

# Cleaner Production Training for EPD Punjab

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

## **5. Best Cleaner Production Option to consider at operational stage**

**14:45 – 16:00**

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**on behalf of GIZ FABRICS and Espire Consult**

# Agenda

- Cleaner Production Measures while Operation
- Low Cost or No Cost Options
- Medium Cost Options
- High-Cost Options

# Environmental impact and contributory processes

## Type of measures

### Liquid waste

- Chemical substances, mineral and silicone oils, EO/PO additives
- Desizing, bleaching, washing, dyeing and finishing

### Energy consumption

- Infrequent use of renewable energy sources
- Production of fibres, scibbling, weaving and garment manufacture

### Atmospheric emissions

- VOCs, solvents and combustion gas
- weaving, knitting, finishing and dyeing

# Environmental impact and contributory processes

## Solid waste management

- Fabric and yarn scraps, yarns, fabrics and packaging waste
  - ✓ Scribbling, knitting, finishing, desizing

## Selection/substitution of chemical products with others that are more environmentally responsible

- For less polluting dyes
  - ✓ Readily biodegradable dispersing agents in colouring agents

## Technique at the end of the chain

- Recycling of waste water by separate flow membrane treatment

# Improve Chemical Handling

**Good housekeeping refers to a number of practical measures that can improve productivity, obtain cost savings, and reduce environment, health & safety impacts of your production.**

- ✓ Rationalizing the use of raw materials, chemicals, water and energy inputs
- ✓ Reducing the volume and toxicity of waste, waste water and emissions
- ✓ Conserving materials and energy
- ✓ Improving working conditions and occupational safety & health, e.g. by the use automatic dispensers

***The implementation of such measures is usually relatively easy and often of low-cost nature!***





# Chemicals management - Storage



## Challenges

- Large stockpiles and insufficient capacities of chemical storage facilities
- Critical condition of storage conditions (e.g. ventilation, cooling, incompatibilities)
- Inefficient warehouse management
- Insufficient preparation for emergencies (e.g. fire, release, exposure of persons)
- Insufficient training of warehouse workers

# Storage of hazardous chemicals





# Best practices for storage of hazardous chemicals and waste

- Ensure all containers of hazardous chemicals are properly labeled with the identity of the hazardous chemical(s) and appropriate hazard warnings.
- Segregate all incompatible chemicals for proper storage of chemicals by hazard class. In other words, store like chemicals together and away from other groups of chemicals that might cause reactions if mixed.
- Do not store chemicals alphabetically except within a grouping of compatible chemicals.
- Flammable materials should be stored in an approved, dedicated flammable materials storage cabinet or storage room if the volume exceeds ten gallons. Keep cabinet doors closed.
- Chemicals should be stored no higher than eye level and never on the top shelf of a storage unit. Do not overcrowd shelves. Each shelf should have an anti-roll lip.
- Avoid storing chemicals on the floor (even temporarily) or extending into traffic aisles.

**Source: CDC, USA**

# Best practices for storage of hazardous chemicals and waste

- Liquids should be stored in unbreakable or double-contained packaging, or the storage cabinet should have the capacity to hold the contents if the container breaks.
- Store acids in a dedicated acid cabinet. Store highly toxic or controlled materials in a locked, dedicated poison cabinet.
- Volatile or highly odorous chemical shall be stored in a ventilated cabinet. Chemical fume hoods shall not be used for storage as containers block proper air flow in the hood
- All chemicals should be labeled and dated upon receipt in the lab and on opening. This is especially important for peroxide-forming chemicals such as ethers, dioxane, isopropanol, and tetrahydrofuran.
- Solutions should be labeled and dated when prepared.

Source: CDC, USA

# Disposal of Unknowns

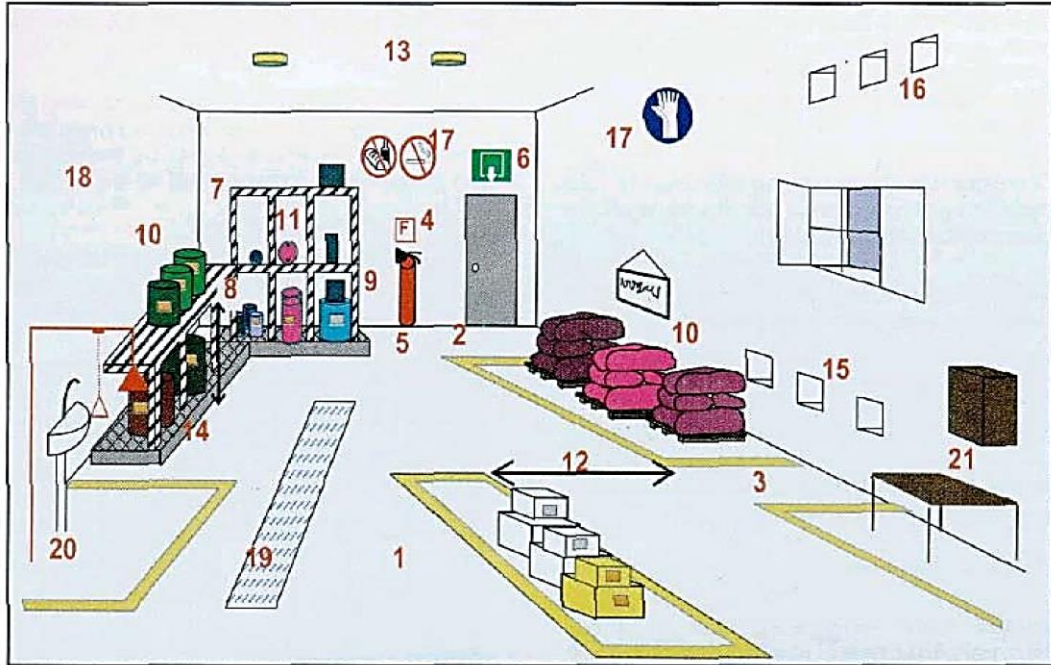
- If an unknown chemical is discovered – contact immediately for professional help for identification and analysis
- The chemical must be tested for flammability and toxicity
- Once it is confirmed that the chemical is none of those, it needs to be tested for acidity and alkalinity of the sample
- Finally, it can be disposed after neutralization of the sample
- However, if it is discovered to be flammable or, toxic, professional disposal bodies should be contacted

# Gaps

- Implementation of procedures for handling hazardous materials;
- Procedure and standards for recycling of hazardous materials;
- Conditions for sale or transfer of hazardous materials for recycling;
- Treatment, storage and disposal facilities for hazardous wastes;
- Monitoring packaging labeling and storage of hazardous materials;
- Transportation of hazardous materials and manifest systems;
- Verifying reporting, records and returns;
- Legal liabilities, legal provisions and appeals
- Certified professional support for hazardous waste management service/facilities



# Good Storage Practice



Source: e-REMC materials by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

1. Flat floor
2. Lockable doors/prohibited entry
3. Clearly designated area for different chemical types
- 4-5. Fire safety
6. Clearly marked emergency exits
9. Secondary confinement for liquid chemicals
10. Proper labeling of containers/area
12. Enough space for trolley/forklift
14. Proper shelving system
- 15-16. Adequate ventilation
17. Available PPE
18. Physically separated from other areas

# Exercise: Good Storage Practice

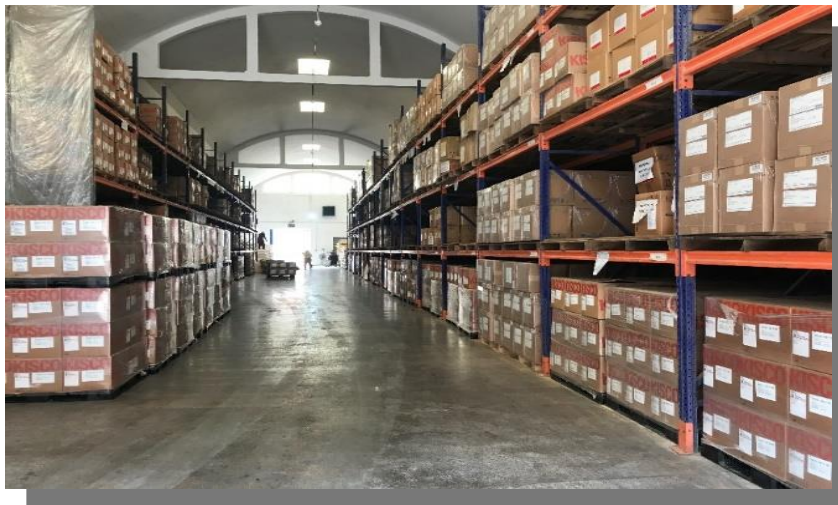
Identify and note down as many chemical related issues as you can



Source: e-REMC materials by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)



# Good Storage Practice



Source: e-REMC materials by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

# Quick Check on Storage Layout

- Storage layout and siting of stores prepared in advance/available
- Areas for storage and movement assigned, taking into account
  - Chemical segregation requirements and storage classes
  - Maximum storage quantities to be expected
  - Regulatory and supplier recommended chemical storage limits (quantity, type) and arrangements (e.g. divider walls, secondary containments)
  - Special storage requirements (see safety data sheets)
  - Space requirements for safe movement of personnel and fork-lifts
  - Space required for allowing for storage and movements on pallets for easier rearrangement
- Colour floor markings used to clearly demarcate different storage and movement areas



# Good Housekeeping? Low-hanging fruits?



# Recovering NPOs – Residue Printing Paste

- **Printing paste from Printing Screens and Paste Drums could be recovered**
  - Reusing the Color As it is
  - Use of Color Dedicated Drums
  - Mixing of Residual and Recovered Colors to get black
- **Benefits**
  - Financial savings (without investment)
  - Reduced BOD and COD in Printing Effluent
  - Reduced Water Consumption for washing drums and machine



# Chemicals management – Internal distribution and preparation

## Great range of good and bad practices





# Chemical management - preparation, intermediate storage, dosing - use

## Practices

- Internal transport of chemicals (from main store to intermediate store, "dyekitchen" to dosing points) mostly manual
- Preparation and mixing (regular calibration of balances rare)
- Dosing - From manual to automatic dosing systems
- Process controls - depending on the degree of modernization of the production facilities

## Challenges

- Limited willingness of production managers to experiment (training?)
- Operational blindness or limited openness to change
- Limited space and time window for implementation of changes



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## Why Water is Important

- No textile production process is possible without water
- Water scarcity in the country
- Water quality affects fabric quality, chemical & energy consumption and machine life
- MORE water
  - i) MORE chemical consumption
  - ii) MORE electrical energy
  - iii) MORE thermal energy
  - iv) MORE pollution and hydraulic load of the wastewater
  - v) MORE treatment cost

# Water should be managed

- 1-Ensure sustainability of the textile business
- 2-Water management has a business sense
- 3-Protection of natural resource

## **The issues:**

- Lack of knowledge and awareness
- Nonrealization of importance of water
- WATER IS FREE-Wasteful attitude
- No metering, No monitoring, No management
- Old and inefficient machines
- Lack of maintenance

# Areas of Water Wastage

- Taps keeps on wasting water
- Water hoses lying on floor and keep on running water
- Large diameter water hoses/pipes are used
- Floor and vessels washing with huge water
- Water keeps on running while machines are stopped
- Overflow from storage tanks
- Extensive and uncontrolled fabric washes
- Leakages
- Wastage of steam condensate
- Wastage of clean streams
- Wastage of cooling water
- No REUSE/RECYCLING of waste streams (Washes/RO/Softener Regeneration Water)



# Cost of Water

- Pumping Cost Rs. 3 –4/m<sup>3</sup>
- Transportation Cost Rs. 3 –5/m<sup>3</sup>
- Water Treatment Cost (Softener) Rs. 10 –12/m<sup>3</sup>
- Water Treatment Cost (RO) Rs. 25 -30/m<sup>3</sup>
- Wastewater Treatment Cost Rs. 30 –40/m<sup>3</sup>
- Hot Water (80oC) Cost Rs. 160/m<sup>3</sup>

## Measurement and Monitoring

**Water Consumption 80-370 liter/kg**

### **IF YOU DON'T MEASURE, YOU DON'T MANAGE**

- 1-Install water flow meters (water turbine, machine inlets, section inlets)
- 2-Monitor water consumption
- 3-Record production in kg
- 4-Analyze specific water consumption (liter/kg)
- 5-Set benchmarks-keep on improving it

Source: Shafqat Ullah, Director Projects Cleaner Production Institute



# Water Quality

- Good quality water produces good quality fabric, consumes less chemicals and increases machine life
- Water treatment for process water and for boiler feed water
- Reverse Osmosis (RO) and Softener



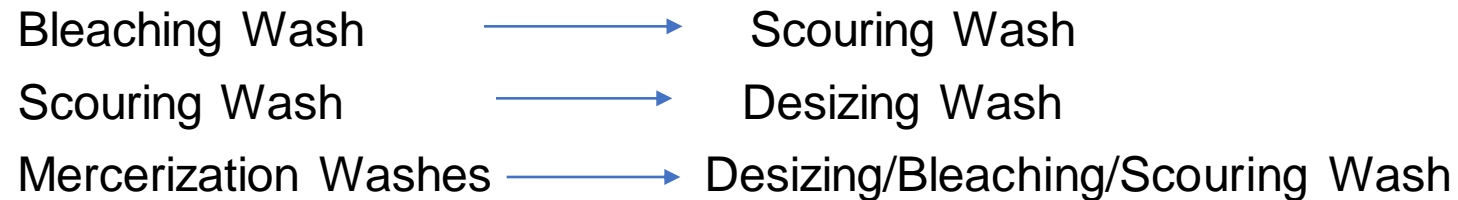
# Piping and Equipment Modification

- Spring operated shut off valves at water hoses
- Automatic motor operated water shut off valves at machines. Blanket wash water keeps on running during stoppage
- Level switches at water storage tanks
- Preventive maintenance and anti corrosion measures

# Reuse and Recycling

- Reuse of cooling water (singeing, compressor, drum dryers, thermoil pumps, chiller, yarn dyeing machines, fabric dyeing machines, ID fans).
- Reuse of RO and Softener reject water (toilets, drum washing, floor washing, wet scrubber , singeing fluff showering, desizewash, screen washing area ).

- Reuse of process washes



- Reuse of mercerization wastewater for preparation of mercerization and scouring baths.
- Soaper wastewater for floor and drum washing at color kitchen.
- Reuse of RO reject water (30% of total intake water)
- Reuse of softener regeneration washes (back washes)

# Reuse and Recycling

- Recycling of blanket wash water. About 50% of water can be recycled.
- Reuse of steam condensate as boiler feed water
- Reuse of cooling water of condensers and vapor condensate from Caustic recovery plant in mercerization, scouring etc



# Pollution Reduction

- Measured quantity of chemicals in the process baths (calibrated beakers for chemical dosing). Automatic chemical dispensing system.
- Chemical leakage and spillage control at chemical stores and machines. Dry cleaning of floors for chemical spills and leakage. Vacuum cleaner for powdered chemical.
- Collection and reuse of residual printing paste from pumps and tubes of rotary printing machine
- Laboratory for the analysis of incoming chemicals (impure chemicals are consumed more)
- Settling of wet scrubber water in the settling pit to remove suspended solids
- Dark shade fabric should not be bleached extensively

# Pollution Reduction

## Chemical Substitution (low water, energy and pollution chemicals)

- Formic acid instead of acetic acid (high BOD) for neutralization
- Hydrogen peroxide instead of Sodium hypochlorite carcinogenic trichloromethane-chloroform)
- Glauber's Salt instead of Sodium Chloride (corrosive)
- Reducing and Oxidizing Agents in Dyeing (Sodium sulfide, Sodium hydrosulfite, Sodium dichromate)
  - Replace oxidizing agents with combinations of:
    - ✓ Sodium dithionite and glucose
    - ✓ Hydroxyacetone and glucose
    - ✓ Formamidine sulfinic acid and glucose
    - ✓ Sodium dichromate with H<sub>2</sub>O<sub>2</sub>, bromate iodide and Chlorite, H<sub>2</sub>O<sub>2</sub> is preferred
- Hydrosoluble Oil instead of Mineral Oil in knitting machines (knitted fabric contains 4-8% of mineral oil)
- Mineral oils are removed through emulsification under alkaline condition with detergents at 80-100 C temperature whereas hydrosoluble oils require simple water washing at 40 C

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