

# TRAINING PROGRAMME FOR ETP OPERATORS IN TEXTILE INDUSTRY

Promotion of Sustainability in the Textile and Garment Industry in Asia - FABRIC

# **Safety and health in ETPs**

GIZ FABRIC – ETP Operator Course



# Contents

- Basic concept of occupational safety and health
- Common hazards in ETPs
- Managing hazards and risks

# Basic concept of occupational safety and health

# Basic concept of occupational safety and health

## Relevance of occupational safety and health (OSH)

- Personal concern for one's and others' well-being
- Maintaining motivation at work
- Economic angle
  - Accidents leading to work-stoppage, investigation and fines by authorities
  - Payment of compensation to injured or sick workers
  - Lower productivity of workers when sick
  - Cost for replacement of workers recruitment, training)
  - Good and safe working conditions for keeping key personnel



# Basic concept of occupational safety and health

## Focus of OSH management

- **Promoting and maintaining** highest degree of workers` physical, mental and social well-being
- **Eliminating and controlling** work-related **hazards** and **risks** to safety and health
- **Adapting work to workers** and each worker to his/her job
- **Preventing workers` departures** for health reasons and poor working conditions
- **Enabling workers** to protect themselves



# Basic concept of occupational safety and health

## Hazard and risk

### Hazard =

- Ability of material/situation to cause harm

### Risk =

- Probability of hazard to cause harm



# Basic concept of occupational safety and health

## Aspects of OSH management

- **Identifying** and **assessing hazards and risks** (regular and non-regular operations and situations)
- **Eliminating hazards** (e.g. hazardous materials or operations)
- **Minimizing exposure** to hazards
- **Implementing** engineering **controls**
- Promoting and using **personal protection and hygiene**
- Providing **training** and instructions
- Monitoring and reporting





# Basic concept of occupational safety and health

## Aspects of OSH management

- Machine safety
- Electrical safety
- Chemical safety
- Ergonomics
- Work environment related safety
- Workloads and material handling
- Psycho-social safety
- Personal protection
- Emergency preparedness



# Common hazards in ETPs

# Common hazards in ETPs

- Physical hazards
- Mechanical hazards
- Biological hazards
- Chemical hazards
- Ergonomic and work-environment related hazards
- Psychological and social hazards



# Common hazards in ETPs

## বিপদ সংকেত সমূহ



Slippery when wet



Corrosive



Bio-hazardous infectious material

# Common hazards in ETPs

## Physical hazards

- **Falls from height** and working in elevated position (tanks, clarifiers, ladders, chambers)
- **Slipping** on wet surfaces (**walkways, stairs**)
- Common in
  - Construction
  - Extraction
  - Transportation
  - Cleaning and maintenance
- Risk of
  - ▶ occupational injuries and fatalities



কর্মীরা কোনরকম যথাযথ নিরাপত্তামূলক যন্ত্রপাতি ছাড়া ঝুঁকিপূর্ণ অবস্থায়

# Common hazards in ETPs

## Mechanical hazards

- Contact with
  - **moving machine parts** (e.g. gears, motors)
  - **sharp edges**
  - **hot surfaces**
  - other hazards with potential to crush, burn, cut, shear, stab, strike workers
- Risk of
  - ▶ occupational injuries, burns and fatalities



# Common hazards in ETPs

## Electrical hazards

- Contact with **high voltage** in
  - motors
  - switchboard
  - cables
- Enhanced risk due to poor installations, maintenance, wet and corrosive environment
  - ▶ electric shocks and (fatal) electrocution
  - ▶ electrical burns
  - ▶ fall injuries caused by jolts after contact with electricity
  - ▶ igniting fire (faulty wire, poor wiring, static electricity)



# Common hazards in ETPs

## Work-environment related hazards

### ▪ Noise

- Equipment in ETP emitting high noise levels
  - **Air blowers**
  - **Sludge centrifuges**
  - Poorly maintained or lubricated moving machine parts
  - Pressurized air leaks or bursts
- Noise exposure for long period causing
  - ▶ gradual and often irreversible hearing loss
  - ▶ stress and high blood pressure
  - ▶ indirect cause of injuries due to lack of concentration or distraction





# Common hazards in ETPs

## Work-environment related hazards

- **Vibration and pressure**
  - Vicinity to poorly balanced machinery
  - Contact to highly pressurized water or air
    - High pressure cleaners
    - Air compressors and compressor lines
- Risk of
  - ▶ injuries
  - ▶ work-related illnesses



# Common hazards in ETPs

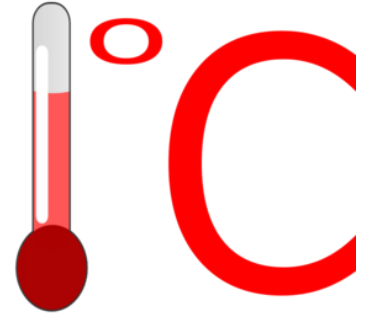
## Work-environment related hazards

### ■ Heat-stress

- Exposure to **high ambient temperature** and direct sunlight during work in ETP
- Exposure to high radiant temperatures from raw effluent as well as hot or heat emitting equipment

### ■ Risk of

- ▶ heat exhaustion
- ▶ dehydration
- ▶ heatstroke and fatigue



# Common hazards in ETPs

## Biological hazards

- Exposure to disease causing biological agents (bacteria, viruses, fungi, mould, blood borne pathogens, parasites)
  - Ingestion (eating, drinking or smoking at workplace or without washing hands)
  - Inhalation (small droplets, aerosols)
  - Skin and eye contact (e.g. skin wounds, softened skin, splashes on eyes)
- Bites by disease-carrying mosquitos
- Many places in ETP (aerated tanks, mixers, inflows)



# Common hazards in ETPs

## Chemical hazards

- Exposure to and contact with treatment chemicals by
  - Skin and eye contact
  - Inhalation (gases, dust, vapours, mist and fume)
  - Accidental ingestion (eating, drinking or smoking at workplace or without washing hands after handling chemicals)
- Common ETP locations with **chemical hazards** (primary treatment)
  - Chemical **storage**
  - Chemical **preparation** and **dosing**
  - Disposal of **chemical waste** (e.g. residuals, packaging)
  - ETP **laboratory**



# Common hazards in ETPs

## Chemical hazards

- Potentially hazardous chemicals in ETP:
  - Lime (e.g. dust released during handling)
  - Acidic chemicals (e.g. Ferrous Sulphate/Alum.)
  - Acids/Alkali stored and used for neutralization.
  - De-foamer used for foam control.
  - Chlorine used for disinfection and sludge bulking control
- ▶ **Identify** possible **hazards** by consulting **safety data sheets**



# Common hazards in ETPs

## Ergonomic hazards

- In processes involving
  - heavy lifting or handling of heavy tools or loads (e.g. machine maintenance, replacement of aeration systems, tank cleaning)
  - prolonged unconformable or strained working position
- Risk of
  - ▶ injuries
  - ▶ musculoskeletal disorders



# Common hazards in ETPs

## Other hazards

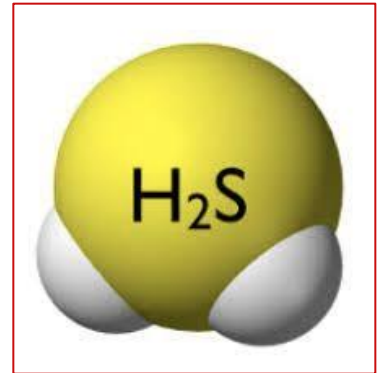
- Asphyxiation (suffocation) while
  - working in confined space
  - Cleaning of clogged pipes
  - Removal of sludge and sediments
- Drowning following falls or slips into tanks
- Risk of
  - ▶ Fatalities



# Common hazards in ETPs

## Other hazards – Hydrogen sulphide gas

- Common hazard and main contributor to fatalities in ETPs
- At any place with stagnating effluent or sludge
- Produced when effluent degrading in anaerobic condition
  - also degradation product of sulphates by sulphate reducing bacteria
- Characteristics
  - Highly corrosive and flammable
  - Heavier than air
  - Poisonous gas (with smell of rotten eggs in low concentration, no detection by smelling in dangerous concentrations!)



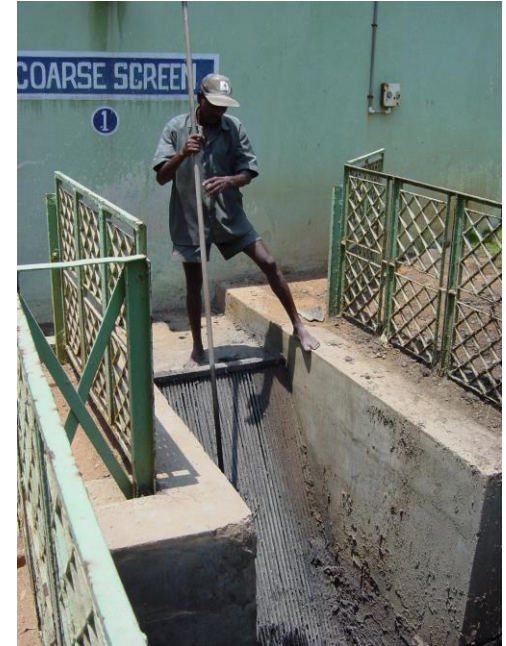


# Managing hazards and risks

# Managing hazards and risks

## How to proceed

- Become **aware of hazards**
- **Identify and map** locations with such **hazards** (e.g. using eco-mapping) in ETP
- Observe and record **unsafe conditions and practices**
- **Assess** risk (**how likely, how severe effects**)
- Consider ways for improving focusing on
  - **eliminating hazards**
  - **reducing risk**
  - **protecting against hazards**
- Prepare and implement **corrective actions**

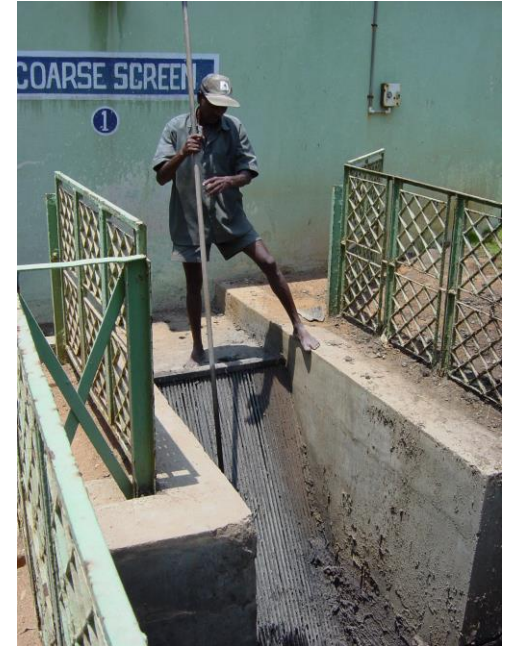


# Managing hazards and risks

## Example - Eliminating hazards

### No hazard – no risk

- Substitution with safer equipment or chemicals
- Process modification (switching from manual to semi-automatic dosing)
- Change/ or modification of plant layout
- Provision of covers for man holes and pits



# Managing hazards and risks

## Example – Minimizing risks

Hazard still there but **less chance of doing harm**

- Installation of machine guards and cover
- Installation of fences and railings
- Installation of noise muffling devices
- Installation and maintenance of local exhaust facilities and general ventilation
- Insulation and proper earthing of electrical installations (chemical corrosion protection)



# Managing hazards and risks

## Machine safety

### Unsafe conditions and practices (Examples)

- **Absence** of passive **guards** preventing access to hazardous machine parts
- Absence or **non-functioning of active guards**
- **Unsafe positioning** – inadequate space for operation, cleaning and maintenance
- **Working close to running machinery** or moving machine parts (without tag-out or lock-out)



# Managing hazards and risks

## Machine safety

### Good practices to check (Examples)

- ✓ Coupling guards for centrifugal pumps, screw pumps, high pressure pumps
- ✓ Guards around agitators of chemical preparation tanks and flash mixers
- ✓ Guards around drive assemblies of clarifiers and clariflocculators
- ✓ Guards on air blowers
- ✓ Noise reduction devices on air blowers
- ✓ Active guards on filter press



# Managing hazards and risks

## Electrical safety

### Unsafe conditions and practices (Examples)

- Index of protection (IP) for electrical installation or motor not maintained
- Absence of terminal boxes, gland fittings, fan and fan cover
- Loose cables hanging without conduits
- Absence of twin earthing
- Make-shift or missing circuit breakers
- Working close to live wires or parts (no tag-out or lock-out procedures)
- Work done by unqualified personnel





# Managing hazards and risks

## Electrical safety

### Good practices (Examples)

- ✓ Correct and clean installation of cable connection, switches and control boards
- ✓ Earthing of motors
- ✓ Proper IP rating of switches and motors
- ✓ Provisions against corrosion
- ✓ Provision of properly rated fluted rubber mats in front of switch boards





# Managing hazards and risks

## Electrical safety

### Good practices – Motor earthing



# Managing hazards and risks

## Electrical safety

### Good practices (Examples)



Use of fans with fan covers for engine cooling



Closed/sealed connectors

# Managing hazards and risks

## Electrical safety

### Good practices



Earth-leakage circuit breakers



Motor overload protection

# Managing hazards and risks

## Chemical safety

### Unsafe conditions and practices (Examples)

- Chemical containers without or with torn labels
- No availability or use of information about chemicals (e.g. safety data sheets)
- Storage of incompatible chemicals together
- Powdered chemical kept in wet areas
- Chemical containers kept open
- No use of prescribed personal protective equipment (PPE) when handling chemicals or chemical waste
- Empty chemical containers used for storage of food or water



# Managing hazards and risks

## Chemical safety

### Good practices (Examples)

- ✓ Standardised **labelling and markings** of all chemical containers
- ✓ Creating awareness using standardized **warning and precautionary signs**
- ✓ **Segregation** of incompatible chemicals and secondary containments



# Managing hazards and risks

## Chemical safety

### Good practices (Examples)

- ✓ Refer to and apply **recommendations in safety data sheet** for safe storage handling and disposal
- ✓ Properly use required **personal protective equipment** (respiratory, skin and eye protection)
- ✓ Apply good **personal hygiene** practices (e.g. washing hands)



# Managing hazards and risks

## Chemical safety

### Hierarchy of controls

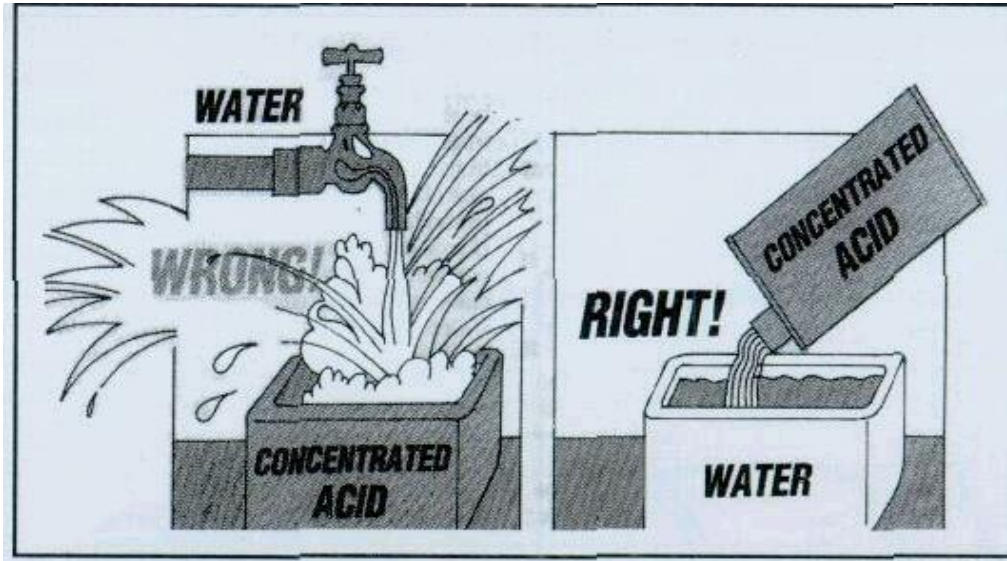
1. **Replace** existing chemicals **with non- or less hazardous** ones
2. **Change processes** (e.g. dosing systems) to reduce need of directly handling chemicals
3. Use **engineering controls** to reduce chance of exposure (e.g. local exhaust ventilation, general ventilation)
4. Use **administrative control** to reduce exposure time of workers
5. Prepare and communicate **work procedures**
6. **Train** and **instruct workers** on safe handling practices
7. Provide and use specified **personal protective equipment**



# Managing hazards and risks

## Chemical safety

### Good practices - Diluting acid for neutralization





# Managing hazards and risks

## Chemical safety

### Good practices – Understanding chemical hazard/warning signs

- Explosive
- Flammable
- Compressed gas
- Toxic
- Harmful
- Oxidising
- Aquatic toxic
- Corrosive
- Systemic effects



# Managing hazards and risks

## Chemical safety

### Good practices – Using and following safety signs

**Do not!**



No smoking

**Do!**



Red colour = prohibited

Blue colour = mandatory

Green colour = emergency

# Managing hazards and risks

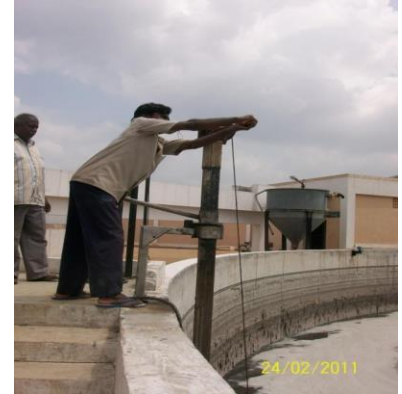
## Ergonomic safety



# Managing hazards and risks

## Ergonomic safety

- To optimize human interactions with products, equipment and processes
  - design of workstations, workplaces and machine controls
  - implementation labor-saving processes (e.g. lifting)
- Common focus on avoiding
  - strained position
  - handling of heavy loads
  - situations causing physical and mental stress



# Managing hazards and risks

## Ergonomic safety



# Managing hazards and risks

## Personal protection

- Covering
  - Use of personal protective equipment (PPE)
  - Personal hygiene practices
- Use of PPE **last option** in hierarchy of control measures
  - **Immediate measures** (!) until other options in place
  - **Protection rating** of PPE limited
- Proper **selection of PPEs**
  - Specific to situation and need
- **Training** on proper use and maintenance needed





# Managing hazards and risks

## Typical PPE in ETPs (selected)

- Helmet
- Safety gloves (e.g. chemical, electrical)
- Overall
- Boots and safety shoes (hardened toe caps)
- Noise protectors
- Safety goggles and shield
- Respiratory protection
  - Air-purifying masks
  - Air supply system (confined space, emergency)
- Safety harness



# Managing hazards and risks

## Emergency provisions and facilities

- On-site emergency plan
- Safety shower (nearby)
- Eye / face rinse station (nearby!)
- First aid box and trained first aid personnel on each shift
- Fire fighting equipment
- Lifebuoys and rescue hooks at tanks





# Managing hazards and risks

## Emergency provisions and facilities

### First aid box - Suggested content

Absorbent gauze [packet of 10 pieces]	Adhesive plaster roll [1.25 cm width]
Crepe bandages [5.0 cm height]	Crepe bandages [7.5 cm]
Disposable glove	First aid pamphlet
Individually wrapped sterile adhesive dressing	One-way valve transparent mask or two-way mouthpiece
Safety pins	Scissors
Sterile water or saline in 100 ml disposable container	Triangular bandage



# Managing hazards and risks

## Supportive measures

- Induction and refresher **safety training** to staff at all levels
  - Basic and advanced safety measures (dealing with common hazards)
  - First aid and emergency training (including regular drills)
- **Hazard and safety communication**
  - Sign boards and safety information
  - Emergency contact numbers of fire station, doctor, EHS manager and staff
- Establishment of **safety committee**
- Periodical **health monitoring**



# Managing hazards and risks

## Supportive measures

### Awareness creation

- Prevalent hazards
- What to do
- What not to do



# Managing hazards and risks

## Supportive measures

- ETP operators playing key role in propagating safe conditions and practices
  - Assess and monitor safety condition as part of routine work
  - Initiate corrective action against unsafe conditions
  - Advises and train staff on safe work practices
  - Apply and demonstrate safe work practices as role model



# To remember



- Safety important for one's and other well-being
- Good safety and health also good for business
- Becoming aware of possible hazards and risk at work first step
- Efforts to focus on eliminating hazards and reducing risks
- Use of personal protective equipment helpful but only one step in controlling hazards and risks
- Important to update one's safety knowledge and skills by regular training and drills
- ETP operator acting as safety role models

**Deutsche Gesellschaft für  
Internationale Zusammenarbeit (GIZ) GmbH**

Registered offices  
Bonn and Eschborn

GIZ Bangladesh  
PO Box 6091, Gulshan 1  
Dhaka 1212, Bangladesh  
T +880 2 5506 8744-52, +880 9666 701 000  
F +880 2 5506 8753  
E [giz-Bangladesh@giz.de](mailto:giz-Bangladesh@giz.de)  
I [www.giz.de/bangladesh](http://www.giz.de/bangladesh)