

Occupational Health and Safety Considerations at Water treatment plants

Workers in the water and wastewater treatment sector are responsible for the day-to-day operation, maintenance, trouble-shooting and handling of special problems of municipal, industrial, and other wastewater treatment plants. Occupations can include Level 1 WWR (Wastewater) Plant Operator, Level 2 WWR Plant Operator, Senior Operator, Water Resources Specialist, Maintenance Operator, etc. in both municipal and private facilities. Certification is set by the Applied Science Technologists and Technicians of BC (ASTTBC).

Accident hazards

Falls, slips, and trips on the level on floors made wet and slippery during the handling of water. Falls due to working with a defective ladder and/or falls from heights while climbing and staying on an elevated industrial installation Falls inside an industrial installation and/or into water well while inspecting them and/or taking water samples for analysis Injuries caused by capture of work-clothes and/or various parts of body, in/between moving/ rotating unprotected parts of machinery Electric shock caused by contact with “live” wires or defective electrical installations (the danger is especially high because the work is done in a wet and humid environment) Exposure to hazardous substances due to the sudden release of toxic materials as a result of an accident or human error, such as addition of chemicals to an unsuitable installation (e.g. release of chlorine gas due to an insertion of disinfectants such as hypochlorite into installation with aluminium sulphate) Fire hazard due to contact of a very strong oxidizer (disinfectant) with a flammable substance, as a result of improper storage of chemicals, human error, sudden release from process piping, etc. Explosion hazard, in the event of contact between ozone (very strong oxidizer) and organic chemical and strong reduction agents Hazard of drowning when working inside reservoirs, or immersed in watercourses with a strong current Suffocation hazard while carrying-out maintenance or installation works, such as working in a confined place (tank, boiler) or when doing excavation work (collapse of excavation or a tunnel)

Physical hazards

Exposure to high noise levels, from electro-mechanical equipment and a noisy environment. Exposure to adverse weather conditions: risk of catching a cold as a result of Working in windy weather, at low temperatures and while raining; or as a result of over-sweating in the summer; and suffering heat and/or cold strokes Exposure to UV radiation during water disinfection may be damaging for eyes and skin.

Chemical hazards

Exposure to various disinfectants used for water disinfection.

- Chlorine (gas): a very strong oxidizer and disinfectant. It is a toxic and corrosive gas that causes irritation of the eyes and the respiratory tract even at low concentrations.
- Hydrofluoric acid: a very strong acid that is used in water fluoridation.

- Sodium hypochlorite: it is used as a solution. The substance is toxic and corrosive, in particular of the respiratory tract; causes burns and irritation to eyes and skin.
- Calcium hypochlorite: the substance is corrosive and very destructive of mucous tissues; may cause chemical pneumonia and lung oedema.
- Ozone is an oxidizing and an irritant gas; when inhaled, it may cause breathing difficulties, headaches, fatigue, eye irritation, tears and conjunctivitis.
- Chlorine dioxide is a very corrosive gas that causes strong irritation of the respiratory tract and the eyes.
- Exposure to coagulants (such as aluminium sulphate): these substances assist precipitation of suspended matter in the water

Biological hazards

No biological hazards have been identified, except possible exposure to insects and rodents that may transmit diseases

Ergonomic, psychosocial and organizational factors

Musculoskeletal injuries caused by awkward working postures during the cleaning/inspection of the pipe system and/or the of installation Over exertion while moving or handling heavy and bulky equipment or big packages of chemicals may affect various systems of the body.

- a. Psychological stress and pressure due to environmental factors: annoying noise, water splashing, odors, high humidity, etc. Psychosocial problems due to increased workload, requirements of improving work output, constant need of high skill levels, lack of privacy due to the increased possibility of superiors to locate and reach the worker (by means of cellular phone or beeper, even after normal working hours), and due to the commitment to answer unexpected calls during emergency situations; requirement of doing shift work overtime
- b. Psychological problems of adaptation to computer-based jobs (especially for elderly workers).

Preventive measures

- Wear safety shoes with non-skid soles.
- Use ladders in good repair; make sure that ladder is in required position without the possibility of displacement and/or collapse; inspect ladder before climbing.
- All cavities, hollow spaces, elevated working surfaces, and other locations where there is hazard of falling should be "securely fenced" by appropriate railing guards.
- During work with these machines, ensure that work clothes are attached to the body; use appropriate headgear; guard all moving parts of equipment that may injure the worker.
- Check electrical equipment for safety before beginning to work; call a qualified electrician for testing of suspect equipment.

- All chemical supply connection points must be checked and post appropriate signs must be posted at these points.
- Apply chemical safety rules when handling or working with hazardous chemicals; read MSDS and consult a safety supervisor regarding specific chemicals.
- Apply safety rules while working in a confined space: check air quality and, if necessary, exhaust ventilation before entering into a confined space; use harnesses that are held by your co-workers; use respirators and gas masks; etc.
- Use appropriate ear protection; consult a safety supervisor or a supplier.
- Work clothes should fit the climatic conditions of the work place.
- Learn and use safe lifting and moving techniques for heavy or bulky loads; if necessary, use lifting aids.
- Consider consultation with an occupational psychologist.

Occupational Health and Safety Considerations at wastewater treatment plants

Sewage is the used water of a community and can include domestic wastewater and industrial wastewater. Combined sewer systems will include storm water such as road runoff which carries oils, salts, metals, and asbestos. Many systems, especially older ones, will receive infiltration which can carry pesticides and herbicides from soil application. For many years, work in the wastewater treatment field was considered the most hazardous, especially due to deaths involving confined space entry. This field is considered somewhat less hazardous today, but treatment plant workers still do experience health problems and deaths. These experiences occur in specific incidents involving chemicals in the sewer system and irregular work exposures throughout the plant and its processes. Some chemically-related health complaints are acute in nature, involving short-term exposures and complaints such as irritations of the eyes, nose or throat. Other problems are chronic in which repeated exposures, some times over several years, have caused effects upon internal organs or have involved occupationally-related allergies. Studies have shown that wastewater treatment may generate aerosols containing microbiological and chemical constituents. In fact, the primary route of exposure for workers is probably inhalation. The physical layouts of many sewage treatment plants involve open tanks and basins; plants typically are not designed to prevent aerial dispersion of wastewater during the treatment process. Volatile organics in wastewater may be vaporized or air-stripped during treatment. Many of the compounds are carcinogens and/or mutagens, so sewage workers may be at increased risk of cancer or adverse birth outcomes. Infections from exposure to waterborne disease organisms may be subclinical or may appear as actual disease in wastewater workers. Treatment personnel have reported nausea, vomiting, indigestion, diarrhoea, and flu-like complaints. Studies of antibodies in the blood of workers have documented that disease exposures have occurred. Although several years of exposure tend to produce eventual immunity for many workers to some organisms, new workers tend to be ill more often than experienced workers. The ways to reduce exposure by engineering controls, administrative controls, process control strategies, and protective equipment; and some suggested medical surveillance.

A single sewage treatment plant may service a hundred or more industries; therefore an enormous range of chemicals may be present in the influent and sludge's. The presence of toxic chemicals and organisms in sewage, in sludge, and in the air at specific sites in sewage plants has raised suspicion regarding their possible effects on the health of the workers in these plants. Wastewater treatment plant workers may be exposed to chemicals or organisms by direct contact with wastewater and sludge's, or by inhalation of gases, particles, aerosols, vapours, or droplets. These hazards may enter the plant in soluble form or attached to suspended solids. Compounds reported from sludge analyses include chlorinated organic solvents and pesticides, PCBs, polycyclic aromatics, petroleum hydrocarbons, flame retardants, nitrosamines, heavy metals, asbestos, dioxins, and radioactive materials. The concentration of organics and metals in sludge is indicative of the areas' industries; for example, high concentrations of PCBs in sludge were due to the manufacture of electrical equipment upstream from the treatment plant. There are also derivatives of chemicals formed by microbiological or other processes during the sewage treatment process; these may be more or less toxic than the original compound. Disease causing organisms have been found in sewage sludge; therefore, sewage Workers may be at increased risk of infection or diseases.

Workers Exposed to Chemicals or Diseases

INHALATION appears to be a major route for chemicals or organisms to enter the body. Some chemicals are air-stripped from wastewater and workers working near weirs, aerated tanks, dewatering processes, and other sludge processes (drying, compacting, and incineration). Aeration and dewatering processes also put droplets and particles into the air which can be inhaled. Much of the material inhaled into the throat or bronchial tubes is cleared from the lungs and swallowed. As a result, respiratory and gastrointestinal exposure can occur from inhaled chemicals and organisms. Wastewater workers have also been exposed to chemicals while attempting to remove these substances from treatment plant equipment.

SKIN CONTACT is also a route of entry for both chemicals and disease. Chemicals can be absorbed through the skin from contact with wastewater or sludge. Disease organisms can also enter the body through cuts or abrasions. There has also been a report of a wastewater worker who received a needle stick injury when removing screenings from a bar screen.

Occupational Health and Safety Considerations at Construction material manufacturing industries like cement plants, RMC Plants, precast plants.

Safety- Hazards

In all the cement production processes there are hazards that can be classed in:

- Safe behaviour
- Environment, Work and Passage Areas

Routine and general hazards such as:

- Safety labelling
- Personal Protective Equipment (PPE)

Special hazards during the cement production phases such as:

- Quarrying
- Crushing
- Clinker production
- Milling processes at raw mill, cement milling and coal milling
- Material transport
- Storage
- Use of hazardous material
- Isolation

Special hazards as a result of the work environment:

- Dust
- Noise
- Fire
- Emergency response

Environment, work and passage Areas

- The environment should be free from obstacles.
- All tools should be placed to their respective tool box.
- All equipment and tools should be placed away from the work area to avoid obstacles in case of emergency.
- All emergency exits including fire exits should be free from obstacle, and should have proper signage and emergency lights.
- Roads and path of trucks should be free from pedestrians and should also have proper signage and traffic warnings.

Safety Labelling

- Attach labels and safety pre-cautions to serve as a guide to the workers.
- Attach directions and labels for emergency exits.
- Place the label to where they are easily seen lest they become useless.
- All workers should have their own materials according safety operations and others.
- All workers should be supervised by a safety engineer and should wear proper ppo (personal protective gear) before going to work.
- Safety precautions should be placed in the entrances or doors to serve as a reminder to the workers.
- Equipment's should also have labels and warnings for basic operations.
- Warnings should be placed in dangerous areas such as sink holes in quarry, excavation, slippery places or roads etc.

SAFETY MEASURES

- Proper signs and safety precautions.
- Proper lightings.
- Proper and frequent maintenance of vehicles and other heavy equipment's. This really helps a lot in reduction of possible risks and hazards just like unexpected mechanical equipment failures.
- Phones are prohibited in the site. This may cause disturbance to the workers.
- Always wear safety gears especially hard caps to protect you to unexpected falling objects.
- Flying over the near the site is really dangerous because of thinness of the atmosphere that may lead to stall.
- Stay away from heavy equipment's, the driver has limited eye site. Install rear cameras to reduce risk in traffic.
- Always wipe or clean the head lights and back lights of heavy equipment's. Dust is always present in cement industry; it might cover the lights of heavy equipment's.
- Always wear safety harness when working in high places.

Crushing

HAZARDS

- Physical direct contact to the machine might injure you.
- Falling objects are also present in this process.
- Traffic hazards are also present.

SAFETY MEASURES

- Always stay away from the machine when it is operating.
- Wear safety equipment's.
- Always be attentive of possible unexpected scenarios.
- Proper slogans should be where it can be easily seen.
- Stay away from heavy equipment's, the driver has limited eye site. Install rear cameras to reduce risk in traffic.

Clinker Production

HAZARDS

Incidents and injuries resulting in burns arise from contact with hot clinker or cement powder. Hazards are particularly associated with hot cement kiln dust (CKD), and dust on preheater systems. Chemical (alkali) burns may also result from contact with CKD.

Raw Mill and Preheated Tower:

Material in the mill is at temperatures up to 120⁰C; in the tower the material can be as hot as 900⁰C.

Contact with the material is more likely when:

Clearing blockages in the tower where there is the potential for it to flush through the process during rodding and cardoxing where it can be ejected over a wide area.

Hot Clinker: Contact is possible in the:

- Clinker cooler building
- Along the clinker pan conveyors
- In the clinker dome
- Along the belts to the cement mills

Precipitator and By-Pass Dust: Contact is possible when:

- Access is required to the precipitator hoppers
- Working on the screws and drag chain conveyors
- Maintaining the dust transfer pumps

Hot Cement: Contact is possible when:

- Accessing the cement transfer lines
- Working on the packers
- Carrying out work on the cement screw conveyors and drag chains

SAFETY MEASURES

- Eliminate the hazard (install insulators)
- Reduce the risk at source
- Isolate people from the hazard
- Control the risk by other means
- Protect yourself with the correct PPE

ISOLATION

Any isolation of energy systems; mechanical, electrical, process, hydraulic and others, cannot proceed unless:

- The method of isolation and discharge of stored energy are agreed and executed by a competent person(s) any stored energy is discharged
- A system of locks and tags is utilized at isolation points
- A test is conducted to ensure the isolation is effective
- Isolation effectiveness is periodically monitored

MATERIAL TRANSPORT

Hazards: Traffic hazards

SAFETY MEASURES

- All categories of vehicle, including self-propelled mobile plant, must not be operated unless: vehicle is fit for purpose, inspected and confirmed to be in safe working order.
- Number of passengers does not exceed manufacturer's design specification for the vehicle.
- Loads are secure and do not exceed manufacturer's design specifications or legal limits for the vehicle
- Seat belts are installed and worn by all occupants
- Safety helmets are worn by riders and passengers of motorcycles, bicycles, quads, snow-mobiles and similar types of vehicle
- Drivers must not be authorized to operate the vehicle unless:
 - They are trained, certified and medically fit to operate the class of vehicle.
 - They are not under the influence of alcohol or drugs, and are Not suffering from fatigue
 - They do not use hand-held cell phones and radios while driving. (Best practice is to switch off all phones and two-way radios when driving)

STORAGE

HAZARDS

A confined space is any space of an enclosed nature where there is a risk of death or serious injury from hazardous substances or dangerous conditions. The risks in confined spaces arise due to Entry into any confined space cannot proceed unless:

- All other options have been ruled out permit is issued with authorization by a responsible person(s)
- permit is communicated to all affected personnel and posted, as required
- All persons involved are competent to do the work
- All sources of energy affecting the space have been Isolated
- Testing of atmospheres is conducted, verified and repeated as often as defined by the risk assessment
- Stand-by person is stationed
- Unauthorized entry is prevented
- Lack of oxygen Poisonous gas, fumes or vapor Liquids and solids, which can fill the space suddenly Fire and explosions
- Dust Hot conditions
- To minimize the risks associated with confined entry:
 - Avoid entry to confined spaces e.g. by doing the work from outside.

- Blockages can be cleared in silos by use of remotely operated rotating flail devices, vibrators or air purges.
- Inspection, sampling and cleaning operations using the right equipment.
- Remote cameras can be used for internal inspection of vessels.
- Make sure combustible material are separated according to its kind and store them in a cool dry place.

Use of hazardous material

HAZARDS

- Irritation
- Possible direct contact of material or chemical to the eyes.
- Direct contact may cause skin disorders.

SAFETY COUNTER MEASURES

- Wear proper PPE (cloves, goggles, boots, hard cap, etc.)
- In case of irritation do not use alcohol, use water instead.
- Possible poisoning due to inhalation of hazardous materials.
- In case of eye irritation, do not rub your eyes, rinse with water and call a physician immediately or go to clinic.
- In case of poisoning, call a physician.

Electrical Isolation

- Turn off electrical isolating switches
- Ensure that local isolation is effective
- Some machinery requires substation isolation.
- Each worker should have his own key ensuring isolation

SPECIAL HAZARDS AS A RESULT OF THE WORK ENVIRONMENT

- Dust
- Noise and Vibration
- Fire

Dust

Hazards

- Inhalation might cause elevated chronic obstructive lung diseases.

SAFETY

- It is good practice to limit dust levels and employee exposure both in terms of employee health and good housekeeping.

- Appropriate respiratory protection should be worn where work has to be carried out in dusty areas in cement plants

NOISE AND VIBRATION

HAZARDS

- Too much exposure to sounds and vibrations might deafen workers.

SAFETY COUNTER MEASURE

- Wear earplugs that are appropriate to your ear.
- Improved noise personal protective equipment is also helping reduce the effects of exposure.
- Regularly monitor employee auditory functions to ensure this does not exceed natural decline with age.

FIRE

HAZARDS

- Unexpected explosions may occur when highly combustible materials are exposed to heat due to confined places.

SAFETY MEASURES

- **Plastics:** Recycled plastics are normally used in shredded form and conveyed pneumatically. There can be considerable associated dust requiring eye protection and breathing masks as well as full body clothing, metal silos and ducts need earthing to prevent an explosion hazard. Fire protection is also required, as well as evacuation instruction in the case of fire, as smoke vapours can be toxic.
- **Solvents:** Recycled solvents must be rigorously sampled at intake because of variable chemical and physical composition in order to determine health precautions. Most solvents are toxic and may be flammable. Therefore health precautions are similar to those used in the source industry (e.g. chemical, pharmaceutical) Intake and storage systems must be designed for safe, automated handling, with spill, fire and explosion protection, with an associated emergency plan. Health procedures require eye protection, breathing masks and full cover clothing.
- **Used Oils:** Used oils will need to be checked for PCB content, which will determine precise precautions required. Requirements are generally similar to those for solvents, with similar health precautions.

Emergency Response

- Fire and emergency procedures
- First aid facilities
- Environmental emission controls

- Emergency response team
- Emergency plan

Health and Safety Considerations at Construction site

The following sections give examples of good practice in safety in cement plants.

Mobile Plant

Common hazards associated with the heavy plant (e.g. dumper trucks, front loading shovels, Fork lift trucks) used in quarrying and bulk material transport include vehicle impact and twisted ankles during embarking and disembarking. Vehicle impact has the potential for particularly high severity incidents, both in quarries and on the manufacturing sites. When reporting and analysing incidents, it is helpful to distinguish between productions, quarrying and general off-site transport activities. Incidents can be reduced by improved driver training, increasing awareness of the people working alongside these vehicles, and by using dedicated routes and crossings to help keep vehicles and pedestrians apart. Modern vehicles also offer improved visibility, helping further reduce the risks as the older equipment is replaced.

Working at Height

Controls relating to working at height or in confined areas (e.g. Permit-to-work, task risk assessment) are effective in reducing injuries by raising awareness of the hazards and ensuring the correct work methods are followed and that the proper precautions are taken. Mandatory use of safety equipment (harnesses, safety nets) to properly protect workers from falls, posting of permits, and regular inspections of the job site are commonly employed techniques.

Ladders

1. Ladders are primarily for access only.
2. Before use, check that the ladder is in good condition.
3. Ladders must be tied and/or footed at all times.
4. Ladders must extend 1 meter above the working platform to provide handholds when mounting/dismounting
5. As an angle guide, ladders must be one-out for every four up.

Scaffolding

1. All scaffolding must be erected, altered or dismantled by a trained, competent and Certified scaffold.
2. Fall arrest equipment must be used by scaffolds if working above 4 meter's with unprotected edges. (For other personnel, this limit is usually 2 meter's.)

3. Scaffolds must be inspected by a competent person and reports entered into the Scaffolding Log.
 - a. Before first use
 - b. After substantial alterations
 - c. Following strong winds or collision
 - d. At regular intervals not exceeding 7 days
4. Never work on scaffold unless minimum platform width is 4 boards, with handrail, intermediate rail and toe board fitted.
5. Minor works may be carried out without handrails but only if a full harness is worn and anchored
6. Access must be by a secured ladder
7. Do not take up boards, move handrails or remove ties to gain access for work.

Mobile Scaffold Tower

1. Must be erected by a trained, competent and certified person, in accordance with Manufacturer's recommendations.
2. Must be erected on firm level ground, free from underground services.
3. Area beneath must be cordoned off by suitable means or signage.
4. Working platforms must have handrail. Intermediate rail and toe boards fitted. Access must be by internal ladders.

Working at the Quarry Face

Drillers and those loading shot holes are working close to the edge of the quarry face, although they may inadvertently approach the edge and a form of edge protection is required. The recommended system involves the use of strapping between aluminum poles, the straps are then ratcheted tight. The poles and strapping can be purchased directly from a specialist supplier. It is important that a safety harness/lanyard is also provided to deal with a situation where a person may have to go in front of the barrier. A safe system of work, to incorporate all parts of this system should be provided to the Safety Officers. All those who may be required to use the harness must be trained in the use of same.

Use of Safety Nets

During roof work, a safety harness is used as a means of protecting the person from falling. However, it is not always practical for roofers to be continuously clipped on, due to the lack of a secure point. The actual use of the harness system by construction workers on such roof

work is quite low – this is due to the discomfort and restrictions in using the harness. Failure to use the harness is a common complaint on construction work at sites. To counter these problems the use of Safety nets should be considered. These are installed under the entire area at which work at height is taking place. It is important to note that the harness system should still be in use and that edge protection is still required on roofing work.

Inspection of Safety Harnesses

All Safety Harnesses (including those worn by contractors) should be checked prior to use for the following

a) That the traceability label is adequately attached to the product.

b) Check the webbings & ropes for:

- Cuts, tears
- Excessive wear
- Burns, chemical attack
- Hardening of the fibers
- Sewing must be free of cuts

C) Check the metal fittings for:

- Sharp edges
- Excessive wear
- Correct operation
- Distortion

D) Do not subject the PPE to activities where it is likely to be damaged e.g. do not choke the lanyard.

E) If PPE's is wet and damp, dry in a well-ventilated area, away from any direct heat source

Plant Isolation/Lock-Out

Plant Isolation is one of the most important areas of plant safety, with improvements in the technology in the industry, these procedures become more complex, and however effective systems which fully isolate machinery from all energy sources are essential

Electrical Isolation:

Turn off electrical isolating switches, ensure that local isolation is effective, some machinery requires substation isolation. Each worker should have his own key ensuring isolation.

Process Isolation:

- Turn off compressed air supply
- Shut off steam

- Prevent elevator run-back
- Divert traffic
- Prevent in-flow of material
- Isolate barring gear

This process should be detailed for each potential isolation procedure. Each step should be performed and then Tagged off. Final check should be made by Supervisor before commencement of maintenance work.

Slips, Trips and falls

Slips, trips and falls are another common cause of injuries in the industry. These can arise from the uneven surfaces in the quarries and roads and from lapses in good housekeeping within the manufacturing plants. As borne out in the injury analysis, Slips, Trips and fall cause almost 30% of all injuries.

PREVENTION AND CONTROL OF RISKS

Fixed and Mobile Equipment

New installations are designed and built taking into account the safety of operating and maintenance personnel. The installations and mobile equipment shall be effectively maintained and where appropriate, examined and inspected. Those subject to regulatory controls are monitored.

Personal Protection Equipment

Personal protection equipment for work shall be identified, the circumstances in which it should be worn defined, and suitable arrangements made including training & supervision to ensure it is worn (See appendix for datasheet on PPE usage)

Instructions, Rules and Procedures

Instructions, rules and procedures are designed so work may be performed safely, without risk to health, and in accordance with risk assessment. They shall be:

- Written
- Up-dated
- In line with regulations
- Realistic
- Cement Sustainability Initiative
- Known and understood by all parties involved
- Followed and respected

Emergency/Security Plans

All sites shall have emergency plans in place, pertinent to the nature of their operations and assessed site risks. These plans shall be updated, as required, communicated and practiced on a regular basis. Exercises shall be conducted and drilled on a regular basis, covering notably scenarios of high potential risks.

Contractors

Health and Safety regulations apply equally to Contractors and their employees working onsite; contracts with Contractors should specify the rights and duties of each party in this respect. The contracted party's ability to work safely is a major selection criterion. Health and Safety shall be effectively managed on work sites. This shall include where appropriate suitable, regular audits. Contractors are actively assisted in safety matters. Safety performance indicators for companies operating on site are recorded and reported. They serve as a performance evaluation tool. Poor safety performance shall not be tolerated and may result in early termination.

- Training and Communication
- Training
- Appropriate arrangements shall be made to ensure all personnel are suitably H&S competent.
- These arrangements shall provide appropriate training & experience.

Safety includes

- Training in safety behaviour and why H&S is important
- Training in risk assessment
- Training in procedures and methods
- Training in use of working equipment
- Training for obtaining authorizations and licenses

It concerns all personnel:

- New recruits and temporary employees
- "Established" staff (recycling, top-up courses, transfers, changes)
- Management (*audits, inquiries, prevention plans, facilitating meetings etc.)
- Contractors as required
- All safety training is registered, notably in the individual personnel files, regularly reviewed.
- Cement Sustainability Initiative

Communication

Communication is an important factor of the safety programme. This shall include Information on the site's safety plan; provide feedback on performance and actions taken, Learning points to prevent injuries. It encourages a free flow of information (top-down and Bottom up)

Heat Burns Incidents and injuries

Heat Burns Incidents and injuries resulting in burns arise from contact with hot clinker or cement powder. Hazards are particularly associated with hot cement kiln dust (CKD), and dust on preheater systems. Chemical (alkali) burns also result from contact with CKD.

During normal operation the hot raw, intermediate and final products are contained or highlighted. There is far greater risk when contact is possible during abnormal operation of the plant, when clearing blockages, carrying out maintenance or in emergency situations. It is not always obvious when something is hot, the risks include personal injury – severe burns and fire – from contact with combustible materials; oils, scaffold boards, ladders, electrical cabling, etc. Raw Mill and Preheater Tower: Material in the mill is at temperatures up to 120⁰C; in the tower the material can be as hot as 900⁰C. Contact with the material is more likely when person Clearing blockages in the tower where there is the potential for it to flush through the process during rodding and cardoxing where it can be ejected over a wide area.

Policies, roles and responsibilities of workers, managers and supervisors

Safety policies

Safe and healthy working conditions do not happen by chance. Employers need to have a written safety policy for their enterprise setting out the safety and health standards which it is their objective to achieve. The policy should name the senior executive who is responsible for seeing that the standards are achieved, and who has authority to allocate responsibilities to management and supervisors at all levels and to see they are carried out. The safety policy should deal with the following matters:

Arrangements for training at all levels. Particular attention needs to be given to key workers such as scaffolds and crane operators whose mistakes can be especially dangerous to other workers;

- Safe methods or systems of work for hazardous operations: the workers carrying out these operations should be involved in their preparation;
- The duties and responsibilities of supervisors and key workers;
- Arrangements by which information on safety and health is to be made known;
- Arrangements for setting up safety committees;
- The selection and control of subcontractors.

Workers

Every worker is under a moral, and often also a legal, duty to take the maximum care for his or her own safety and that of fellow workers. There are various ways of involving workers directly in site conditions, such as:

- “tool-box briefing” (figure 2), a five- to ten-minute session with the supervisor just prior to starting a task gives the workers and the supervisor a chance to talk about safety problems likely to be encountered and potential solutions to those problems. This activity is simple to implement and it may prevent a serious accident;
- safety check”; a check by workers that the environment is safe before starting an operation may allow them to take remedial action to correct an unsafe situation that could later endanger them or another worker.

Safety officer/manager

Every construction company of any size should appoint a properly qualified person (or persons) whose special and main responsibility is the promotion of safety and health. Whoever is appointed should have direct access to an executive director of the company. His or her duties should include:

- The organization of information to be passed from management to workers, including those of subcontractors;
- The organization and conduct of safety training programs, including induction training for all workers on the site;
- The investigation and review of the circumstances and causes of accidents and occupational diseases so as to advise on preventive measures;
- acting as consultant and technical adviser to the safety committee;
- Participation in pre-site planning. To carry out these functions the safety officer should have experience of the industry and should be properly trained and qualified and, where such exists, should be a member of a recognized professional safety and health body.

Supervisors

Good planning and organization at each work site and the assignment of clear responsibility to supervisors are fundamental to safety in construction. “Supervisor” here means the first level of supervision, which on site is variously termed as “foreman”, “charge hand”, “ganger”, and so on. Each supervisor requires the direct support of site management and should seek to assure within his or her field of competence that:

- Working conditions and equipment are safe;
- Workplace safety is regularly inspected;
- Workers have been adequately trained for the job they are expected to do;
- Workplace safety measures are implemented;

- The best solutions are adopted using available resources and skills;
- Necessary personal protective equipment is available and used.

Making the work site safe will require regular inspection and provision of the means for taking remedial measures. The training of workers enables them to recognize the risks involved and how they can overcome them. Workers should be shown the safe way of getting a job done.