vi) Erection, alteration and removal shall be done under supervision of experienced personnel.

vii) Use of barrels, boxes, loose bricks etc., for supporting scaffolds shall not be permitted.

viii) Each supporting member of platform shall be securely fastened and braced.

ix) Where planks are butt-joined, two parallel putlogs shall be used, not more than 100mm apart, to give support to each plank.

x) Platform plank shall not project beyond its end support to a distance exceeding 4 times the thickness of plank, unless it is effectively secured to prevent tipping. Cantilever planks should be avoided. If it is unavoidable overhang should be effectively secured to prevent tipping.

xi) The platform edges shall be provided with 150mm high toe board to eliminate hazards of tools or other objects falling from platform.

xii) Erect ladders in the “four up-one out position”

xiii) Ladder shall be properly secured with the structure.

xiv) Use non-slip devices, such as, rubber shoes or pointed steel ferules at the ladder foot, rubber wheels at ladder top, fixing wooden battens, cleats etc.

xv) When ladder is used for climbing over a platform, the ladder must be of sufficient length, to extend at least one meter above the platform, when erected against the platform in “four up-one out position.”

xvi) Portable ladders shall be used for heights not more than 4mt. Above 4mt flights, fixed ladders shall be provided with at least 600 mm landings at every 6mt or less.

xvii) The width of ladder shall not be less than 300mm and rungs shall be spaced not more than 300mm.

xviii) Every platform and means of access shall be kept free from obstruction.

xix) If grease, mud, gravel, mortar etc., fall on platform or scaffolds, these shall be removed immediately to avoid slippage.

xx) Workers shall not be allowed to work on scaffolds during storms or high wind. After heavy rain or storms, scaffolds shall be inspected before reuse.

xxi) Don't overload the scaffolding. Remove excess material and scrap immediately.

xxii) Dismantling of scaffolds shall be done in a pre-planned sequential manner.

### 6.2.5 Suspended scaffolds/ boatwain's chair

In addition to the requirements for scaffolds in general as regards soundness, stability and protection against the risk of falls, suspended scaffolds should meet the following specific requirements.

(a) platforms should be designed and built with dimensions that are compatible with the stability of the structure as a whole, especially the length;
(b) the number or anchorage should be compatible with the dimensions of the platform;
(c) the safety of workers should be safeguarded by an extra rope having a point of attachment independent of the anchorage arrangements of the scaffold;
(d) the anchorage and other elements of support of the scaffold should be designed and built in such a way as to ensure sufficient strength;
(e) the ropes, winches, pulleys or pulley blocks should be designed, assembled, used and maintained according to the requirements established for lifting gear adapted to the lifting of persons according to national laws and regulations;
(f) before use, the whole structure should be checked by a competent person.

#### 6.2.6 Bamboo Scaffolding

i) It should not be used in oil & gas installations and in the areas where hot work is to be done.

ii) For construction and maintenance of low rise residential and office buildings, situated outside explosive licensed area, bamboo scaffold, if unavoidable, should conform to provisions given in IS-3696 (Part 1)-1987.

### 6.3 STRUCTURAL WORK, LAYING OF REINFORCEMENT & CONCRETING

#### 6.3.1 General provisions

i) The erection or dismantling of buildings, structures, civil engineering works, formwork, falsework and shoring should be carried out by trained workers only under the supervision of a competent person.

ii) Precautions should be taken to guard against danger to workers arising from any temporary state of weakness or instability of a structure.

iii) Formwork, falsework and shoring should be so designed, constructed and maintained that it will safely support all loads that may be imposed on it. Conformity with design during job execution shall be certified by the competent person and the relevant records shall be maintained.

iv) Formwork should be so designed and erected that working platforms, means of access, bracing and means of handling and stabilising are easily fixed to the formwork structure.

v) Proper methodology based on the design of the building / structure to be developed and approved by competent person before resorting to dismantling / modifications.

vi) All works / facilities should be certified for structural stabilities by a competent person and on statutory requirement completed before putting to use.

### 6.3.2 Erection and dismantling of steel and prefabricated structures

i) The safety of workers employed on the erection and dismantling of steel and prefabricated structures should be ensured by appropriate means, such as provision and use of:

(a) ladders, gangways or fixed platforms;
(b) platforms, buckets, boatswain's chairs or other appropriate means suspended from lifting appliances;
(c) safety harnesses and lifelines supported on properly designed anchor, catch nets or catch platforms;
(d) Mechanical / Power-operated mobile working platforms;
(e) Proper Personal Protective Equipment.

ii) Steel and prefabricated structures should be so designed and made that they can be safely transported and erected. Route survey to be carried out from works to construction site route considering the load bearing capacity of the bridges, height of the bridges en-route and maximum width and length permissible without causing any hazard to public, the route and the equipment.

iii) In addition to the need for the stability of the part when erected, the design should explicitly take following into account:

(a) the conditions and methods of attachment in the operations of transport, storing and temporary support during erection or dismantling as applicable;
(b) Methods for the provision of safeguards such as railings and working platforms, and, when necessary, for mounting them easily on the structural steel or prefabricated parts.

iv) The hooks and other devices built in or provided on the structural steel or prefabricated parts that are required for lifting and transporting them should be so shaped, dimensioned and positioned as:

(a) to withstand with a sufficient margin the stresses to which they are subjected;
(b) Not to set up stresses in the part that could cause failures, or stresses in the structure itself not provided for in the plans, and be designed to permit easy release from the lifting appli-ance. Lifting points for floor and staircase units should be located (recessed if necessary) so that they do not protrude above the surface;
(c) To avoid imbalance or distortion of the lifted load.

v) Storeplaces should be so constructed that:

(a) there is no risk of structural steel or prefabricated parts falling or overturning;
(b) storage conditions generally ensure stability and avoid damage having regard to the method of storage and atmo-spheric conditions;
(c) racks are designed and secured on firm ground so that units cannot move accidentally.

vi) While they are being stored, transported, raised or set down, structural steel or prefabricated parts should not be subjected to stresses prejudicial to their stability.

vii) Every lifting appliance should:

(a) be suitable for the operations and not be capable of accidental disconnection;
(b) be approved or tested as per statutory requirement.

viii) Lifting hooks should have safety latch (self closing type).

ix) Lifting hooks, Tongs, clamps and other appliances for lifting structural steel and prefabricated parts should:

(a) be of such shape and dimensions as to ensure a secure grip without damaging the part;
(b) be marked with the maximum permissible load in the most unfavourable lifting conditions.
(c) be periodically inspected and certified to ensure further usage as per requirement of factory act / Building & Construction Workers Regulation (BOCWR).

x) Structural steel or prefabricated parts should be lifted only after rigging plan approved by competent person to prevent them from spinning, slipping or dropping accidentally.

xi) When necessary to prevent danger, before they are raised from the ground, structural steel or prefabricated parts should be provided with safety devices such as railings and working platforms to prevent falls of persons.

xii) While structural steel or prefabricated parts are being erected, the workers should be provided with appliances such as guiding ropes for guiding them as they are being lifted and set down, so as to avoid crushing of hands and to facilitate the operations. Use of such appliances should be ensured.

xiii) A raised structural steel or prefabricated part should be so secured and wall units so propped that their stability cannot be affected, even by external factors such as wind and passing loads before its release from the lifting appliance.

xiv) At work places, instruction should be given to the workers on the methods, arrangements and means required for the storage, transport, lifting and erection of structural steel or prefabricated parts, and, before erection starts, a meeting of all those responsible should be held to discuss and confirm the requirements for safe erection.

xv) During transportation within the construction area, attachments such as slings and straps mounted on structural steel or prefabricated parts should be securely fastened to the parts. Vehicle loading should be such that the vehicle and the load remain stable at all positions during transportation and unloading.

xvi) Structural steel or prefabricated parts should be so transported that the conditions do not affect the stability of the parts or the means of transport result in jolting, vibration or stresses due to blows, or loads of material or persons.

xvii) When the method of erection does not permit the provision of other means of protection against fall of persons, the workplaces should be protected by guardrails, and if appropriate by toe-boards.

xviii) When adverse weather conditions such as snow, hailstorm, rain and wind or reduced visibility, etc. entail risks of accidents, the rigging work should be interrupted after taking necessary safety precautions.

xix) If necessary, to prevent danger, structural steel parts should be equipped with attachments for suspended scaffolds, lifelines or safety harnesses and other means of protection.

xx) The risks of falling, to which workers moving on high or sloping girders are exposed, should be limited by all means of adequate collective protection or, where this is impossible, by the use of a safety harness that is well secured to a properly designed support.

xxi) Structural steel parts that are to be erected at a height should as far as practicable be assembled on the ground.

xxii) When structural steel or prefabricated parts are being erected, a sufficiently extended area underneath the workplace should be barricaded or guarded

xxiii) Steel trusses that are being erected should be adequately shored, braced or guyed until they are permanently secured in position.

xxiv) Load-bearing structural member should not be dangerously weakened by cutting, holing or other means.

xxv) Structural members should not be forced into place by the hoisting machine while any worker is in such a position that he could be injured by the operation.

xxvi) Open-web steel joists that are hoisted singly should be directly placed in position and secured against dislodgment.

xxvii) All structures should be designed for either permanent anchors or provision for erection of anchors as and when required to support life line during any Maintenance work etc. during life of the structure. The point of provision of anchor should be indicated through suitable signage for ease of use as and when required.

### 6.3.3 Reinforcement

i) Ensure that workers use Personnel Protective equipment like safety helmet with chin straps, safety shoes, gloves, full body safety harness, safety goggles, etc.

ii) Don't place the hand below the rods for checking clear distance. Use measuring devices.

iii) Don't wear loose clothes while checking the rods.

iv) Don't stand unnecessarily on cantilever rods.

v) To carry out welding/cutting of rods, safety procedures/precautions as mentioned in Item No. 6.5 to be followed.

vi) For supplying of rods at heights, proper staging and/or bundling to be provided.

vii) Ensure barricading and staging for supplying and fixing of rods at height.

viii) For short distance carrying of materials on shoulders, suitable pads to be provided.

ix) While transporting material by trucks/trailers, the rods shall not protrude in front of or by the sides of driver's cabin. In case such protrusion cannot be avoided behind the deck, then it should not

extend 1/3rd of deck length or 1.5 Meters whichever is less and tied with red flags/lights.

x) Reinforcement rods, cut pieces etc. should be properly stored at identified locations and the scrap should be disposed off promptly on regular basis.

### 6.3.4 Concreting

i) Ensure stability of shuttering work before allowing concreting.

ii) Barricade the concreting area while pouring at height/depths.

iii) Keep vibrator hoses, pumping concrete accessories in healthy conditions and mechanically locked.

iv) Pipelines in concrete pumping system shall not be attached to temporary structures such as scaffolds and formwork support as the forces and movements may affect their integrity.

v) Check safety cages & guards around moving motors/parts etc. provided in concreting mixers.

vi) Use Personal Protective Equipment like gloves, safety shoes, full body safety harness, safety goggles, etc. while dealing with concrete and wear respirators for dealing with cement.

vii) Earthing of electrical mixers, vibrators, etc. should be done and verified.

viii) Cleaning of rotating drums of concrete mixers shall be done from outside. Lockout devices shall be provided where workers need to enter the drum for cleaning / inspection.

ix) Where concrete mixers are driven by internal combustion engine, exhaust points shall be located away from the worker's workstation so as to eliminate their exposure to obnoxious fumes.

x) Don't allow unauthorised person to stand under the concreting area.

xi) Ensure adequate lighting arrangements for carrying out concrete work during night.

xii) Don't allow the same workers to pour concrete round the clock. Insist on shift pattern.

xiii) During pouring, shuttering and its supports should be continuously watched for defects.

xiv) Never look into the drum mounted on truck (such as in case of Ready Mix Concrete).

## 6.4 ROAD WORK

6.4.1 Site shall be barricaded and provided with warning signs, including night warning lamps at appropriate locations for traffic diversion. This should be done sufficiently advance as a warning to the approaching drivers for the impending dander ahead.

6.4.2 Filled and empty bitumen drums shall be stacked separately at designated places.

6.4.3 Mixing aggregate with bitumen shall preferably be done with the help of bitumen batch mixing plant, unless operationally non-feasible.

6.4.4 Road rollers, Bitumen sprayers, Pavement finishers shall be driven by experienced drivers with valid driving license.

6.4.5 Workers handling hot bitumen sprayers or spreading bitumen aggregate mix or mixing bitumen with aggregate shall be provided with PVC hand gloves and rubber shoes with legging up to knee joints.

6.4.6 At the end of day's work, surplus hot bitumen in tar boiler shall be properly covered by a metal sheet, to prevent anything falling in it,

6.4.7 If bitumen accidentally falls on ground, it shall be immediately covered by sprinkling sand, to prevent anybody stepping on it. Then it shall be removed with the help of spade.

6.4.8 For cement concrete roads, besides site barricading and installation of warning signs for traffic diversion, safe practices mentioned in the chapter on "Concreting", shall also be applicable.

6.4.9 Any excavation for road work should be done only after surveying underground utilities and after taking suitable precautions. The underground utilities to be rerouted as required after approval of competent person / authority.

6.4.10 All the raw material for road construction/ maintenance to be stored on designated place which should be away from the running road. The running road should not be used for storing the sand, hot bitumen, etc..

6.4.11 Precaution should be taken that no construction material/ slab/ pre-fabricated object can come on the running road accidently or due to slipping. In such case, an erection plan should be designed and got approved from the competent authority.

## 6.5 CUTTING / WELDING

6.5.1 Common hazards involved in welding/cutting are sparks, molten metal, flying particles, harmful light rays, electric shocks , depletion in $O_2$ concentration due to generation of toxic gases, etc. Following precautions should be taken: -

i) A dry chemical powder (DCP) type fire extinguisher shall be made available in the work area.

ii) Adequate ventilation shall be ensured by opening manholes and fixing a shield or forced circulation of air etc, while doing a job in confined space.

iii) Ensure that only approved and well-maintained apparatus, such as torches, manifolds, regulators or pressure reducing valves, and acetylene generators, be used. Also their regular calibration where ever necessary.

iv) All panels and covers shall be kept in place, when operating an electric Arc welding machine. 30mA rating ELCB shall be ensured in the power receptacle of the welding machine.

v) The work piece should be connected directly to Power supply, and not indirectly through pipelines/ structures/ equipment etc.

vi) The welding receptacles shall be rated for 63 A suitable for 415V, 3-Phase system with a scraping earth. Receptacles shall have necessary mechanical interlocks and earthing facilities.

vii) All cables, including welding and ground cables shall be checked for any worn out or cracked insulation before starting the job and such cables shall not be used. Ground cable should be separate without any loose joints.

viii) Cable coiling shall be maintained at minimum level, if not avoidable. Criss-crossing of welding/electrical power supply cables & gas cutting hoses shall be avoided. Care to be taken against damage of gas cutting hoses.

ix) An energised electrode shall not be left unattended.

x) The power source shall be turned off at the end of job.

xi) All gas cylinders shall be properly secured in upright position.

xii) Acetylene cylinder shall be turned and kept in such a way that the valve outlet points away from oxygen cylinder.

xiii) Acetylene cylinder key for opening valve shall be kept on valve stem, while cylinder is in use, so that the acetylene cylinder could be quickly turned off in case of emergency. Use flash back arrestors to prevent back-fire in acetylene/oxygen cylinder.

xiv) When not in use, valves of all cylinders shall be kept closed.

xv) All types of cylinders, whether full or empty, shall be stored at cool, dry place under shed.

xvi) Forced opening of any cylinder valve should not be attempted.

xvii) Lighted gas torch shall never be left unattended.

xviii) Store acetylene and oxygen cylinders separately.

xix) Store full and empty cylinders separately.

xx) Avoid cylinders coming into contact with heat.

xxi) Cylinders that are heavy or difficult to carry by hand may be rolled on their bottom edge but never dragged.

xxii) If cylinders have to be moved, be sure that the cylinder valves are shut off.

xxiii) Before changing torches, shut off the gas at the pressure reducing regulators and not by crimping the hose.

xxiv) Do not use matches to light torches, use a friction lighter. Gas torch should be ignited with the lighter only. It should not be ignited by touching other hot surfaces.

xxv) Move out any leaking cylinder immediately and cap it. No hot work should be permitted in the vicinity of such leaked cylinders.

xxvi) Use trolleys for oxygen & acetylene cylinder and chain them.

xxvii) Always use Red hose for acetylene and other fuel gases and Black for oxygen, and ensure that both are in equal length.

xxviii) Ensure that hoses are free from burns, cuts and cracks and properly clamped.

xxix) Avoid dragging hoses over sharp edges and objects

xxx) Do not wrap hoses around cylinders when in use or stored.

xxxi) Protect hoses from flying sparks, hot slag, and other hot objects. Protect cylinders by covering welding blanket while hot work in the vicinity.

xxxii) Lubricants shall not be used on Ox-fuel gas equipment.

xxxiii) During cutting/welding, use required PPEs like hand gloves, full body clothing of fire retardant / suitable material, safety shoes, full body safety harness, mask, goggles / face shields, welding screen of required DIN glass as per approved Weld Preparation Scheme.

xxxiv) Hot work permit to be taken if working in hazardous area.

## 6.6 WORKING IN CONFINED SPACES

6.6.1 Following safety practices for working in confined space like towers, columns, tanks and other vessels should be followed in addition to the safety guidelines for specific jobs like scaffolding, cutting/welding etc.

i) Shut down, positively isolate, depressurise and purge the vessel as per laid down procedures.

ii) Entry inside the vessel to carry out any job shall be done after issuance of valid permit only in line with the requirement of OISD-STD-105.

iii) Ensure proper and accessible means of exit before entry inside a confined space.

iv) The number of persons allowed inside the vessel should be limited to avoid overcrowding. Record of entering person shall be maintained with in and out time.

v) When the work is going on in the confined space, there should always be two men standby at the nearby manway / manhole equipped with communication arrangement to contact seniors and to evacuate the worker inside confined space in case of emergency.

vi) Before entering inside the vessels underground or located at lower elevation, probability of dense vapours accumulating nearby should also be considered in addition to inside the vessel and corrective action should be ensured.

vii) Ensure requisite $O_2$ level before entry in the confined space and monitor level periodically or other wise use required respiratory devices.

viii) Check for no Hydrocarbon or toxic substances before entry and monitor level periodically or use requisite Personal Protective Equipment.

ix) Ensure adequate ventilation or use respiratory devices.

x) Depending upon need, necessary respirator system, gas masks and suit shall be worn by everyone entering confined space. In case of sewer, OWS or in the confined area where there is a possibility of toxic or inert gas, required respiratory device, shall be used by everyone while entering.

xi) Barricade the confined spaces during hoisting, radiography, blasting, pressure testing etc.

xii) Use 24V flameproof lamp fittings only for illumination.

xiii) Use tools with air motors or electric tools with maximum voltage of 24V.

xiv) House keeping shall be well maintained.

xv) Required PPEs like Safety helmet, safety shoes and full body harness shall be worn by everyone entering the confined space.

xvi) Don't wear loose clothing while working in a confined space.

xvii) In case of the vessels which are likely to contain pyropheric substances (like Iron Sulphide), special care need to be taken before opening the vessel. Attempt should be made to remove the pyropheric substances. Otherwise, these should be always kept wet by suitable means.

xviii) The cutting torches should also be kept outside the vessel immediately after the cutting.

xix) The gas cylinders used for cutting/welding shall be kept outside. Care to be taken for the integrity of gas hoses and welding cables while work is in progress.

xx) All cables, hoses, welding equipment etc., shall be removed from confined space at end of each work day, even if the work is to be resumed in the same space the next day.

xxi) To the extent possible sludge shall be cleared and removed from outside before entering.

xxii) No naked light or flame or hot work such as welding, cutting and soldering should be permitted inside a confined space or area unless it has been made completely free of the flammable atmosphere, tested and found safe by a competent person. Only non-sparking tools and flameproof hand lamps protected with guard and safety torches should be used inside such confined space or area for initial inspection, cleaning or other work required to be done for making the area safe.

xxiii) Communication should be always maintained between the worker and the attendant.

xxiv) Inside the confined space spray painting should be avoided. If absolutely essential it should be done after ensuring adequate precautions including exhaust of paint vapours and continuous monitoring of concentration of oxygen and toxic gases.

xxv) Before issuing the vessel entry permit, it should be ensured that all the incoming and outgoing lines to and from the vessel are positively isolated. Where this is not applicable like dampers in HRSG system, Sufficient time is to be allowed to observe the leakage of hot gases from the dampers/ passing valves before taking any decision on vessel entry permit.

## 6.7 PROOF/PRESSURE TESTING

6.7.1 Review test procedure before allowing testing with water or air or any other fluid. Testing should be done only after proper Job Safety Analysis (JSA) and its approval.

6.7.2 Provide relief valves of adequate size while testing with air or other gases.

6.7.3 Ensure compliance of necessary precautions, step wise loading, tightening of fasteners, grouting etc. before and during testing.

6.7.4 Inform all concerned in advance of the testing.

6.7.5 Keep the vents open before opening any valve for filling/draining of liquid used for hydrotesting. The filling/draining should not exceed the designed rate for pressure testing.

6.7.6 Provide separate gauges of suitable range for pressurising pump and the equipment to be tested.

6.7.7 Provide gauges at designated locations for monitoring of pressures.

6.7.8 Check the calibration of all pressurising equipment and accessories and maintain records.

6.7.9 Take readings at pre-defined intervals.

6.7.10 Arrangement to be made to ensure that the pressurizing system i.e. motor-pump set is out of circuit so that the system under hydro testing is not re-pressurized by the contractor due to pressure drop before a pre-defined time.

## 6.8 WORKING AT HEIGHTS

### 6.8.1 General Provision

i) While working at a height of more than 2.2 meters, ISI approved full body harness shall be used.

ii) While working at a height of more than 2.2 meters, permit should be issued by competent person before commencement of the job.

iii) Worker should be well trained on usage of full body harness including its proper usage at the time of ascending/descending.

iv) All tools should be carried in tool bag/belt to avoid their falling.

v) If the job is on fragile/sloping roof, roof walk ladders shall be used.

vi) Provide lifeline properly designed, secured and anchored, wherever required. Mock Drill of use of lifeline at regular intervals to be carried out.

vii) Additional safety measures like providing Fall Arrestor type full body harness, safety net should be provided depending upon site conditions, job requirements.

viii) Keep working area neat and clean. Remove scrap material immediately.

ix) Don't throw or drop material/equipment from height.

x) Avoid jumping from one member to another. Use proper passageway.

xi) Keep both hands free while climbing. Don't try to bypass the steps of the ladder. Same to be followed while climbing down. Further on climbing down, front of the body to be towards the ladder.

xii) Try to maintain calm at height. Avoid over exertion.

xiii) Avoid movements on any structural member without fall protection.

xiv) Elevated workplaces including roofs should be provided with safe means of access and egress such as stairs, ramps or ladders.

xv) Fall protection hierarchy to be followed as below:

(a) Elimination: Explore possibility whether job can be done avoiding work at height.

(b) Prevention: Prevent fall of a worker by providing appropriate fall prevention system.

(c) Fall arrest system: Arrest the fall using suitable fall arrest system. Ensure to have a strong suitably designed anchor point.

(d) Warning Lines: Use a warning line using a rope or wire barrier around roof to warn workers that they are getting close to the roof edge.

(e) Safety Monitoring: Use a safety monitor to warn the workers.

(f) Administration: Prepare a written administrative procedure to ensure workers are doing the best that they can.

### 6.8.2 Roof Work

i) All roof-work operations should be pre-planned and properly supervised.

ii) Roof work should only be undertaken by workers who are physically and psychologically fit and have the necessary knowledge and experience for such work.

iii) Work on roofs shouldn't be carried on in weather conditions that threaten the safety of workers.

iv) Crawling boards, walkways and roof ladders should be securely fastened to a firm structure.

v) Roofing brackets should fit the slope of the roof and be securely supported.

vi) Where it is necessary for a person to kneel or crouch near the edge of the roof, necessary precautions should be taken.

vii) On a large roof where work have to be carried out at or near the edge, a simple barrier consisting of crossed scaffold tubes supporting a tubing guardrail may be provided.

viii) All covers for openings in roofs should be of substantial construction and be secured in position.

ix) Roofs with a pitch of more than 10 should be treated as sloping.

x) When work is being carried out on sloping roofs, sufficient and suitable crawling boards or roof ladders should be provided and firmly secured in position.

xi) During extensive work on the roof, strong barriers or guardrails and toe-boards should be provided to stop a person from falling off the roof.

xii) Where workers are required to work on or near roofs or other places covered with fragile material, through which they are liable to fall, they should be provided with suitable roof ladders or crawling boards strong enough and when spanning across the supports for the roof covering to support those workers.

xiii) A minimum of two boards should be provided so that it is not necessary for a person to stand on a fragile roof to move a board or a ladder, or for any other reason.

### 6.8.3 Work on tall chimneys

i) For the erection and repair of tall chimneys, scaffolding should be provided. A safety net should be maintained at a suitable distance below the scaffold.

ii) The scaffold floor should always be at least 65 cm below the top of the chimney.

iii) Under the working floor of the scaffolding the next lower floor should be left in position as a catch platform.

iv) The distance between the inside edge of the scaffold and the wall of the chimney should not exceed 20 cm at any point.

v) Catch platforms should be erected over:

(a) the entrance to the chimney;
(b) Passageways and working places where workers could be endangered by falling objects.

vi) For climbing tall chimneys, access should be provided by:

(a) stairs or ladders;
(b) a column of iron rungs securely embedded in the chimney wall;
(c) Other appropriate means.

vii) When workers use the outside rungs to climb the chimney, a securely fastened steel core rope looped at the free end and hanging down at least 3 m should be provided at the top to help the workers to climb on to the chimney.

viii) While work is being done on independent chimneys the area surrounding the chimney should be enclosed by fencing at a safe distance.

ix) Workers employed on the construction, alteration, maintenance or repair of tall chimneys should not:

a) work on the outside without a safety harness attached by a lifeline to a rung, ring or other secure anchorage;
b) put tools between the safety harness and the body or in pockets not intended for the purpose;
c) haul heavy materials or equipment up and down by hand to or from the workplace on the chimney;
d) fasten pulleys or scaffolding to reinforcing rings without first verifying their stability;
e) work alone;

f) climb a chimney that is not provided with securely anchored ladders or rungs;
g) Work on chimneys in use unless the necessary precautions to avoid danger from smoke and gases have been taken. Ensure that the outside surface temperature of the chimney is at
h) room temperature before taking up any job after shut down of the (system) chimney.

x) Work on independent chimneys should not be carried on in high winds, icy conditions, fog or during electrical storms.

## 6.9 HANDLING AND LIFTING EQUIPMENT:

### 6.9.1 General Provisions

Following are the general guidelines to be followed with regard to all types of handling and lifting equipment in addition to the guidelines for specific type of equipments dealt later on.

i) There should be a well-planned safety programme to ensure that all the lifting appliances and lifting gear are selected, installed, examined, tested, maintained, operated and dismantled with a view to preventing the occurrence of any accident;

ii) All lifting appliances shall be examined by competent persons at frequencies as specified in "The Factories act".

iii) Check thoroughly quality, size and condition of all lifting tools like chain pulley blocks, slings, U-clamps, D-shackles etc. before putting them in use.

iv) Safe lifting capacity of all lifting & handling equipment, tools and shackles should be got verified and certificates obtained from competent authorities before its use. The safe working load shall be marked on them.

v) Check periodically the oil, brakes, gears, horns and tyre pressure, lighting fixtures of all moving equipments like cranes, forklifts, trailers, etc. as per manufacturer's recommendations.

vi) Check the weights to be lifted and accordingly decide about the crane capacity, boom length and angle of erection.

vii) Allow lifting slings as short as possible and check packing at the friction points.

viii) While lifting/placing of the load, no unauthorised person shall remain within the radius of the boom and underneath the load.

ix) While loading, unloading and stacking of pipes, proper wedges shall be placed to prevent rolling down of the pipes.

x) Control longer jobs being lifted up from both ends.

xi) Only trained operators and riggers should carry out the job. While the crane is moving or lifting the load, the trained rigger should be there for keeping a vigil against hitting any other object.

xii) During high wind conditions and nights, lifting of heavy equipments should be avoided. If unavoidable to do erection in night, operator and rigger should be fully trained for night signaling. Also proper illumination should be there.

xiii) Allow crane to move on hard, firm and leveled ground. Ensure that all the crane pedestals/ hydraulic jacks taking weight of the crane and load are on a firm compacted surface.

xiv) When crane is in idle condition for long periods or unattended, crane boom should either be lowered or locked as per manufacturer's guidelines.

xv) Hook and load being lifted shall remain in full visibility of crane operators, while lifting, to the extent possible.

xvi) Don't allow booms or other parts of crane to come within 3 meters reach of overhead electrical cables.

xvii) No structural alterations or repairs should be made to any part of a lifting appliance, which may affect the safety of the appliance without the permission and supervision of the competent person.

### 6.9.2 Hoists

i) Hoist shafts should be enclosed with rigid panels or other adequate fencing at:

(a) ground level on all sides;
(b) all other levels at all points at which access is provided;
(c) all points at which persons are liable to be struck by any moving part.

ii) The enclosure of hoist shafts, except at approaches should extend where practicable at least 2 meters above the floor, platform or other place to which access is provided except where a lesser height is sufficient to prevent any person falling down the hoistway and there is no risk of any person coming into contact with any moving part of the hoist, but in no case should the enclosure be less than 1 meter in height.

iii) The guides of hoist platforms should offer sufficient resistance to bending and, in the case of jamming by a safety catch, to buckling.

iv) Where necessary to prevent danger, adequate covering should be provided above the top of hoist shafts to prevent material falling down them.

v) Outdoor hoist towers should be erected on firm foundations, and securely braced, guyed and anchored.

vi) A ladderway should extend from the bottom to the top of outdoor hoist towers, if no other ladderway exists within easy reach.

vii) Hoisting engines should be of ample capacity to control the heaviest load that they will have to move.

viii) Hoists should be provided with devices that stop the hoisting engine as soon as the platform reaches its highest stopping place.

ix) Winches should be so constructed that the brake is applied when the control handle is not held in the operating position.

x) It should not be possible to set in motion from the platform a hoist, which is not designed for the conveyance of persons.

xi) Winches should not be fitted with pawl and ratchet gears on which the pawl must be disengaged before the platform is lowered.

xii) Hoist platforms should be capable of supporting the maximum load that they will have to carry with a safety factor.

xiii) Hoist platforms should be equipped with safety gear that will hold the platform with the maximum load if the hoisting rope breaks.

xiv) If workers have to enter the cage or go on the platform at landings there should be a locking arrangement preventing the cage or platform from moving while any worker is in or on it.

xv) On sides not used for loading and unloading, hoist platforms should be provided with toe-boards and enclosures of wire mesh or other suitable material to prevent the fall of parts of loads.

xvi) Where necessary to prevent danger from falling objects, hoist platforms should be provided with adequate covering.

xvii) Counterweights consisting of an assemblage of several parts should be made of specially constructed parts rigidly connected together.

xviii) Counterweights should run in guides.

xix) Platforms should be provided at all landings used by workers.

xx) Following notices should be posted up conspicuously and in very legible characters:

(a) on all hoists:

- on the platform: the carrying capacity in kilograms or other appropriate standard unit of weight;
- on the hoisting engine: the lifting capacity in kilograms or other appropriate standard unit of weight;

(b) on hoists authorised or certified for the conveyance of persons:

- on the platform or cage: the maximum number of persons to be carried at one time;

(c) on hoists for goods only:

- on every approach to the hoist and on the platform: prohibition of use by persons.

xxi) Hoists intended for the carriage of persons should be provided with a cage so constructed as to prevent any person from falling out or being trapped between the cage and any fixed part of the structure when the cage gate is shut, or from being struck by the counterbalance weight or by articles or materials tailing down the hoistway.

xxii) On each side in which access is provided, the cage should have a gate fitted with devices which ensure that the gate cannot be opened except when the cage is at a landing and that the gate must be closed before the cage can move away from the landing.

xxiii) Every gate in the enclosure of the hoist shaft which gives access from a landing place to the cage should be fitted with devices to ensure that the gate cannot be opened except when the cage is at that landing place, and that the cage cannot be moved away from that landing place until the gate is closed.

### 6.9.3 Derricks

**Stiff-leg derricks**

i) Derricks should be erected on a firm base capable of taking the combined weight of the crane structure and maximum rated load.

ii) Devices should be used to prevent masts from lifting out of their seating.

iii) Electrically operated derricks should be effectively earthed from the sole plate or framework.

iv) Counterweights should be so arranged that they do not subject the backstays, sleepers or pivots to excessive strain.

v) When derricks are mounted on wheels:

a) a rigid member should be used to maintain the correct distance between the wheels;
b) they should be equipped with struts to prevent them from dropping if a wheel breaks or the derrick is derailed.

vi) The length of a derrick jib should not be altered without consulting the manufacturer.

vii) The jib of a scotch derrick crane should not be erected within the backstays of the crane.

**Guy derricks**

i) The restraint of the guy ropes should be ensured by fitting stirrups or anchor plates in concrete foundations.

ii) The mast of guy derricks should be supported by six top guys spaced approximately equally.

iii) The spread of the guys of a guy derrick crane from the mast should not be more than $45^0$ from the horizontal.

iv) Guy ropes of derricks should be equipped with a stretching screw or turnbuckle or other device to regulate the tension.

v) Gudgeon pins, sheave pins and fool bearings should be lubricated frequently.

vi) When a derrick is not in use, the boom should be anchored to prevent it from swinging.

### 6.9.4 Gin poles

i) Gin poles should:

(a) be straight;
(b) consist of steel or other suitable metal;
(c) be adequately guyed and anchored;
(d) be vertical or raked slightly towards the load;
(e) be of adequate strength for the loads that they will be required to lift/move.

ii) Gin poles should not be spliced and if a gin pole is composed of different elements, they should be assembled in conformity with their intrinsic material strength.

iii) Gin poles should be fastened at their feet to prevent displacement in operation.

iv) Gin poles, which are moved from place to place and re-erected, should not be taken into use again before the pole, lifting ropes, guys, blocks and other parts have been inspected, and the whole appliance has been tested under load.

v) When platforms or skips are hoisted by gin poles, precautions should be taken to prevent them from spinning and to provide for proper landing.

### 6.9.5 Tower cranes

i) Where tower cranes have cabs at high level, persons, capable and trained to work at heights, should only be employed as crane operators.

ii) The characteristics of the various machines available should be considered against the operating requirements and the surroundings in which the crane will operate before a particular type of crane is selected.

iii) Care should be taken in the assessment of wind loads both during operations and out of service. Account should also be taken of the effects of high structures on wind forces in the vicinity of the crane.

iv) The ground on which the tower crane stands should have the requisite bearing capacity. Account should be taken of seasonal variations in ground conditions.

v) Bases for tower cranes and tracks for rail-mounted tower cranes should be firm and level. Tower cranes should only operate on gradients within limits specified by the manufacturer. Tower cranes should only be erected at a safe distance from excavations and ditches.

vi) Tower cranes should be sited where there is clear space available for erection, operation and dismantling. As far as possible, cranes should be sited so that loads do not have to be handled over occupied premises, over public thoroughfares, other construction works and railways or near power cables.

vii) Where two or more tower cranes are sited in positions where their jibs could touch any part of the other crane, there should be direct means of communication between them and a distinct warning system operated from the cab so that one driver may alert the other of impending danger.

viii) The manufacturers' instructions on the methods and sequence of erection and dismantling should be followed. The crane should be tested before being taken into use.

ix) The climbing operation of climbing tower cranes should be carried out in accordance with manufacturers' instructions. The free-standing height of the tower crane should not extend beyond what is safe and permissible in the manufacturers' instructions.

x) When the tower crane is left unattended, loads should be removed from the hook, the hook raised, the power switched off and the boom brought to the horizontal. For longer periods or at times when adverse weather conditions are expected, out of service procedures should be followed. The main jib should be slewed to the side of the tower away from the wind, put into free slew and the crane immobilised.

xi) A windspeed measuring device should be provided at an elevated position on the tower crane with the indicator fitted in the drivers' cab.

xii) Devices should be provided to prevent loads being moved to a point where the corresponding safe working load of the crane would be exceeded. Name boards or other items liable to catch the wind should not be mounted on a tower crane other than in accordance with the manufacturers' instructions.

xiii) Tower cranes should not be used for magnet, or demolition ball service, piling operations or other duties, which could impose excessive loading on the crane structure.

### 6.9.6 Lifting ropes

i) Only ropes with a known safe working capacity should be used as lifting ropes.

ii) Lifting ropes should be installed, maintained and inspected in accordance with manufacturers' instructions.

iii) Repaired steel ropes should not be used on hoists.

iv) Where multiple independent ropes are used, for the purpose of stability, to lift a work platform, each rope should be capable of carrying the load independently.

## 6.10 VEHICLE MOVEMENT

6.10.1 Park vehicles only at designated places. Don't block roads to create hindrance for other vehicles.

6.10.2 Don't overload the vehicle.

6.10.3 Obey speed limits and traffic rules.

6.10.4 Always expect the unexpected and be a defensive driver.

6.10.5 Drive carefully during adverse weather and road conditions.

6.10.6 Read the road ahead and ride to the left.

6.10.7 Be extra cautious at nights. Keep wind screens clean and lights in working condition.

6.10.8 All vehicles used for carrying workers and construction materials must undergo predictive/preventive maintenance and daily checks

6.10.9 Driver with proper valid driving license shall only be allowed to drive the vehicle

6.10.10 Routes shall be leveled marked and planned in such a way so as to avoid potential hazards such as overhead power lines and sloping ground etc.

6.10.11 While reversing the vehicles, help of another worker should be ensured at all times

6.10.12 An unattended vehicle should have the engine switched off

6.10.13 Wherever possible one-way system shall be followed

6.10.14 Barriers/fixed stops should be provided for excavation/openings to prevent fall of vehicle

6.10.15 Load should be properly secured

6.10.16 The body of the tipper lorry should always be lowered before driving the vehicle off.

6.10.17 Signs/signals/caution boards etc. should be provided on routes.

6.10.18 All vehicles in a running process plants to use spark arrester on the exhaust.

6.10.19 No material should be protruding outside the vehicle for the safety of the public. If necessary, same to be marked as per RTO regulations.

6.10.20 Proper caution tag should be available on the vehicle for hazardous material like oil,.LPG, explosives, nuclear material, toxic fluids etc and the vehicle staff should be well informed about the potential danger of the material being transported by them.

6.10.21 An earth chain for the discharge of static electricity generated during transportation of specific material with the vehicle to be provided.

6.10.22 Drunken driving should be prohibited.

## 6.11 ELECTRICAL

### 6.11.1 General Provisions

i) Only persons having valid licenses shall be allowed to work on electrical facilities as per prevailing IE Act and rules thereunder including CEA rules/regulations.

ii) No person should be allowed to work on live circuit. The same, if unavoidable, special care and written authorisation need to be taken.

iii) Treat all circuits as "LIVE" unless ensured otherwise.

iv) Electrical " Lock Out - Tag Out (LOTO)" procedure "MUST" be followed for work on electrical system.

v) Display voltage ratings prominently with "Danger" signs in local language also.

vi) Put caution/notice signs before starting the repair works.

vii) All electrical equipment operating above 250V shall have two separate and distinct connections to earth grid.

viii) Proper grounding to be ensured for all switch boards and equipment including Portable ones prior to taking into service.

ix) Make sure that electrical switch boards, portable tools, equipment (like grinding machine etc.) don't get wet during their usage. If it happens, stop the main supply, make the tools dry, check for specified insulation value and then only use them. Check proper earthing.

All temporary switch boards/ KIOSKS put up at work site should be suitably protected from rain and the level of same should be high enough to avoid contact with water due to water logging.

x) Don't work wet on electrical system.

xi) Don't overload the electrical system.

xii) Use only proper rated HRC fuses / ELCB / MCB.

xiii) Only ISI marked or equivalent industrial type extension boards and Plug sockets are to be used.

xiv) ELCB for all temporary connections must be provided using 3 pin plug.

xv) All power supply cables should be laid properly and neatly so that they don't cause hindrance to persons working and no physical damage also takes place to the cables during various construction activities.

xvi) All Power cables to be properly terminated using glands and lugs of proper size, type and crimped.

xvii) Use electrical fittings in Hazard zones as per area classification under OISD-STD-113.

xviii) Ensure pipe sleeve / conduit to protect underground cables at crossings.

xix) Don't lay unarmored cable directly on ground, wall, roof or trees. All temporary cables should be laid at least 750 mm below ground and cable markers should be provided. Proper sleeves should be provided at road crossings. In case temporary cables are to be laid on wooden poles/steel poles, the minimum cable heights should be 4.5 M.

xx) Maintain safe overhead distance of HT transmission lines as per latest CEA Safety Regulation.

xxi) Don't use pipelines/structures for earthing.

xxii) Don't make any unsafe temporary connections, e.g. naked joints etc.

xxiii) Ensure that temporary cables are free from cuts, damaged insulation, kinks or improper insulated joints.

xxiv) Check at periodic intervals that pins of sockets and joints are not loose.

xxv) Protect electrical wires/equipment from water and naked flames.

xxvi) Illuminate level in all the work areas should be in line with OISD-RP-149.

xxvii) All switchboards should be of MS structure only and incoming/outgoing feeders should be marked.

xxviii) Hand lamps/ Torch should not be of more than 24V rating, and E'x' type should be in line with hazardous area classification.

xxix) Fire extinguishers (DCP/$CO_2$/Sand buckets) should be kept near temporary switch boards being used for construction purposes. Don't use water for fighting electrical fires.

xxx) ISI marked Insulating mats shall be provided in the front and back end of switch boards.

xxxi) All parts of electrical installations should be so constructed, installed and maintained as to prevent danger of electric shock, fire and explosion.

Periodic checking of electrical safety appliances such as gloves, insulating mats, hoods etc. to be done/witnessed in line with OISD-STD-137, and records to be maintained duly endorsed by the concerned.

xxxii) A notice displaying following, should be kept exhibited at suitable places in local language also:

a) prohibiting unauthorized persons from entering electrical equipment rooms or from handling or interfering with electrical apparatus;
b) containing directions as to procedures in case of fire, rescue of persons in contact with live conductors and the restoration of persons suffering from electric shock;
c) specifying the person to be notified in case of electrical accident or dangerous occurrence, and indicating how to communicate with him.

xxxiii) No other cables/pipes to be laid in trench used for electrical cables.

xxxiv) Utmost care should be taken while excavating Earth from cable trench to avoid damage or any accident.

xxxv) Sub-station floor cut-outs meant for switch board installations to be covered wherever installation is incomplete.

xxxvi) Flameproofness integrity of all flameproof equipment / fittings/fixtures to be ensured at all times.

**NOTE:** A Residual Current Operated Circuit Breaker (RCCB) or Earth Leakage Circuit Breaker (ELCB), when installed, protects a human being to the widest extent. RCCB or ELCB should be provided as per latest CEA Safety Regulation.

### 6.11.2 Inspection and maintenance

i) All electrical equipment should be inspected before taking into use to ensure suitability for its proposed use.

ii) At the beginning of every shift, the person using the electrical equipment should make a careful external examination of the equipment and conductors, especially the flexible cables.

iii) Apart from some exceptional cases subject to work permits, work on or near live parts of electrical equipment should be forbidden.

Before starting any work on conductors and/or equipment, it is to be ensured that: power supply should be isolated by an authorized person following the concept of LOTO;

iv) After work has been done on conductors and/or equipment, the power supply should only be switched on again after work permit is returned back, lock/tag on isolated feeder are removed and the workplace is reported safe.

v) Electricians should be provided with approved and tested tools and personal protective equipment such as rubber gloves, arc flash suit etc.

vi) All conductors and equipment should be considered to be live unless there is a proof of the contrary.

vii) When work has to be done in dangerous proximity to live parts the power supply should be cut off. If for operational reasons this is not possible, the live parts should be fenced off or enclosed by qualified staff from the sub-station concerned.

### 6.11.3. Testing

i) Electrical installations should be inspected and tested as per approved plan and the results recorded.

ii) Periodic testing for proper functioning of the earth leakage protective devices should be carried out.

iii) Particular attention should be paid to the earthing of apparatus, the continuity of protective conductors, polarity and insulation resistance, protection against mechanical damage and condition of connections at points of entry.

## 6.12 OFFSHORE

### 6.12.1 General

The isolated nature of offshore installations are hazardous. They call for greater need for health safety and survival at offshore. Safety at offshore is safety of installations and safety of personnel. Safety problems and accidents at offshore have high risks due to limited space, helicopter operation, sea transport etc. Following are the general health and safety guidelines to be followed in addition to the safety guidelines stipulated for specific jobs dealt later on:

i) Workers should be well trained to do their job independently with high degree of self-control and self-discipline.

ii) On arrival at offshore, everyone should be briefed about the safety rules to be followed at offshore, evacuation system etc. All personnel should wear overall (dangri), helmet and shoes for personnel protection.

iii) In case of emergency, workers should follow instruction of Field Production Superintendent (F.P.S.). In certain cases instructions may be given to abandon the offshore installation and evacuate the persons to safe location.

iv) To overcome above problems, offshore personnel must receive training for using life saving appliances and other personal survival techniques.

v) Any person working at offshore should have one person as standby for any eventuality.

vi) Periodical health check-up of all personal on platforms shall be ensured and remedial measures shall be taken as per statutory and other requirements.

### 6.12.2 Drilling Rigs

i) Location of jack up rigs should not be less than 5 Kms from shipping route. Orientation of the rig, wind direction, etc. are required for safe landing of helicopter. Information w.r.t. sea currents, wind speed, Hi- Low tide, etc. are required for mooring of supply vessels.

ii) Sea bed condition at every location should be ensured for safety of rig.

iii) Radio and other communication facilities should be such to maintain contact with base all times.

iv) During toeing of rig, the rig deck should be clear of load, toeing lines should be in good condition and tensions in various toeing lines should be constantly monitored.

v) Few steps during toeing are:

a) crane booms should be secured to their vesta,
b) all hatches and water tight doors should be closed,
c) number of personnel on board should be restricted,
d) evacuate in case of emergency and operation should be completed preferably in day light.

### 6.12.3 Drilling

i) In view of $CO_2$ and $H_2S$ gas cut from well, effective ventilation should be provided where drilling is in progress.

ii) Safety alarm shall be checked in advance in view of failure of ventilation system.

iii) Suitable sensors for $H_2S$ and Methane should be function tested time to time and suitable colour code should be given.

iv) Working areas of the crane should be illuminated during night to avoid accident.

v) Clear space should be available for despatch and receipt of load and, in particular, basket transfer of passengers. Persons engaged in loading/unloading of materials should be protected from falling into the sea.

vi) Signal light should be fitted at the top of the jib.

vii) Crane hook should be fitted with safety latches.

viii) Experienced person should be engaged in operation of specific equipment like winches, cranes etc.

ix) At least three cable turns shall always be there on the winch drum.

x) Adequate communication like walkie talkie, round robin phone should be available between the crane operator, supervisor and helper.

xi) Crane operation should be completely stopped during helicopter landing/ taking off.

xii) Except for helicopter landing deck, all decks, platforms, bridges, ladders should have rigid and fixed guard rails atleast one meter high and should have one intermediate rail midway between the handrail and 100 mm toe board.

xiii) Wooden ladders shall not be used at offshore.

xiv) Flow sensor in the flow line should be ensured for safe working and to avoid blow out.

xv) Hydrogen sulphuide gas In offshore is of great risk and at 10 ppm (0.001%) concentration in air, a person should not be exposed for more than 8 hours, If concentration is more, then breathing apparatus should be used. Corrosion of equipment is also caused by $H_2S$.

xvi) Portable $H_2S$ gas detector should be continously used.

### 6.12.4 Production Platforms

i) In case hydrocarbon Is released due to overpressure, leak, overflow, gas blow etc., shut down process to stop flow *of* hydrocarbon. Prevent ignition of released hydrocarbon and in case of fire shut in the process complex and follow emergency contigency plan.

ii) Sub surface safetv valve (SSSV)) below the well head should be actuated during uncontrolled well -flow and they should be regularly checked.

iii) Surface safety valve or SDV should be checked for no gas leakage from bleed port / flange etc., in the well head area. It should not be in "mechanical override" or bypassed from panel.

iv) High pressure gas lift lines - blowdown system should be O.K.

*Auto actuation of SDVs in the inlet of pressure vessels should be O.K. and in "normal position" from shutdown panels. A record of status of switches normal/bypassed

in auto-con* panels (PSH, PSL, LSL, ILSL) should be maintained.

*Shut Down Panels

v) Welders rectifier set and electrical connections to it should be checked and approved by electrical-in- charge for proper electrical safely.

vi) "SCADA" telementry system if available should be operational for remote opening and closing of wells at unmanned platforms (through RPMC).

vii) Local ESD/FSD (near the work site) should be provided for jobs of very critical nature, so that the persons working can access it immediately in emergency for safety. Safety officer should judge the requirement & inform FPS for the same.

viii) Railings and Gratings etc. in and around work area should be O.K. and inspected to avoid slippage of man into sea.

ix) Emergency Shut Down (ESD) system is initiated when an abnormal condition is detected. ESD should be checked once in six months.

x) Platform should be manned round the clock.

xi) Welding and cutting work should be regulated by hot work permit.

xii) All detectors should be calibrated as per recommendation of the manufacturer.

xiii) No system should be by-passed which affects the system of platform.

xiv) In $H_2S$ field platforms, due care shall be taken as per recommendations.

xv) Follow the instructions of F.P.S. during stay at platform

### 6.12.5 Fire Prevention And Control

i) Provision be made for safe handling and storage of dirty rags, trash, and waste oil. Flammable liquids and chemicals applied on platform should be immediately cleaned.

ii) Paint containers and hydrocarbon samples, gas cylinders for welding and cutting should be stored properly. Cylinders should be transported in hand-cart.

iii) Smoking should be restricted and no smoking area should be identified.

iv) Special attention should be given to crude oil pump seals; diesel and gas engines which are potential source of ignition in the event of failure.

v) Fire and smoke detectors i.e. ultraviolet heat, thermal and smoke detector should be function tested once in three months.

vi) Fire is controlled in offshore by water spraying, Halon, $CO_2$ flooding, DCP and sprinkler system.

vii) Foaming agent is applied for controlling fire in liquid hydrocarbon. The system is not effective in gas fire.

viii) Light weight breathing system should be used.

ix) The fire control plan at offshore should reveal control station, fire alarms and fire detectors, deluge valves and sprinkler, fire extinguishing appliances, fireman outfit and ventilation system.

x) Fire fighting equipment should be maintained in ready to use condition.

### 6.12.6 Life Saving Appliances

i) Life boats with a speed of 6 knots and carrying capacity upto 50 persons are used in offshore.

ii) No. of life boats on one installation should have a capacity to accommodate twice the number of persons onboard installation.

iii) Launching appliances and life boat equipment should be checked every week.

iv) Boat landing areas should be adequately illuminated.

v) Life raft has no power and they rely on drift.

vi) Life jacket lifts the wearer after entering water.

vii) Life buoys are used to rescue persons if any person accidentally falls in the sea.

viii) All life saving appliances should be inspected by the MMD surveyor /sr. officials once a year.

ix) Every life boat shall be inspected once a week.

x) Every life boat and life raft should be serviced once a year by a competent authority.

### 6.12.7 Safety Precautions during Helicopter Transportation

i) Passenger briefing regarding safety rules while travelling in helicopter should be carried out before boarding the helicopter.

ii) Emergency procedure should be briefed to all the passengers in case helicopter is to ditch into the sea.

iii) Heli-pad should have a non-skid surface. Nylon rope net should be stretched on the deck.

iv) Proper drainage should be available on helideck.

v) There should be no obstruction on the helideck itself and within 3 meters of its perimeter. Closest super structure above the helideck should have red obstruction light.

vi) While landing on helicopter, fire crew of two persons should be standby adjacent to helideck.

vii) Heli-deck should be properly illuminated for night landing.

viii) During switching off helicopter, persons should not be allowed to go out/ towards helicopter

## 6.13 DEMOLITION

### 6.13.1. General provisions

i) When the demolition of any building or structure might present danger to workers or to the public:

(a) necessary precautions, methods and procedures should be adopted, including those for the disposal of waste or residues;
(b) the work should be planned and undertaken only under the supervision of a competent person.

ii) Before demolition operations begin:

(a) structural details and builders' drawings should be obtained wherever possible;
(b) details of the previous use should be obtained to identify any possible contamination and hazards from chemicals, flammables, etc.;
(c) an initial survey should be carried out to identify any structural problems and risks associated with flammable substances and substances hazardous to health. The survey should note the type of ground on which the structure is erected, the condition of the roof trusses, the type of framing used in framed structures and the load-bearing walls;
(d) a method of demolition should be formulated after the survey and recorded in a method statement having taken all the various considerations into account and identifying the problems and their solutions;

iii) All electric, gas, water and steam service lines should be shut off and, as necessary, capped or otherwise controlled at or outside the construction site before work commences.

iv) If it is necessary to maintain any electric power, water or other services during demolition operations, they should be adequately protected against damage.

v) As far as practicable, the danger zone round the building should be adequately fenced off and sign posted. To protect the public a fence 2m high should be erected enclosing the demolition operations and the access gates should be secured outside working hours.

vi) The fabric of buildings contaminated with substances hazardous to health should be decontaminated. Protective clothing and respiratory devices should be provided and worn.

vii) Where plant has contained flammable materials, special precautions should be taken to avoid fire and explosion.

viii) The plant to be demolished should be isolated from all other plant that may contain flammable materials. Any residual flammable material in the plant should be rendered safe by cleaning, purging or the application of an inert atmosphere as appropriate.

ix) Care should be taken not to demolish any parts, which would destroy the stability of other parts.

x) Demolition activities should not be continued under adverse climatic conditions such as high winds, which could cause the collapse of already weakened structures.

xi) To prevent hazards parts of structures should be adequately shored, braced or otherwise supported.

xii) Structures should not be left in a condition in which they could be brought down by wind pressure or vibration.

xiii) Where a deliberate controlled collapse technique is to be used, expert engineering advice should be obtained, and:

(a) it should only be used where the whole structure is to come down because it relies on the removal of key structural members to effect a total collapse;
(b) it should only be used on sites that are fairly level and where there is enough surrounding space for all operatives and equipment to be withdrawn to a safe distance.

xiv) When equipment such as power shovels and bulldozers are used for demolition, due consideration should be given to the nature of the building or structure, its dimensions, as well as to the power of the equipment being used.

xv) If a swinging weight is used for demolition, a safety zone having a width of at least one-and-a-half times the height of the building or structure should be maintained around the points of impact.

### 6.13.2. Demolition of structural steelwork

i) All precautions should be taken to prevent danger from any sudden twist, spring or collapse of steelwork, ironwork or reinforced concrete when it is cut or released.

ii) Steel construction should be demolished tier by tier.

iii) Structural steel parts should be lowered and not dropped from a height.

## 6.14 RADIOGRAPHY

6.14.1 All radiography jobs shall be carried out as per BARC Safety Regulations

6.14.2 During field radiography, nearby area around the radiation source should be cordoned off.

6.14.3 If the field radiography is to be done at the same location repeatedly, it is advisable to provide either a wire fencing around or a temporary brick enclosure.

6.14.4 Special permission/permit should be taken for radiography from area-in-charge.

6.14.5 As far as possible, field radiography should be done only during night time when there is little or no occupancy there.

6.14.6 Radiation warning signals should be pasted all along the cordoned off area.

6.14.7 Entry into the restricted area by unauthorised persons should be strictly prohibited during exposure.

6.14.8 The radiation level alongwith the cordon should be monitored by a suitable and well-calibrated radiation survey meter.

6.14.9 All personnel working with radiography sources should wear appropriate protective equipment and film badges issued by BARC.

6.14.10 Protection facilities such as manipulator rod, remote handling tongs, lead pots, radiation hazard placards and means of cordon off shall be available at each site.

6.14.11 The radiography source shall never be touched or handled directly with hands.

6.14.12 The package containing radiography cameras and sources should never be carried by public transport like bus, train etc.

6.14.13 Radiography sources and cameras, when not in use, should be stored inside a source pit with lock and key arrangement as approved by BARC. The storage room should preferably be located in an isolated area of minimum occupancy and radiation level outside the storage room should not exceed 0.25 mR/hr as per BARC Regulations.

6.14.14 In case of an accident (due to loss or of damage to radiography source), action should be taken in line with BARC Safety Rules/Guidelines.

6.14.15 Technologically advance methods should be preferred for reduced radiation effect wherever safety so warrants.

## 6.15 GRIT SHOT/ SLAG BLASTING/ SPRAY PAINTING

6.15.1 Blasting for surface preparation should be used only after approval from competent person.

6.15.2 Air Compressor used for grit/shot/slag blasting/painting should have guard and positioned away from the work place.

6.15.3 Exhaust of the prime mover, if IC engine is used, should be fitted with PESO approved spark arrester (in case of work in hazardous area) and directed away from the work place.

6.15.4 In case of motor driven compressor, the body of the motor as well as the compressor to be properly earthed.

6.15.5 The hoses used for compressed air should be of proper quality, and health of the same to be ensured through regular check/ test.

6.15.6 The operator of grit/shot/slag blasting/painting should wear suitable PPE's including mask and the area should be cordoned off.

6.15.7 Adequate measures to be taken to suppress dust/spray particle.

6.15.8 When these activities are done in confined places, adequate measure to be taken including monitoring Oxygen level and ensuring proper ventilation.

6.15.9 Proper fire fighting arrangements are to be made where spray painting is in progress.

6.15.10 Some paints and their supplements are toxic also and emit offensive smell. PPE to workers should be suitable to address this issue.

6.15.11 "No Smoking Zone" boards should be displayed prominantly in paints shop/ spray paint area.

## 6.16 WORK ABOVE WATER

### 6.16.1 General Provisions

i) Where work is done over or in close proximity to water & where possibility of drowning exists, provision should be made for:
   a) preventing workers from falling into water;
   b) the rescue of workers in danger of drowning;
   c) safe and sufficient transport.
   d) deputation of lifeguards/divers.
   e) preventing of persons suffering from hydrophobia on deputation to work above water.

ii) Provisions for the safe performance of work over or in close proximity to water should include, where appropriate, the provision and use of suitable and adequate:
   a) fencing, safety nets and safety harnesses;
   b) lifebuoys, life jackets and manned boats;
   c) protection against such hazards as reptiles bushes/ polluted water and other animals.
   d) deputation of lifeguards/divers.

iii) Gangways, pontoons, bridges, footbridges and other walkways or work places over water should:
   a) possess adequate strength and stability;
   b) be sufficiently wide to allow safe movement of workers;
   c) have level surfaces free from tripping hazards;
   d) be adequately lit when natural light is insufficient;
   e) where practicable and necessary, to prevent danger, be provided with toe-boards, guard rails, hand ropes etc.
   f) be secured to prevent dislodgment by rising water or high winds;
   g) if necessary, be equipped with ladders which should be sound, of sufficient strength and length and be securely lashed to prevent slipping.

iv) All deck openings including those for buckets should be fenced.

v) All the employees (owner, contractor and contractor workers) working above and under the water should comply with the requirements of Standards of Training, Certification and Watchkeeping 95 (STCW 95).

### 6.16.2 Rescue & Emergency procedures

i) Persons who work over water should be provided with some form of buoyancy aid. Life jackets should be provided for sufficient freedom of movement, have sufficient buoyancy to bring persons to the surface and keep them afloat face upwards, be easily secured to the body, be readily visible by way of self luminous paint/strip.

ii) Nobody should work alone on or above water.

iii) Each worker should be trained in the procedure to be followed in the event of an emergency.

iv) Necessary rescue arrangements like divers, rescue boats etc to be in place.

v) Persons to be trained for CPR/ Artificial resuscitation as an first aid to the rescued person.

vi) Also for off shore operations. Speed of water current and water temperature to be considered.

## 7.0 ADDITIONAL SAFETY PRECAUTION FOR UNITS WITH HYDROCARBONS

In addition to general safety precautions as outlined above for the activities in Clause 6.0, following additional safety precautions need to be taken for the sites within the operating area or nearby, where presence of Hydrocarbons cannot be ruled out.

i) No job shall be carried out without a valid permit. Permit should be in line with OISD-STD-105 "Work Permit System".

ii) Smoking should be prohibited in all places containing readily combustible or flammable materials and "No Smoking" notices be prominently displayed.

iii) In confined spaces and other places where flammable gases, vapours or dusts can cause danger, following measures should be taken:

(a) only approved type electrical installations and equipment, including portable lamps, should be used;
(b) there should be no naked flames or source of ignition;
(c) oily rags, waste and clothes or other substances liable to spontaneous ignition should be removed without delay to a safe place;
(d) Air operated ventilation system should be provided.

iv) Regular inspections should be made of places where there are fire risks. These include the vicinity of heating appliances, electrical installations and conductors, stores of flammable and combustible materials, welding and cutting operations.

v) Welding, flame/gas cutting and other hot work should only be done after issuance of work permit in line with the requirement of OISD-STD-105

after appropriate precautions, as required, are taken to reduce the risk of fire. For carrying out other jobs also, OISD-STD-105 should be followed strictly.

vi) Fire-extinguishing equipment should be well maintained and inspected at suitable intervals by a competent person. Access to fire-extinguishing equipment such as hydrants, portable extinguishers and connections for hoses should be kept clear at all times.

vii) All supervisors and workers should be trained in the use of fire-extinguishing equipment, so that adequate trained personnel are readily available during all working periods.

viii) Audio means to give warning in case of fire should be provided where this is necessary to prevent danger. Such warning should be clearly audible in all parts of the site where persons are liable to work. There should be an effective evacuation plan so that all persons are evacuated.

ix) Notices should be posted at conspicuous places indicating:

(a) the nearest fire alarm;
(b) the telephone number and address of the nearest emergency services.

x) The work site shall be cleared of all combustible materials, as Sparks and molten metal coming from the welding job can easily ignite combustible materials near or below the welding site. If the combustible materials cannot be removed from the area, the same shall be properly shielded.

xi) A dry chemical type fire extinguisher (DCP) shall be made available in the work area. Also fire protection facilities like running hoses etc. as per permit should be complied with.

xii) Wherever required, welding screens shall be put up to protect other equipment in adjoining areas against flying sparks. Material used should be metal/ fire proof blanket/water curtain.

xiii) Welding or cutting of vessels/ equipments used in Hydrocarbon/ hazardous flammable chemicals shall be done after ensuring hydrocarbon free area and verifying the same with the suitable hydrocarbon detector.

xiv) The confined space/equipment shall be made gas free (hydrocarbon and toxic) and cleaned and shall be ensured, with the help of suitable gas detectors.

xv) Used and hot electrode stubs shall be discarded in a metal bucket.

xvi) Use PESO approved and certified spark arrestors for vehicles, wherever applicable.

xvii) Relevant work permit ( hot work, cold work, vessel entry etc. as the case maybe) to be obtained, if construction work is carried out within existing operating area.

xviii) Precaution against pyrophoric material shall be ensured.

## 8.0 Environment Protection

### 8.1 Waste

The contractor is required to develop, institute and maintain a Waste Management Programme (WMP) during the construction of the project for his works and obtain approval of the owner. WMP may include: -

i) Identification of disposal sites.
ii) Identification of waste/surplus quantities to be disposed off.
iii) Identification of amounts intended to be stored temporarily on site location of such storage.
iv) Use of proper PPEs.
v) Identification of intended transport means and route.
vi) Obtaining permission, where required, for disposal.

Such a mechanism is intended to ensure that the designation of areas for the segregation and temporary storage of reusable and recyclable materials are incorporate into the WMP. The WMP should be prepared and submitted to the Engineer for approval.

The Contractor shall handle waste in a manner that ensures they are held securely without loss or leakage thus minimizing potential for pollution and fire. The Contractor shall maintain and clean waste storage areas regularly.

The Contractor shall make arrangement to stack the metal scrap at designated location and maintain the site free from obstruction. The scrap to be disposed as per owner instruction at regular interval.

## 8.2 Hazardous Waste Management

If encountered or generated as a result of Contractor's activity, then waste classified as hazardous under the "Hazardous Wastes (Management & Handling) Rules, 1989, and amendments thereunder time to time" shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.

Chemicals classified as hazardous chemicals under "Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 of Environment (Protection) Act, 1986 (latest) shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.

## 8.3 Air Quality

The Contractor shall take all necessary precautions to minimise fugitive dust emissions from operations involving excavation, grading, and clearing of land and disposal of waste. He shall not allow emissions of fugitive dust from any transport, handling, construction or storage activity to remain visible in atmosphere beyond the property line of emission source for any prolonged period of time without notification to the Employer.

The Contractor shall use construction equipment designed and equipped to minimise or control air pollution. He shall maintain evidence of such design and equipment and make these available for inspection by Employer.

If after commencement of construction activity, Employer believes that the contractor's equipment or methods of working are causing unacceptable air pollution impacts then these shall be inspected and remedial proposals shall be drawn up by the Contractor, submitted for review to the Employer and implemented.

The Contractor shall maintain the MSDS of the chemicals used / stacked at site and same shall be handled as per the standard prescribed procedure. The quantity shall be stored strictly as per the norms and emergency handling procedure shall be known and displayed prominently.

### 8.4 Noise

The Contractor shall consider noise as an environmental constraint in his design, planning and execution of the Works and provide demonstrable evidence of the same. The Contractor shall, take all appropriate measures to ensure that work carried out by the Contractor, whether on or off the Site, will not cause any unnecessary or excessive noise.

### 8.5 Occupational Noise

i) Protection against the effects of occupational noise exposure should be provided when the sound levels exceed the threshold values as prescribed.
ii) When employees are subjected to expose the sound levels beyond the prescribed limit, feasible administrative or engineering controls should be ensured.
iii) If such controls fail to reduce sound levels within the levels, personal protective equipment shall be provided and used to reduce sound levels within the prescribed limit.

## 9.0 OCCUPATIONAL HEALTH

### 9.1 Medical Examination

The contractor shall arrange a medical examination of all his employees before employing, after illness or injury, if it appears that the illness or injury might have affected his fitness and, thereafter, at periodicity stipulated under Factories Act / Building & Construction Workers Regulation (BOCWR).

The Contractor shall maintain the confidential records of medical examination by the physician authorized by the Employer.

### 9.2 Occupational Health Centre

The contractor shall ensure at a construction site an occupational health centre, mobile or static is provided and maintained in good order. Services and facilities as per the scale lay down under Factories Act / Building & Construction Workers Regulation (BOCWR). A construction medical officer appointed in an occupational health centre possess the qualification as laid down under Factories Act / Building & Construction Workers Regulation (BOCWR).

### 9.3 First Aid

First aid facilities should be provided in line with various statutory regulations like The Factory Act etc. However following care should be taken:

i) First aid, including the provision of trained personnel should be ensured at work sites. Arrangement should be made for ensuring the medical attention of the injured workers.

ii) Suitable rescue equipment, like stretchers should be kept readily available at the construction site.

iii) First-aid kits or boxes, as appropriate and as per statutory requirements, should be provided at workplaces and be protected against contamination by dust, moisture etc.

iv) First-aid kit or boxes should not contain anything besides material for first aid in emergencies.

v) First-aid kits and boxes should contain simple and clear instructions to be followed, be kept under the charge of a responsible person qualified to render the first aid and be regularly inspected and replenished.

vi) Where the work involves risk of drowning, asphyxiation or electric shock, first-aid personnel should be proficient in the use of resuscitation and other life saving techniques as specified in rescue procedures.

vii) Emergency telephone numbers of nearby Hospitals, Police, Fire Station and Administration should be prominently displayed.

## 10.0 DOCUMENTATION

The intention of keeping documentation of all types of accident(s) is to prevent recurrence of similar accident(s). All accidents should be reported as per OISD Guidelines and The Factories Act, 1948/ BOCWR.

All accidents (major, minor or near miss) should be investigated, analysed and recommendations should be documented along with implementation status.

All related data should be well-documented and further analysis highlighting the major cause(s) of accidents be done. This will help in identifying thrust areas and training needs for prevention of accidents.

## 11.0 SAFETY AWARENESS & TRAINING

Safety awareness to all section of personnel ranging from site-in-charge to workmen helps not only preventing the risk but also build up the confidence. Time and expenditures also get saved as a result.

Safety awareness basically seeks to persuade/inform people on safety besides supplementing skill also. Awareness programme may include followings:

i) **Poster:** Posters with safety slogan in humorous, gruesome demonstrating manner may be used to discourage bad habits attributable to accidents by appealing to the workers' pride, self-love, affection curiosity or human aspects. These should be displayed in prominent location(s).

ii) **Safety Sign Boards**: Different type of message of cautioning, attention, notice etc. should be displayed at the appropriate places for learning/ awareness of the workmen while working at site.

iii) **Films & Slides:** Film(s) narrating the accident case study including the causes and possible remedial ways of preventing the recurrence of a similar accident should be displayed at regular intervals. Slides consisting main points of the film show may also be shown to workers.

iv) **Talks, lectures & conferences:** The success of these events would depend much on audience's understandings of the speaker (s). The speakers are to be knowledgeable and good presenter. Speakers should know to hold the attention and to influence the audiences.

v) **Competitions:** Organise competition(s) between the different deptts/categories of workers. The sense of reward/recognition also will improve safety awareness and result in enhancing safety levels.

vi) **Exhibitions:** Exhibitions also make the workers acquainted with hazards and means of preventive measures.

vii) **Safety Publication:** Safety publications including pocket books dealing with ways of investigation and prevention in the field of safety and so on, may be distributed to workers to promote the safety awareness.

viii) **Safety Drives:** From time to time, an intensive safety drive by organising a safety day or a safety week etc. should be launched.

ix) **Training:** Training for covering the hazards for different trade should be imparted. Training should also include the specific hazards related to a job in addition to the general safety training as has been dealt in various chapters and should include all workers. Reference may be drawn from OISD-STD-154.

## 12.0 REFERRENCES

i) *Factory Act, 1948*

ii) *Indian Electricity Rules*

iii) *Safety & Health in Construction by ILO*

iv) *The Building & Other Construction Workers (Regulation, Employment and Conditions of Service) Act 1996 and Central Rules 1998*

v) CSB guidelines

vi) *IS 1161: 2006 or latest edition - Steel tubes for structural purposes — specification*

vii) *IS 2750: 1964 or latest edition - Specification for steel scaffolding.*

viii) *IS : 3696 (Part 1) – 1987 (Scaffolds) Safety code of scaffolds and ladders*

ix) *IS : 3696 (Part 2) – 1987 (Ladders)Safety code of scaffolds and ladders*

x) *IS 4014 Part I: 2006 or latest edition - Code of practice for steel tubular scaffolding - definitions and materials.*

xi) *IS 4014 Part II: 2005 or latest edition - Code of practice for Steel tubular scaffolding - Safety regulations for scaffolding.*

xii) *Building & Other Construction Workers(Regulation on employment &conditions of service) central rules, 1998 (Provision related to Scaffold).*

xiii) *OHSA Standard on Scaffold (CFR 1926.452)*

**ANNEXURE I**

**LIST OF SAFETY CODES FOR CIVIL WORKS PUBLISHED BY BUREAU OF INDIAN STANDARDS**

| Sr.no | Code No. | Title |
|---|---|---|
| 01. | IS : 818 | Code of Practice for Safety and Health Requirements in Electric and Gas Welding and Cutting Operations – First Revision. |
| 02. | IS : 875 | Code of practice for Structural safety of buildings: Masonry walls |
| 03. | IS : 933 | Specification for Portable Chemical Fire Extinguisher, Foam Type – Second Revision. |
| 04. | IS : 1179 | Specification for Equipment for Eye and Face Protection during Welding – First Revision. |
| 05. | IS : 1904 | Code of practice for Structural safety of buildings: Shallow foundations |
| 06. | IS : 1905 | Code of practice for Structural safety of buildings: Masonry walls |
| 07. | IS : 2171 | Specification for Portable Fire Extinguishers, Dry Powder Type – Second Revision. |
| 08. | IS : 2361 | Specification for Building Grips – First Revision. |
| 09. | IS : 2750 | Specification for Steel Scaffoldings. |
| 10. | IS : 2925 | Specification for Industrial Safety Helmets – First Revision. |
| 11. | IS : 3016 | Code of Practice for Fires Precautions in Welding and Cutting Operations – First Revision. |
| 12. | IS : 3521 | Industrial safety belts and harnesses |
| 13. | IS : 3696 – Part I | Safety Code for Scaffolds and Ladders : Part I – Scaffolds. |
| 14. | IS : 3696 – Part II | Safety Code for Scaffolds and Ladders : Part II – Ladders. |
| 15. | IS : 3764 | Safety Code for Excavation Work. |
| 16. | IS : 4014 -Part I & II | Code of practice for Steel tubular scaffolding |
| 17. | IS : 4081 | Safety Code for Blasting and Related Drilling Operations. |
| 18. | IS : 4082 | Recommendations on staking and storage of construction materials at site |
| 19. | IS : 4130 | Safety Code for Demolition of Buildings – First Revision. |
| 20. | IS : 4138 | Safety Code Working in Compressed Air-First Revision |
| 21. | IS : 4756 | Safety code for Tunneling works |
| 22. | IS : 4912 | Safety requirements for Floor and Wall Openings, Railings and toe Boards –First Revision. |
| 23. | IS : 5121 | Safety Code for Piling and other Deep Foundations. |
| 24. | IS : 5916 | Safety Code for Construction involving use of Hot Bituminous Materials. |
| 25. | IS : 5983 | Specification for Eye Protectors – First Revision. |
| 26. | IS : 6922 | Structures subject to underground blasts, criteria for safety and design of |
| 27. | IS : 7155 | Code of recommended practices for conveyor safety |
| 28. | IS : 7205 | Safety Code for Erection on Structural Steel Works. |

| Sr.no | Code No. | Title |
|---|---|---|
| 29. | IS : 7069 | Safety Code for Handling and Storage of Building Materials. |
| 30. | IS : 7293 | Safety Code for Working with Construction Machinery. |
| 31. | IS : 7323 | Guidelines for operation of Reservoirs |
| 32. | IS : 7969 | Safety code for handling and storage of building material |
| 33. | IS : 8758 | Recommendation for Fire Precautionary Measures in construction of Temporary Structures and Pandals. |
| 34. | IS : 8989 | Safety Code for Erection of Concrete Framed Structures. |
| 35. | IS : 9706 | Code of Practices for construction of Arial ropeways for transportation of material |
| 36. | IS : 9759 | Guidelines for de-watering during construction |
| 37. | IS : 9944 | Recommendations on safe working load for natural and man-made fibre rope slings |
| 38. | IS : 10291 | Safety code for dress divers in civil engineering works |
| 39. | IS :10386 – Part I | Safety Code for Construction, Operation and Maintenance for River Valley Projects. |
| 40. | IS :10386 – Part II | Safety Code for Construction, Operation and Maintenance of River Valley Projects. |
| 41. | IS : 11057 | Code of practice for Industrial safety nets |
| 42. | IS : 13415 | Code of Practice on safety for Protective barriers in and around building |
| 43. | IS : 13416 | Recommendations for preventive measures against hazards at working places |

**OISD-GDN- 206**
**First Edition, September, 2001**

# Guidelines on Safety Management System in Petroleum Industry

**OISD-GDN- 206**


**Oil Industry Safety Directorate**
**Government of India**
**Ministry of Petroleum & Natural Gas**

# Preamble

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain – upstream, midstream and downstream – Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry, Oil Industry Safety Directorate (OISD) was set up in 1986 Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits.

In more than 25 years of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards – starting with research by in-house experts and iterating through seeking & validating inputs from all stake-holders – operators, designers, national level knowledge authorities and public at large – with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD – except in the Upstream Petroleum Sector – is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self-regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of International and national level Knowledge Organizations – both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

**Executive Director**

**Oil Industry Safety Directorate**

# FOREWORD

The oil industry in India is over 100 years old. As such, various practices have been in vogue because of collaboration/association with different foreign companies and governments. Standardisation in design philosophies and operating and maintenance practices at a national level was hardly in existence. This, coupled with feed back from some serious accidents that occurred in the recent past in India and abroad, emphasised the need for the industry to review the existing state of art in designing, operating and maintaining oil and gas installations.

With this in view, the Ministry of Petroleum and Natural Gas in 1986 constituted a Safety Council assisted by the Oil Industry Safety Directorate (OISD), staffed from within the industry, formulating and implementing a series of self regulatory measures aimed at removing obsolescence, standardising and upgrading the existing standards to ensure safer operations. Accordingly, OISD constituted a number of functional committees comprising of experts nominated from the industry to draw up standards and guidelines on various subjects.

OISD have brought out a number of documents on various topics like layouts of installations, design, engineering, maintenance and operations of various facilities / equipment etc.

In an economic environment of rising cost of various inputs to the industry, in the form of man, material , machine and increasing cost of health care, it is vital for an organisation to effectively manage occupational safety and health. Benefit may be derived from such management in the form of increased productivity and morale. These benefits are a direct consequence of the reduction in workplace accident, injuries and illness. If workmen are to remain productive, they must be protected from injuries and illness.

There is an obvious effort to protect our facilities including personnel and managing the issue of safety and health in totality. The present document outlines the areas, in the form of elements, which need to be given due attention with a view to enhance productivity, morale of personnel and image of the organisation.

This document will be reviewed periodically for improvements based on the experience and better understanding.

Suggestions from industry members may be addressed to :

The Coordinator,
Committee on " Safety Management System",

**Oil Industry Safety Directorate**

Government of India
Ministry of Petroleum & Natural Gas
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These documents are intended to supplement rather than replace the prevailing statutory requirements.

# COMMITTEE

# ON

# SAFETY MANAGEMENT SYSTEM

| NAME | ORGANISATION |
|---|---|
| **Leader** | |
| A.A.Raichur | Hindustan Petroleum Corpn. Ltd. ( R), Mumbai |
| **Members** | |
| C.S.Chakrabarti | Bharat Petroleum Corpon. Ltd. (R), Mumbai |
| T.S.Lamba | Oil & Natural Gas Corpon. Ltd, Kolkata |
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| Dr. D.Buragohain | Gas Authority of India Ltd., New Delhi |
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(In addition to the above, several other experts from industry contributed in the preparation, review and finalisation of this document).

# SAFETY MANAGEMENT SYSTEM

## INDEX

# SAFETY MANAGEMENT SYSTEM

## 1.0 Introduction

An effective Safety Management System is required to prevent hazardous incidents and eliminate or mitigate their consequences. A number of catastrophic incidents in hazardous process industry have drawn attention to the safety of processes. Employees have been and continue to be exposed in their workplace to the hazards of chemicals which may be toxic, reactive, flammable or explosive. The present document emphasises the application of management controls for tackling the risks associated with handling / working with or near to hazardous substances in petroleum industry.

## 2.0 Scope

This document provides guidelines for development of detailed procedures for Safety Management System and covers the petroleum industry as a whole.

## 3.0 Definitions

**Competent Person :** A person duly designated / authorised by the management to carryout a specified job

**Material Safety Data Sheet (MSDS):**Data sheet incorporating safety information / properties of a chemical / product and useful for handling the material

**Incident :** An unplanned event (occurrence, condition or action) which did or could have resulted in personal injury or damage to the plant, community or environment.

**Near-miss :** An incident which does not result any injury or damage to property but has the potential to result in injury and / or property damage.

**Process :** Any activity involving a highly hazardous chemical including any use , storage, manufacturing, handling, or on the site movement of such chemicals , or combination of these activities.

For the purpose of this definition, any group of vessels which are interconnected or separate vessels which are located such that a highly hazardous chemical could be involved in potential release should be considered as single process.

**Catastrophic release :** A major release involving one or more dangerous substances that leads to serious danger to persons as well as environment both within and outside the workplace and results from uncontrolled developments.

**Critical equipment** : refers to columns, vessels, machinery, piping, interlocks, and controls determined by management to be vital for preventing the occurrence of a catastrophic release.

**Facility :** Buildings, containers, piping and equipment that could reasonably be expected to participate in catastrophic release as a result of being physically interconnected or of their proximity and in which hazardous substances are used, stored , manufactured , handled or moved.

**Process Hazard Analysis** : Process Hazard Analysis (PHA), sometimes called process hazard evaluation, is an organised and systematic effort to identify and analyse the significance of potential hazards associated with the processing or handling of highly hazardous chemicals.

## 4.0 Safety Management System

System for managing safety intend to cover all aspects of plant and facilities like to control loss to personnel, equipment, material and environment. Objective of developing such a system is to standardise the procedures which should continue to be followed by one and all unless a change in the system is duly authorised by a competent person. Such a Safety Management System should comprise the following basic elements :

1. Safety Organisation
2. Employees Participation
3. Process Safety Information
4. Process Hazard Analysis
5. Operating Procedures
6. Training
7. Contractors
8. Pre-startup Safety Review
9. Mechanical Integrity
10. Work Permit
11. Management of Change
12. Incident Investigation and Analysis
13. Emergency Planning and Response
14. Compliance Audit
15. Occupational Health
16. Off-the job Safety

17. Customers and Products
18. Road Transportation
19. Trade Secrets

Each of the these elements should be taken care of as given below:

## 4.1 Safety Organisation

### 4.1.1 Safety Policy

Every organisation should have safety policy duly approved by the Board of Directors of the organisation. It should contain intentions and commitment from the top management. It should be made available to all employees in a language easily understood.

It should be displayed at various locations in the organisation.

Organisational set-up for implementation and monitoring of safety policy should be in place. Safety target and objectives for each position in the organisation should be set and pursued. It should be revised as and when required.

### 4.1.2 Safety Committees

Safety Committees should be formed in the organisation. The Committees should encourage employees participation.

It should meet at least once in a quarter and minutes of the meetings should be
recorded.

Deliberations of safety reports, audits, incident enquiries should be a part of agenda of safety meetings.

For implementation of safety committee recommendations, time bound programme should be enforced.

### 4.1.3 Enforcement of Safety

In the organisation, Safety should be ensured through repeatedly highlighting it's utility in preventing loss of life and property and providing training / retraining to employees in safe working. Following modes should be followed for enforcing safety :

a) Work Permit System
b) Job safety analysis
c) Training of employees and contractors

d) Surprise checks
e) Drills
f) Operating manuals / Safety manual
g) Periodic MIS reports for monitoring by top management

### 4.1.4 Monitoring of Systems

Following systems should be monitored regularly for effective implementation :

a) Checking of safety interlocks
b) Internal audits of plants /facilities in line with OISD-STD-145
c) Management of change
d) Testing / Inspection of equipment
e) Checking of fire detection and protection system

### 4.1.5 Safety Promotion

Visuals play an important role in reminding personnel of safety information. Therefore, display of following information should be done in the premises:

(a) Safety precautions for critical operations at strategic locations
(b) Safety posters and slogans
(c) Safety records
(d) Do's and Don'ts at toxic chemicals handling/storage/operation areas
(e) Wearing helmet and other Personal Protective Equipment (PPEs)
(f) Labeling of chemicals
(g) Material Safety Data Sheet (MSDS)
(h) Safety manuals, Rules and Regulations
(i) Safety News Letters & bulletins
(j) Dissipation of incident information

## 4.2 Employees Participation

Following activities should be undertaken to involve employees in the working of the plants / facilities :

1. Company should develop a written action plan to implement the employees' participation.

2. Employees should be involved in Internal Safety Audits and Job Safety Analysis.

3. Employees should be explained about operation of the plant, including safety & health hazard associated with products & work environment.

4. Employees should be trained on use of personal protective equipment (PPE).

5. Means & methods should be established to keep employees informed about relevant safety & health issues.

6. Safety & health committee at floor level should be formed with participation of employees & employer's representatives to review safety & health related issues of the plant. The committee should meet periodically to discuss the relevant issues & suggest and implement remedial measures.

7. Written information about process, chemicals including MSDS and equipment should be accessible to employees.

8. Critical procedures & instructions should be prepared in English and in a local language, understood by employees.

9. Employees should be involved in management of change related to process & equipment.

10. Safety quiz / suggestion schemes / competitions etc. should be conducted to enhance participation of employees.

## 4.3 Process Safety Information

Process safety is defined as the operation of facilities that handle, use, process or store hazardous materials in a manner free from episodic or catastrophic incidents. Knowledge of chemicals, process and plants is one of the prime asset. This knowledge is required for developing other modules of the management system like process hazard analysis, operating procedures, training, emergency preparedness plans etc.

### 4.3.1 Process Information

Complete and accurate written information should be compiled for the following three categories:

1) Process chemicals
2) Process technology
3) Process equipment

This information should represent current operation. All data sheets, drawings, specifications and other documents should be updated / revised based on the present condition of the process. Care should be taken for incorporation of all modifications. Field verification of drawings

to ensure consistency with the actual process equipment and arrangement may be made.

Information should be so located that it can be easily available at the time of need. Computerisation of the information is desirable. It facilitates easy up-dation and retrieval. It may be put on local network for easy accessibility by all concerned.

A master-index indicating the location of information and the medium in which it is available should be prepared.

### 4.3.2 Process Chemicals

Process chemicals should include all raw materials, intermediates / finished products and chemicals used in the process. Data pertaining to process chemicals should help in assessing fire and explosion characteristics, reactive hazards, safety and health hazards to workers and the corrosion and erosion effects on the process equipment. Complete inventory of the process chemicals should be prepared. For each process chemical, following information should be available wherever applicable:

(A) Physical properties:
Physical state, calorific value, heat of vapourisation, Boiling point, Vapour pressure, Melting / Freezing point, Vapour density & specific gravity

(B) Fire & explosion Hazards:
Flash point, Auto-ignition Temperature, Explosive limits, Burning rate

(C) Reactive Hazards :
The tendency of the material to react violently when subjected to heat or the presence of other process chemicals, water, air (oxygen) or other possible contaminants.

Hazardous combustion/decomposition products.

(D) Health Hazard Data:

Personnel exposure hazard properties (long term & short term)

Information of toxicity of the material and exposure limit values such as Threshold Limit Value (TLV), Short Term Exposure Limit (STEL), Permissible Exposure Limit (PEL), Lethal Dose 50 (LD 50) etc.

(E) Corrosive properties of the chemical, runaway reaction and over-pressure hazards

(F) Information on fire fighting media, use of personal protective equipment (PPE), emergency treatment for exposure and release / spill containment.

Note:
Material Safety Data Sheet (MSDS) : OISD-STD-114 on 'Hazardous Chemicals and Their Handling' may be referred.

### 4.3.3 Process Technology

Process technology information should include the following:

a) Written process descriptions

b) Process chemistry

c) Process Flow Diagrams (PFD)

d) Safe operating limits of process parameters like pressure, temperature, flow rate etc. and the consequences or results of deviation that could occur if operating beyond the established process limits

e) Maximum inventory levels for process chemicals

f) Material and energy balances

A block flow diagram (BFD) showing major process equipment and pipelines is a preliminary tool for understanding about the process. Flow rates, pressures, temperatures and stream composition may be indicated for better clarity.

Process flow diagrams (PFD) are more elaborate than block flow diagrams. PFD should indicate all main streams including critical valves. Major process parameters like flow rate, temperature and pressure should be indicated at the ins and outs of major process equipment and at the control points. Whenever necessary, pump capacities, compressor power and other such relevant information may be mentioned. Major control loops and key utilities may be preferably shown in the PFDs.

Piping and instrument diagrams (P&ID) are the detailed representation of the plant. Each and every piece of equipment, pipelines, valves and

instrument along with their interconnection are shown and most appropriate to show relationship between equipment and instrument. Information mentioned under PFD and all the components of the control loops are depicted to enhance clarity.

P&IDs should be updated whenever any modification is carried out.

**4.3.4 Process Equipment**

Process equipment include columns, vessels, heat exchangers, reactors, pumps & compressors, valves, piping; drilling rigs & work-over rigs; cross country pipelines; tanks, loading & un-loading facilities and other equipment that contain process chemicals. Design data of process equipment should be documented and should include the following:

a) Materials of construction

b) Design specifications

c) Codes, standards and industry accepted engineering practices used for design and fabrication

d) Electrical classification

**4.3.5** Design basis for the pressure relief system and arrangement of shut-down & interlock system should be documented.

**4.3.6** For the existing plants where the codes used for design are no longer in general use, design and construction of such equipment should be documented. It should be ascertained that the equipment is still suitable for its intended use and testing/inspection carried out for this purpose should be documented.

**4.3.7** When process technology requires departure from applicable codes, it should be documented that the equipment is suitable for the intended use.

**4.4 Process Hazard Analysis**

The purpose of Process Hazard Analysis (PHA)) is to minimise the likelihood of the occurrence and the consequences of a dangerous substance release by identifying, evaluating and controlling the events that could lead to the release.

A PHA provides information which assists in making decisions for improving safety and reducing the consequences of unwanted or unplanned releases of hazardous chemicals.

The PHA of existing facilities should be performed in order of priority in terms of hazards of the process. A preliminary hazard analysis may be useful in determining the coverage of the process safety management standard. The factors like quantities, susceptibility to failure, mode of failure, proximity, severity, process complexity, operating history etc. should be considered while establishing priority.

In performing the PHA for a new process or facility , special consideration should be given to previous experience with the process and design circumstances , such as shorter- than - normal design periods or changes in the design team or the design itself after the project is under way.

### 4.4.1 Conducting Process Hazard Analysis ( PHA)

Following considerations should be taken into account for conducting PHA :

1) A process hazard analysis should be performed for all facilities and processes.

2) The process hazard analysis should be appropriate to the complexity of the process.

3) The priority order of conducting process hazard analysis should be determined and documented based on a rationale which includes such considerations as extent of the process hazards, number of potentially affected employees , age of the process, and operating history of the process.

4) A PHA is directed toward analysing potential causes and consequences of fires, explosions, releases of toxic or flammable chemicals and major spills of hazardous chemicals.

5) The PHA focuses on equipment, instrumentation, utilities, human action ( routine and non-routine), and external factors that might impact the process. These considerations assist in determining the hazards and potential failure points or failure modes in a process.

6) The process hazard analysis should also address to :
   a) Human factors
   b) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.

### 4.4.2 Basic Steps

Steps to be incorporated in PHA should include :

a) Identification - Based on the process safety information, expertise and experience with similar facilities, failure scenarios that could result in catastrophic release should be identified.

b) Assessment - The likelihood and consequences of the failure scenarios should be assessed using qualitative or quantitative techniques judged to be appropriate.

c) Alternatives- Feasible changes to reduce the risk of occurrence and the consequences of the failure scenarios should be identified.

### 4.4.3 Methodology and Technique

The selection of PHA methodology or technique should be influenced by many factors including the amount of existing knowledge about the process, age of the process, operational experience of the process, changes, limitations and assumptions

The PHA should take an orderly , systematic approach. One or more of the following methodologies that are appropriate to identify, determine and evaluate the hazards of the process being analysed should be used. What if, checklist, Hazard and Operability Study ( HAZOP), Failure Mode and Effects Analysis, Fault Tree Analysis, an appropriate equivalent methodology.

The application of PHA may involve the use of different methodologies for various parts of the process. A process involving a series of unit operations of varying sizes, complexities, and ages may use different methodologies and team members for each operation. The conclusion can be integrated into one final study and evaluation.

When there is large continuous process which has several control rooms for different portions of the process such as for distillation tower and blending operation , each segment can be done separately and then integrate the final results.

### 4.4.4 The Team

The process hazard analysis should be performed by a team with expertise in engineering and process operations , and the team should include at least one employee who has experience and knowledge specific to the process being evaluated . Also, one member of the team

must be knowledgeable in the specific process hazard analysis methodology being used. Following aspects should be considered while constituting such teams :

a) The team conducting the PHA should understand the methodology being used.

b) The team should have intimate knowledge of the standards, codes, specifications, and regulations applicable to the process being studied.

c) The selected team members need to be compatible.

d) The PHA team can vary in size from two people to number of people with varied operational and technical back ground.

e) The team members should be fully knowledgeable in the proper implementation of PHA methodology that is to be used and should be impartial to the evaluation.

### 4.4.5 Frequency

The process hazard analysis should be updated and revalidated by a team, having requisite back ground, at least every 5 years after the completion of initial process hazard analysis.

The PHA for a new process or facility or modification in existing facility and recommendations resulting from the PHA should be completed before start-up.

### 4.4.6 Recommendations and Follow up

Following approach should be adopted once recommendations of Process Hazard Analysis are made available:

1. System to promptly address to the team's findings and recommendations should be established.

2. Recommendations should be resolved in a timely manner and resolution should be documented.

3. Written schedule should be drawn for completion of the recommendations and should be monitored.

4. The actions taken should be communicated to the operating, maintenance and other employees who may be affected by the recommendations or the actions.

5. Process hazard analysis, updates or revalidation for each process as well as the documented resolutions of recommendations should be retained for the life of the process.

## 4.5 Operating Procedures

4.5.1 Operating procedures describe tasks to be performed, data to be recorded, operating conditions to be maintained, samples to be collected and safety & health precautions to be taken. Written down operating procedures should be available for all process plants for safe operation.

4.5.2 Operating procedures should be based on process safety information so that all known hazards are taken care of. Operating parameters should be consistent with the process safety information.

4.5.3 The operating procedures should provide specific instructions on what steps to be taken or followed while carrying out the following:

(a) Startup - including procedure for initial startup of the process or equipment as well as startup after normal and emergency shut downs.

(b) Normal operation - including limits of the "normal" operating ranges for parameters such as pressure, temperature and flow, the consequences of operating outside these limits, and the actions that should be taken to correct or avoid deviation from the normal ranges.

(c) Temporary operation - including special requirements while operating in the temporary mode and the acceptable duration of the temporary operating mode.

(d) Normal shut-down - including actions to be taken to safely shut down the process or equipment and conditions to be avoided.

(e) Emergency operation and shut-down - including the conditions under which an emergency shut-down is required. This should also include assignment of authority and responsibility to qualified operators to ensure that shutdown is executed in a safe and timely manner.

4.5.4 Operating instructions should be specific to the plant / facility.

4.5.5 Operating manuals should contain hazards of exposure of the chemicals being handled. Preventive methods and control measures adopted for exposure protection should be clearly brought out. These information may be provided in a separate volume of the operating manual. MSDS provides majority of such information. Operation manuals should also describe the following:

I. Purpose and function of safety interlocks
II. Equipment handing over procedure
III. Work permit system
IV. Fire protection/fighting facilities

4.5.6 Manuals should be available to the employees. All operators must understand thoroughly and should be fully conversant with the operating manual. Training should be imparted to the operators on operating procedures and should be certified as competent.

4.5.7 Computerisied process control system has added a new dimension. Logic of the software and relationship between the equipment and the control system should be described.

4.5.8 Operating manuals should be updated as often as necessary. Every year, operating manuals must be certified as updated by competent person.

**4.6 Training**

Personnel in the plant / facilities should be trained and retrained for improving their understanding and up grading skill in their area of work based on identification of their training needs.

**4.6.1 Initial Training**

Each employee, before being involved in operating a newly assigned process, should be trained in an over view of the process and in the

a) operating procedures viz., initial startup, normal operations, temporary operations, emergency shutdowns including the conditions under which emergency shutdown is required, emergency operations, normal shutdown and startup following a turnaround or after an emergency shutdown.

b) Operating limits viz. consequences of deviation and steps required to correct or avoid deviation.

c) Safety and health considerations viz. properties of, and hazards presented by, the chemicals used in the process, precautions

necessary to prevent exposure, including engineering / administrative controls and PPEs.

d) control measures to be taken if exposed(physical, air borne), Quality control for raw materials and control of hazardous chemical inventory levels and special/unique hazards

e) Safety systems and their functions

f) Each employee should be given training on operating procedures & safe work practices, emergency preparedness or disaster management plan, safety procedures, work permit system and areas pertinent to process safety & health.

g) Each employee should be explained action to be taken in the event of unwanted release of hazardous chemicals.

The training should also include/reflect

I. current operating practice, changes that result from changes in process chemicals, equipment and facilities;

II. on safe work practices to provide for the control of hazards during operations such as lockout / tagout, confined space entry, opening process equipment and piping and maintenance.

### 4.6.2 Refresher Training

Refresher training should be provided at-least every three years and more often, if necessary to each employee involved in operating a process to assure that the employee understands and adheres to the current operating procedures of the process.

### 4.6.3 Training Documentation

Record should be prepared containing the identity of the employee, the date of training and the means used to verify that the employee understood the training.

Refer OISD-STD-154 for further information.

## 4.7 Contractors

In petroleum industry where contractors are deployed to accomplish various types of jobs of different nature, it is very much essential to formulate an elaborate system for ensuring their safety at work place. Suitable space for contractors camp, if required, inside factory area for any construction activities to be made available at a safe distance from hazardous area. The camp should be dismantled on completion of the job. To meet the requirement, following measures should be incorporated in the system :

1) Management should ensure that contractor personnel are trained in the work practices necessary to perform their job safely.

2) Contractor should provide & maintain work places, plant, equipment, tools, machinery and so organise construction work that as far as reasonably practicable, there is no risk of accident or injury to workers.

3) Contract personnel are to be informed about the known potential fire, explosion or toxic release hazards related to their job & the process and in the applicable provisions of the emergency preparedness plan.

4) Contractor must ensure that each of their personnel has received and understood their roles in safe working practices by preparing a record and should verify the efficacy of dissemination of the safety information. He should also ensure use of PPEs at work place.

5) Contractor should ensure that each of their personnel follows the safety rules of the owner's facility including safe work practices.

6) Contractor should keep owner informed about any unique hazard presented by their personnel's work.

7) Management should ensure for regular safety inspection of its own as well as contractors' construction equipment / tools & tackles by competent person

8) Contractor should assign workers only that job for which they are suited by their age, physique, state of health and skill.

9) Contractor should be made responsible for application & enforcement of safety & health measures in respect of the workers at site and should maintain constant liaison with management.

10) Management, while selecting a contractor, should obtain information regarding their safety performance.

## 4.8 Pre-startup Safety Review

One of the most critical period in an operation is the start up of the process. Before a new or modified unit is started, a systematic check should be made to ensure that the equipment has been installed properly, operating procedures have been reviewed , items needing attention from PHA's have been resolved and personnel have been trained. The main purpose of the review is to reduce chance of some item being overlooked that could create a hazard or introduce un-expected safety problem as process is brought to normal operating conditions.

The management should perform a pre startup safety audit for new facilities, for modified facilities when the modification is significant enough to require a change in the process safety information as well as for startup of existing facility / plant after turn around.

Pre startup safety review should confirm that construction is in accordance with design specifications, Safety, operating, maintenance and emergency procedures are in place and are adequate.

For new facilities, process hazard analysis is performed and recommendations have been resolved or implemented before start up and modified facilities meet the requirements contained in management of change

## 4.9 Mechanical Integrity

Mechanical integrity of the plant or the facility need to be ensured so as to perform intended activities without the chances of its failure. Following aspects should be taken into considerations:

1. Applicable requirements of the codes of practices should be met or exceeded & mechanical integrity should be maintained by use of clearly defined maintenance, inspection and corrosion control procedures.

2. Equipment used to process, store or handle hazardous materials should be designed, constructed, installed and maintained to minimise the risk of releases of such materials.

3. The overall maintenance plan should be drawn taking into consideration the safety, reliability and quality objectives.

4. Feedback from maintenance activities should be given to other elements of safety systems i.e. design & operations for up-dation of P&IDs and operating manuals as required.

5. Safety aspects with regard to organising maintenance activities should be focused in the maintenance plan and prioritised as below :

   (a) Annual plan
   (b) Tasks and responsibilities
   (c) Manpower (number and type)
   (d) Contractors, if any
   (e) Equipment control and calibration
   (f) Control of spare parts
   (g) System of work permits, records
   (h) Recording of conditions of parts during use and replacement
   (i) Incident reporting

6. The procedures, methods and techniques should be so selected as to eliminate risk in carrying out maintenance activities.

### 4.9.1 Mechanical Integrity Program

Mechanical integrity program should be in place to assure continued integrity of process equipment. The appropriate working procedures, methods and techniques should used, which are considered most fit for the purpose and in line with the codes of practices.

Elements of mechanical integrity program should include:

(a) Identification and categorisation of equipment and instrumentation, inspection and tests, training of inspection personnel, testing and inspection frequencies, development of maintenance procedures, the establishment of criteria for acceptable test results, documentation of test and maintenance results, and documentation of manufacturer recommendations as to meantime to failure for equipment and instrumentation.

(b) The information pertaining to process equipment design should be documented as to what were the codes and standards relied on to establish good engineering practice.

(c) Documented system should be in place to confirm that equipment complies with recognised and generally accepted good engineering practices.

(d) For existing equipment designed and constructed in accordance with codes, standards or practices that are no longer in general use, it should be determined and documented that the equipment is designed, maintained, inspected, tested and operating in a safe manner.

### 4.9.2 Equipment Data

Information should be documented covering following:

1. The list of process equipment and instrumentation should be compiled and categorised to be included in the mechanical integrity program. The list should include pressure vessels, storage tanks, process piping, relief and vent systems, fire protection system components, emergency shut down systems, and alarms and interlocks and pumps.

2. The list of equipment should be prioritised to determine which piece of equipment requires closer scrutiny than others.

3. Information pertaining to the equipment in the process should include material of construction, piping and instrumentation diagram, electrical classification, relief system design and design basis, ventilation system design, design codes and standards employed.

### 4.9.3 Inspection and Testing

This should consider the following :

1. Inspection and testing should be done on all process equipment.

2. Inspection and test procedures should follow recognised and generally accepted good engineering practices.

3. Each inspection and test done on equipment and its components should be documented.

4. The applicable national / inter-national codes and standards provide criteria for external and internal inspections including frequency and methodology which should be adhered to.

5. Procedures should be developed and be in place to ensure that tests and inspections are conducted properly and that consistency is maintained even where different employees are involved.

6. Internal inspections should cover items such as vessel shells, bottom and head, metallic linings, thickness measurement for vessels and piping, inspection for erosion, corrosion, cracking and bulge, internal equipment like trays , baffles, sensors and screens for erosion , corrosion, or cracking and other deficiencies.

7. The relevant OISD standard and guidelines should be used for developing inspection and maintenance systems.

8. Frequency of testing / inspection should be based on following considerations :

   a) Meantime between failure of various instrumentation and equipment parts would be known from manufacturer's data or operating experience with the parts which will influence the inspection and testing frequency and associated procedures.

   b) Failure data from operating experience should be documented and analysed.

   c) The frequency and methodology of test of process equipment should be consistent with applicable manufacturer's recommendations, national/international codes,OISD standards / recommended practices / guidelines, good engineering practices. Such inspections/testing should be done more frequently if determined to be necessary by prior operating experiences.

### 4.9.4 Non-routine Work Authorisation

Following issues should be considered :

1. All non-routine jobs should be carried out in line with OISD-STD -105.

2. List of non-routine jobs should be prepared and procedures defined to carry out them.

3. Roles and responsibilities for work authorisation, issue/receipt of permit, handing over, taking over should be documented and implemented.

4. In case of any change in procedures and practices system of proper authorisation should be instituted.

### 4.9.5 Maintenance Procedures

The maintenance programs and schedules should be reviewed and analysed to see if there are areas where break down maintenance is used rather than an ongoing mechanical integrity program consisting predominantly of preventive & predictive maintenance.

1. The maintenance procedure should address to the safety aspects with regard to organisation of maintenance (system of work permit and non-routine work), determining whether execution should be on line/off-line, regulations to be followed, harmonising with operation, incident reporting system, maintenance analysis, do it one self or contract out.

2. Use of personal protective equipment should be laid down for specific maintenance activities.

3. The task, role and responsibilities should be defined

4. Records of trend analysis of machine and equipment should be taken into consideration.

5. The risks associated with different phases of maintenance should be established.

6. All maintenance procedures should be duly authorised.

7. Maintenance manual should be formulated, regularly certified, updated and approved.

### 4.9.6 Inspection and Test Results

Inspection programme should cover the following :

a) Each inspection and test performed on the process equipment should be documented.

b) The list of process equipment, components, instruments should be made for inclusion in the mechanical integrity/maintenance program.

c) The documentation should identify the date of inspection or test , the name of the person who performed the inspection and test , the serial number or other identifier of the equipment on which the inspection and test was performed , a description of the inspection or test performed and the results of the inspection or test.

### 4.9.7 Criteria for Accepting Equipment after Maintenance

Following considerations should be taken into account while accepting equipment after maintenance :

1. Equipment that has been out of service for maintenance should be taken over after due testing and documentation.

2. Criteria for acceptable test results should be well defined taking into consideration codes of practices, manufacturer's recommendation, anticipated life and operating experience.

3. Any deviation accepted should be approved by competent person.

4. Equipment deficiencies which are outside acceptable limits as defined by the process safety information should be corrected before further use or in safe and timely manner when necessary means are taken to assure safe operation.

5. Proper records for handing / taking over of equipment to be maintained.

### 4.9.8 Documentation of Manufacturer's Recommendations

Documentation should cover :

1. Manufacturer's recommendations for periodic inspection / testing / maintenance of equipment supplied by them should be documented

2. In case of any deviation from the inspection procedure as recommended by manufacturers reason for the same should be documented.

### 4.9.9 Training of Maintenance Personnel

Training aspects should consider :

1. Appropriate training is to be provided to maintenance personnel to ensure that they understand the preventive maintenance program procedures, safe practices, and the proper use and application of special equipment or unique tools that may be required.

2. Maintenance training should be integrated with overall training program and records should be documented

3. The frequency and contents should be in line with OISD -STD-154.

### 4.9.10 Line of Defence

Following aspects should be considered for safety of plant :

1. The first line of defence is to operate and maintain the plant and the process as designed and to keep the hazardous materials contained.

2. This line of defence is backed up by the next line of defence which is the controlled release of materials through venting to scrubbers or flares, or to surge or overflow tanks which are designed to prevent unwanted releases.

3. The above two are the primary line of defence or means to prevent unwanted releases. The secondary line of defence would include fixed fire protection system like sprinklers, water spray or deluge systems, monitors etc. Dykes, designed drainage systems and other systems

will control or mitigate hazardous chemicals once an unwanted release occurs.

4. The primary and secondary lines of defence should be protected by mechanical integrity program and strengthened where ever necessary.

### 4.9.11 Quality Assurance

The quality assurance program is an essential part of mechanical integrity program and will help to maintain the primary and secondary line of defence that have been designed into the process to prevent / control / mitigate unwanted chemical release. This require following :

1. In the construction of new plants and equipment, it should be ensured that equipment as it is fabricated is suitable for the process application for which they will be used.

2. Appropriate checks and inspections should be performed to ensure that the equipment is installed properly and consistent with design specifications and the manufacturer's recommendations.

3. The quality assurance system is needed to help that the proper materials of construction are used, that fabrication and inspection procedure are proper , and that installation procedures recognise field installation concerns.

4. The maintenance materials, spare parts and components should be suitable for the equipment for which they will be used.

5. 'As built' drawings, together with certifications of coded vessels and other equipment and materials of construction need to be verified and retained in the quality assurance documentation.
6. Equipment installation jobs should be properly inspected in the field for use of proper materials, and procedures and to assure that qualified craftsmen are used to do the job.

7. Use of appropriate gaskets, packing, bolts, valves, lubricants and welding rods should be verified in the field and documented.

8. The procedures for installation of safety devices should be verified such as torque on the bolts on rupture disc installations, uniform torque on flange bolts, proper installation of pump seals etc.

9. If the quality of the parts is a problem, it may be appropriate to conduct audits of the equipment supplier's facilities to better assure purchase of required equipment which is suitable for intended use.

10. Any change in equipment that may become necessary will need to go through the management of change procedures.

11. Calibration / standardisation of all equipment required for fabrication.

## 4.10 Work Permit

In case work is required to be performed in the plant / facility by any person other than the operating personnel of that area, a duly authorised written permit should be obtained by the person / agency executing the work before commencement of the work.

Based on the nature, the work would be undertaken under different types of permits. For example, following jobs should be undertaken with the duly issued hot work permit :

Cutting, Welding, Excavation, Road/Dyke cutting, Electrical lock out / Energising, Confined space entry, Boxing up of a vessel, Working on fragile roof structures, Radiography, Material Handling in operational areas, Crane operation etc.

Refer OISD-STD-105 on Work Permit System for details.

## 4.11 Management of Change

Management of Change refers to implementing any change intended to bring in any of the inputs to the plant / facility.

Primarily, plants are modified or changed in order to achieve higher efficiency, improve operability and safety, reliability, to accommodate technical changes etc. Another objective of carrying out such modifications / changes may be to prevent mishaps, improve utilisation and optimisation of facilities, reduce downtime, reduce risk to public, enhance knowledge of plants and process activities.

The procedure for management of change should cover review of the specification of piping and equipment, process engineering, instrumentation, maintenance, relief, safety, health, environment etc. After implementation of the changes, the training of personnel in accordance with the changed process, updation of document, equipment history cards, data sheets etc. to be taken care of before commissioning of plant / facilities.

The modifications may require changes in process / technologies, hardware, addition, alteration or removal of an equipment or a part of it from the plant, in piping system and process equipment, replacement of equipment or machinery that differs from the original equipment, change in metallurgy, change in instrument which may include pressure, temperatures, flow, set points, alarm points, speed, logic and control parameters.

The procedure should be established and documented for implementing a change covering all the stages like commissioning, operation, inspection, maintenance, review of performance of the plant / facility.

Refer OISD-GDN-178 "Guidelines for Management of Change" for details. This should be followed by all plants and facilities.

### 4.12 Incident Investigation and Analysis

For the management, an incident investigation is a critical feedback about the system of control of a hazard. Feedback control involves gathering information about an occurrence or completed activity, evaluating that information and taking steps to improve the situation in the future. This form of control is valuable as it helps prevent recurrence of the incident.

An incident is a failure in the control of any hazard that results in un-planned event like fire, explosion, run away reaction release of toxic or flammable material, injury or fatality. A workplace incident is an indication that prevention was ineffective and that prompt changes need to be made.
Feedback control gives management the capability to use information on past performance to improve upon future performance and to meet planned objectives and acceptable standards.

A nearmiss incident is a little better situation in that it is a warning given before actual injury. It gives an opportunity for concurrent control which has the advantage of permitting corrective action before an injury, illness, death or property loss.

Therefore, every incident and nearmiss incident must be recorded and thoroughly investigated.

#### 4.12.1 When to investigate

Incident investigation should be initiated as promptly as possible but not later than 24 hours following the incident.

### 4.12.2 The Objectives of the Incident Investigation

The basic purpose of an incident investigation is to determine the cause of the incident and to formulate a system to prevent reoccurrence of such incidents.

### 4.12.3 Who Should Investigate

The immediate and first level investigation should be performed by the immediate supervisor of the effected area. The immediate supervisor is closest to the scene, knows the nature of the work, the employees who do the work, and the nature of the hazards associated with the work.

### 4.12.4 What should an Investigation Report Contain

A detailed investigation report, prepared at the conclusion of the investigation, should include at a minimum the date of incident, date that the investigation began, a description of the incident , the factors that contributed to the incident and recommendations resulting from the investigation. Refer OISD-STD-107 format for further details.

### 4.12.5 Review of the Initial Investigation

The results of the investigation should be presented to and reviewed with the next higher level supervisor.

### 4.12.6 The Role of the Safety Professional

A Safety professional should also be called in to review the investigation. An independent review and a second opinion in such situations will help.

If necessary, a second investigation should be performed. The safety professional can conduct a joint investigation with the primary investigation.

The primary safety responsibility still rests with the immediate line management. When the nature of the accident is complex and the causative factors are elusive, an outside expert can be engaged to provide additional knowledge. For accidents involving hazardous chemicals or exposure to toxic substances, the services of an industrial hygienist may prove valuable.

### 4.12.7 Investigation by the Committee

In case of major incident, management should establish multi-disciplinary team to enquire into the incident. Such safety Committee for an accident investigation has the advantages of bringing in a good mix of knowledge / viewpoints as also injects a new dose of objectivity into the investigation.

In case of catastrophe or disaster where the losses are very large and the consequences are severe, a senior level of inquiry or investigation may be instituted and assigned with completing an independent investigation.

### 4.12.8 Salient Parameters for Incident Investigation

The incident investigator's job is to gather all available information to essentially explain how the accident happened and how the occurrence may be prevented.

The investigation should be open to input from all persons who were directly or indirectly involved in the accident. The primary thrust of the investigation should not be to cast blame but should be to prevent it's reoccurrence

The six key questions that should be asked and answered are who, what, where, when, how, and why as below :

**(1) "Who" Questions**

Who was injured? Who witnessed the accident? Who was involved in responding to the accident? Who contributed to causing the accident, if any? Who has immediate responsibility for safety and health of the work area?

**(2) "What" Questions**

What occurred (the complete sequence of events should be determined). What equipment, process, or facility was involved? What chemicals or energy was involved? What Safety controls failed to protect? What did the injured worker do or not do? What did others do or not do? What did management do or not do? What Safety factors did management fail to recognize and evaluate?

**(3) "Where" Questions**

Where did the incident happen? Where was the immediate supervisor / operating personnel at the time of the accident?

**(4) "When" Questions**

When did the incident happen? When did controls fail to protect? This question should not be answered by a simple hour, day, and month answer. The time of occurrence in relationship to the process cycle and equipment timing must be determined. So is the time in relationship to the work activities of other workers in vicinity / related functions.

**(5) "How" Questions**

How did the incident happen? How did all the physical conditions and human behavior come together and combine to cause the accident? How well did the safety controls (all types from engineering to administrative) work or fail? How was personal protective equipment used or not used?

**(6) "Why" Questions**

Why did the incident occur? Why the controls fail to protect? Why did the workers not recognize the hazard. Why did the worker fail to evaluate the hazard. Why was management unable to prevent the incident from taking place?

Some of the above questions overlap, but the investigation must be thorough. Regardless of the investigation is being done by the first line supervisor or by a Committee , the above questions should be raised and the best answers found. The accident can then be properly analyzed after getting the above questions answered.

### 4.12.9 Analysis of the Incident

After all the facts and data have been gathered, the information must be analyzed . The function of analysis is to organize the information and mentally synthesize the raw information into useful ones to arrive at conclusion.

### 4.12.10 Follow-up Questions

If necessary, after the initial facts have been collected and digested, a set of follow-up questions may be raised. Like a computer routine, the same Who, What, Where, When, How, and Why questions may be pursued except with greater accuracy. The basic idea is to fine-tune the inquiry until the sharpest picture of the accident has been obtained.

### 4.12.11 Findings Should be Put into a Written Report

A major accident or exposure will generate a significant amount of investigative work. The effectiveness of the investigation is enhanced by a well written report. A written report is a permanent record of the results of the investigation.

### 4.12.12 Communicating the Report

One of the basic purposes of the written report is to communicate the findings of the investigation within and outside the organization. Thus, careful thought must be expended to determine to whom the written report should be released. Additional thought must be given to the legal ramifi-cations of such records and documents.

### 4.12.13 Legal Ramifications of the Accident Report

Every written report, document, and physical record have legal ramifications as they have legal significance. The most obvious is that they constitute evidence which may be used during a trial to prove or disprove a fact that is under dispute. For this reason alone, a report should be prepared with the realization that it can, one day, be used as evidence or proof in a legal proceeding.

### 4.12.14 Post Investigation Actions

A system should be established to promptly address and resolve the report findings and implement recommendations. Resolution and corrective actions should be documented.

The report should be reviewed with all affected personnel whose job tasks are relevant to the incident findings including contract employees when applicable.

Findings should be accessible to all departments and personnel concerned. Communication methods may be safety bulletins, newsletter, meetings, revision of procedures etc. It is important to prepare information in suitable form for the intended recipient.

There should be a system of maintaining an incident data base wherein information is properly recorded in a form suitable for easy use.

Trend analysis of causes of incidents is vital and help in setting priorities to reduce risk potential. Information gathered on various incidents provides immediate lessons. In long term, it useful in monitoring performance changes, building up a data base on plant history and trend analysis .

Incident investigation reports to be retained for minimum period of five years in order to determine if an incident pattern develops or exists.

## 4.13 Emergency Planning and Response

The basis for the Emergency Preparedness Plan should be derived from the hazard analysis and the consequences of identified Maximum Credible Accident scenario. The objective of the emergency plan is to provide a measures to contain and minimise the effects of such incidents.

**4.13.1** On-site Emergency Plan should contain the following key elements :

**a) Early warning/alarm system**

Providing an early warning system is recommended as a standard procedure as it has an advantage of initiating basic action to control over the emergency situation. The warning system can be via telephone, fire sirens etc. Alarm system should have distinctive signal for fire & other emergencies.

**b) Immediate response Procedures / Measures**

It is essential to list down immediate action in case of an emergency and nominate people / positions to perform the initial task. The people and positions nominated for such task must be available round-thc-dock at the site. This goes long a way in mobilising further resources in controlling the emergency.

**c) Manpower / Organogram and their responsibilities**

The organogram should be drawn by appointing key personnel and defining their specific duties, which will be handy in case of an emergency. The number of coordinators at a location would depend on the manpower in location. The roles identified for the positions should be consistent with the normal day-to-day responsibilities of the personnel.

**d) Emergency Control Room**

The emergency control room location should be identified in the plan. The emergency control room should be set up at a safe location and marked on the site plan. The personnel manning the control rooms and their duties should be identified in the plan. The control room will be activated in case of an emergency to direct and coordinate the operations to handle the emergency. It should be furnished with external and internal telephone connections, PA / Paging / VHF etc.; list of essential telephone numbers; list of key personnel and their address; fire fighting system and site plan. Depending upon site requirements, additional control room can be considered.

**e) Resource Mobilisation Plan (internal / external)**

The emergency plan must contain resource mobilisation scheme so that key personnel will be able to activate the scheme to mobilise the internal & external resources within shortest time available. Such plan must contain identified resources needed and its availability, location and activation methods.

**f) Mutual Aid**

It is one of the major resources for fire fighting and emergency handling. Mutual aid arrangements are to be worked out in the

plan to facilitate additional help in the event of fire fighting or in rescue operation by way of rendering manpower, medical aid or fire fighting equipment etc.

**g) Evacuation procedures / Assembly Points**

In a major emergency, if it is essential to evacuate the non essential personnel from affected area it is advisable to have a plan for evacuation. There should be pre-designated areas where the personnel like workers, staff, contractor workers etc. not involved in emergency operations (as per Emergency Preparedness Plan) should assemble in case of an emergency. Depending on the location of the emergency, the assembly point can vary. For each potential hazardous zone, a specific assembly point(s) should be identified and marked on the zones/maps. During emergency, Pre-designated persons would take charge of this point and plan for necessary evacuation.

**h) List of Attachments, Sketches**

i) Layout showing various facilities, fire fighting system, hazardous zones and accompanying assembly point(s) and control room.

ii) Address and telephone numbers of Emergency coordinators and key persons in the location; Mutual aid members; Fire Brigade; Police and Hospitals; Higher officials at region / zone / HO; Government officials like District Collector, Inspector of Factories, Commissioner of Police; Local controller of Explosives.

iii) List of fire fighting & safely equipment available at location.

iv) List of Do's and Don'ts during emergency

v) Formats for reporting to Govt. Authorities, Local Agencies, Police and Hospitals.

vi) Material Safety Data Sheet (MSDS) for each hazardous product handled in the location.

**4.13.2 Information to public**

The safety measures to be taken in the event of an emergency should be made known to the general public who are likely to be affected.

**4.13.3 Training / Drills and Updating of the On-site plan**

Mock drills activating the Emergency Preparedness Plan should be conducted periodically for ensuring its efficacy during emergency as well

as for refinement and updation. The above drills based on the plan will help to achieve the following objectives :-

a) to familiarize emergency response personnel with their roles and duties to be performed.

b) to ensure the efficacy of the emergency response mechanism.

c) to check the coordination of reactions and response of emergency services.

d) to gain experience and confidence,

### 4.14 Compliance Audit

Safety Audits are the periodic examination of the functioning of safety system. It gives an idea about how effectively the safety system is implemented and how they are being accomplished. It is the feed back mechanism that provides management with the status and measurement of effectiveness of the various safety system elements and activities and leads to the appropriate control over these efforts.

Following three types of safety audits should be carried out:

1. Internal Safety Audit
2. External Safety Audit
3. Safety Management System Audit

### 4.14.1 Internal Safety Audit

Internal Safety Audit is important as it is carried out by the personnel who are deeply involved in the operation / maintenance of the facility, thus are aware of each and every aspect of it. Therefore, such audit can best bring out any shortcoming in the work area. Following methodology should be followed for such audits:

a) Processing, storage, handling and transportation facilities should be audited once in a year.

b) A calendar containing the area, names of auditors and period of audit should be prepared for every calendar year in advance and be circulated to all the departments and concerned area managers.

c) Areas to be audited should be logically grouped based on functions.

d) Audits should be carried out through a multi-disciplinary team.

e) Detailed guidelines including checklists as given in OISD-GDN-145 on 'Internal Safety Audits' should be followed.

f) A time bound action plan should be prepared for implementing audit recommendations.

g) Implementation status of the recommendations should be reviewed in the Management Safety Committee Meetings.

### 4.14.2 External Safety Audit (ESA)

External Safety Audits are carried out by a team of experts. The duration of the audit may be two to five days. Location management should make a presentation for the audit team giving brief description of the process plants / other facilities and the safety management systems. The audit team should study the different manuals, technical documents, implementation status of recommendations of internal and external safety audits, risk analysis / HAZOP studies and enquiry committee recommendations of fires and incidents. The audit team should give more emphasis on system audit as safety survey is carried out by the internal safety audit team. Environment and occupational health aspects may also be included in ESA. Report of the audit team should be submitted within a reasonable time frame.

Time bound action plan should be prepared for implementation of the recommendations and the same should be closely monitored.

Board of Directors should be appraised about the implementation status of the recommendations twice in a year. Whenever, any recommendation cannot be implemented, specific approval should be obtained from the Board of Directors.

### 4.14.3 Safety Management System Audit

Compliance of the Safety Management System, as per this document, should be assessed by carrying out compliance audit once in 3 years. Companies should develop their own methodology for such audits. Care should be taken to select team member / members who have adequate experience and training for auditing safety management system. Such audit report should be reviewed at an appropriate level with a view to update the procedures.

## 4.15 Occupational Health

The successful implementation of management plans and polices greatly depend on its adaptability by the personnel (employees) and maintaining their health is vital for productivity and effectiveness. As such, their health should be strongly emphasised in the organisation's strategic plan.

Promotion of health of employees in the widest sense, should, therefore, be a high priority, both a goal and a challenge for the organisation.

To meet the above objective, it is necessary to have a structured Occupational Health Monitoring so as to have a scientific basis for decisions aimed at protection of human health from any possible adverse consequences of exposure to the hazards in the occupational environment.

Necessary engineering / administrative controls should be exercised to prevent personnel from undue exposure to various hazards at the work place.

Refer OISD-GDN-166 "Guidelines for Occupational Health Monitoring in Oil and Gas Industry" for details.

## 4.16 Off-the job Safety

Off-the-job safety is a worthy goal in its own right. Analysis of the off-the-job injuries and rates normally shows that they are more costly than lost-time on-the-job injuries. Encouraging employees to be safe away from the work help to preserve skills that could be temporarily or permanently lost. It has added advantage of keeping the absenteeism low.

Further, being careful everywhere creates good mindset. Individual's concentration on the job is likely to be enhanced by ones concentration off-the-job and the plant or office is a healthier and safer environment because of it. The benefits also are widely shared throughout the plant or office communities. Following measures should be adopted to encourage off-the-job safety :

(a) The company should have policy to encourage covering off-the-job safety of the employees.

(b) The reporting and analysis of the off-the-job injuries to employees and their families should be encouraged.

(c) Findings of the analysis of the off-the-job injuries should be known to all the employees through news letters / bulletins

(d) There should be topics covering off-the-job safety incorporated in the news letters / magazines.

(e) Safety quiz, contests and competitions should be organised for the family members of employees to motivate them towards off-the-job safety.

## 4.17 Customers and Products

Primary objective of the management should be to make available their customer the intended product without causing any harm to human and the environment.

It can further be elaborated as below:

### 4.17.1 Customer and Product Safety Goals

The product and customer safety goals of the organisation should be defined to ensure that every product is manufactured, transported, used and disposed off safely. It should cover the following :

(a) The potential safety, health, environmental and liability risks associated with every product sold , every service offered should be recognised and dealt with.

(b) The organisation policy and objectives should focus on long term commitment to continuously improve performance in health, safety and environmental quality.

(c) Product and customer safety should be managed as an integral part of the business and marketable feature of product and services.

(d) Demonstration to the public , government and customers of the organisation's intention to be socially responsible supplier of products and services

(e) All statutory guidelines with regard to health, safety and environmental aspects of products in their manufacture, processing, storage, transportation and marketing should be incorporated in the safety procedures and manuals and updated as and when there is a change.

(f) Intermediate custodians including transporters, dealers and distributors should understand and accept the safety policy and commitment to product and service safety of the organisation.

(g) Roles and responsibilities should be defined with appropriate procedure.

### 4.17.2 Products Safety Procedures

Risk associated with the product should be analysed, defined, controlled and instructional material should be developed for the same. It should cover the following :

(i) New products

Assessment should be made for new products prior to marketing and distribution to identify health , safety and environmental hazards with normal use and foreseeable misuse.

(ii) Periodic reassessment of products

Periodic reassessment should be conducted for all manufactured, rebranded products and intermediate streams. This includes a review of adverse effects reported or experienced by those handling these products.

(iii) Existing products

New uses or markets for existing products should be evaluated to ensure that health, safety and environmental hazards and risks are identified and addressed.

(iv)Records and documentation

Records of assessment , background information and conclusions should be kept up to date through out the product's life and retained as appropriate.

(v) Product Information/ Material Safety Data Sheets

Up-to-date information on health, safety and environmental hazards and risks relating to use , storage , handling, transport and disposal of products should be available to the workforce , customers and community. The database on products should cover following aspects:

Synonyms of chemical names, target organs of chemicals, first aid requirements for skin, first aid requirements for eye, first aid requirements for swallowing, first aid requirements for breathing, symptoms of exposure, protective clothing requirements, washing instructions, clothing change requirements, clothing removable requirements, protective eye gear requirements. OISD-STD-155 on Personal Protective Equipment should be referred to.