of lateral travel in the trench.
- Ladders shall be securely supported at the bottom as well as at the top.
- Excavated material shall be placed **1m** from the edge of the excavation for depth up to 1.2 meter.
- (Accordingly placement of excavated material shall be increased proportion to the depth of excavation.)
- Heavy equipment, machinery shall be kept **at least 3 meters away** from the edge.
- Any walkway across trench shall have scaffold type platform with handrails.
- All trenches shall have barrier (such as fixed guardrails) and reflective warning notices clearly displayed. Flashing lights are mandatory during poor visibility.
- The access to plant, equipment and emergency services must not be obstructed by the trenches.
- No mechanical excavation is allowed inside the existing KOC facilities (Gathering Center, Booster Station, water injection and handling facilities, etc.)
- Trenches beyond a depth of 1.2 meter is considered as Confined space- confined space procedure shall be followed.

1. BEFORE START THE WORK:

The following factors shall be considered before the job starts:

- Size and purpose of the excavation;
- Location of underground obstruction such as pipes, electric cable, etc.
- Weather and soil moisture conditions, especially high water table;
- Adjacent roads and footpaths;
- Method of excavation;
- Sources of soil vibrations (highway traffic, machinery, etc.);
- Collapse or cave-in of the sides;
- Stability of adjacent structures;
- People and vehicles falling into the excavation
- Materials falling onto people working in the excavation
- Fumes
- People being struck by mobile plant.

These factors must be taken into consideration when performing the risk assessment. Suitable protective measures shall be provided whenever excavation work is to be carried out. A Hot/ Cold work permit and Excavation certificate shall be obtained prior to start work commencing in restricted area. For excavation outside a restricted area, only a excavation certificate is required. However, in both cases, a Risk assessment of the activity must be conducted and approved before start the work.

2. UNDER GROUND OBSTRUCTIONS:

- Whenever the presence of underground pipes, cables, vessels, or structures is known or suspected, mechanical excavators shall not be used until all such obstructions have been exposed by hand

digging. Mechanical excavators shall not be used within 3 meters (10 feet) of any such obstruction and including, wellheads and exposed pipes.

- No mechanical excavation work may be undertaken within 5 meters of another OPCO's pipelines.
- In certain circumstances, this critical distance may be reduced by an authorized and qualified person following a suitable and sufficient assessment of the hazards and risks of the change, which must be approved and authorized, in writing, by the field management. Pneumatic breakers shall only be used where necessary to break concrete or other hard surface.

3. GENERAL PRECAUTIONS:

Shoring Protective Systems:

As soon an excavation reaches a depth of 1.2 meters (4 feet) suitable shoring shall be installed on the other side sloped back to a safe angle. Shoring may be timber or any other suitable material, such as steel sheet piling. The determination of the other protective systems shall be based on evaluation of:

- Types of soil;
- Potential depth of the excavation;
- Possible variation in water content of the material being excavated while the excavation is open.
- Loading imposed by structures, equipment, overlying material, or stored material;
- Vibration from the equipment, blasting, traffic, or other sources.

Excavation shall not be sloped at an angle greater than one and one half horizontal to one vertical (34° measured from the horizontal).

A qualified and authorized person shall design the shoring system.

All excavation shall be inspected

- At the start of the each shift before start the work.
- After any event likely to affect the strength or stability of the excavation; and
- After any accidental fall of rock, sand or other material.

4. INSPECTION:

Excavations that are open for 7 days or more shall be inspected and the results recorded in the "Excavation Inspection Register".

- **In your site, there is welding activity, lifting activity and excavation activity, which activity will be your priority to attend?**

Excavation Activity, Because Excavation activity is doing by incompetent person but lifting and welding activities are doing by competent person.

5. CLEARANCE:

In order to provide a safe footing at the edge, and to prevent spoil falling into an excavation, a clear space at least 1 meter (3 feet) wide shall be maintained on all sides from the excavation to the barriers.

6. EDGE PROTECTION, MARKERS AND FIXED LIGHTING:

Whenever it is necessary to place or operate power shovels, derricks, trucks, materials, soil banks or other heavy objects on a level above and near an excavation, the sides of the excavation shall be sheet-piled, shored and braced as necessary to resist the extra pressure due to such loads. When mobile equipment is utilized or allowed adjacent to the excavation. If possible the grade should be slope down and away from the excavation. If men or vehicles are in the vicinity after dark, e.g. in camp locations, fixed warning lights shall be used to mark the limits of the work.

Excavations shall be provided with rigid barriers and may require a confined space entry certificate more than 1.2 meter depth excavation. (As per ADCO may require a confined space entry certificate more than 2 meter depth excavation with the width to depth ratio less than 2).

7. CROSSING PIPE LINES:

The relevant field manager or Terminal & Pipeline manager shall be given minimum of 7 days advance notice of the intention to excavate in the vicinity of existing pipe lines.

8. EXCAVATION ADJACENT TO OIL WELL OR OTHER WELL INSTALLATIONS:

The relevant field manager or Terminal & Pipeline manager shall be given minimum of 48 hours advance notice of the intention to excavate in the vicinity of a well installation.

9. CROSSING TRACKS AND OIL COMPANY ROADS:

Where possible, restrict excavation of roads and recognized tracks to outside normal hours of peak road use.

A minimum of 7 days' notice shall be given to the relevant Field manager or Terminal & Pipeline Manager if it is necessary to close an established rig crossing on the overhead electrical transmission system or any other established ADCO access track or road.

17. CONFINED SPACE.

DEFINITIONS:

• CONFINED SPACE:

Any Enclosed area which has the limited access and egress and it has deficiency and Enrichment of the oxygen and it is not designed for continuous human occupancy.

Examples: Process vessels, Tanks, Bins, Stacks, Large pipe, Duct, Pits & Trench etc.; Any excavation with depth more than 1.2 meter;

• LOCAL EXHUAUST VENTILATION (LEV) .

This type of ventilation removes air-borne contamination at the point of emission.

CONFINED SPACE HAZARDS:

A confined space may have one or combination of the following hazards:

- Limited Access /egress.
- Asphyxiation arising from gas, fumes, vapors.
- Deficiency and Enrichment of oxygen.
- Drowning.
- Presence of flammable, combustible or pyrophoric materials (HC, Sludge etc.)
- Presence of toxic gases, corrosive or hazardous materials (H₂S, Co, NH₃ etc.)
- Improper Isolation.
- Electrocution.
- Poor Illumination & Ventilation.
- Lack of communication.
- Falling / Tripping hazards
- Presence of reactive or self-igniting material.
- High temperature and humidity.
- Lone Working.
- Improper housekeeping.

CONFINED SPACE CONTROL MEASURES:

Procedure for entering confined space:

- Permit must be procured form operations, making sure of the following;
 - Complete isolation of the space to be entered.
 - Draining, depressurization and purging or cleaning should be performed.
 - Gas test should be conducted to ensure no hazardous atmosphere is present.
 - Space ventilation.
- A Pre task meeting must be conducted with all authorized entrants prior to entering confined space.
- The attendant (Stand by man) shall be assigned at the entrance to maintain communication with employees working inside to ensure their safety. A log book shall be maintained at the entrance to keep track of the people inside the space.
- Safety attendant must be trained and authorized to use gas testing equipment.
- Entrants must wear body harness, and if necessary a life line be attached to the harness to avoid entry-rescue.
- Lighting should be provided, if necessary a maximum of 24 volts, lighting should be used attached a GFCI.
- Only intrinsically safe or explosion-proof equipment shall be used inside.
- Depending on the situation, emergency rescue team may be put on standby.
- If an emergency occurs within the confined space, the standby person must not enter it until rescue team arrived.
- Barricade the area with warning sign board.

Procedure for working in a confined space entry:

- Any enclosure having a limited means of entry & exit and it is not designed for continuous employee occupancy.
- Before entering in the confined space, must need to obtain a confined space entry work permit, make sure that all required isolation being done.
- Frequently gas test is to be carried out to confirm that area is free of toxic gas or flammable atmosphere.
- If the area is contaminated or it has oxygen deficiency the provided BA sets or air line respiratory system.
- Conduct pre-task meeting for the employees who will be entering inside the confined area and get there signature to conform that they are aware of the hazards and safety measures.
- The attendant (Stand by man) to assigned at the entrance; A log book shall be maintained at the entrance to keep track of the people inside the space. The attendant shall not be assigned to other duties. If an emergency occurs within the confined space, the standby person must not enter it until rescue team arrived.
- The entering people should use body harness with lifeline for the emergency rescue purpose.
- Any required electrical lighting or tools should not exceed more than 24 volts and attached with GFCI / ELCB. It should be intrinsically safe or explosive proof.
- Barricade the area with warning sign board.

LIFE LINE SIGNALS/COMMUNICATION BETWEEN ATTENDER AND WEARER:

SIGNALS	PULLS	BY	MEANING
1ST	One Pull	Attender	How are you?
	One Pull	Wearer	I am Fine.
2ND	Two Pull	Wearer	Slack the line.
	Two Pull	Attender	Yes, I am Slacking the line.
3RD	Three Pull	Attender	Your time is Over, Come back, My Warning.
	Three Pull	Wearer	Whistle has blown .I want to come out.
4TH	Repeated Pull	Attender	Danger, Come out immediately.
	Repeated Pull	Wearer	I am in danger take me out immediately (due to injury, giddiness).

EXCAVATION SHALL BE CONSIDERED AS CONFINED SPACE IS:

- International Standard : If the excavation depth is 1.2 Meter or more.
 - As per GASCO : If the excavation depth is 1.5 Meter or more.
 - As Per ADCO : Width to Depth ratio is less than 2 Meter
- Eg: if the excavation width is 4 meter and depth is 2 meter; $4/2=2$ and it is not confined space.
i.e. if the excavation width is 3 meter and depth is 2; $3/2=1.5$, it is confined space.*



18. LIFTING ACTIVITIES.

TYPES OF LIFTING: (As per ADCO)

- Simple Lift.
- Heavy Lift
- Critical Lift.

• **SIMPLE LIFTING:**

The lifting is carrying out below 20 Tons.

• **HEAVY LIFTING:**

The lifting is carrying out more than 20 Tons.

CRITICAL LIFTING:

Critical Lifting involves:

- Over the Existing Utilities;
- Tandem Lifting.

DEFINITIONS:

• **CRANE LIFTING:**

A **crane** is a type of machine, generally equipped with a hoist rope, wire ropes or chains, and sheaves, that can be used both to **lift** and lower materials and to move them horizontally. It is mainly used for **lifting** heavy things and transporting them to other places.

• **MULTIPLE LIFTING OR TANDEM LIFTING:**

Lifts involving two or more cranes are complex operations requiring considerable skill and planning. As a result, multiple crane **lifts** (or **tandem lifts**) must be planned and carried out under a competent person's supervision.

• **LIFTING APPLIANCE:**

a crab, winch, pulley block or gin wheel used for raising or lowering and a hoist, crane, sheer legs, excavator, drag line, piling frame, aerial cableway, aerial ropeway or overhead runway.

• **LIFTING GEAR:**

A chain sling, rope sling or similar gear, and a ring, link, hook, plate-clamp, shackle & swivel or eyebolt;

• **HOIST:**

A lifting machine, whether worked by mechanical power or not, with a carriage, platform or cage, the movement of which is restricted by a guide or guides; but does not include a lifting appliance used for the movement of trucks or wagons on a line or rails.

• **RADIUS:**

The distance from the center to the edge of a circle is Radius.

• **PERIMETER:**

The boundary line or the area immediately inside the boundary is Perimeter.

• **DEAD LOAD:**

The weight of building or structure with any equipment permanently attached to or built in.

• **WIND LOAD:**

The force applied by the wind on the structure/Building.

• **WORKING LOAD LIMIT (WLL):**

The maximum load or mass that an item of lifting equipment is designated to sustain, ie. Raise, lower or suspend.



- **SAFE WORKING LOAD (SWL):**

The relevant safe working load required to be specified in records of test and examinations and to be marked on the lifting appliance, lifting gear, etc. This load should never be exceeded.

- **CRANE COORDINATOR:**

A person who is appointed by ADCO Management to be responsible for the organization and control of lifting operations;

- **LIFTING SUPERVISOR:**

A person who has undergone training by an ADCO approved Third Party Inspection Authority and demonstrated sufficient practical experience in supervising lifting operations.

- **BANKSMAN /SLINGER/ SIGNALLER:**

A person over the age of 18 whom has undergone training in banking, slinging and signaling of lifting operations;

- **THOROUGH EXAMINATION:**

A systematic and specialized process of examination by a competent person for any defect in lifting equipment;

- **COMPETENT PERSON:**

An individual nominated by an ADCO approved third party inspection authority (LEICC) to carry out thorough examination on basis of his level of knowledge of the equipment, defects and their causes, methods of testing and fault diagnosis.

- **LEICC :**

Lifting Equipment & Operators Inspection & Certification Company - a UAE registered crane and lifting equipment inspection agency, approved by ADCO.

- **LIFTING OPERATIONS COORDINATOR:**

An appointed competent person (ADCO 11th Grade) selected by ADCO Management to be in overall control of the lifting operations in his area of responsibility He must have an adequate training, knowledge and experience to be competent.

- **LIFTING OPERATION SUPERVISOR:**

Person selected by the Lifting Operation Coordinator who controls lifting operation, and ensures that it is carried out in accordance with the coordinator's safe system of work.

- **CRANE OPERATOR:**

Person who responsible for the correct operation of the crane in accordance with the manufacturer instructions and within the safe system of work and in accordance with the operating plan for proper positioning of loads. He should be trained to the specific crane model, able to assimilate reports and duty charts information and familiar with the safe rigging / slinging operations.

- **SLINGER (RIGGER):**

ADCO/ Contractor person responsible for attaching and detaching the load to/ from the crane-lifting attachment and for the use of the correct lifting gears and equipment in accordance with the operating plan for proper positioning of loads, He should be trained in inspection, safe use and storage of lifting equipment.

- **SIGNALLER (BANKSMAN):**

Person who is responsible for relaying the signal from the slinger to the crane operator;

- **LIFTING EQUIPMENT:**

Means work equipment for lifting or lowering loads and include its attachments used for anchoring, fixing and supporting it.

- **LIFTING GEAR :**

Means work equipment for attaching loads to machinery for lifting. A device such as a sling, shackle, eyebolt, clamp, spreader beam ...etc. used to connect the load to a lifting appliance but which is not itself part of the load or the appliance.

- **LIFTING MACHINES:**

A device or mechanism such as crane, crab, winch, pulley block, gin wheel, chain block, which does the work in lifting the load or provides the means of movement, or the supporting structure and anchoring devices for such a mechanism, e.g. runway, gantry ...etc. which may also permit a suspended load to be moved in the horizontal plane.

- **CHECKING:**

Looking for obvious visual signs of damage that has occurred in use or storage of lifting equipment, e.g. a slinger (Rigger) is required to CHECK that there are no defects apparent before he uses gear.

- **INSPECTION:**

Visual inspection carried out by a responsible person, who has received specific training, to identify possible faults or other factors that may impair the safe and efficient working of the equipment (items suspected of being defective as the result of an inspection would be withdrawn from service and referred to a competent person for thorough examination).

SAFETY DEVICES ON CRANE:

- **ASLI**(Automatic Safe Load Indicator);
- **A2B** Devices(Anti- two block devices);
- **LMI** (Load Moment Indicator).
- **Anemometer.**
- **Outrigger.**

- **ASLI (AUTOMATIC SAFE LOAD INDICATOR):**

- All jib cranes with a Safe Working Load (SWL) of over one tone shall be fitted with an Automatic Safe Load Indicator (ASLI) to warn when the crane is being overloaded and is at risk of overturning.
- ASLI's shall be set in accordance with the crane's rigged condition and manufacturer's instructions. Only an ADCO approved third-party inspection authority (LEICC) shall be permitted to make ASLI adjustments and test its operation and record the test results in an appropriate form.

- **A2B DEVICES (ANTI- TWO BLOCK DEVICES):**

- It is an electro sensing device to prevent the contact of boom sheave assembly point and hook assembly.
- This device which automatically prevents damage from contact between the load block, overhaul ball, or similar component, and the boom tip (or fixed upper block or similar component). The device(s) must prevent such damage at all points where two blocking could occur. Temporary alternative measures: Clearly mark the cable (so that it can easily be seen by the operator) at a point that will give the operator sufficient time to stop the hoist to prevent two-blocking, and use a spotter when extending the boom.

- **LMI (LOAD MOMENT INDICATOR):**

- Technology of a Safe Crane Lift, in the beginning, the crane device was simply called a computer. Then it became known as a load-moment indicator (LMI) and in some cases the technology has been referred to as a rate capacity indicator (RCI) or a rate capacity limiter (RCL).
- Load moment (or rated capacity) indicator means a system which aids the equipment operator by sensing (directly or indirectly) the overturning moment on the equipment, i.e., load multiplied by radius. It compares this lifting condition to the equipment's rated capacity, and indicates to the operator the percentage of capacity at which the equipment is working. Lights, bells, or buzzers may be incorporated as a warning of an approaching overload condition.

- **ANEMOMETER OR WIND SENSOR:**

- Determining Safe Wind Speed Operating Conditions on Cranes, Cranes are prohibited from operating in high wind speeds. In order to determine safe operating conditions, an anemometer (or wind sensor) are typically used.
- It is mounted high up (top of the boom) on the crane.

• OUTRIGGER:

- Outriggers are crucial to a successful lift with a mobile crane. Outriggers provide a solid base for the crane. Their purpose is to improve the stability of the crane during operation. An outrigger can be exerting hundreds of thousands of pounds of force (PSI - KPSI) into the ground beneath the crane.

LIFTING OPERATION HAZARDS:

- **Overturning:** because of unstable ground, Overloading, Non use of outriggers and Travelling with load.
- **Overloading:** may cause Boom breakage.
- **Collision:** Collision with adjacent structures, Overhead power lines.
- **Failure Of support.**
- **Loss of load:** because of Nonuse of safety latch, Improper Rigging Parts, Improper Rigging procedure
- **Failure of load bearing part:** because of lack of maintenance and inspection.
- **High winds.**
- **Working under the suspended load.**

LIFTING OPERATION CONTROL MEASURES:

- Crane must have 3rd Party certificate and must be carried out periodically and routine inspection prior to work.
- Crane Operator and Rigger must have the competency and 3rd party certificate.
- Lifting slings must have the 3rd party certificates and maintain the inspection prior to work.
- Permit to work shall be obtained.
- Ground must be stable.
- Outriggers should be fully extended and supported with the ground, Sole board should be there.
- Limit switches should be operated and inspected prior to start work.
- Maintain suitable distance from overhead power lines and structures.
- Do not exceed the SWL (Safe Working Load).
- Do not allow anybody to work under the suspended load.
- Lifted to correct height.
- Moved at appropriate speed, putdown in a safe position.
- Avoid obstruction from walk ways.
- Use suitable lifting Tackle.
- Travelling with load should be avoided.
- Good visibility should be established for the operator.
- Good Communication should be established in between operator and rigger/banks man.
- Wind speed to be monitored prior to work (don't above 18 KN mile).
- Adequate Supervision.
- Appropriate PPE.

LIFTING SAFETY PRECAUTIONS: (Detailed).**WRITTEN PLANS:**

- The Crane Coordinator shall provide a written plan for lifting operations which shall include a risk assessment, details of the equipment to be used, together with safe working loads, the general precautions to be taken, availability of telephones, first aid equipment, etc.
- The written plan shall also provide details of the person who will be in charge of the operation, together with details of other key personnel.

WEIGHT OF LOAD:

- The Crane Coordinator shall determine the weight and Centre of gravity of the load to be lifted. In the absence of this information from the supplier, the weight of the load shall be determined either by weighbridge, load cell or accurate calculation.
- The weight of the block and of any lifting gear to be used shall be included in the total weight to be lifted.

SETTING UP CRANES (MOBILE CRANE):

- The Lifting supervisor shall check the setting up of the crane as per manufacturer recommendation and best practices to ensure the ground upon which the outriggers are placed have sufficient good material beneath them that will provide an acceptable load bearing surface.
- Either good quality timber railway sleepers or similar laid tightly side by side to form an even surface or alternately purpose made steel plates as material for load distribution under outriggers shall be used.
- The lifting supervisors shall ensure that there are no underground pipes, culverts, excavations, etc. which may weaken the ground under the weight of the crane.

- The lifting supervisor shall inspect the outriggers before commencing any lifting and again frequently during the lifting operation. If necessary, stop the operation and re-level the crane in the event of any untoward movement.

OPERATION OF CRANES:

- Crane Operators shall have satisfactorily completed a 'Crane Operators' course run by an ADCO approved third-party inspection authority (LEICC). Copies of training certificates shall be kept for record purposes.
- Banks man /Slings shall have satisfactorily completed a Banks man /Slings course run by an ADCO approved LEICC (Lifting Equipment & Operators Certifying Companies). Copies of such training certificates shall be kept for record purposes.
- All cranes shall be fitted with the crane signal chart.

ACCESS:

Access for both the lifting equipment and the load to be lifted is considered at the planning stage. The following matters shall be included.

- The suitability of public roads and site condition for the movement of large cranes and large loads;
- The width of the entrances to allow the passage of large loads without interrupting the movement of other traffic.
- Sufficient space shall be available in which to erect mobile cranes for the work and space to accommodate the maximum length of jib to be erected, together with sufficient space for movement of the auxiliary crane;
- Arrangements for closing the area during the erection of the crane, the lifting operation and the subsequent dismantling of the crane, so as to be completely excluded all personal, other than those immediately connected with the operation.

GROUND CONDITION:

The Crane coordinator shall ensure that the ground conditions both in relation to access and the load, which will be imposed during the erection and operation of the crane, are capable of withstanding the pressure.

EFFECT OF WIND SPEED ON CRANE OPERATIONS:

Any Crane working on site should have wind speed indicator (Anemometer) in order to warn the operator and/ or cut off crane operation if the wind exceeds the pre- determined speed as per ADCO requirements 32 km/h (20 mph), or the crane limitation due to manufacturer specification.

OVERHEAD POWER LINES AND OTHER OBSTRUCTIONS:

- At all stages during the progress of lifting operation, from planning through to completion, the crane coordinator shall ensure that precautions are in place to avoid overhead power lines and other overhead obstructions. The overhead protection shall be placed at least 1½ jib length on either side of the power line.
- Arrangements to ensure clearance from obstructions shall include due allowance for the tendency of crane jibs to "bob up and down", both during the lifting operation and when travelling. As a general rule, a minimum clearance from overhead power lines of 6 meters is required to be maintained at all times.
- Flagman should be appointed to warn the crane operator if accidentally exceeds the minimum clearance.
- When it is necessary for lifting appliances to pass under power lines, warning notices shall be placed on both sides before and after the overhead line of the road or track and an overhead barrier, supported on goal posts and provided with bunting shall be erected to ensure that jibs are brought below the danger level before passing under the lines.

PROXIMITY HAZARDS:

- Consideration should be given to the presence of proximity hazards such as overhead electric lines or cables, nearby structures, other cranes, vehicles or public access including highways.
- The danger to or from underground services, such as pipe lines, electric cables should not be overlooked. Precautions should be taken to ensure that the crane foundation is clear of any underground services or where this is not possible, that the services are adequately protected against damage. At any place where a crane or its load passes an obstacle, the following points should be observed.
- Where practicable, the crane path should be clearly defined by marking to ensure it is kept free from obstruction all the time, and a clearance of not less than (600mm) should be arranged between any part of the crane and any obstacle. Precaution must be taken to avoid access to any trapping hazards.
- Where goods are regularly stacked near a crane boundary, lines for the stacking goods should be permanently marked on the ground.

GENERAL PRECUATIONS:

- During lifting operations, no person shall be positioned beneath the load, hoist or jib. Similarly, loads shall not be slewed over the heads of personnel. During lifting operations no load shall be slewed over any vessel, pipe or container containing hydrocarbons or other flammable or hazardous material without the express consent of the Operation Department.
- No lifting appliance shall be left unattended with a suspended load.
- After completing a lift, all slings shall be hooked back to the hook to avoid catching on obstructions.
- If the Automatic Safe Load Indicator (ASLI) is activated during lifting operations, the operator shall not carry on with the lift, but shall return the load to its original position.
- Where a lifting appliance has a traveling or slewing motion, a clearing of at least 1m shall be provided between the lifting appliance and any adjacent fixture. If this is not possible, the access shall be barricaded off to prevent personnel access.
- The hoisting mechanism on a crane shall only be used for direct raising or lowering operations.
- Crane jibs shall not be worked at a radius greater than specified on the test certificate.
- All cranes shall be marked clearly with their maximum Safe Working Loads (SWL).
- If the lifting radius can be varied, a sign shall be displayed inside the cab showing the safe load at each radius (Mobile Crane) and on the jib (boom) in case of Tower Crane.
- Any crane should not be used if there is no Duty Load Chart available in the cab.
- Except for testing purposes, lifting appliances shall not be used for loads greater than the specified Safe Working Load.

19. ELECTRICAL SAFETY.

Electricity is a Flow of electrons through a conductor.

FUNDAMENTALS OF ELECTRICITY:

Current, Voltage, Resistance & Power.

DEFINITIONS:

- **CURRENT (I):** Flow of electrons is known as current.
- **VOLTAGE (V):** It is potential difference between two points in an electrical circuit.
 - **HIGH VOLTAGE (H.V) APPARATUS** : Any equipment and conductor system normally operated above 650 Volts.
 - **MEDIUM VOLTAGE (H.V) APPARATUS** : Any equipment and conductor system normally operated above 250 Volts, but not exceeding than 650 Volts.
 - **LOW VOLTAGE (H.V) APPARATUS** : Any equipment and conductor system normally operated below 250 Volts.
- **RESISTANCE (R):** It is the property of a substance which gives opposite flow of current.
- **POWER:** It is the product of voltage and current.
- **ELECTRICAL PROPERTIES MATERIAL):** Conductor, Insulator & Semi-Conductor.
- **CONDUCTOR:** Material, which passes electric current through it .e.g. Copper, Aluminum.
- **INSULATOR:** Material, which does not allow electrical current flow e.g. PVC, Rubber, Wood, etc.
- **SEMI-CONDUCTOR:** The conductivity of a material lies in between conductor and insulator. E.g. Germanium, Silicon;
- **BONDING:** Occurs where suitable electrically continuous path is established between conducting bodies. It may arise by construction through the boiling together of metallic bodies, thus affording electrical continuity.
- **DANGER:** A risk of bodily injury or loss of life or health from shock, burn, asphyxiation or other cause.

- **DEAD:** at or about zero voltage and disconnected from any live system.
- **CIRCUITE MAIN EARTH:**
An earth applied to either the feeder circuit or bus bars on high voltage (HV). Switch gear by closing the circuit breaker (CB) in the appropriate earth position or by closing the pole mounted earth switch for the overhead transmission lines.
- **ADDITIONAL EARTH:**
An earth applied after the issue of high voltage and a permit to work e.g. portable earth applied to either side of the isolated and clearly specified and identified working area in the work permit on all overhead lines.
- **EARTHED:**
Connected to the general mass of the earth in such a manner as will ensure at all times an immediate discharge of electrical energy, e.g. all phases short circuited and connected efficiently to the earth.
- **LIVE:** Electrically charged.
- **LIVE LINE WORK:** Work on high voltage overhead lines/ outdoor substation with live conductor.
- **CAUTION NOTICE:**
A notice attached to apparatus conveying a warning against interference with such apparatus.
- **DANGER NOTICE:**
A notice attached to apparatus when calling attention to the DANGER of approach to or interference with such apparatus.
- **ELECTRICAL WORK PERMIT:**
A form of declaration signed by an "Authorized Person"; to a person in charge of work to be carried out on any electrical apparatus, for making known to such person the conditions which the work may be carried out.
- **AUTHORIZED PERSON:**
A Person who has been assessed as having sufficient technical knowledge and has been authorized by the company in writing to carry out specific work on electrical systems, apparatus and equipment.
- **SWITCHING:**
The operation of switch gear, isolation, air breaks, fuses, inks, or other methods of breaking or making a circuit.
- **ELECTRICAL PROTECTION DEVICES:**
Fuses, Circuit breaker, earthing, Isolation, Reduced low voltage, Residual current devices, Double insulation.

ELECTRIC SHOCK:

Instructions for the treatment of persons suffering from electric shock shall be prominently displayed in all switch rooms, workshops etc., where electric equipment is located.
All personnel, who are exposed to the possibility of electric shock, shall be trained in emergency procedures, with regard to treatment of electric shock victims.

- **FACTORS OF SEVERITY OF THE EFFECT OF ELECTRIC SHOCK:**
 - The level of voltage,
 - The amount of body resistance of current flow,
 - The path the current taken through your body,
 - The length of time of current flow through your body.
- **ELECTRICAL BURNS WILL BE HAPPEND BASED ON:**
Voltage, Duration, Frequency, Current path Resistance, Contact surface area, Environment, Nature of the clothing and footwear & Presence of potential secondary hazards;

• **EFFECT ON THE BODY OF ELECTRICITY:**

- Damage to the Nervous System;
- Fibrillation (Irregular heart beat);
- Tissue burns at entry and exit;
- Damage to Internal organ;
- Muscular contraction;
- Physical Trauma;
- Respiratory Paralysis (Stopping Breath);
- Cardiac Arrest (Stopping heart beat);

10 mA	Minor Shock.
Above 30 mA	Severe Shock.
100 mA	Death.

PORTABLE AND HAND HELD EQUIPMENT:

- The Use of portable electrical equipment and hand held tools at over 110 volts (between conductors) in an industrial application are not permitted by ADCO, except in special cases. Such cases shall have the approval in writing of the Senior ADCO maintenance Engineer (Electrical) in the area and this approval shall be given only if a suitable and sufficient risk assessment has been completed and stringent safety precautions have been taken.
- Approval shall be withheld if the appliance is considered unsuitable for the conditions.
- Approved appliances over 110 Voltage (between conductors) must be connected to a power supply via earth leakage circuit breakers (ELCB) rated at **30mA/0.3 sec.**

WELDING TRANSFORMERS:

- Portable welding transformers are potentially hazardous, and their use shall be stringently controlled.
- Welding transformers may only be supplied from a socket outlet designed for the purpose and mounted immediately adjacent to an isolating switch. The trailing cable shall be armored. In addition, the transformers shall be connected by a separate earth lead to a good earth.
- Wherever possible welding transformers installed in workshops shall be wired as permanent fixtures.

TRAILING CABLES:

- It is the essential that trailing cables be kept to the minimum. I.e. between socket outlet and the tool or hand lamp only. The wiring socket outlets (metal clad) shall be secured and earthed.

PORTABLE HAND LAMPS AND ELECTRICAL TOOLS:

- Hand lamps are not permitted at voltage above 12.5 volts to earth (e.g. 25 volts between conductors).
- Hand lamps used outside hazardous areas are to be properly designed for the purpose with and earthed metal guard protecting the lamp and armored or screened trailing cable.
- Hand lamps used in hazardous areas are to be certified flame-proof or explosion proof with trailing cables of armored or screened type, and approved by the Senior maintenance engineer (Electrical) in the area.
- It is the responsibility to the user to ensure that portable hand lamps and electrical tools are maintained in safe working condition. Any portable hand-lamps or electrical tool with frayed or disconnected leads or in any ways damaged, or any hand-lamp with broken guard, shall not be used until after repair and inspected by a competent electrician. Portable tools and Hand-lamps in regular use shall be tested weekly for earth continuity by a competent electrician and labeled as fit for use. Defective electrically powered tools shall not be used.

DOMESTIC ELECTRICAL APPLIANCES:

- Domestic (personal use and house hold type) electrical appliances shall be operated only from an ADCO approved 3 pin socket outlet (industrial plugs).
- All domestic electrical appliances shall be fitted with earth connections back to the socket outlet, which shall also be earthed, unless the appliance is of the "double insulated" type.
- Power supply to any domestic electrical appliance should be via earth leakage circuit breaker (ELCB).
- Any damage or defect in domestic electrical appliances or the trailing cables shall be repaired before such apparatus is used again.

LOCKOUT/ TAGOUT PROCEDURES:

- Unexpected or inadvertent operation of electrical and mechanical equipment that can be started automatic or manual remote control may result injuries to person who happen to be nearby.
- Personnel working on such equipment may be at risk, as may employees operating machines driven by electrical motors.

ISOLATION:

- By definition, isolation means the separation of the supply source from the circuit has to be such that inadvertent re-energisation of the circuit is prevented.

- Isolating switches or control circuit blocking switches provided with padlocking facilities may be considered by ADCO to be suitable and sufficient when used in combination with a control system which even in the case of a fault occurring in the control cable, excludes energisation, when such facilities are not available, fuses shall be withdrawn and/ or breakers or contractors shall be racked out.

EARTHING:

- For HV electrical equipment, ADCO require that earthing switches shall be used whenever possible; alternatively, other ADCO approved means of earthing shall be adopted.
- Earthing equipment and leads shall always be examined prior to use by a competent person
- When using portable earth connections, the following procedures to be followed:
 - Ensure the circuit (s) to be earthed is (are) isolated;
 - Ensure that each phase of the circuit is dead by means of proper testing equipment (e.g. HV tester, neon indicating stick, voltmeter etc. but never with lamp)
 - **Note:** The testing equipment itself shall be tested to ensure it is functioning properly immediately before and after verification of the circuit. Ensure discharge of any static charges that might be remaining by using a special HV discharge stick with a built in high resistor connected to the ground.
- Connect earthing leads to the system before securing them to the phase conductors and Care shall be taken to ensure that good contact is made;
- Earth and short circuit all phases, even if work is to be carried out on one phase only connection. When the circuit breaker is used, the trip features shall be rendered inoperative before closing, unless this is impracticable. After closing, steps shall be taken to lock any means of tripping or opening the circuit breaker or switch.
- When removing the earthing connection, disconnect it from the phase conductors first and the earth system last; all earthing shall be recorded in the switch room logbook and this book is numbered maint.

ELECTRICAL HAZARDS:

- **B**-Burn.
- **E**- Electrocutation.
- **S**-Shock.
- **A**- Arching.
- **F**- Fire.
- **E**- Explosion.

PRECAUTION TO BE TAKEN TO AVOID ELECTROCUTION:

- All electrical work must be covered by an appropriate work permit.
- The authorized person approved by the relevant Maintenance Team can carry out electrical work.
- Electrical safety floor mats made from a special grade of insulating rubber shall be provided in front of switchboards or high-voltage equipment to protect personnel against accidental electric shock.
- Warning tape on top of buried cables and electrical cable tiles must be provided as an early warning notice for excavations.
- All portable electrical equipment must be approved by the Maintenance Team and shall be used as per suitability for the relevant area only.
- Do not reach blindly into areas that may contain energized parts.
- Do not enter into a space where adequate lighting and working space is not available.
- Only Industrial type plugs and sockets shall be used on all locations other than offices and houses.
- All testing and measuring equipment used for the electrical works should be tested, calibrated and documented.
- Ensure all equipments are grounded and should be attached GFCI / ELCB.
- Inspect electrical equipments before use.
- Electrical Panel, Junction boxes, pull boxes and fitting must have approved covers.
- Unused openings in cabinets, boxes and fittings must be closed.
- Do not overload on a circuit.
- Maintain the distance from overhead power lines during the Crane activity and scaffolding erection and other activities.
- All cable of power tools / portable tools should be double insulated.
- Do not use damage extension cords and do not touch live wire and another wire at a different voltage.
- Damaged equipment must not be touched until the isolated.
- Disconnect the power when not in use and when changing accessories.
- Use the appropriate PPE for the job.
- Competent, qualified and approved personnel should be carry out testing & energizing of the equipment.

- Electrical lock-out and tag-out system should be used when working on electrical equipments.
- In the event of fire on electrical panel or equipment, the electrical power supply must be isolated and suitable Fire Extinguisher shall be used to extinguish the fire.

PRECAUTIONS TO BE TAKEN FOR A TEMPORARY ELECTRICAL CONNECTION:

- Temporary wiring shall be guarded or isolated by elevating to prevent accident contact with workmen or equipment.
- Vertical clearance above walkways shall not be less than 3m (10feet) for circuits carrying 600V or less.
- Wires shall be insulated from their support.
- Temporary festoon lighting strings shall be made up with cords having lamp sockets and connections protected by insulating coverings.
- Extension cord shall be of approved types and used for the purpose for which they are made.
- Exposed empty light sockets and broken bulbs shall be prohibited.

TYPES OF ELECTRICITY:

- Static electricity.
- Dynamic electricity.

• STATIC ELECTRICITY:

Electricity which is produced by friction of two non-conducting substances. Static Electricity means electricity at rest, it can be transferred from one place to another and hence of no use at all.

• DYNAMIC ELECTRICITY:

Electricity which is produced by conservation of energy such as mechanical into electrical, chemical into electrical, thermal into electrical, etc...it can be transferred from one place to another and can be safely utilized.

STATIC ELECTRICITY HAZARDS:

- Four conditions required for explosive ignition.
- Mechanisms for producing hazardous conditions.
- Static generation, Accumulation of charge and potential.
- Spark discharge, Flammable vapor.

METHOD TO CONTROL THE ACCUMULATION OF STATIC ELECTRICITY:

- Grounding & Bonding;
- Humidification of the process area (about 70%);
- To make material conductive (e.g. belts coated with metals);
- Discharge method (Static eliminators);
- Ionizers (Radioactive); and
- Metallic spiral on pipe lines.

20. NON DESTRUCTIVE TEST (NDT).

DEFINITIONS:

- **RADIATION:** Emission of waves is called radiation.

IONIZING & NON-IONIZING RADIATION:**• IONIZING:**

Radiation that carries enough energy to liberate electrons from atoms or molecules, thereby ionizing them
e.g.:- Alpha, Beta, Gamma, X-Ray, neutrons, mesons

• NON-IONIZING:

It is the Electromagnetic radiation that does not carry enough energy per quantum to ionize atoms or molecules, e.g.:- Radio waves, Ultra Violet Radiation, Infrared Radiation, Lasers, Micro wave.

- **CONTROLLED AREAS:**

Any area in which anyone is exposed to radiation and is likely to exceed 3/10th's of any dose limit of 1mSv/year.

- **DOSIMETER:**

Electronic instrument device used to measure personnel accumulated external radiation exposure (gamma).

- **DOSIMETRY:**

The process of measuring radiation dose rate;

- **SURVEY METERS:**

Some suitably hand-held radiation detectors used in the field during the assessment of NORM contamination area.

To determine the area of barricading (Analog and digital surveyor meter is available).

PLANNING:

- Prior to beginning the work, the construction engineer must verify with design that radiography is required.
- All phases of industrial radiography, both gamma and x ray, must be performed by trained radiographers and assistant radiographers licensed for the location in which the work being performed.
- The construction engineer is responsible for all radiographic work via sub-contractors Radiation Protection Supervisor (RPS).
- All RPS's shall be formally trained in all aspects of their work and possess a valid certificate of competence from a recognized authority, such as the NRPB (National Radiological Protection Board of the United Kingdom). Copies of such certification shall be kept for record purposes.
- The construction engineer must obtain the approval of the Project/ Site Manager (or designee) prior to beginning of any radiographic work.
- Caution must be used to confirm that radiography source in instruments (e.g. level gauges) are in the "off" or shielded position prior to allowing employees to work on associated equipment or vessels.
- Allocate enclosed, barricaded area separate from site works or
- Enclose / shield radiography (Allocated enclosure will allow greater flexibility in radiography timings. Or
- Carry out radiography out of normal working hours or
- Radiography items before they reach site or
- Use other form of non-destructive testing (NDT) like liquid penetrating test, ultrasonic test (UT), etc.

REQUIREMENTS:

Radiography sub-contractors to be provided as following:

- Experience history;
- Employee qualifications Radiation Protection Supervisors (RPS) fully qualified with certificates;
- Medical history- Pre employment medical & Annual medical;
- Work Procedures/ Method Statement.
- Emergency Action Plan;
- Emergency Kit –(Lead Gloves, Lead POT, Lead Sheet, Emergency Cutter, Long tong, PPEs, etc;
- Emergency contact Numbers.
- Information about source type / strength/ size.
- Source storage requirements;
 - Personnel **Dosimeter** and Calibration certificate, **survey meter** and calibration, **TLD badge** (Thermo luminescent Dosimeter) for Personnel,
 - Source transportation vehicle shall be approved from **FANR (Federal authority for Nuclear Regulation)** in Abu Dhabi they are giving approval for radiography; and
 - Source Movement Control log.

Gamma sources used for Non-Destructive Testing (NDT) shall in the case of IR 192, not exceed a strength of 30 curies on site without written approval from the ADCO HEALTH, SAFETY & ENVIRONMENT DIVISION.

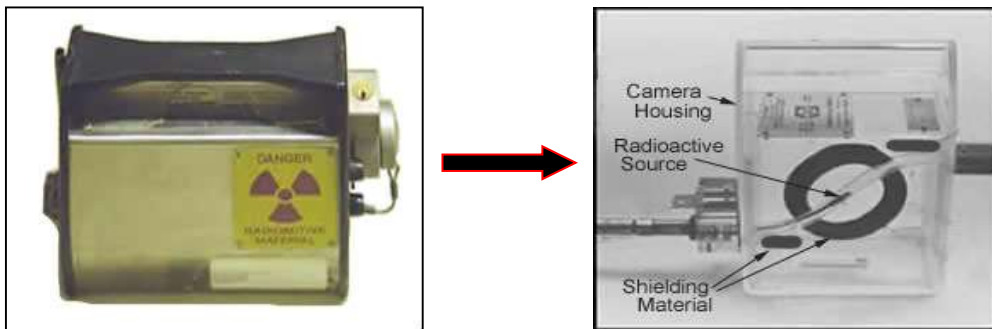
RADIO ISOTOPE (GAMMA) SOURCES & OPERATION:

- Iridium;
- Cobalt;
- Celerium;

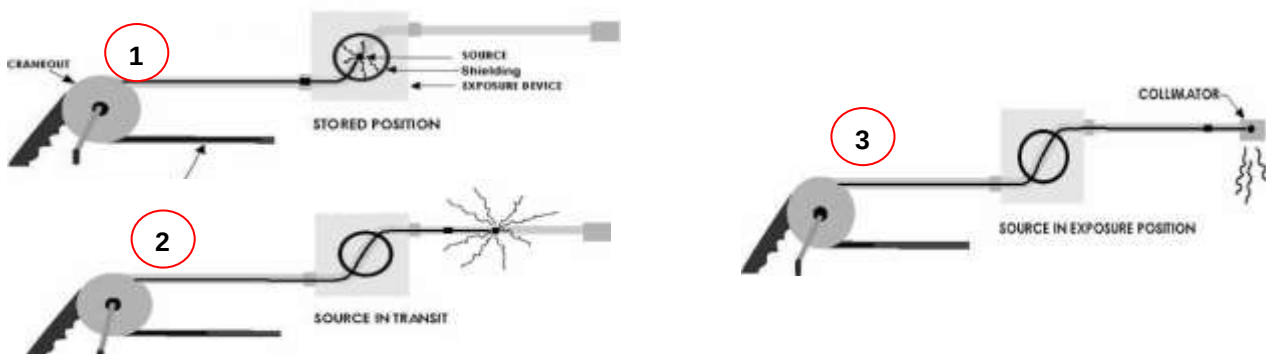
Physical size of isotope materials varies between manufacturers, Depending on the level of activity desired, a pellet or pellets are loaded into a stainless steel capsule and sealed by welding. The capsule is attached to short flexible cable called a pigtail.



The source capsule and the pigtail is housed in a shielding device referred to as a exposure device or camera. Depleted uranium is often used as a shielding material for sources. i.e. The exposure device for iridium-192 and cobalt-60 sources will contain 45 pounds and 500 pounds of shielding materials, respectively. When the source is not being used to make an exposure, it is locked inside the exposure device.



To make a radiographic exposure, a crank-out mechanism and a guide tube are attached to opposite ends of the exposure device. The guide tube often has a collimator at the end to shield the radiation except in the direction necessary to make the exposure. The end of the guide tube is secured in the location where the radiation source needs to be to produce the radiograph. The crank-out cable is stretched as far as possible to put as much distance as possible between the exposure device and the radiographer. To make the exposure, the radiographer quickly cranks the source out of the exposure device and into position in the collimator at the end of the guide tube. At the end of the exposure time, the source is cranked back into the exposure device. There is a series of safety procedures, which include several radiation surveys, that must be accomplished when making an exposure with a gamma source. See the radiation safety material for more information.



NORM – NATURALLY OCCURRING RADIOACTIVE MATERIALS:

- All operations involving the use of ionizing radiation's which are carried out on behalf of ADCO shall be performed under the ADCO "Permit To Work" system contained in Part 3 of this Manual.
- A Cold Work Permit together with a Radiation Certificate will be required for Source radiography inside a Restricted Area. While for X-rays radiography, which requires introducing high-tension transformer into the hazardous area, a HWP is required. For any radiography work outside a Restricted Area, only the Radiography Certificate is required.

RADIOGRAPHY CONTROL MEASURES:**Prior to radiography ensure that:**

- Identify and mark items for radiography;
- If possible close together or away from the current work site activity.
- Arrange access, lighting, transport, Permit to work (Restrict area need radiation certificate & Cold work permit, Outside of the restricted area only radiography certificate, X-ray with high tension transformer HOT Work Permit).
- Isolate / barricade the area.

Radiographic Personal must have the following items available at the site:

- A copy of license to handle the radiographic source;
- Emergency and operating procedures;
- Year to date radiation exposure records of the employee who perform the radiography and their training certification records;
- The type of radioactive source to be used for the project/ site and the activity of the source;
- Make and Model of survey equipment and their calibration records and the types of camera or source handling facilities to be used and the leak test records on the source and container.
- Radiographic Personal must consult appropriate contractor / company personal to inform them of the location, date and time of work and type of source. A valid PTW should be obtained. Radiography notification attached.

X-Ray Equipment:

- X- Rays are generated by electrical current and can be turned on and off unlike radioactive isotopes that emit radiation continuously.
- Radiation coming from a X-Ray machine is much greater than from radioactive isotopes.

Barricades and Signs:

All work areas must be barricaded with magenta and yellow tape with signs affixed reading: "CAUTION-RADIATION AREA" OR "CAUTION- RADIOGRAPHY IN PROGRESS"

- Signs must have magenta letters and symbols on yellow back ground.
- Radiographic Personal must erect a barricade so that doses do not exceed specific limits.
- Unauthorized personnel are prohibited inside the barricade while the source is exposed.
- At a minimum, all personal entering the barricade area must wear a radiation monitoring badge and a self-reading dosimeter.
- The construction engineer or designee must maintain a continuous patrol outside the barricade.

Reporting:

What to do in an incident involving radiation:

Announce it:

- Let everyone in the immediate area know that you have an incident involving radioactive material. Though it may be a little embarrassing to draw attention to the situation, it will help to prevent anyone from walking in to a potentially contaminated area.

Clean it:

- Wash any exposed skin and remove article of clothing that have become contaminated and place them on an absorbent pad or in a bag to reduce the spread of contamination.

WORK AREA CLASSIFICATION AND ENTRY RESTRICTION

- Any area in which doses of ionizing radiation are likely to exceed three-tenths of any dose limit for employees aged 18 years or over, or in which the instantaneous dose rate exceeds 7.5 μ Sv/hr shall be designated as a Controlled Area.
- A Controlled Area shall be set up, with boundaries clearly defined and entry restrictions imposed each time sources of ionizing radiation's are used. The boundaries of such Controlled Areas shall be at a

distance, defined by direct measurement or calculation, such that the instantaneous dose equivalent rate is less than 7.5 Sv/hr at the boundary.

- Clear warning shall be given each time a chemical source of ionizing radiation is to be unshielded or a radiation generator activated.

21. PRESSURE TESTING.

Pressure tests are applied to certain items of equipment, e.g. pipelines, vessels, drums, etc., to ensure that each item remains suitable for the proposed service. Pressure testing carried out using a liquid, usually water, as the pressurizing medium (hydraulic testing) as it is the least dangerous method, hydraulic testing shall be used wherever practicable.

HAZARDS:

- Test assembly rupture, creating flying fragments;
- Component or connector failure, creating missiles projected under force;
- Test hose failure including detachment, with consequential hose whip, striking people;
- Sudden release of the test medium (liquid, gas, vapor, dust or other substance under pressure) causing injury, e.g. burns, eye damage or pressure injection into bodily tissue;
- Unauthorized Entry;
- Lack of supervision;
- In competent person.

PRECAUTIONS FOR HYDRO TESTING:

Don't forget to tell the underline bullets as first priority:

- All fittings, joints, flanges, blinds & hoses shall be rated and capable of withstanding the combined weight of any equipment and the test medium.
- All the Gauges shall be calibrated and certified.
- Pressure safety Valve shall be installed in test line to prevent the test pressure being exceeded.
- Whip arrestor shall be provided for all joins.
- Controls/gauges must be located at a safe distance from the equipment to be tested and gauges shall be clearly visible to the operator controlling the pressure.
- No personnel other than those directly involved in the testing shall be allowed in the test area and it shall be cordoned off to prevent unauthorized entry. Warning signs are to be strategically posted on equipment being tested and at the perimeter of the test area. Lookout personnel are to patrol the area perimeters continuously during the testing operation.
- Testing shall only be performed under the direct supervision of a Responsible Person. All personnel involved with testing shall be aware of, and trained in, the procedures to be implemented, and familiar with the hazards and risks associated with the activity.
- Standard warning signs are to be strategically posted on equipment being tested and at the perimeter of the test area. Lookout personnel are to patrol the area perimeters continuously during the testing operation.
- A non-hazardous fluid for the leak test shall only be used; usually nitrogen or water.
- Leak test with a hydrocarbon gas or liquid; shall only be done in exceptional circumstances with the written approval of the Site Manager following a suitable and sufficient risk assessment.
- Systems that have contained air following the test shall be inserted prior to the introduction of hydrocarbons to avoid any possible explosive pockets during process phase.

"Note: The test pressure will be more than 2.5% of running pressure, e.g. if the running pressure is 10 bar, the test pressure will be 12.5%"

CALCULATION FORMULA TO DETERMINE BARRICADES SAFE DISTANCE

Safe distance = $(0.15) \times (D) \times (a)^{0.4} \times (p)^{0.6}$

Where 0.15 is the design pressure, D- Internal diameter (m), a- length/diameter of the piece (m), p- test pressure (bar);

Note: "A" this symbol known as exponent.

22. HOT WORK ACTIVITIES.

HOT WORK:

Any work that may produce the heat, Work that involves continues or potential source of ignition. (E.g. Cutting, Grinding, welding, sandblasting, etc);

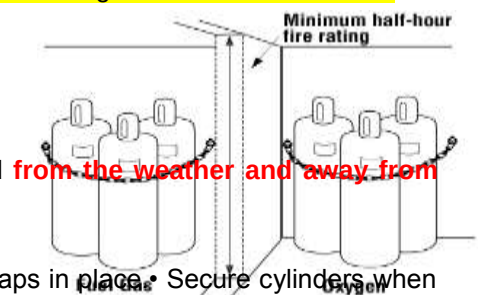
HANDLING, STORE, USE & DISPOSAL OF COMPRESSED GAS CYLINDERS:

CYLINDER FITTINGS:

- Valves and fittings should be kept clean, and care taken to ensure no grit or foreign matter is allowed to remain on them.
- Cylinders having faulty outlet valve connections, e.g. damaged threads, immovable valve spindles, must be returned immediately to stores with a note stating the Cylinder number, nature of the fault and whether the cylinder is charged.
- Under no circumstances may the user of the cylinder attempt any repair whatsoever.
- Only standard valve keys may be used, cylinder valves shall always be opened slowly by gently tapping the key. Cylinder valves shall always be closed when the cylinders are empty or not in use. Keys with long leverage should never be employed to force a valve to close. If the valve leaks when closed it is usually due to grit and this can often be removed by opening the valve slowly and closing it sharply.
- Only automatic pressure regulators and pressure gauges as recommended by the gas cylinder supplier shall be fitted to oxygen and fuel gas cylinders. The adjustable screw on the regulator must always be released before the cylinder is opened. The cylinder valve must be closed before the regulator is removed.
- Only the manufacturer's recommended tip cleaner, not a hard metal reamer, should be used for cleaning of altering the blowpipe tip. Accumulated slag should be frequently removed during welding operations. The blowpipe tip should not be dipped into the molten metal or otherwise blocked as deformation of the tip may occur potentially leading to flash-back. **Oxygen and fuel gas hose lengths should be the same.**

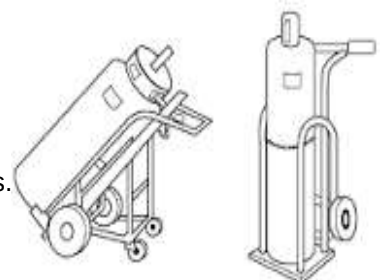
ALWAYS:

- Store cylinders in areas designated for that purpose.
- Segregate full and empty cylinders.
- Store cylinders in a dry, cool, well ventilated, secure area protected **from the weather and away from** combustibles materials.
- Use a cylinder cage or cradle to lift a cylinder.
- Store cylinders upright with valve outlet seals and valve protection caps in place. • Secure cylinders when in storage, transit, or use
- Ensure that there is adequate separation from combustibles as specified by national regulations
- Monitor the atmosphere in areas where gases may vent and collect.
- Use a first-in, first-out (FIFO) inventory system to prevent full containers from being stored for long periods of time.
- Move cylinders using a suitable hand truck or cart. (Refer to figure 1)
- Leave the valve protection cap and valve seal outlet in place until the cylinder has been secured in place and is ready to be used.
- Secure cylinders when in storage, transit, or use.
- When returning cylinders to the supplier, properly close the cylinder valve, replace and secure any valve outlet seals, and properly install the cylinder cap.



NEVER:

- Drag or slide cylinders, even for short distances.
- Drop cylinders or permit them to strike each other violently.
- Subject cylinders to mechanical shocks that may cause damage to their valves.
- Lift a cylinder by its cap using a sling or a magnet.
- Attempt to catch a falling cylinder.



Cylinder Trolleys

- Use cylinders as rollers for moving material or other equipment.
- Tamper with pressure-relief devices.
- Permit oil, grease, or other readily combustible substances to come in contact with cylinders, valves, or other equipment in oxidizer service.
- Remove any product labels or shipping hazard labels.
- Refill compressed gas cylinders. This is to be done only by qualified producers of compressed gases.

THE FOLLOWING SAFETY FEATURES MUST BE INCORPORATED:

- **Pressure regulators** that filter the gas and provide a constant delivery pressure in accordance with **BS 5741: 1979**.
- **Gas cylinders** shall be color coded in accordance with the content and as per the international color code system such as **BS 349 and 1319**.
- **Only hose** that conforms to **BS 5120** shall be used to connect the torch to the gas cylinders
- Pressure regulators, which incorporate safety diaphragms that burst before the bonnet is blown off.
- Pressure gauges with safety backs, which deflect the bursting, gases.
- Hose check valves (non-return valves) which allow gases to the blowpipe, but not back from it.
- Flashback arrestors which quench flash back flames and cut off the gas flow automatically, must be incorporated in both oxygen and fuel gas lines.
- Storage compounds for flammable gases shall have at least two means of exit at opposite ends of the storage area.
- Hoses shall be new, in very good working condition and comply with the following color coding:
 - **Blue** for Oxygen
 - **Red** for Acetylene
 - **Orange** for Propane
- Flashback arrestors which quench flash back flames and cut off the gas flow automatically, must be installed in both oxygen and fuel gas lines.
- Traveling with equipment attached to the cylinders is prohibited. Protective valve caps shall be fitted where provided.
- Whenever gas cylinder is to be left unattended, valves shall be closed.
- The main cylinder valve shall always be kept shut during transit and valve protection guards or caps shall be fitted.
- Safe work practices shall be always applied when working and dealing with gas cylinders and the necessary caution / safety signs are provided
- Cylinders shall never be lifted by their valve cap or guard. Cylinders shall not be rolled. Cylinders shall normally be stored upright and secured so that they will not fall.
- Safe work practices shall be always applied when working and dealing with gas cylinders and the necessary caution / safety signs are provided.
- Lengths of hose shall be kept as short as possible. Non-return check valves shall be fitted to each hose at the torch. Flashback arrestors designed to quench the flashback and release pressure shall be fitted to both fuel gas and oxygen regulators. Flashback arrestors shall be tested and replaced in accordance with the manufacturer's instructions.
- Cut-off valves shall also be incorporated for automatically shutting off the gas supply. Hoses shall not be dragged around sharp corners or placed where they can be run over by vehicles.

WELDING MACHING INSPECTION:

- Grounding/ Earthing- shall be properly penetrated to the ground.
- Third Party Inspection Certificate.
- ELCB (Earth leakage circuit Breaker).
- Emergency Stop Button.
- Drip Tray.
- Spark Arrestor.
- Fire extinguisher.

WELDING & GAS CUTTING HAZARDS:

- Risk due to toxic gas & fumes generated while welding or cutting.
- Fire or explosion started by flame, sparks and hot material from the activities.
- Electrical shock from arc welding equipment.
- Burn hazard due to heat generated while welding or cutting.
- Weld bead particulars or slag entering unprotected eyes during chipping.
- Inhalation of welding fumes.
- Falling of Gas cylinders.
- Radiation from UV and Infra-Red (flash eye).

PRECAUTION DURING WELDING / HOT WORK:

- Hot Work will start with a valid hot work permit.
- All valves, flanges, drains, canals etc. where gas leaks or presence of flammable atmosphere is possible should be covered.
- Frequent gas test to be carried out
- Wet the area with water and pressurized firewater hose to be kept near the hot work area.
- Area is always free from combustible and flammable materials.
- Keep the certified and valid fire extinguisher near the hot work area.
- Trained and certified fire watcher should be present.
- Equipment, which will be used for hot work to be inspected before starting up the job.
- All welding machine must be connected with GFCI (Ground Fault Circuit Interrupter) or ELCB (Earth Leakage Circuit Breaker) and approved spark arrester.
- All welding machines must be ground with static-earthing device.
- All cable must be properly insulated and electrode holder plugs and sockets must be in good condition.
- The equipment or pipe, spool should be supported on a secured and firm base during welding or grinding.
- All valves, flanges, drains, canals etc. where gas leaks or presence of flammable

SAFETY PRECAUTIONS DURING GAS CUTTING: *(Additional controls than the Welding Works)*

- In a gas welding or cutting operations, the oxyacetylene flames shall be ignited by the lighter specially designed.
- The pressure regulators and gauges shall be suitable and in good working condition.
- The cylinder valve must be closed before the regulator is removed.
- Flash back arrestors should be fitted both end with the hoses to prevent flash back.
- The adequate ventilation must be provided to expel toxic gases/fumes, if activities carried out inside a tank / vessel / any confined space.
- All hose and cable, plugs and sockets must be in good condition.

HAZARDS - ABRASIVE WHEEL:

- Wrong selection of grinding disk and Cutting disk
- Incompetent & inexperienced operator
- Flying object.
- Broken Disk
- Dust containing lead based paint.
- Rotating equipment.
- Electricity.
- Noise and Improper housekeeping.

PRECAUTIONS - ABRASIVE WHEEL:

- Ensure the spindle speed does not exceed the maximum speed marked on the wheel.
- Ensure fit the wheel on the spindle freely.
- Ensure that Disc RPM is greater than of grinding machine.
- Tighten the spindle nut enough to hold the wheel in place without distorting the flange.
- Use Cutting discs for cutting work and use grinding discs for grinding work.
- Do not stand in front of the rotated wheel.

- Do not run the grinding machine between legs.
- Provide protective guard for a moving abrasive wheel and maintain proper alignment with the wheel.
- For any bench mounted abrasive wheel, the wheel rest should be adjusted as close as practicable to the abrasive wheel, which shall be firmly secured.
- Before mounting inspect closely for damage, perform sound-test or ring-test to ensure free from cracks/defects.
- Do not adjust wheel while it is rotating and disconnect tools when changing the wheel.
- Do not use expired abrasive wheel and removed damage/crack wheel and tag it "do not use".
- Must be used eye and face protective device (goggles, face shield etc.).
- Wear the suitable respiratory protection also in case abrasive wheel generates dust.
- A sign shall be posted near all fixed abrasive wheel.

GAS GROUND COLOR OF CYLINDERS AS PER BS 349C CYLINDER COLOUR CODES:

Gas		Ground Color of Cylinder	Color of bands
Name	Symbol	Nominal	Nominal
Acetylene	C ₂ H ₂	Maroon	None
Ammonia	NH ₃	Black	Red & Yellow
Argon	A	Blue	None
Carbon Dioxide for temp. use	CO ₂	Black	None
Carbon Monoxide	CO	Red	Yellow
Chlorine	Cl	Yellow	None
Coal Gas	-	Red	None
Ethylene	C ₂ H ₄	Violet	Red
Ethylene oxide	C ₂ H ₄ O	Violet	Red & Yellow
Helium	He	Brown	None
Hydrogen	H	Red	None
Methane	CH ₄	Red	None
Neon	NE	Brown	Black
Nitrogen	N	Grey	Black
Oxygen	O ₂	Black	None
Propane	-	Red	None
Sulphur Dioxide	SO ₂	Green	Yellow

23. HOT TAPPING.

HOT TAPPING:

Hot tapping is a means whereby, under controlled conditions, a connection into a live system in service is made in a safe manner.

HOT TAPPING TECHNIQUE USED FOR MAKING CONNECTIONS INTO PIPELINES, VESSELS OR TANKS:

The term "hot tapping" refers to a method of making a connection into a pipeline, vessel or tank whilst in service. This attachment is concerned with safety aspects of this specialized operation in which a valve stub piece is welded to a pipeline, vessel or tank, and the connection is made by trepanning a hole using a specialized cutting machine. This operation calls for a high degree of expertise and experience, and should only be undertaken in very special circumstances, after all other means of making a connection have been explored and a suitable and sufficient risk assessment has been conducted and approved.

It is intended for those situations where it is extremely difficult to isolate, clean and gas free the equipment, e.g. on Main Oil Lines.

- “Hot Tapping” will only be performed after written authorization has been obtained from the Divisional Manager of the site concerned following completion of a suitable and sufficient assessment of the hazards and risks. The Field Area Safety Officer must also be informed of any proposed hot tapping operations. Following authorization of the risk assessment, a Hot Work Permit must be applied for.
- Before any hot tapping operation commences, and before a hot work permit is issued, the following conditions must be ensured:
 - The contents of the system shall not be degraded or decomposed by the application of localized heating and, sufficient flow can be maintained to dissipate heat.
 - If any air is likely to be within the system, the oxygen content shall be insufficient to create a flammable/explosive atmosphere at all times.
 - The material of the connection to be used and the valve size shall be correct for the proposed work.
 - The method of hot tapping to be used is suitable for the pressures, temperatures, and contents of the pipeline.
 - The condition of the system is such that it is of sufficient strength and thickness to receive the connection. Ultrasonic or X-ray testing of the system should be carried out to check if there is any corrosion.
 - Adequate firefighting appliances and trained, competent personnel are standing by.

THE FOLLOWING PROCEDURES SHALL BE STRICTLY ADHERED TO:

- Prior to welding the connection, adequate flow through the system must be established and its continuity safe guarded.
- After the connection has been welded to the system, and a valve fitted to the flanged end, the whole shall be hydrostatically pressure tested to prove the weld, the connection and valve.
- Clear, concise written instructions and a risk assessment shall be prepared for “hot tapping” work, incorporating a “hot tap” checklist as contained.

IMPORTANT:

Before undertaking a modification involving hot tapping, the recommended check-out procedure for modifications should be followed to ensure that it does not adversely affect the integrity of the system or its pressure relieving capability, i.e. sizing of safety devices.

REQUIRED CONDITIONS FOR HOT TAPPING:

- Before welding commences, it must be established that the equipment or pipeline, etc., has sufficient thickness and strength. In any event the metal thickness should not be less than 5mm and the material must be free from laminations, cracks, or other defects. In some cases the equipment may require strengthening to take the new connection.
- The atmosphere around the pipeline must be checked to ensure that it is gas free and that the area is free from combustible material. As a guide, the atmosphere up to a height of 2m above ground level or above the point at which welding is to take place, whichever is the greater, and within 15 meters radius at all levels up to this height, should remain free at all times from dangerous concentrations of gas or vapor. The wind direction should also be taken into account. The ground within 15 meters of the welding should be free from any flammable liquids or other combustible material. Continuous combustible gas monitoring is recommended.
- When welding underground pipelines, an excavation of adequate size, with suitable shoring and ladder access, and a secondary means of escape, should be provided. The excavation or pit should be adequately vented, and gas tested before entry and monitored throughout the operation.
- The reduced strength zone governs the temperatures and pressures inside the equipment to which such welding operations may be carried out during the welding operation and the measured wall thickness. These factors need to be determined in each individual case in order to ensure that at all times during the welding operation sufficient thickness of metal in the area remains unaffected so as to contain the internal pressure. As a guide, the pressure and temperature in the system should, where practicable, be kept below 3.3 bars (50 psig) and 120 OC (250 OF).
- This operation should not be carried out where the internal pressure is less than atmospheric or the temperature less than 0 OC (32 OF).

- Hot tapping operations should never be carried out on equipment which contains any flammable mixture of gases or vapors.
 - Any substances which may undergo any reaction or decomposition leading to a dangerous increase of pressure, explosion, or attack of the metal. In this connection, attention is drawn to the possibility that under certain conditions of temperature and pressure, acetylene, ethylene and possibly other unsaturated hydrocarbons may decompose explosively under the initiation of a welding hot spot.
 - Gaseous mixtures containing hydrogen where the presence of hydrocarbons or other flammable materials.
 - Oxygen enriched atmospheres in the presence of hydrocarbons or other flammable materials.
 - Compressed air in the presence of hydrocarbons or other flammable materials, such as lubricating oil carryover from an air compressor.
 - Process streams containing or contaminated with caustic soda or elemental sulphur if the concentration and temperature are such that the pipeline fabrication specification calls for stress relief.
 - Products in cryogenic service.
 - Pure oxygen either in liquid or gaseous form.
- Welding on pressure vessels, pipelines, or equipment in service should not be allowed in circumstances where the materials of construction are such that postweld heat treatment is necessary. Hot tapping should not be carried out on lines or equipment lined with special materials.
- Note: Welding procedures are most important and must be established and approved by the Senior Site Engineer prior to commencing any hot tapping operation. Paint or other contaminants should be removed from the surface of equipment prior to welding
- Hot tapping should not be carried out on any equipment where effective control over its contents cannot be exercised and such lack of control could make the operation dangerous, for example, any part of a flare line system.
- Drains in the vicinity of the welding operations must be effectively sealed.
- Flow in the line should be established before commencing operations, and maintained at least until after welding is completed and the metal has been cooled to the temperature of the flowing liquid.
- Because of the heavy weight of valves and drilling equipment used in these operations, it is preferable to mount them vertically. Where the connection cannot be made vertically, the engineering design should take into account the weight of the valve and drilling machine. In all cases the connection should be suitably supported.
- Before hot tapping is commenced, the cutter and its pilot bit should be inspected to ensure that it is in a satisfactory condition and the coupon recovery attachment is fitted correctly.
- All connections must be fitted with a block valve; the material of construction, flange rating, jointing and gland packing of which should be suitable for the equipment design and operating conditions. The connection and valve should be strength tested in accordance with the code requirements to prove the fitting welds and valve flange gaskets. Before commencing cutting operations the machine flange gasket and spindle stuffing box gland should be tested to prove they are leak-tight under the operating conditions. After the hydraulic test fluid has been drained from the stool, the assembly should be purged with nitrogen to prevent the formation of a flammable atmosphere during the cutting operation. Attention is drawn to the need to establish that the strength of the section of the equipment to which the connection is to be welded is adequate to withstand the external pressure loading prior to applying a strength test.
- Care should be taken in the design and selection of the branch connection. It should be long enough to accommodate the cutter and pilot and be designed to the appropriate code.
- Hot taps should not be carried out on:
 - Areas of the tank where there is, or may be, large accumulations of sludge;
 - Tanks which are coated or lined.
- **The following should be observed when hot tapping on tanks:**
 - Equipment should be adequately supported to ensure that no undue load is imposed on the connection piece.
 - Never pump in or out of tanks or agitate the contents of tanks while hot work is in progress.
 - Where agitators are fitted, they should be rendered inoperable.
 - Lock shut all valves on oil lines into and out of the tanks.
 - Avoid any operation, which might cause the operation or blanketing of vent valves.
 - Isolate steam to heating coils.
 - Maintain at least 1-meter liquid head above the hot work area.
 - Hot tapping is not permitted on the roof of a fixed or floating roof tank.

- The workmen must wear the appropriate protective clothing, e.g. overalls; face shields, welding goggles, gloves, gaiters, boots and aprons, etc. xvii. Welding must be done by the electric arc welding process and shall be carried out by an experienced coded welding operator under skilled supervision.
- A Hot Work Permit must be issued and countersigned by a Departmental Head.
- There must be at least ONE fireguard on duty at the site with suitable first aid and fire-fighting equipment, e.g. dry powder extinguisher and pressurized water hose.
- A Senior Engineering Supervisor, Safety and Loss Prevention Officer and a Senior Operations Supervisor should be present whilst hot tapping is in progress.
- A slightly modified form of Hot Tap Checklist extracted from the API PSD 2201 Petroleum Data Sheet "Welding or Hot Tapping on Equipment Containing Flammable and Other Hazardous Material" is attached and it is recommended that this be adopted.

24. WORKING AT HEIGHT.

DEFINITIONS:

- **SCAFFOLD:**

A temporary structure, which provide access, or from which person work, or which is used to support materials, plant or equipment;

- **BASE PLATE:**

A metal plate with a spigot for distributing the load from a standard or raker or other load bearing tube.

- **BAY:**

The space between the centre lines of two adjacent standards along the face of a scaffold.

- **BRACE:**

A tube placed diagonally with respect to the vertical or horizontal members of a scaffold and fixed to them to afford stability.

- **BRACE COUPLER:**

A coupler used for fixing braces, which may be a right angle coupler or any other coupler capable of sustaining a safe working load of 5kN.

- **BRICK GUARD:**

A metal or other fender filling the gap between the guard-rail, toe board and sometimes incorporating one or both of these components;

- **CHECK COUPLER OR SAFETY COUPLER:**

a coupler added to a joint under load to give additional security to the coupler(s) carrying the load.

- **COMPETENT SCAFFOLDER:**

A trained, qualified, and skilled person with assigned duties to perform scaffold erections, alteration, dismantling, or staging in a safe manner;

His tasks are performed under the supervision of a foreman scaffolder. A qualified scaffolder must have successfully completed an ADCO approved training course in this area.

- **COUPLER :**

A component used to fix scaffold tubes together.

- **FOREMAN SCAFFOLDER:**

A trained, qualified, and experienced person with assigned duties, but not limited to, the supervision of scaffold erections, alteration, dismantling, or staging in a safe manner. Foreman scaffolder must have successfully completed and ADCO approved advanced training course in this area.

- **GUARDRAIL:**

A member incorporated in a structure to prevent the fall of a person from a platform or access way.

- **JOINT PIN:**

An expanding fitting placed in the bore of a tube to connect one tube to another coaxially.

- **LEDGER:**

A longitudinal tube normally fixed parallel to the face of a structure in the direction of the larger dimensions of the scaffold. It acts as a support for the putlogs and transoms and frequently for the tie tubes and ledger braces and is usually jointed to the adjacent standards.

- **LIFT:**

The assembly of ledgers and transoms forming each horizontal level of a scaffold.

- **PARALLEL COUPLER :**

A coupler used to join two tubes in parallel.

- **PUTLOG :**

A horizontal tube with a flattered end, to rest in or on part of the brickwork or structure;

- **PUTLOG COUPLER :**

a coupler used for fixing a putlog or transom to a ledger, or to connect a tube used only as a guard-rail to a standard.

- **QUALIFIED INSPECTOR:**

An Client employee, who has been selected by the Area Manager and be trained officially on professional and practical scaffolding course mainly on "Scaffold Inspection and Tagging System.

- **REVEAL PIN:**

A fitting used for tightening a reveal tube between two opposite surfaces;

- **REVEAL TUBE:**

a tube fixed between two opposite surfaces by means of a threaded (expanding) fitting or by placing it across an opening in a structure to form an anchor to which the scaffold may be tied.

- **RIGHT ANGLE COUPLER:**

A load-bearing coupler used to join tubes at right angles.

- **SCAFFTAG:**

A simple means of indicating whether or not a scaffold is safe to use and at the same time provides various other information to help prevent overloading, etc.

- **SLEEVE COUPLER :**

An external coupler used to join one tube to another coaxially.

- **SOLE PLATE:**

A timber, concrete or metal spreader used to distribute the load from a standard or base plate to the ground.

- **STANDARD:**

A vertical or near vertical tube, which carries the scaffold's weight and loads imposed to the supporting structure.

- **SWIVEL COUPLER :**

A coupler used for joining tubes at an angle other than a right angle.

- **TIE OR TIE ASSEMBLY:**

The components attached to an anchorage, or the structure, or framed around a part of it, or wedged or screwed into it with a tie tube. Use to secure the scaffold to the structure.

- **TOEBOARD:**

An up stand at the edge of a platform, intended to prevent materials or operatives feet from slipping off the platform.

- **TRANSOM:**

A tube spanning across ledgers to form the support for boards or units forming the working platform, or to connect the outer standards to the inner standards;

- **UNIVERSAL COUPLER :**

A load-bearing coupler used for connecting two tubes together at right angles or in parallel.

MATERIALS STANDARD, INSPECTION AND RECORDING:

STEEL TUBES AND FITTINGS (SPECIFICATION NO. BS 1139):

- Tubes shall be straight, free from cracks, splits, surface flaws and other defects. The ends of the tubes shall be cut clean and square.
- All couplers and fittings shall be properly oiled and maintained. Nuts shall have a free running fit on their bolts. Bolts with worn or damaged threads shall be replaced.
- Aluminum tube shall not be used if bent more than 15mm in any 3m length. Aluminum tube shall not be straightened; the straight parts of the tube may be cut out and re-used, but the remainder shall be disposed of. Aluminum tube shall not be heated by welding or flame cutting etc.

SCAFFOLD BOARDS (BRITISH STANDARD SPECIFICATION NO. BS 2482):

- Standard boards are nominally 225mm wide and 37mm thick, but 50mm and 63mm are available.
- Boards shall not be painted or treated in any way, which shall conceal defects in them. The ends of all scaffold boards shall be bound and protected by metal hoops. Boards shall not be split up more than 300mm from the end with the metal hoop fixed and shall not be decayed or warped by more than 12mm. The parts affected may be cut out to obtain shorter boards that shall also comply with BS 2482 or acceptable equivalent.

FIRM FOUNDATION:

- All scaffolds shall be erected on a firm level and consolidated base. No excavation should be carried out near to any scaffolding supports.
- Base plates shall be used below each standard on surfaces where there is the possibility of standards deforming the surface.
- On surface which shall be penetrated by base plates which support standards, Sole plates of timber shall be used beneath the base plates in order to achieve a greater distribution of the load.
- Sole plates shall be at least 35mm thick and 219 mm wide. The sole plate area beneath any one standard shall be at least 1000 cm². But, if the ground is soft or has been distributed, this area shall be increased to 1700 cm².

BRACING:

- Bracing shall be in the form of ledger or cross bracing and longitudinal or façade bracing. Ledger bracing shall be positioned at alternative standards in a scaffold and each brace shall run from a ledger in one lift to the diagonally opposite ledger the lift above.
- Longitudinal bracing shall be in the form of a zigzag arrangement of tubes running from the bottom to the top of the scaffold between a pair of adjacent standards.
Or
- A continuous tube running from the bottom to the top of the scaffold at an angle of between 35 and 55 to the horizontal.
Or
- Individual tubes running from the bottom to the top of the scaffold between a pair of adjacent standards, all sloping the same way.

- Bracing assemblies shall be fixed along the face of the scaffold at intervals not exceeding 30m.

STABILITY:

- The prevention of inward and outward movement of the scaffold shall be achieved with ties to the façade at a number of points.
- Only one tie shall be temporarily removed and this shall be replaced before removing another.
- Ties shall be staggered in location wherever the building surface permits.

SAFE WORKING PLATFORM:

- All boards that make up the platform shall rest squarely and evenly on correctly spaced transoms, and be secured to prevent accidental displacement.
- All boards shall be same thickness.
- All boards shall have at least three supports unless its thickness or span is enough to prevent sagging under load. The maximum spacing is related to the thickness of the board.

Board thickness spacing:

- 32mm, spacing will be 0.990
- 40mm, spacing will be 1.520
- 51mm, spacing will be 2.590
- 63mm, spacing will be 3.250
- No board shall overhang its end support by more than four times its thickness; the minimum overhang shall be at least 50 mm. where men have to sit at the edge of the platform between the structure, the gap between the platform and structure shall not exceed 300 mm.
- Guard rail and toe board shall be positioned at every edge from which a person is liable to fall more than 2 meter.
- Guardrails shall be fixed on the inside of standards at a height of between 910mm and 1.15 m above the level of the platform.
- An intermediate guard rail shall be fitted midway between the guard rail and the top of the toe-board on all working platforms from which person may fall a distance of 2 meters, except for the platform used only for the passage of persons.
- The Toe boards shall be fixed on the inside of standards and shall be at least 150 mm high.
- The distance between guardrails and toe boards shall not exceed 765 mm.

SAFE LADDER ACCESS:

- Access ladders shall stand on firm and level bases at an angle of 4 units vertical to 1 unit horizontal (that is 75 degree to the horizontal), they shall be secured by their stiles to the platforms to which they give access to prevent movement.
- Ladder clamps or lashing shall be used to secure ladders in place.
- Ladders shall project at least 1 meter above the landing place, having on rung level with or slightly above the landing.
- Ladders shall be placed inside a scaffold wherever possible, and landing places shall be provided vertical intervals of no more than 9.0 meter.
- The edges of Landings, through which the ladders pass, shall not exceed 500mm in width.

TAGGING SYSTEM-(SCAFFTAG PROCEDURE):**• SCAFFOLD UNDER CONSTRUCTION (RED TAG):**

During the construction of the scaffold the scaffolding Foreman or competent scaffolder must fix Scafftag holders to all approved access points to the scaffold. When the scaffold is incomplete, the scaffold is incomplete; the scaffold holder showing the international prohibition symbol and script “**DO NOT USE SCAFFOLD**” will be showing. The information will apply to all personnel not involved in the scaffold construction. All the Scafftag holders and inserts should be weather proof.

• CONSTRUCTION COMPLETE (GREEN TAG):

When construction is completed the scaffold is inspected to ensure compliance with statutory legislation and code of practice. If satisfied the Qualified Inspector completes the Green faced Scafftag, which means the scaffold, is “SAFE FOR USE”.

The status Scaffold tag contains the following data:

- Date erected with name competent scaffolder;
- Initials of scaffolding foreman ;
- Maximum loading in KN/m² or Kg/m²
- Date inspected, with name and initials of Qualified Inspector;

Note: *All entries on to the tag shall be made with a permanent ink pen.
All personal, who come in to contact with scaffolding, shall be trained in the use of the scaffolding Tagging system.*

- It may be the qualified inspector responsibility to enter the details and conditions of scaffolds inspected into a Scaffold Inspection register.
- Special purpose to be stated in the design drawings.

• **ON ALTERNATION OR MODIFICATION (YELLOW TAG):**

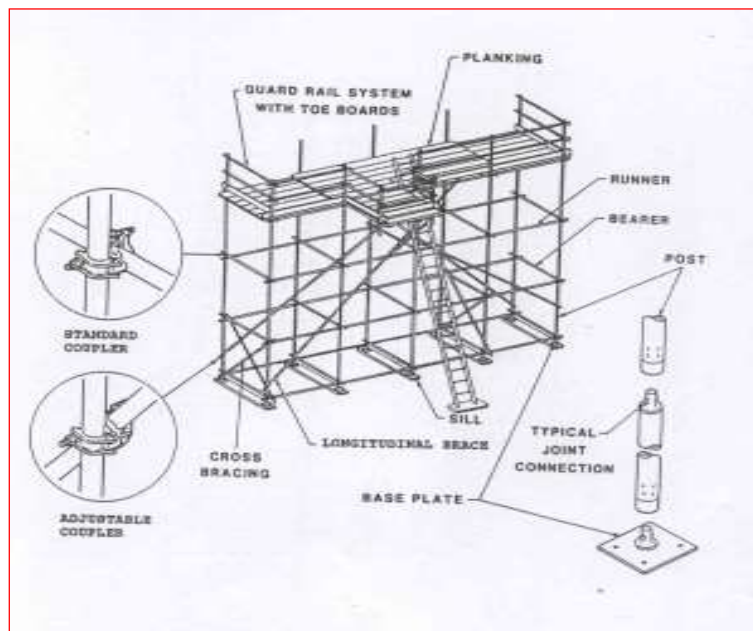
Ongoing inspections will need to be carried out every seven days of after adverse weather condition to conform the scaffold is safe for use to comply with statutory requirements. On satisfactory inspection the Qualified Inspector will sign and Date the reverse YELLOW side of status Scaffold tag and update the scaffold inspection register.

TYPES OF SCAFFOLDS:

1. Tower Scaffold.
2. Bridge Scaffold.
3. Cantilever Scaffold.
4. Independent Scaffold.
5. Bird-Cage Scaffold.
6. Truss-out Scaffold.
7. Mobile Scaffold.
8. Hanging Scaffolds.
- 9.

BASED ON LOAD CAPACITY:

- Very light duty- 75 kg/m²
- Light duty- 150 kg/m²
- Medium duty- 200 kg/m²
- Heavy duty- 250 kg/m²
- Special purpose- 300+ kg/m²



STANDARDS:

- | | | |
|----------------------|---|--------------|
| • Scaffold | : | BS 5973:1993 |
| • Scaffolding Clamps | : | EN74. |
| • Put log | : | BS1139. |
| • Scaffolding Plank | : | BS 2482. |
| • Tube | : | BS1139. |

SCAFFOLDING WORK HAZARDS:

- Slip, trip, fall.
- Falling From height.
- Falling objects.
- Flying Objects.
- Collapse of Scaffolding.
- Manual Handling.
- Overhead power lines.
- Working beneath the scaffolding work.

- Transportation of Material.
- Vehicles.
- Temperature (Heat Stress).
- Adverse weather.

SCAFFOLDING WORK CONTROL MEASURES:

- Provide Barricades and Signages.
- Ensure all access/egress routes are kept clear at all times, to maintain work area clean during and end of work.
- Maintain good housekeeping to avoid the slip, trip, and fall.
- Use full body harness with double lanyard and maintain 100% tie-off.
- Gin wheel and rope should be inspected and have 3rd Party certificate and do not exceed the maximum load.
- Secure all the materials and tools.
- Only competent person can doing the scaffolding works (Erection, Modification and Dismantling). Close supervision should be required. Good communication should be established among the crew.
- Follow Manual handling procedure.
- Maintain distance from overhead power lines.
- Do not allow anybody to work beneath the scaffolding work.
- Secure the material while transferring the material, Good Communication between the operator and banks man.
- Only Competent and certified (Valid license) person can drive the vehicle.
- Drink plenty of water, take rest in shaded area (resting shelter), take regular intervals, and follow the client procedure.
- Do not allow any body to work due to adverse weather like heavy wind. Stop the activity and wait for the further client instruction.

LADDER TERMINOLOGY:

Beam, Bed section, Heel, Shoes, Fly sections, Pads, Hooks & rungs;

TYPES OF LADDERS

- Straight ladder.
- Step ladder.
- Extension ladder.
- Roof/ Hook ladder.
- Folding ladder.

**LADDER HAZARDS:**

- Fall from height- falling of ladders, toppling of ladders to sideways, ladder base slipping out from the wall.
- Falling of Objects.
- Over reach
- Contact with overhead lines.

LADDER CONTROL MEASURES:

- Do not handle the ladder near overhead lines.
- Site on a solid, flat base, weight should only be supported on the styles, never on the rungs.
- Angle of the ladder should be 75 degree to the horizontal or at a ratio 1:4 distance away from the wall to height.
- Do not over reach from the ladder.
- Top of the ladder must be 1 meter (3 rungs) from the landing and secured properly.
- The base should also be secured or be footed by someone standing on the bottom rungs.
- Face the ladder when ascending or descending.
- Maintain 3 point contact on the ladder.

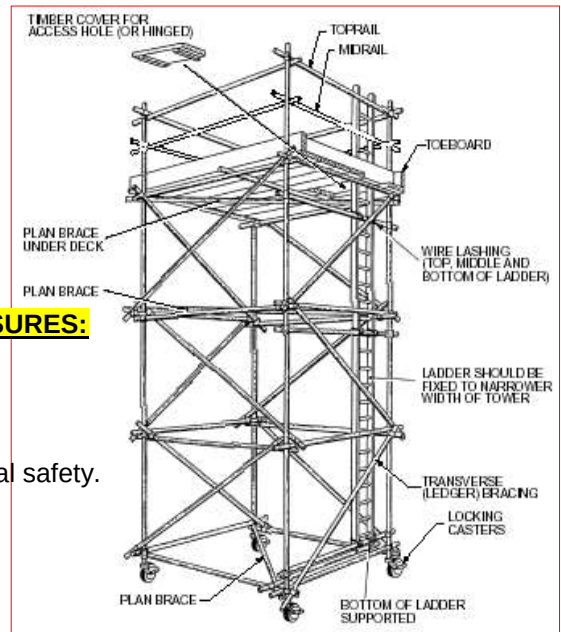
- Only 1 person shall climb the ladder at a time.
- Do not place the ladder in aisles or where there may be the danger or traffic.
- Do not stretch or reach beyond the side rails of ladder.
- Do not carry anything on hand while using the ladder.

MOBILE ELEVATED WORKING PLATFORM HAZARDS:

- Fall from the work platform.
- Falling of object from the platform.
- Collapse.
- Overturn.
- Contact with overhead power lines.
- Unauthorized use.

MOBILE ELEVATED WORKING PLATFORM CONTROL MEASURES:

- Vehicle to be placed on firm, stable ground.
- Keep distance from overhead power obstruction and line.
- Barricading MEWP including the cradle.
- Guard rail around the cradle and safety harness as an additional safety.
- Not driven with cradle raised.
- Do not store any loose items on the platform, secure all items.
- Must not be over loaded.
- Do not move MEWP While person on the top of the platform.
- Caster wheels shall be locked always whenever person working at height.
- Must be inspected periodically.
- Use restricted to authorized people.



MAN LIFT HAZARDS:

- Slip Trip Fall.
- Falling/Dropped Object
- Falling of Personal.
- Collapse of Man lift.
- Unauthorized Operation of Man lift.
- Contact with overhead Object.
- Working beneath the Man lift.



MAN LIFT PRECAUTIONS:

- Do not position man lifts between overhead hazards.
- Ensure personnel working on Man Lift are using full body harness with double hook lanyard & maintain 100 % tie off.
- Ensure the access gates or openings are closed.
- Stand firmly on the floor of the lift platform.
- Do not climb on or lean over the guard rails.
- Do not use planks, ladders, or other devices to increase size or working height of platform as working position.
- Do not tie off to adjacent structures or poles while in the lift platform.
- Do not exceed the load capacity limits. Take the combined weight of the worker(s), tools and materials into account when calculating the load.
- Do not use the man lift as crane
- Do not carry any object larger than the platform.
- Do not drive with the lift platform raised.
- Do not operate lower level controls unless permission is obtained from the workers in the lift.
- Do not exceed vertical or horizontal reach limits.
- Do not operate a man lift in high winds.

- Do not store any material on the man lift Platform.
- Trained & Authorized person shall be operated the man lift.
- Do not override hydraulic, mechanical, or electrical safety devices.
- Be aware of overhead clearance and overhead objects.
- Provide Barricades and Signages around the man lift working area.
- Flag man shall be assigned for the movement of the Man Lift.

25. CIVIL CONSTRUCTION ACTIVITES.

DEFINITIONS:

CIVIL CONSTRUCTION:

It is a segment of the broader construction industry focused on building core infrastructure like pipelines, telecommunications, sewers, water treatment systems, highways, roads, bridges, subway tunnels and light rail transit lines.

PILING:

It is a type of deep foundation, used to transfer the load to a deeper level than is possible with a traditional shallow foundation. Vertical columns of concrete, steel or wood, or a combination, are driven deep into the ground to give extra support to the building that sits on top.

PILING ACTIVITIES:

- Site Preparation
- Installation of piling Machine
- Using of Equipment
- Piling Operation;
- Placing of steel reinforcement cages and concrete by using crane and concrete pump;
- Dismantling of piling Machine

PILING OPERATION HAZARDS:

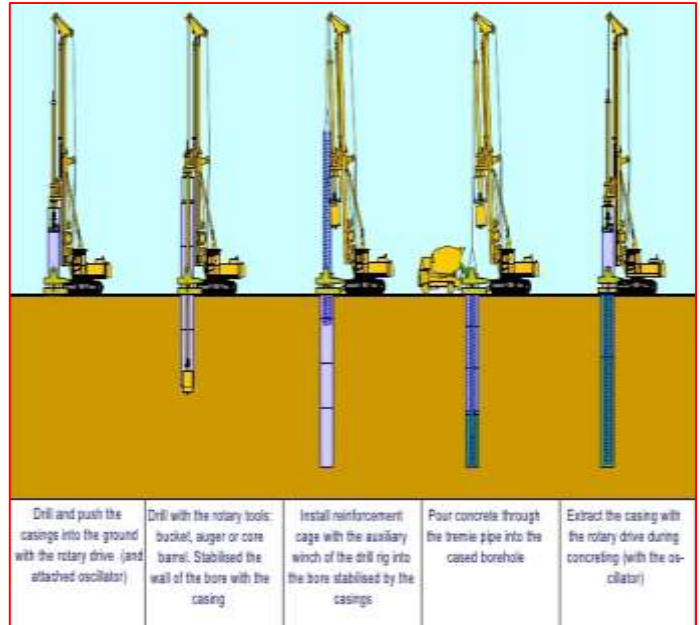
- Underground utilities
- Oil/fuel leak
- Suspended loads
- Slips, trips and falls.
- Rotary parts & pinch points.
- Improper Piling.
- Movement of machinery
- Failure to perform proper housekeeping.



PILING OPERATION CONTROL MEASURES:

- Driller must be competent & 3rd party certified.
- Inspect all tools and equipment for safety before use.
- Existing facility shall be marked with line powder.
- Have drip trays to contain any possible leak
- Keep area of lifting operations clear.
- Machinery must be properly maintained and serviced & daily inspection of machinery for oil leaks

- Restrict area of work to authorized personnel.
- Ensure proper housekeeping is maintained all time.
- Excavated area to be reinstated & gravel applied.
- Ensure proper disposal of trash & dry wastes and Keep work area free of excess materials and wastes.
- Proper housekeeping of hand tools & equipments.
- Keep work platform dry or provide rough surface.
- Stay aware of your footsteps & never run
- Communicate to all personnel prior to start the work.
- Never exceed manufacturer's speed, force or torque.
- Clear area of rotary operation from personnel.
- Remove any loose clothing or jewelleries.
- Use proper PPE including hand gloves
- Ensure all access/egress routes are kept clear at all times.
- Have proper fire extinguisher near ignition source.



HAZARDS-PLACING OF STEEL REINFORCEMENT CAGES AND CONCRETE BY USING CRANE AND CONCRETE PUMP:

- Damage to nearby structure/existing lines
- Suspended load / Swinging of load
- Failure of lifting gears
- Defective /unsuitable equipment
- Unstable ground condition & improper positioning of crane.
- Caught in-between
- Unauthorized entry
- Poor/Damaged lashing strap/slings
- Incompetent/untrained operators/ riggers.
- Falling materials.
- Dermatitis.
- Spillage on skin.
- Splashing of concrete
- Damage of delivery hose
- Concrete pipe clamp failure
- Hit by delivery hose

CONTROL MEASURE-PLACING OF STEEL REINFORCEMENT CAGES AND CONCRETE BY USING CRANE AND CONCRETE PUMP:

Lifting activity control measures shall be included in this control measure:

- Ensure the pile caps shall be covered and protected.
- Use hand tools/ mechanical means/aid to reduce direct contact with skin.
- All workers handling concrete shall wear dust mask, hand gloves & full sleeve coverall to avoid skin contact the delivery shall be at a minimum height from the pouring surface in order to avoid excessive splashing and eye contact with splashing concrete.
- Check hose for damage before being fitted.
- Fix the delivery hose fitting on a boom pump by a safety chain, sling or other retaining device.
- Use a delivery hose able to handle the pumping concrete pressure.

- Steel re-enforced hoses should be used with high pressure pumps on high- rise 'satellite' booms. Non re-enforced hoses should not be used on piston type pumps unless specified by the manufacturer
- Avoid sharp bends on hoses.
- Beware of structural failure of the boom caused when additional hose is added to the end of a concrete placement boom for pumping concrete.
- Use reducers to avoid overload of the hose or other parts of the unit.
- The pipe clamps used shall be able to sustain the maximum concrete pressure applied to the pipeline by the pump.
- Ensure that the locking pins are used and are engaged.
- All pipe clamps shall be regularly inspected by a competent person for signs of wear and fatigue.
- Pipe clamps which show any deformation or damage shall be immediately replaced.
- Pipe clamps that are manufactured with no provision for locking pins shall not be used.
- Clamps shall be locked as per the manufacturer's instructions and shall not be locked by hammering the quick release clamp lever, or by other methods which may cause fatigue of the clamp's metal.
- Hold the hose below head level, close to the pouring point.
- Ensure that co-workers stay away from the delivery hose.
- Appropriate PPE shall be used including activity based such as Gum boots.

HAZARDS: PILE HEAD BREAKING USING AIR COMPRESSOR, JACK HAMMER& POWER TOOLS.

- Vibration.
- Electricity.
- Over loading of the compressor.
- Contact with flying particle and Exposure to dust.
- Uncontrolled release of pressure.

CONTROL MEASURE: PILE HEAD BREAKING USING AIR COMPRESSOR, JACK HAMMER& POWER TOOLS.

- Provide proper scaffold platform with sufficient guardrails and access.
- Do not wear loose clothes during the operation.
- Use suitable safety harness if height is more than 1.8 meters.
- Ensure working platform is provided with toe boards.
- Do not allow any work below the pile breaking area.
- The area must be cordoned off.
- Ensure cushioning to the jack hammer.
- Do periodic rotation of the worker in the sufficient interval.
- Provide ELCB in the circuit.
- Purchase double insulated power tools otherwise ensure proper earthing.
- Ensure periodical maintenance of the power tools.
- Follow manufacturer's instructions to avoid over loading.
- Conduct training about proper usage and to avoid overloading.
- Provide required Signage & Information Tags.
- Provide adequate required PPE's for protection against flying particles e.g. (Face shield, Gloves, Apron etc.)
- Proper clamping arrangement must be done to connect the hoses.
- Ensure periodical maintenances of compressor.
- Do regular Inspection of Compressor as per inspection checklist of manufactures.

SHUTTERING & DE-SHUTTERING- HAZARDS:

- Failure of shuttering material,
- Unsecured shutters,
- Protruding edges,
- Improper use of hand and power tools,
- Use of Homemade tools,

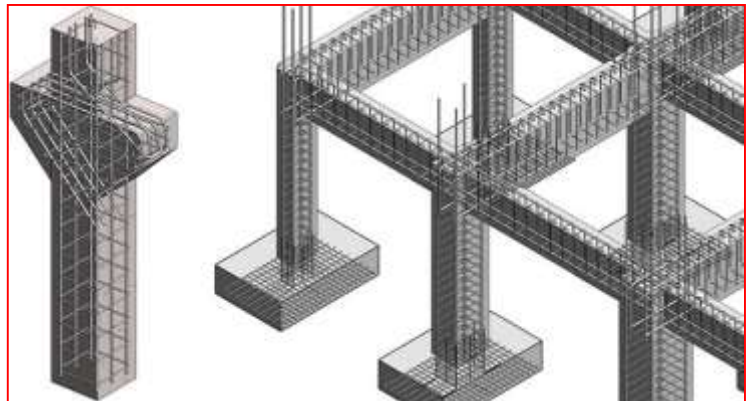
- Damaged electrical cables,
- Electrocution,
- Poor access or egress,
- Protruded nails on the shuttering,
- Failure to follow safe method of de-shuttering,

SHUTTERING & DE-SHUTTERING- CONTROL MEASURES:

- Proper access and egress shall be constructed by site team prior to start work
- Maintain the access way free of obstruction and material storage.
- Ensure all workers are competent for this job.
- Follow design of the shuttering works; Civil engineer shall design and inspect the shuttering system.
- Maintain good housekeeping.
- All dangerous sharp edges shall be covered sharply.
- All personnel should wear mandatory PPE and job specific PPE.
- All unused nails and clamps shall be removed from site.
- De-nailing shall be done after de shuttering.
- All hand tools and powered tools shall be inspected before receiving from store
- Color coding of power tools shall be done by electrician under the close supervision of safety officer.
- Personnel are not allowed to fabricate tools at site.
- All homemade tools shall be discarded from site
- All electrical leads will be damage free, use industrial socket and elevate the cable as to avoid the tripping.
- Inspection of shuttering structure supports and clearance shall be done prior to start concreting work.
- Follow safe sequence of removal of shuttering.
- Ensure open edges and openings are barricaded
- All surplus materials shall be removed from site.
- Avoid stacking of materials on high elevations which may cause collapse of material
- Used lumbers & ply wood should de-nail and properly stored.

RE-BAR WORKS-HAZARDS:

- Protruding edges,
- Inadequate access to workplace,
- Use of Power tools,
- Improper PPE
- Untrained / uncertified operators,
- Damaged Equipment



RE-BAR WORKS-CONTROL MEASURES:

- Provide re-bar caps on all steel rods end.
- Restrict all unauthorized entry in the area
- Excessive tension shall not be applied to tie- wire causing breakage.
- Wire shall be tied properly in/down.
- Maintain the access way free of obstruction.
- Provide appropriate platform above reinforcement for the movement of workers.
- Color coding of power tools shall be done.
- Use appropriate tools/equipment for the job.
- All hand tools and power tools shall be inspected before receiving from store.

CONCRETE WORKS BY CONCRETE PUMP-HAZARDS:

- Concrete spillage on skin.
- Splashing of concrete
- Damage of delivery hose.
- Concrete pipe clamp failure

- Hit by delivery hose.

CONCRETE WORKS BY CONCRETE PUMP-CONTROL MEASURES:

- Use hand tools/ mechanical means/aid to reduce direct contact with skin.
- All workers handling concrete shall wear dust mask, hand gloves & full sleeve coverall to avoid skin contact.
- The delivery shall be at a minimum height from the pouring surface in order to avoid excessive splashing and eye contact with splashing concrete.
- Check hose for damage before being fitted.
- Fix the delivery hose fitting on a boom pump by a safety chain, sling or other retaining device.
- Use a delivery hose able to handle the pumping concrete pressure.
- Steel re-enforced hoses should be used with high pressure pumps on high- rise 'satellite' booms. Non re-enforced hoses should not be used on piston type pumps unless specified by the manufacturer
- Avoid sharp bends on hoses.
- Beware of structural failure of the boom caused when additional hose is added to the end of a concrete placement boom for pumping concrete.
- Use reducers to avoid overload of the hose or other parts of the unit.
- The pipe clamps used shall be able to sustain the maximum concrete pressure applied to the pipeline by the pump.
- Ensure that the locking pins are used and are engaged.
- All pipe clamps shall be regularly inspected by a competent person for signs of wear and fatigue.
- Pipe clamps which show any deformation or damage shall be immediately replaced.
- Pipe clamps that are manufactured with no provision for locking pins shall not be used.
- Clamps shall be locked as per the manufacturer's instructions and shall not be locked by hammering the quick release clamp lever, or by other methods which may cause fatigue of the clamp's metal.
- Hold the hose below head level, close to the pouring point.
- Ensure that co-workers stay away from the delivery hose.
- Appropriate PPE shall be used.

26. INSULATION ACTIVITY.

FUNCTION OF INSULATION:

Insulation will keep the heat of product, without insulation oil will be wax.

INSULATION HAZARDS:

- Dropped/falling material..
- Improper handling of cladding sheet.
- Inhalation of airborne fibrous.
- Improper hand tools and power tools.
- Improper Manual handling.
- Slip, trip.
- Improper Housekeeping.

INSULATION CONTROL MEASURE:

- Erect barriers and Signages around the work site
- Secure all the materials before leaving the work site. Ensure unauthorized personnel are restricted from the work area, Postpone work during adverse weather condition.
- Worker must be competent to use proper tools; Ensure proper gloves shall be worn by the sheet metal fitters, helpers while handling the sheet metals.
- Suitable personnel protective equipment to be used, Ensure good housekeeping standards maintained. Ensure that waste insulation materials are bagged ASAP.
- Inspect all tools and equipment for safety prior to use, Tools & equipment must be tested and certified fit for use and within defined test period.



- Ensure good housekeeping standards are maintained; secure all loose flooring before start the work. Clean spills immediately.
- Ensure all access/egress routes are kept clear at all times, to maintain work area clean during and end of work.

27. ABRASIVE BLASTING.

Abrasive blasting which is also commonly referred to as sand blasting is a process in which a medium is used to smoothen out or polish a rough surface. In a world full of machinery and metal parts, rust and corrosion are a common pestilence. Thankfully, abrasive blasting is a quick and efficient solution to getting these metal parts functioning and looking their optimum best. This process can also be used to prepare surfaces that need repainting.

TYPES OF BLASTING:

- Silica Sand or Silicon Dioxide. Silicon Dioxide refers to ordinary sand, which is also known as silica or quartz.
- Soda. Soda sandblasting refers to the use of baking soda or bicarbonate of soda in the blasting process.
- Steel Grit.
- Glass Bead.
- Bristle Blasting.

SILICA SAND OR SILICON DIOXIDE:

Silicon dioxide refers to ordinary sand, which is also known as silica or quartz:

Silicon Dioxide refers to ordinary sand, which is also known as silica or quartz. Silica Sandblasting was a commonly used method of removing impurities from surfaces; this is because sand particles are almost the same size and the edges of the particles are sharp, hence making this type of grit efficient in abrasive blasting. However, this kind of abrasive blasting is no longer a popular choice as there are other blast mediums that work better than sand, and also, silica can cause some types of respiratory diseases.

SODA:

Soda sandblasting refers to the use of baking soda or bicarbonate of soda in the blasting process. Soda is used as an abrasive to remove rust from metals without causing depression or damaging the metal beneath the rough surface. Soda is also a great grit to use on delicate materials that may be destroyed by tougher abrasives.

STEEL GRIT:

In this process, steel grit is used as an abrasive in the removal of paint and rust from steel metals. The use of steel leaves a smooth finish. Steel grit is often preferred due to its fast cutting nature.

GLASS BEAD:

For a matte and satin finish glass bead sandblasting is best; this is because this grit has very fine materials that polish the surface of the object being sandblasted. This type of abrasive blasting is often used on cabinets.

BRISTLE BLASTING:

- In this type of abrasive blasting, no separate medium is used. Instead, steel wire bristles are rotated on a surface. This rotating action aids in the removal of impurities, hence leaving the surface smooth. This method is often used to clean metal surfaces with some form of corrosion.
- There are various types of abrasive blasting including, silicon dioxide, soda, steel, bristle, glass bead and much more. All these different abrasive blasting methods usually use a specific type of grit to achieve the desired results, hence the need to determine the correct technique to use. For instance, if you want to remove old paint from Pipe line or vessel or tank etc, so that you can repaint it, consider using the beads abrasive blasting method. This is because beads will delicately remove the surface paint without damaging the vehicles metallic body.

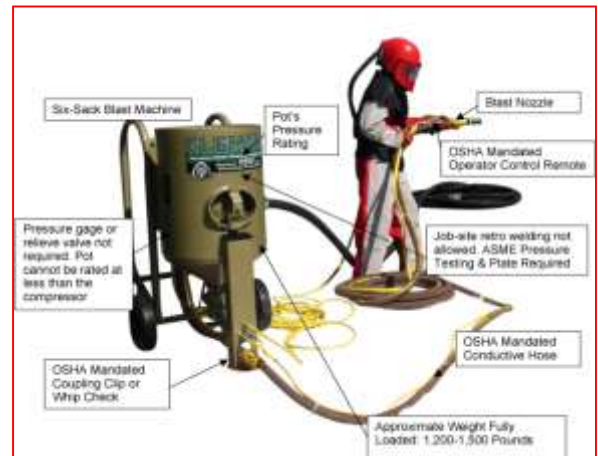
FUNCTIONS OF DEAD MAN SWITCH:

Dead man switch is a control switch, which is connected with sand blasting nozzle (gun) to control the flow from sand blasting nozzle (gun) while sand blasting. In case the hose nozzle loss from the sand blaster hands automatically the system will cut off and the individual and the property will be safe.

- The nozzle shell is electrically grounded to prevent static electrical discharge or shocks to the operator.
- Airline spray guns: airline spray gun operates at very high pressures: 140.6 to 170Kg/Sq. Cm (2,000 to 2,500 Psi). They are extremely hazardous, since the jet is strong enough to slice through human flesh. The control switch or lever may have a catch device to hold switch or lever in the ON position; however, it shall be so adjusted that if it is dropped from height of 61 Cm (2Ft.) to a soil surface the device will immediately disengage, thereby shutting of the gun.
- The spray gun shall also be equipped with a safety catch that shall be activated when the gun is not in use.

BLASTING HAZARDS:

- Use of hand held power tools, and air compressor.
- Hose breakage due to weak connections or improper hoses.
- Improper flow of breathing air through the air line respirators.
- Exposure from Dust/Noise,
- Material /tools drop down from height.
- Improper handling / misuse of garnet.
- Personnel Injury/Property Damage.
- Slip, trip & fall.
- Injury due to incorrect handling during removal of materials.

**BLASTING CONTROL MEASURES:**

- All equipments/tools involved in this activity are inspected by the competent person and current color coded.
- Assured grounding /earthing system provided to the hopper and other equipment that require.
- Only competent personnel to perform the sand blasting job.
- Barricades and Sign boards "**Danger! Blasting works in progress**" to be provided.
- Hoses to be secured with heavy duty couplings and firmly secured. Whip checks to be used.
- Breathing apparatus with filter system to be used.
- The quality of breathing air used for airline respirator is monitored on daily basis. It is tested and certified by 3rd party.
- The switch shall not be tied or bound with nozzle for continuous operation.
- Covered with tarpaulin (outside blasting) to prevent spreading of garnet dust all over the area.
- Removal of the used garnet done at the end of every shift
- Personnel shall be used dust mask as recommended MSDS.
- Ear protection must be used.
- Garnet stored in designated enclosed areas..
- Required sing boards and MSDS provided at the storage location.
- All used garnet stored in a different location are identified by sing boards.
- All maintenance activities on the installations and (gear) motors should be carried out while the installation is switched off.
- Ensure adequate safe access and Egress
- Use appropriate PPE
- Ensure all area shall be free from material & maintain good housekeeping.
- Secure all hoses to avoid tripping hazard.

28. REFRACTORY WORKS.

Material that can withstand very high temperatures 3000°C or more without degrading or softening; Refractory materials include certain ceramics and super alloys, and are used in heat insulation of furnaces.

REFRACTORY HAZARDS:

- Failure of Tools & Equipment.
- Hose Joint Removal / Hose Failure.
- Missing whip checks.
- Hose breakage due to weak connections or improper hoses.
- Lack of Training and lack of Knowledge about the task.
- Vibration.
- Electrocution.
- Entangled in rotating parts.
- Expose to dust.
- Flying particles.
- Skin Contact, Hand cut, Absorption, Injection and Inhalation.
- Slip, trip & fall.



REFRACTORY CONTROL MEASURES:

- All tools & equipment to be inspected by a competent person.
- Hoses to be secured with heavy duty couplings and firmly secured. Whip checks and spilt pins to be used.
- Hoses used are to be rated/ designed for greater pressure than the operating pressure.
- Appropriate PPE Shall be used as per MSDS.
- Only competent to perform the gunning & casting work.
- All fittings (Valves/Regulators) and hoses will be the correct rated capacity and checked visually for any damage.
- Hoses used are designed for greater pressure than the operating pressure
- Unauthorized entry shall be prohibited in the work area.
- Ensure hand gloves for the brick cutting operators as per MSDS.
- Don't continue operation for a long time, take a break.
- Safety guard in place if guard is loose tight properly.
- Assigned competent person to operate the machine.
- No loose clothing allowed in the vicinity of the cutting activities and Jewelers not to be worn at work.
- All electrical connection must be connected through ELCB.



29. MANUAL HANDLING.

The **Manual Handling** Operations Regulations define it as 'any transporting or supporting of a load (including the lifting, putting down, pushing, pulling, carrying or moving thereof) by hand or by bodily force'.

Manual handling causes over a third of all workplace injuries. These include work-related **musculoskeletal disorders (MSDs)** such as pain and injuries to arms, legs and joints, and repetitive strain injuries of various sorts.

DEFINITIONS:

• **ERGONOMICS:**

The relationship of science between worker, equipment and working environment;

• **ERGONOMIC ASSESSMENT:**

It Depends on TILE (Task, Individual, Load & Environmental).

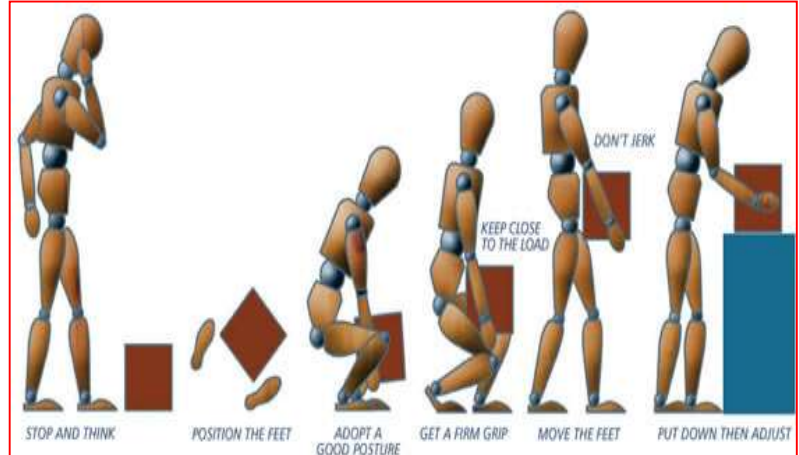
• **MANUAL HANDLING IMPORTANCE:**

Manual handling injuries can have serious implications for the employer and the person who has been injured. They can occur almost anywhere in the workplace and heavy manual labor, awkward postures, repetitive movements of arms, legs and back or previous/existing injury can increase the risk.

MANUAL HANDLING HAZARDS:

To help prevent manual handling injuries in the workplace, you should avoid such tasks as far as possible. However, where it is not possible to avoid handling a load, employers must look at the risks of that task and put sensible health and safety measures in place to prevent and avoid injury.

- Back pain,
- Fatigue,
- Overloading,
- Improper manual handling technique.
- awkward postures,
- repetitive movements of arms & legs,
- Lack of awareness.
- Slip, falls,



FOR ANY LIFTING ACTIVITY:

Always take into account:

- Individual capability
- The nature of the load
- Environmental conditions
- Training
- Work organization

IF YOU NEED TO LIFT SOMETHING MANUALLY:

- Reduce the amount of twisting, stooping and reaching;
- Avoid lifting from floor level or above shoulder height, especially heavy loads;
- Adjust storage areas to minimize the need to carry out such movements;
- Consider how you can minimize carrying distances;
- Assess the weight to be carried and whether the worker can move the load safely or needs any help – maybe the load can be broken down to smaller, lighter components.

IF YOU NEED TO USE LIFTING EQUIPMENT

- Consider whether you can use a lifting aid, such as a forklift truck, electric or hand-powered hoist, or a conveyor;
- Think about storage as part of the delivery process – maybe heavy items could be delivered directly, or closer, to the storage area;
- Reduce carrying distances where possible.

GOOD HANDLING TECHNIQUE FOR LIFTING:

There are some simple things to do before and during the lift/carry:

- Remove obstructions from the route.
- For a long lift, plan to rest the load midway on a table or bench to change grip.
- Keep the load close to the waist. The load should be kept close to the body for as long as possible while lifting.
- Keep the heaviest side of the load next to the body.
- Adopt a stable position and make sure your feet are apart, with one leg slightly forward to maintain balance.

Think before lifting/handling:

Plan the lift. Can handling aids be used? Where is the load going to be placed? Will help be needed with the load? Remove obstructions such as discarded wrapping materials. For a long lift, consider resting the load midway on a table or bench to change grip.

Adopt A Stable Position:

The feet should be apart with one leg slightly forward to maintain balance (alongside the load, if it is on the ground). Be prepared to move your feet during the lift to maintain your stability. Avoid tight clothing or unsuitable footwear, which may make this difficult.

Get A Good Hold:

Where possible, the load should be hugged as close as possible to the body. This may be better than gripping it tightly with hands only.

Start In A Good Posture:

At the start of the lift, slight bending of the back, hips and knees is preferable to fully flexing the back (stooping) or fully flexing the hips and knees (squatting).

Don't Flex The Back Any Further While Lifting:

This can happen if the legs begin to straighten before starting to raise the load.

Keep The Load Close To The Waist:

Keep the load close to the body for as long as possible while lifting. Keep the heaviest side of the load next to the body. If a close approach to the load is not possible, try to slide it towards the body before attempting to lift it.

Avoid Twisting The Back Or Leaning Sideways, Especially While The Back Is Bent:

Shoulders should be kept level and facing in the same direction as the hips. Turning by moving the feet is better than twisting and lifting at the same time.

Keep The Head Up When Handling:

Look ahead, not down at the load, once it has been held securely.

Move Smoothly:

The load should not be jerked or snatched as this can make it harder to keep control and can increase the risk of injury.

Don't Lift Or Handle More Than Can Be Easily Managed:

There is a difference between what people can lift and what they can safely lift. If in doubt, seek advice or get help.

Put Down And Then Adjust:

If precise positioning of the load is necessary, put it down first and then slide it into the desired position.

30. HEAT STRESS.

Heat stress occurs when the body's means of controlling its internal temperature starts to fail. As well as air temperature, factors such as work rate, humidity and clothing worn while working may lead to heat stress. Therefore it may not be obvious to someone passing through the workplace that there is a risk of heat stress.

- **DEHYDRATION:**

The body excretes too much water, **leading to dehydration.**

- **EFFECTS OF HEAT STRESS:**

Heat stress can affect individuals in different ways, and some people are more susceptible to it than others.

- **TYPICAL SYMPTOMS ARE:**

- An inability to concentrate
- **Muscle cramps**
- **Heat rash**

- Severe thirst - a late symptom of heat stress
- Fainting
- **Heat exhaustion** - fatigue, giddiness, nausea, headache, moist skin
- **Heat stroke** - hot dry skin, confusion, convulsions and eventual loss of consciousness. This is the most severe disorder and can result in death if not detected at an early stage.

HEAT STRESS PREVENTION:

• **PROVIDE MECHANICAL AIDS:**

Provide mechanical aids where possible to reduce the work rate. Regulate the length of exposure to hot environments by:

- Allowing employees to enter only when the temperature is below a set level or at cooler times of the day;
- issuing permits to work that specify how long your employees should work in situations where there is a risk;
- Providing periodic rest breaks and rest facilities in cooler conditions.

• **PREVENT DEHYDRATION:**

- Working in a hot environment causes sweating which helps keep people cool but means losing vital water that must be replaced. Provide cool water in the workplace and encourage workers to drink it frequently in small amounts before, during (this is not possible in some situations e.g. respiratory protective equipment use or asbestos removal) and after working.
- Urine color chart shall be provided and advice employees to make sure their urine color are safe zone.

• **DRINKING WATER & SHADED REST AREA:**

- Make sure that all workforce having individual Thermal water bottles and Insulated Water Cooler Jug will be provide each crew at easily accessible location.
- Adequate shaded & ventilated rest area will be provided at working sites for employees.

• **TRAINING**

Provide training for your workers, especially new and young employees telling them about the risks of heat stress associated with their work, what symptoms to look out for, safe working practices and emergency procedures.

• **ACCLIMATISATION:**

Allow workers to acclimatize to their environment and identify which workers are acclimatized/assessed as fit to work in hot conditions.

• **IDENTIFY WHO IS AT RISK**

- Identify employees who are more susceptible to heat stress either because of an illness/condition or medication that may encourage the early onset of heat stress, e.g. those with heart conditions.
- Advice may be needed from an occupational health professional or medical practitioner.

• **MONITOR HEALTH:**

Monitor the health of workers at risk. Where it is considered that a residual risk remains after implementing as many control measures as practicable, you may need to monitor the health of workers exposed to the risk. You should then seek advice from occupational health professionals with a good working knowledge of the risks associated with working in heat stress situations.

• **SITE WORKING HOURS DURING SUMMER:**

- Work schedules shall be modified to avoid exposure to intense heat. Mid-day break shall be followed As per Abudhabi MOL (12.30 hrs. to 15.00 hrs.).
- Site working hours will be displayed at site notice board,

• **TOILET:**

- An adequate number of toilets shall be provided at all times. The number provided shall be sufficient to ensure that facilities are available without delay at all times. Toilet facilities shall be arranged to ensure privacy for the user. They and the rooms containing them shall be ventilated and lit, and be kept in a clean and orderly condition.

• **FLAG SYSTEM SHALL BE FOLLOWED ACCORDING TO THE PER TWL MONITORING:**

LOW RISK- GREEN FLAG	MEDIUM RISK-YELLOW FLAG	HIGH RISK-RED FLAG
TWL >140	TWL $\geq$ 115 $\leq$ 140	TWL <115
Safe for all continuous self-paced work	Light work –safe for continuous.	Light work 45 Minutes work - 15 Minutes rest /
	Heavy work 40 minutes work - 20 Minutes rest minutes	Heavy work 20 minutes work - 40 Minutes rest

31. ABBREVIATIONS.

SL NO.	SHORT FORM	ABBREVIATIONS
1	NEBOSH	National Examination Board in Occupational Safety and Health.
2	IOSH	Institution of Occupational Safety and Health.
3	OSHA	Occupational Safety and Health Administration
4	SMART	S: Specific M: Measurable A: Achievable R: Realistic T: Time scale
5	COSHH	Control of Substance Hazard to Health.
6	MSDS	Material Safety Data Sheet.
7	COMAH	Control of Major Accident Hazards.
8	ALARP	As Low As Reasonably Practicable.
9	SFAIRP	So Far As Is Reasonably Practicable.
10	HAZOP	Hazard Operability.
11	HAZID:	Hazard Identification.
12	IDLH	Immediate Danger to Life and Health.
13	NIHL	Noise Induced Hearing Loss.
15	WRULD:	Work Related Upper Limb Disorder.
16	HVAS:	Hand Arm Vibration Syndrome.
17	MSD:	Muscular Skeletal Disorders.
18	CPR:	Cardio Pulmonary Resuscitation.
19	LEV:	Local Exhaust Ventilation.
20	LEL:	Lower Exposure Limit.
21	PPE:	Personnel Protective Equipment.
22	PPM:	Parts Per Million.
23	SIMOP	Simultaneous Operation.
24	HIRA	Hazard Identification Risk Assessment.
25	JSA	Job Safety Analysis.
26	JHA	Job Hazard Analysis.
27	TRA	Task Risk Assessment.
28	ARA	Activity Risk Assessment.
29	OJRA	On Job Risk Assessment.
30	SRA	Site Risk Assessment.
31	ERA	Environmental Risk Assessment.
32	QRA	Quantitative Risk Assessment/Qualitative Risk Assessment.
33	JSRA	Job Specific Risk Assessment.
34	RAM	Risk Assessment Matrix.
35	RAMS	Remote Area Medical Service.
36	SPOs	Safe Practice Observations

SL NO.	SHORT FORM	ABBREVIATIONS
37	PASS	Pull the pin, Aim the base, Squeeze lever below the handle, Sweep side to side.
38	SWL	Safe Working Load.
39	MBL	Maximum Breaking Load.
40	ASLI	Automatic Safe Load Indicator.
41	COG	Centre of Gravity.
42	ELCB	Electrical leakage circuit breaker.
43	GFCI	Ground Fault Circuit Interrupter.
44	LOTO	Lock Out Tag Out
45	HMIS	Health Flammability Instability Specific.
46	NRV	Non Return Valve.
47	B.A	Breathing Apparatus
48	FBA	Forced Breathing Apparatus/ Flash Back Arrestor.
49	ELSA	Emergency Life Saving Apparatus.
50	CABA	Compressed Air Breathing Apparatus.
51	UV	Ultra Violet.
52	IR	Infra Red.
53	BIS	Bureau of Indian Standards.
54	BSI	British Standard Institution.
55	ISO	International Standard Organization.
56	NBC	National Building Codes.
57	DRDO	Defense Research and Development Organization.
58	RPE	Respiratory Protection Equipment.
59	AFFF	Aqueous Film Forming Form.
60	FMB	Foam Breaking Branch.
61	FMC	Foam Making Chamber.
62	ERT	Emergency Response Team.
63	FRP	Facilitate Response Plan.
64	TRIR	Total Recordable incident Rate
65	FAC	First Aid Case.
66	MTC	Medical Treatment Case
67	BLEVE	Boiling Liquid Expanding Vapor cloud Explosion.
68	UCEVE	Un Confined Vapor Expanding Cloud Explosion.
69	FANR	Federal Authority of Nuclear Regulations.
70	INIS	International Nuclear Information System



The End