Risk Assessment

Risk is a measure of the probability of occurrence (likelihood) of an event and severity of adverse effects. Its assessment, communication and control form the cornerstone for healthy environment and to ensure proper health and safety conditions of the workers.

Risks are peculiar to each particular project and each project participant. In general handling of toxic and or hazardous chemicals in large quantities at construction sites is rare and the usage of the same is temporary for specific tasks. The proposed project shall ensure the safety of workers and equipment to reduce and mitigate hazards.

The hazards and mitigation measures associated with various construction activities, and hazards to specific professions of construction are discussed below.

I. THE MAIN Occupational, Safety & Health HAZARDS/RISKS IN THE CONSTRUCTION INDUSTRY

The most frequent hazards/risks in the construction industry fall into two main categories as stated below and shown pictorially in Figure.1.

a) hazards/risks that may cause occupational accidents, sometimes fatal, immediately or soon after they occur;

b) hazards/risks that may cause occupational illness, sometimes also fatal, in the medium or long term (from a few hours to many years later).

II. HAZARDS ASSESSMENT ATTRIBUTES

The attributes that are pertinent to each hazard trade for assessing hazard level in building projects, were identified which is shown in Figure.2 and evaluated individually. The general hazard diagram is given below which discussed in detail in subsequent sections.
Proposed “Construction of 2 BHK housing in Phase I at Ahmedguda (V), Keesara (M), Medchal-Malkajgiri (D) bearing Sy. No. 24/3, near Rajiv Gruha Kalpa”.

Figure 2
A. OCCUPATIONAL ACCIDENTS

i. Physical Hazard

The leading accident hazards/risks in the construction industry are:

1. Falls from height: involves workers falling from higher floors to lower floors/ground and falling from ground level to excavation level from unguarded floors, platforms, scaffoldings, roofs, etc.);

2. Struck by falling/moving objects/vehicles: This primarily involves workers being struck by equipment, private vehicles, falling materials, vertically hoisted materials and horizontally transported materials.

3. Cave in: encompasses accidents due to malfunction of the shoring system, contact with underground utilities, subsiding of nearby structures, falling of materials/vehicles/objects onto people working in the excavation as well as fumes, gases and in rushes of water at the bottom of excavations.

4. Accident by operation of machinery/tools: It is caused by toppling of machinery, collapsing of the parts of machinery and unsuitable or unsafe hand-held tools.

5. Electrocution: caused by contact with electric current from machinery, tools, appliances or light fixtures, faulty electrical equipments and tools, and contact with overhead/underground power lines.

6. Fire/explosion: Accidents resulting from the explosion of pressure vessels or gasoline pipes and fire due to welding/hot works.

7. Failure of temporary structures: Accidents owing to the failure of formworks and scaffoldings.

8. Others : slipping on the same level, oxygen deficiency in confined spaces, lightning strike, etc.

Apart from the above stated physical hazards the other types of hazards that the workers are exposed to are social, biological and chemical. These hazards are explained below

ii. Chemical hazards

Chemical hazards are often airborne and can appear as dusts, fumes, mists, vapours or gases; thus, exposure usually occurs by inhalation, although some airborne hazards may settle on and be
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absorbed through the intact skin (e.g., pesticides and some organic solvents). Chemical hazards also occur in liquid or semi-liquid state (e.g., glues or adhesives, tar) or as powders (e.g., dry cement). Skin contact with chemicals in this state can occur in addition to possible inhalation of the vapour resulting in systemic poisoning or contact dermatitis. Chemicals might also be ingested with food or water, or might be inhaled by smoking.

iii. Biological hazards

Biological hazards are presented by exposure to infectious micro-organisms, to toxic substances of biological origin or animal attacks. Excavation workers, for example, can develop histoplasmosis, an infection of the lung caused by a common soil fungus. Since there is constant change in the composition of the labour force on any one project, individual workers come in contact with other workers and, as a consequence, may become infected with contagious diseases—influenza or tuberculosis, for example. Workers may also be at risk of malaria if work is conducted in areas where these organisms and their vectors are prevalent.

Toxic substances of plant origin may cause skin eruptions. Some wood dusts are carcinogenic, and some are allergenic.

Attacks by animals are rare but may occur whenever a construction project disturbs them or encroaches on their habitat. This could include wasps, hornets, fire ants, snakes and many others.

iv. Social hazards

Social hazards stem from the social organization of the industry since the employment is intermittent and constantly changing, and control over many aspects of employment is limited because construction activity is dependent on many factors over which construction workers have no control, such as the state of an economy or the weather. Because of these factors, there can be intense pressure to become more productive and with it the hours and location of work, projects requiring living in work camps away from home and family, thereby may lack stable and dependable networks of social support. The limited control and limited social support are the very factors associated with increased stress. These hazards are common to all construction workers.

B. Occupational illness/health Hazard

Construction workers are exposed to a wide variety of health hazards on the job. Exposure differs from trade to trade, from job to job, by the day, even by the hour. Exposure to any one hazard is typically intermittent and of short duration, but is likely to reoccur. A worker may not only encounter the primary hazards of his or her own job, but may also be exposed as a bystander to hazards produced by those who work nearby or upwind. This pattern of exposure is
a consequence of having many employers with jobs of relatively short duration and working alongside workers in other trades that generate other hazards. The severity of each hazard depends on the concentration and duration of exposure for that particular job.

Several illnesses have been linked to the construction trades, among them:

- Bronchitis among welders
- Skin allergies among masons and others who work with cement
- Neurologic disorders among painters and others exposed to organic solvents and lead.
- Elevated death rates from cancer of the lung and respiratory tree have been found among roofers, welders and some woodworkers.
- Lead poisoning occurs among painters, and
- White finger (Raynaud’s syndrome) appears among some jackhammer operators and other workers who use vibrating drills (e.g., stoper drills among tunnellers).

The Summary of occupational hazards/risks in the construction industry pertinent to their occupation is detailed out in Table 1 below.

<table>
<thead>
<tr>
<th>Occupations</th>
<th>Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brickmasons</td>
<td>Cement dermatitis, awkward postures, heavy loads</td>
</tr>
<tr>
<td>Stonemasons</td>
<td>Cement dermatitis, awkward postures, heavy loads</td>
</tr>
<tr>
<td>Hard tile setters</td>
<td>Vapour from bonding agents, dermatitis, awkward postures</td>
</tr>
<tr>
<td>Carpenters</td>
<td>Wood dust, heavy loads, repetitive motion</td>
</tr>
<tr>
<td>Drywall installers</td>
<td>Plaster dust, walking on stilts, heavy loads, awkward postures</td>
</tr>
<tr>
<td>Electricians</td>
<td>Heavy metals in solder fumes, awkward posture, heavy loads, asbestos dust</td>
</tr>
<tr>
<td>Electrical power installers and repairers</td>
<td>Heavy metals in solder fumes, heavy loads, asbestos dust</td>
</tr>
<tr>
<td>Painters</td>
<td>Solvent vapours, toxic metals in pigments, paint additives</td>
</tr>
</tbody>
</table>
Proposed “Construction of 2 BHK housing in Phase I at Ahmedguda (V), Keesara (M), Medchal-Malkajgiri (D) bearing Sy. No. 24/3, near Rajiv Gruha Kalpa”.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Hazards / Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paperhangers</td>
<td>Vapours from glue, awkward postures</td>
</tr>
<tr>
<td>Plasterers</td>
<td>Dermatitis, awkward postures</td>
</tr>
<tr>
<td>Plumbers</td>
<td>Lead fumes and particles, welding fumes</td>
</tr>
<tr>
<td>Pipefitters</td>
<td>Lead fumes and particles, welding fumes, asbestos dust</td>
</tr>
<tr>
<td>Steamfitters</td>
<td>Welding fumes, asbestos dust</td>
</tr>
<tr>
<td>Carpet layers</td>
<td>Knee trauma, awkward postures, glue and glue vapour</td>
</tr>
<tr>
<td>Soft tile installers</td>
<td>Bonding agents</td>
</tr>
<tr>
<td>Concrete and terrazzo finishers</td>
<td>Awkward postures</td>
</tr>
<tr>
<td>Glaziers</td>
<td>Awkward postures</td>
</tr>
<tr>
<td>Insulation workers</td>
<td>Asbestos, synthetic fibres, awkward postures</td>
</tr>
<tr>
<td>Paving, surfacing and tamping equipment operators</td>
<td>Asphalt emissions, gasoline and diesel engine exhaust, heat</td>
</tr>
<tr>
<td>Rail- and track-laying equipment operators</td>
<td>Silica dust, heat</td>
</tr>
<tr>
<td>Roofers</td>
<td>Roofing tar, heat, working at heights</td>
</tr>
<tr>
<td>Sheetmetal duct installers</td>
<td>Awkward postures, heavy loads, noise</td>
</tr>
<tr>
<td>Structural metal installers</td>
<td>Awkward postures, heavy loads, working at heights</td>
</tr>
<tr>
<td>Welders</td>
<td>Welding emissions</td>
</tr>
<tr>
<td>Solderers</td>
<td>Metal fumes, lead, cadmium</td>
</tr>
<tr>
<td>Drillers, earth, rock</td>
<td>Silica dust, whole-body vibration, noise</td>
</tr>
<tr>
<td>Air hammer operators</td>
<td>Noise, whole-body vibration, silica dust</td>
</tr>
<tr>
<td>Pile driving operators</td>
<td>Noise, whole-body vibration</td>
</tr>
<tr>
<td>Hoist and winch operators</td>
<td>Noise, lubricating oil</td>
</tr>
<tr>
<td>Crane and tower operators</td>
<td>Stress, isolation</td>
</tr>
<tr>
<td>Excavating and loading machine operators</td>
<td>Silica dust, histoplasmosis, whole-body vibration, heat stress, noise</td>
</tr>
<tr>
<td>Grader, dozer and scraper operators</td>
<td>Silica dust, whole-body vibration, heat noise</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Highway and street construction workers</td>
<td>Asphalt emissions, heat, diesel engine exhaust</td>
</tr>
<tr>
<td>Truck and tractor equipment operators</td>
<td>Whole-body vibration, diesel engine exhaust</td>
</tr>
<tr>
<td>Demolition workers</td>
<td>Asbestos, lead, dust, noise</td>
</tr>
<tr>
<td>Hazardous waste workers</td>
<td>Heat, stress</td>
</tr>
</tbody>
</table>

### III. CONTROLLING OF HAZARDS

Exposure in construction is already intermittent; consequently, the most effective way to reduce exposure is to reduce the concentration of hazards by enabling provisions for eating and sanitary facilities and awareness and training.

For reducing exposure duration, it is useful to consider the source, the environment in which a hazard occurs and the workers who are exposed. For mitigating of the hazard the following parameters should be considered.

#### i. Site planning and layout

Site planning is essential for safety and health of workers, in urban work sites due to space constraints. Site planning shall reduce and or help avoiding accidents due to collision of men with material and equipment etc. Therefore it is essential to plan the sequence of construction operations, marking access routes for workers in and around the site with legible signage, easy access and location of first aid facility, providing adequate lighting for work areas, site security by provision of fence or barricades, necessary housekeeping arrangements.

#### ii. Site cleanliness and tidiness

All the construction workers are briefed about the importance of keeping the site clean and tidy. “Daily Cleaning” shall be emphasized i.e cleaning and tidying up after work of tools, equipment, unused materials, storage areas and common areas such as passageways, daily removal of waste materials from works areas, removal of any rubbish and debris dumped onto the Site to a safe designated area shall be made mandatory.

#### iii. Engineering controls

Hazards originate at a source. The most efficient way to protect workers from hazards is to change the primary source with some sort of engineering change. Many of the changes are straightforward- For example, a less hazardous substance can be substituted for one that is more
hazardous. A process can be fundamentally changed, such as by replacing pneumatic hammers with impact hammers that generate less noise and vibration. If sawing or drilling generates harmful dusts, particulate matter or noise, these processes could be done by shear cutting or punching, a two-handed screwdriver with a longer handle increases torque on the object and reduces stress on the wrists.

Therefore technological improvements reduce the risks of some musculoskeletal and other health problems.

iv. Environmental controls

Environmental controls are used to remove a hazardous substance from the environment, if the substance is airborne, or to shield the source, if it is a physical hazard. Local exhaust ventilation (LEV) can be used at a particular job with a ventilation duct and a hood to capture the fumes, vapours or dust. If the location of task emits toxic gases etc, any LEV would have to be mobile and flexible in order to accommodate these changes if provided wuld be more feasible.

The simple and effective method for controlling exposure to radiant physical hazards (noise, ultraviolet (UV) radiation from arc welding, infrared radiant (IR) heat from hot objects) is to shield them with some appropriate material. Plywood sheets shield IR and UV radiation, and material that absorbs and reflects sound will provide some protection from noise sources.

Major sources of heat stress are weather and hard physical labour. Adverse effects from heat stress can be avoided through reductions in the workload, provision of water and adequate breaks in the shade and, possibly, night work which would not cause disturbance to locals.

v. Personal protection

When engineering controls or changes in work practices do not adequately protect workers, workers may need to use personal protective equipment (PPE). In order for such equipment to be effective, workers must be trained in its use, and the equipment must fit properly and be inspected and maintained. Furthermore, if others who are in the vicinity may be exposed to the hazard, they should either be protected or prevented from entering the area.

IV. PREVENTING/MITIGATING HAZARDS:

- The entire work site should be inspected on a regular basis and results to be recorded.
- Equipment is to be inspected to ensure its safe operation (e.g., brakes on vehicles, alarms, guards and so on).
- Preparations are to be made for emergency situations and emergency drills are to be conducted as needed. Preparations would include assignment of responsibilities,
provision of first aid and immediate medical attention at the site, communication at the site and with others off the site (such as ambulances, family members, home offices and labour unions), transportation, designation of health care facilities, securing and stabilizing the environment where the emergency occurred, identifying witnesses and documenting events. As needed, emergency preparedness would also cover means of escape from an uncontrolled hazard such as fire or flood.

- Accidents and injuries should be investigated and recorded so that in the future, similar occurrences can be prevented. Reports should be organized with a standardized record-keeping system to better facilitate analysis and prevention.
- Workers and supervisors should receive training and education in safety. This education consists of teaching general principles of safety and health, is integrated into task training, is specific for each work site and covers procedures to follow in the event of an accident or injury.
- Education and training for workers and supervisors is an essential part to prevent injuries and disease.
- It is also important to provide site-specific training, covering unique features about the job site such as means of entry and exit. Training should include instruction about dangerous substances. Performance or hands-on training, demonstrating that one knows safe practices, is much better for instilling safe behavior than classroom instruction.

V. RISKS AND HAZARDS IN STP

Operating and maintaining Sewage Treatment Plant (STP) is a challenging job because of various health risks

i. Risk of Chlorine

Chlorine gas has specific weight that is 2.49 times heavier than air. It is a yellowish green gas and is a strong irritant. Although its disinfecting effect is high, its toxicity is also high.

- At a concentration of 2 to 5 ppm the symptoms are tear, cough, sneeze and running nose.

- At a concentration of 5 to 30 ppm, breathing becomes difficult and eyes cannot be opened. There is a crisis of life in 30 minutes to 1 hour.

- At a concentration of 30 to 60 ppm, difficulty in breathing and loss of consciousness are caused. If exposed with this concentration level for 30 minutes to 1 hour, it results in death.

- At a concentration of 1000 ppm, it results in death.

ii. Fall

- Accidents frequently occur while climbing/descending ladders.
• Accident often occurs while working at high elevations.

iii. Slip

Slippery surfaces are often encountered when working in an STP and sewers.

iv. Electrical Shock

Electric shocks occur because of the following:

• Exposure of live parts and defects such as damage to insulating sheath.

• Absence of insulated protective gear,

• Getting in contact with live parts by mistake.

• Adequate care shall be taken against these and relatable issues.

v. Odour

Hydrogen sulphide (H₂S) is the most common odorous gas found in sewage collection and treatment systems and results from the reduction of sulphate by bacteria under anaerobic conditions. Its characteristic rotten-egg odour is well known. The gas is corrosive, toxic and soluble in sewage.

Its formation is prevented by maintaining dissolved oxygen not less than one mg/L in reaction tanks of the STP in sewage treatment process. It is ensured.

Ensuring safety during Operation & maintenance:

- Use safety shoes with non-slippery soles
- Wear protective and chemically resistant clothing to avoid exposure skin to liquids, vapors or gases
- Do not mix chemicals without supervision of chemist or safety professional
- Check electrical equipment for safety before use or at least check if all cables are properly insulated
- Wear goggles all time to avoid exposure of eyes to vapors, dust or chemical splashes
- Obey all safety instructions while handling or transporting chemicals like liquid or gaseous chlorine, concentrated acids or alkalis or toxic gases etc.
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- Wear respirator or gas masks when exposed to harmful gases of vapors
- Do not drink or eat in areas where biological or chemical contamination is expected
- Use non-latex gloves if sensitivity to latex is observed.
- All workers should undergo routine health checking to reveal early symptoms of chronic effects or allergies
- Learn to use safe lifting and moving techniques for heavy chemical containers. Also mechanical assistance pursued

**First aid in case of chemical exposure:**

- Inhalation: Remove person from source of contamination and into fresh air. Perform cardiopulmonary resuscitation (CPR) if victim is not breathing. Get medical attention, keep person warm and quite. Do not leave unattended.
- Ingestion: Remove person from source of contamination. Do not induce vomiting. Give 2 cups of water after every 2 minutes. Get medical attention, keep person warm and quite. Do not leave unattended.
- Skin Contact: Remove person from source of contamination and take immediately to source of water. Remove cloths, socks, jewelry from unaffected areas. Get medical attention.
- Eye Contact: immediately flush eyes with lukewarm water for at least 15 minutes. Assist victims by holding eyelids away from the eyeballs and instruct them to rotate their eyeballs.

Always wear proper gloves when working with acids, safety boots, safety masks, goggles, apron, safety belts, and helmets. Also make sure work area has first aid kits, fire extinguishers and respiratory protective masks. Make sure to report any flaws or troubles observed so that accidents can be avoided which can increase safety at workplace.