FABRIC Asia

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Supplementary Guidelines for The Handling of Hazardous Substances Rules, 2022 for Environmental Protection Department Punjab

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Program on Promoting Sustainability in the Textile and Garment Industry in Asia (FABRIC)

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Imprint

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List of Abbreviations

CAS	Chemical Abstracts Service
CLP	Regulation on Classification, Labelling and Packaging
CMR	Carcinogenic, Mutagenic, and Toxic for reproduction
CMS	Chemical Management System
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
FABRIC	Fostering and Advancing Sustainable Business and Responsible Industryal Practices in the Clothing Industry in Asia
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HSIL	Hazardous Substances Inventory List
MRSL	Manufacturing Restricted Substances List
MSDS	Materials Safety Data Sheet
PPE	Personal Protective Equipment
REMC	Resource Efficient Management of Chemicals
RSL	Restricted Substances List
SDS	Safety Data Sheet
VOC	Volatile Organic Compound
ZDHC	Zero Discharge of Hazardous Chemicals

BACKGROUND

Hazardous Substances, especially chemicals, are used in virtually all work activities during manufacturing of many products including textiles, leather, and ready-made garments. While not all these chemicals are hazardous, several of these chemicals possess intrinsic properties which may pose a hazard and risk to workers, the environment and the public. The establishment of a systematic approach to the responsible use of the chemicals helps to prevent and mitigate such effects.

Effective control of chemical risks requires an efficient flow of information from the manufacturers, traders and importers of the hazardous substances to the users of these substances (factories) on the potential hazards and precautions to be taken. The flow of information should translate in the development of necessary chemical management knowledge among all levels in the factory. Based on such chemical management knowledge, employers should initiate action at the management system and operational level to ensure that the necessary measures are taken to protect workers, environment, and the public in Pakistan.

Adherence to good practices in the use of hazardous substances at work does only help striving for such protection at the national level, but also contributes to establishing and maintaining a good standing of the industry in Pakistan in the international context, especially Textile and Garment Industry.

For this purpose, this guideline is intended for use of all those who have a responsibility for the safe and responsible use of chemicals. The objective is to provide guidance to those who may be engaged in the framing of provisions relating to the safe and environmentally sound use of chemicals such as competent national authorities, the management of textile and garment factories where chemicals are supplied or used, chemical suppliers and emergency services.

This is aligned with the objectives of the GIZ and its regional project Fostering and Advancing Sustainable Business and Responsible Industrial Practices in the Clothing Industry in Asia (FABRIC). GIZ is an enterprise owned by the Government of the Federal Republic of Germany and provides services worldwide in the field of international cooperation for sustainable development and international education. GIZ is mainly commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). GIZ's regional project FABRIC is being implemented in Bangladesh, Cambodia, China, Myanmar, Pakistan and Vietnam by German Development Cooperation (GIZ). FABRIC is addressing sustainability in the textile and garment industry in its social, economic, and environmental dimensions, supporting knowledge exchange and sharing of good practices in the textile and garment industry in Asia. Through its project activities, FABRIC supports the textile and garment industry in Asia to reduce GHG emissions, thereby contributing to the global climate agenda.

GIZ FABRIC has commissioned a consortium of consulting companies; adelphi consult of Germany taking the lead, and one consulting company from each of the three partner countries (Espire Consult in Pakistan, RCB in Bangladesh and TUV Rheinland in Vietnam); support GIZ for implementation of the environment component of the project; and to develop this document.

OBJECTIVES

The objective of developing this document is to provide supplementary guidelines for The Punjab Environmental Protection (Handling of Hazardous Substances) Rules, 2022. The guidelines shall provide additional information and references to clarify the purpose of various clauses in the Rules.

DISCLAIMER

This document is only provided as supplementary reference material and does not act as a legal or regulatory document in any way.

The content of this document is largely organized to provide additional information against certain clauses which may not be self-explanatory in The Punjab Environmental Protection (Handling of Hazardous Substances) Rules, 2022.

INTRODUCTION

The Governor of Punjab (Pakistan) made The Punjab Environmental Protection (Handling of Hazardous Substances) Rules, 2022, under section 31 read with section 14 of the Punjab Environmental Protection Act, 1997 and notified on _____.

The Supplementary Guidelines for The Punjab Environmental Protection (Handling of Hazardous Substances) Rules, 2022 is prepared under the Fostering and Advancing Sustainable Business and Responsible Industrial Practices in the Clothing Industry in Asia (FABRIC) program implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Detailed guidelines are provided in this document to enable facilities to perform following functions in line with the Rules.

a) Identifying and documenting of Hazardous Substances
b) Identifying and assessing chemical hazards and risks
c) Storage of Hazardous Substances
d) Safe Handling of Hazardous Substances
e) Preparing and responding to emergencies relating hazardous substances
f) Treatment and Disposal of Hazardous Substances

Kommentiert [1]: Arjmand, please write an introductory paragraph of the Rules

Kommentiert [2]: Date of notification?

1. Identifying and documenting hazardous substances used and stored in the facilities

Relevance: Rule 18, Rule 21, Rule 22, Rule 24

It is important to develop and maintain a robust process in organizations for identification and documentation of hazardous substances. This process should provide a clear understanding of the hazardous substances stored and used in a facility and promote responsible usage and pollution prevention.

Typical sources of information on hazardous substances are;

- Facility plan that details the physical areas of the property involved in hazardous substances storage, usage, and disposal
- Inventory of Hazardous Substances
- Safety Data Sheets
- Transportation and Storage Container Labels

1.1. Facility Plan

Facilities shall develop a Facility Plan that details the physical areas of the property involved in hazardous substances storage, usage, and disposal.

A. The Facility Plan shall include minimum following.

   a) Purchasing and delivery areas
   b) Product storage areas
      a. Chemical storage areas
      b. Non-chemical storage areas
   c) Process areas
   d) Manufacturing areas
   e) Waste storage areas
      a. Chemical waste storage areas
      b. Wastewater storage
      c. Non-chemical waste storage areas
   f) Other areas with chemicals, such as laboratories and maintenance areas

B. The facility shall conduct a chemical flow analysis showing (on the facility plan) (i) how chemicals move in the facility for production and non-production activities, and (ii) Understand where and how (storage conditions) chemicals and chemical (containing) wastes are present and stored within the site. Such analyses help in understanding chemical flows, usage patterns, concentration points, and may even be used later for advanced purposes like hazard and risk assessment

- See example in following figure taken from GIZ Resource Efficient Management of Chemicals (REMC) Toolkit

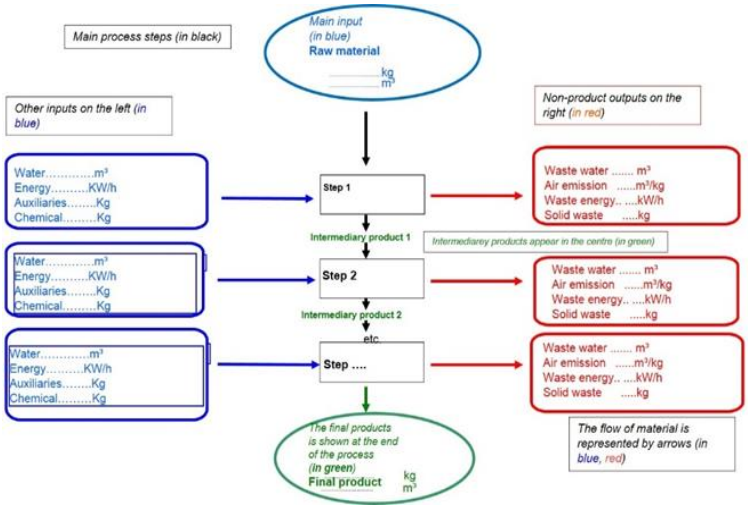


Figure 1: Example of a Process Flow Chart

C. Develop a chemical tracking system to (i) segregate chemicals used for production and non-production activities, (ii) keep record of procured chemicals, (iii) keep up-to-date information about quantities of chemicals stored in various locations, and (iv) Record quantities of chemicals used in production and non-production activities; and (v) Develop Chemical Balance based on flow mapping and recorded data

1.2. Inventory/Record of Hazardous Substances

Relevance: Part-II, Rule 21, Para (iv): The licensee shall maintain complete record of hazardous substance as given in Schedule – IV and submit it on annual basis.

Hazardous Substances Inventory List (HSIL) is a list of all hazardous substances stored and used in a facility for the (i) manufacturing processes (including chemicals in production, spot cleaners, freshwater treatment chemicals, and wastewater treatment chemicals), (ii) tooling/equipment (lubricants and grease), (iv) operating and maintaining the facility, or (v) kept in the facility. HSIL assists a facility in making purchasing decisions, promoting responsible use of hazardous substances, preventing pollutions, increasing traceability, simplifying chemical handling decisions, and controlling disposal costs. For this purpose, the facilities shall ensure following.

A. Develop and use a storage management system (e.g. first-in-first-out) to reduce the probability of surplus stocks and expired stocks.

B. Maintain a robust procedure for establishing and updating the HSIL, with at least one dedicated person specifically responsible for maintaining and updating the HSIL.

C. The HSIL shall contain the following minimum information about a hazardous substance to serve as a ready information tool.

a) Hazardous Substance name and type
b) UN Number, Chemical Abstracts Services (CAS) or similar unique identification number for a single chemical/substance or several numbers for the different components when a mixture
c) Harmonized System (HS) Commodity Code for imported substances as per World Customs Organization
d) Formulator and supplier/vendor name and their contact details
e) Use/function of the hazardous substances
f) Location for storage and use (for example, which building/process/machine)
g) Quantity delivered or in stock
h) Average consumption or usage
i) Required storage conditions
j) Availability and location of the safety data sheet (SDS) as well as a technical data sheet, if latter being made available by the chemical supplier
k) Manufacturers' lot numbers (if not available, then use other identification numbers e.g. purchase order number through which the substance is purchased)
l) Date of purchase of the substance
m) Expiry date
n) Hazard information retrieved from safety data sheets (SDS) such as hazard statements, hazard class indications for physical, health and environmental hazards
o) Relevant precautionary information, for example, recommended fire extinguishers, personal protective equipment, special storage conditions, etc.
p) Availability of permits for purchasing, storing and/or using the hazardous substances, and relevant regulatory reference
q) Availability of certificates proving compliance with specific global chemical legislation, eco-certificates, or international supply chain standards (e.g., manufacturer or brand restricted substances lists, etc.)

D. The HSIL shall be updated whenever a new chemical is purchased or information about any hazardous substance is changed by the supplier/manufacturer (e.g., updated SDS is provided, hazard or risk related information is changed etc.)

Table 1: Quick check for Hazardous Substances Inventory List

Quick check for your HSIL:	
☐	Hazardous Substances Inventory covers all hazardous substances / chemicals used for manufacturing, tooling/equipment, operation and maintenance (including chemicals in production, spot cleaners, ETP chemicals, grease and lubricants etc.).
☐	Facility maintains inventory of minimum a full year's list of all purchased hazardous substances / chemicals.
☐	A HSIL exists with the minimum information that include Chemical identification and other data as suggested above

Quick check for your HSIL:	
☐	HSIL records the usage quantity information and the quantity needs, and is updated at least monthly
☐	A real time tracking system (electronic or manual) is in place at the storage/warehouse, production, and temporary storage areas to track usage quantity and amount (in/out log) of hazardous substances
☐	Facility-wide balance check of hazardous substances (purchased, used) are monitored at least every 6 months
☐	The HSIL is updated whenever a new chemical is purchased. A new chemical addition initiates a worker training, PPE, review of any hazard and storage requirements including secondary containment, emergency planning, and disposal requirements.
☐	New hazardous substances are not moved into stock or storage until verification takes place: matched to purchase order, added into HSIL, US/CAS no. screened against regulatory or other restrictions, acceptable for use, assigned to proper storage as per its hazard class and compatibility, and properly labelled.

An HSIL template is given in Annex 4. Additional columns can be added according to the facility´s other requirements.

1.3. Using safety data sheets (SDS)

Relevance: Part-II, Rule 18: Collection, Consignment, and Transportation, Rule 22: Handling, Rule 24: Packing and Labelling.

A. Safety Data Sheet (SDS) is a widely recognized fundamental source of information on hazardous substances, used for identifying and controlling the possible environmental, health and safety impacts from hazardous substances being stored, transported, used and discarded. It is a document that provides information on:

   a) Hazards of a hazardous substance or preparation
   b) Potential health effects on exposure to a substance
   c) Safe handling and storage of hazardous substances

B. Facility shall obtain an SDS for every hazardous substance or chemical product used in its territory from the chemical suppliers, both in English and Urdu.

C. SDS shall be kept at a central location as well as at the main store and sub-store (at least as hard copy) to be readily available for reference to the workers.

D. SDS shall be made available in the official national or local language understood by the workers and contain all relevant hazard and safety information.

E. The outline and content of the SDS should ideally follow the recommendations under Globally Harmonized System of Classification and Labelling of Chemical (GHS) standards (e.g. containing the 16 standard sections). The relevant recommendations regarding SDS as per GHS standard can be found at GHS_Rev9E_0.pdf (unece.org).

F. SDS soft copies can be uploaded on a facility server and access given to the relevant personnel (e.g., chemical management team, compliance personnel, production teams).

G. The date of issue of the SDS and its version number shall be carefully checked and monitored. An SDS must be updated by a chemical manufacturer when:

   a) Any ingredient used in the formulation is changed due to which there is an impact on the hazard classification of the formulation
   b) New toxicological/legislative information applies to any ingredient used in the formulation that may impact the overall hazard classification of the formulation
   c) Any type of restriction or authorization has been imposed on a substance or mixture under the national legislation or any international reference/standard relevant to the facility.

H. At least one qualified person shall be responsible for monitoring the validity of the SDSs for each hazardous substance or chemical product by checking with the chemical supplier for any potential updates at least once a year. The responsible person shall delete outdated information and upload any updated SDS as applicable.

I. Relevant workers shall be trained to obtain information from SDS, particularly about personal safety, hygiene, and proper handling and disposal of hazardous substances they are assigned to handle or to which they are exposed.

J. The relevant contents of SDS shall be translated into shorter work instructions for the workers to be easily understandable, and relevant to their job requirements.

1.4. Transportation and Storage Container Labels

Relevance: Part-II, Rule 18: Collection, Consignment, and Transportation

A. Every single hazardous substance/chemical container shall be clearly identified with printed labels on the containers, in English and Urdu.

B. Hazardous substances contained in unlabelled containers shall not be used until the relevant information is obtained from the supplier or other reliable sources.

C. Labels on the containers shall follow the standard of the Globally Harmonized System of Chemical Classification and Labelling (GHS) or a similar uniform and recognized system (see Figure 1).

D. For transport, the pictograms prescribe by the UN Model Regulations should be used. The UN Model Regulations prescribe transport pictogram specifications including colour, symbol, size, background contrast, additional safety information (e.g. hazard class) and general format. Transport pictograms are required to have minimum dimensions of “100mm x 100mm”, with some exceptions for allowing smaller pictograms for very small packaging and for gas cylinders.

E. More details on use of symbols and labels may be accessed at GHS_Rev9E_0.pdf (unece.org). The readers of this document may look for latest versions of the document at website of United Nations Economic Commission for Europe (UNECE).

F. Besides the GHS label requirements, the following information should also be present on the container label: (i) The lot number or batch number (ii) Date of manufacture and expiry date.

G. If the packaging is too small or oddly shaped to contain all relevant information, the facility may include only a distinctive product identifier and reference to the source of required additional information.

H. Proper labelling shall also be applied to the hazardous waste containers, both in English and Urdu.

I. If full labelling is not practicable, the labelling on the waste container shall include the contact number of relevant personnel who can provide information about the composition and potential risks of the waste. However, having the hazardous substance identifier and hazard symbol are mandatory for all waste containers

J. Facility shall provide adequate training on chemical classification and labelling, GHS pictograms and hazard and precautionary statements to all the workers handling hazardous substances or chemical products; including transportation workers.

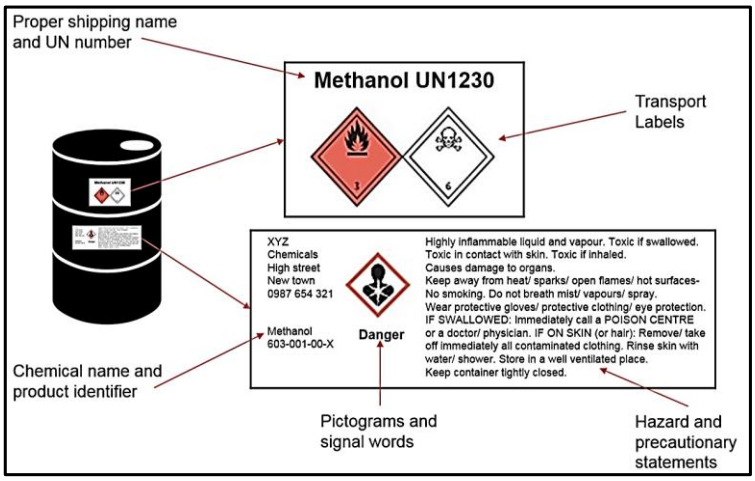


Figure 2: A standard GHS label elements (Source: UNIDO IAMC Toolkit, 2015)

Table 2: Quick-check for container labels

Quick check for your container labels:		
☐	Product is clearly identified	This is the name of the chemical product that is the same as mentioned in the SDS. This is also the name used by the supplier in their purchase orders/contracts with the chemical supplier/formulator.

Quick check for your container labels:		
☐	Standard hazard pictogram indicating hazards associated with chemical substance	For example, GHS refers to nine distinctive hazard pictograms. The pictogram is related to the hazard class and category of classification as per the GHS, which is conveyed through the Hazard or H-Statement(s). Use the pictograms from https://unece.org/transportdangerous-goods/ghs-pictograms Use detailed guidelines available in Annexure-1 of GHS_Rev9E_0.pdf (unece.org)
☐	Signal word used	A signal word is used to "signal" the relative level of severity of hazard to the reader of the label. The signal words used in the GHS are "Danger" and "Warning". Danger is mostly used for the more severe hazard categories Warning is mostly used for the less severe hazard categories
☐	Hazard Statement(s) available either as description of abbreviated code (e.g. H-xxx)	In GHS standard hazard statements and three-digit hazard codes are available for all physical, health and environmental hazards. To find the meaning for the hazard codes, refer to Annexure-3 Section-1 of GHS_Rev9E_0.pdf (unece.org).
☐	Supplier or manufacturer names and contact details	The name of the chemical supplier and/or manufacturer with an emergency contact number should be available on the label. Information on the container or packaging label and in the safety data sheet should match.
☐	Precautionary Statement(s) available either as description of abbreviated code (e.g. P-xxx)	In GHS standard statements and three-digit codes are available for different types of recommended precautionary statements. To find the meaning for these statements and codes, refer to Annexure-3 Section-2 of GHS_Rev9E_0.pdf (unece.org)

2. Identifying and assessing chemical hazards and risks

2.1. General principles

The facility should have a process for identifying and controlling the potential health and safety impact from hazardous substances stored, used and discarded.

A. Designate a person or team (as per size of facility) dedicated to management of hazardous substances with appropriate qualifications to understand and enact appropriate occupational safety and health measures indicated in the MSDS/SDS and/or Technical Data Sheets (TDS) to protect workers, the community, and the environment.

B. Update Legal Registry and Permits Inventory with related regulations / laws / permit requirements and ensure compliance with routine monitoring and reporting to senior management

C. Conduct a systematic hazard and risk assessment at site considering hazard information in SDS and exposures at site. Conduct the risk assessment for all hazardous substances, chemicals and chemical containing hazardous wastes, at all locations where hazardous substances /chemicals and hazardous waste are stored, used and disposed of. Also include the impacts to environment by chemicals in wastewater, solid waste, and air emissions.

   a) A hazard is an intrinsic property of a substance to cause harm to humans and/or the environment. Risk is the probability of a hazardous substance causing harm or an adverse impact. Hazard and risk are linked by exposure i.e., the possibility of a hazardous substance contacting a person or the environment.
   b) Exposure of workers to hazardous substances should be monitored so that workers are not exposed more than the established exposure limits or other exposure criteria for the evaluation and control of the working environment.
   c) The significance of risk may depend on the duration and frequency of exposure and the concentration of the hazardous substance(s) involved. Any operational risks such as leaks, overflow of tanks, fire, flood, waste storage, and chemical handling, should also be considered.
   d) There are many methodologies of conducting risk assessment like UNEP Responsible Production Toolkit, ILO Control Banding, BAuA (EMKG) Toolkit for Chemical Control Banding etc. Based on the risk assessment, the Facility Map could be updated to show the risk levels at various areas in the facility.

D. Widely communicate the results of hazard and risk assessment in the facility through awareness sessions, trainings, posters and identification of risks using signage at site. Update hazardous substances inventory list with identified hazards (and/or risks)

E. Develop written procedures for safety and health related to storage, handling, usage, disposal of hazardous substances, and environmental controls for waste or discharge to the environment based on risk assessment.

   a) The procedures also need to consider the most likely natural disaster in the region, for example, areas prone to heavy rain and flooding, earthquake, typhoon, etc.

b) Update the emergency plan and safety provisions (e.g., PPEs) as per risk assessment and control gap assessment

F. Provide basic health/wellness process on site or through a third party when hazardous substances are handled, or exposure occurs. Facilities may consider hiring an in-house doctor, nurse and first aid team.

G. Provide systematic need-based training on the safety and health procedures, chemical management system and other subjects, to safety program responsible persons, key employees, and workers dealing with hazardous substances.

2.2. Assessing, classifying, and mapping hazards and risks

A. The standard classification systems of hazards under the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) distinguishes between three main groups of hazards: (1) physical, (2) health and (3) environmental hazards.

a) Physical: substances that may be explosive, self-reactive, corrosive to metals, oxidising liquids, etc.

b) Health: substances that may be toxic or cause cancer, germ cell mutagenicity, skin/ eye allergies, damage organs, affect fertility and reproduction or may be an endocrine disruptor.

c) Environmental: substances that are toxic to aquatic or terrestrial life, persistent, bio accumulative or impact the ozone layer.

These groups are further separated into classes of hazards; for example, for physical (P) hazards there are 17 classes of hazards, for health (H) hazards, there are 10 classes and for environmental (E) hazards, there are two classes according to the GHS version 9, 2021.

Table 3 – Hazard classes and groups as per GHS (Version 9, 2021)

Physical (P)		**Health (H)**	**Environment (E)**
1. Explosives	11. Self-heating substances and mixtures	1. Acute toxicity	1. Hazardous to aquatic environment
2. Flammable gases	12. Substances and mixtures which, in contact with water, emit flammable gases	2. Skin corrosion/irritation	2. Hazardous to ozone layer
3. Aerosols and chemicals under pressure	13. Oxidizing liquids	3. Serious eye damage/ irritation	
4. Oxidizing gases	14. Oxidizing solids	4. Respiratory or skin sensitization	
5. Gases under pressure	15. Organic peroxides	5. Germ cell mutagenicity	
6. Flammable liquids	16. Corrosive to metals	6. Carcinogenicity	

7. Flammable solids	17. Desensitised explosives	7. Reproductive toxicity
8. Self-reactive substances and mixtures		8. Specific target organ toxicity (single exposure)
9. Pyrophoric liquids		9. Specific target organ toxicity (repeated exposure)
10. Pyrophoric solids		10. Aspiration hazard

B. Hazards in chemical products can be identified in the following ways:

a) By consulting information in the safety data sheets (SDS)

b) By consulting the labels (and pictograms) on the chemical container

c) Information on ingredients through chemical identification codes such as the UN numbers or Chemical Abstracts Service (CAS) numbers.

d) Factories should specifically consult the following sections on the GHS SDS for chemical hazards and properties associated with the chemical: (i) Section 2 on general description of hazards, (ii) section 11 on toxicological information, (iii) Section 12 – ecotoxicological information as well as (iv) Section 9 on physical and chemical properties and (v) Section 10 on information related to stability and compatibility aspects.

Figure 3 GHS Pictogram and examples of associated hazard

C. Once the hazard(s) of the hazardous substances or chemical products have been identified; the information should be documented in the Hazardous Substances Inventory List (HSIL)

D. Hazards in hazardous substances or chemical products applied in the production should be communicated to workers and other stakeholders in the factory through signage and/or chemical snapshots.

E. Hazardous substances should be assessed for their impact on the safety and health of staff by identifying which activities at the factory and to which extent may expose them to the chemical risk(s).

F. The following aspects may be considered for health and safety assessment:

a) General housekeeping and maintenance of machinery, piping and other equipment for leakages, pressure gauges, heat emissions, etc. as well as emergency response equipment (eye wash and body showers), First-Aid boxes, engineering controls, electrical wiring, heat exchangers, boilers, ventilation, secondary containment, spill kits, assembly points, etc.

b) Safety precautions at all solid and hazardous waste collection and storage areas

c) Ergonomic risks such as the heavy lifting of containers/cartons for work-related musculoskeletal disorders

d) Expiry, adequacy and appropriateness of PPE

e) Records of incident management with preventive actions implementation

f) Regular training and drills to all workers and staff on chemical handling and Health and Safety measures

g) Emergency contacts for responsible persons, First-Aid, nearest hospital, fire station, etc. to be displayed prominently throughout the factory

G. The assessment of risks must consider actual conditions at the ground which may contribute towards the significance of a risk. These may include.

a) the quantity of hazardous substances at the workplace

b) the operating conditions and processes applied at the workplace

c) the range of uses of hazardous substances for which the employers is responsible (e.g., including storage, transport, handling, and disposal)

d) the variety of tasks that contribute to work activity, particularly those where engineering controls provided are not available (e.g., during maintenance, break-down or cleaning tasks)

e) the nature of the hazardous substances and whether the hazards and associated risks are increased by the way they are used (e.g., high temperature, pressure, mixing)

f) the consequences and likelihood of a possible failure or sequence of failures of control measures.

H. The results of the risk assessment shall be documented and used as a reference base for deciding the selection and implementation of control measures to either eliminate or contain the risk at an acceptable level.

I. A Control Gap assessment based on assessed risks, risk control provisions at site, and control recommendations in SDS may also be conducted to design the environmental and occupational health and safety program

J. The assessment of risks should be reviewed on a regular basis (at last once a year) and whenever significant changes occur in the work to which the assessment relates (e.g., change of chemicals or process machinery, retrofitting of control measures)

K. The use of a risk assessment matrix may be considered as one possible approach to establish a risk factor for the chemical handling and storage in the factory. The following steps should be followed to perform a risk matrix-based risk assessment:

a) Description of the situation/process/task

b) Determination of the number of persons involved (e.g., contractor, supervisors, worker)

c) Identification and categorization of severity - as part of the factory´s risk assessment procedure, the severity categories will have to be defined separately (examples of severity rating can be found in UNEP Responsible Production Toolkit)

d) Estimation of probability/ likelihood – similar to the severity categories, criteria for the probability/likelihood will have to be defined as part of the factory´s risk assessment procedure

e) Establishment of a risk scoring system, such as by using the risk matrix assign each hazard situation risk factor from 1/1 (lowest) to 5/5 (highest) (see graphic below)

f) Verification of the controls in place. The top right corner of the matrix is the riskiest scenarios and should be avoided. The bottom left corner is the scenario where it is typically safe to operate.

g) Deciding whether further action is required, and assignment of priorities

h) Repetition of steps for each activity in the manufacturing processes involving use of chemicals and mark the risk factor on your flow chart.

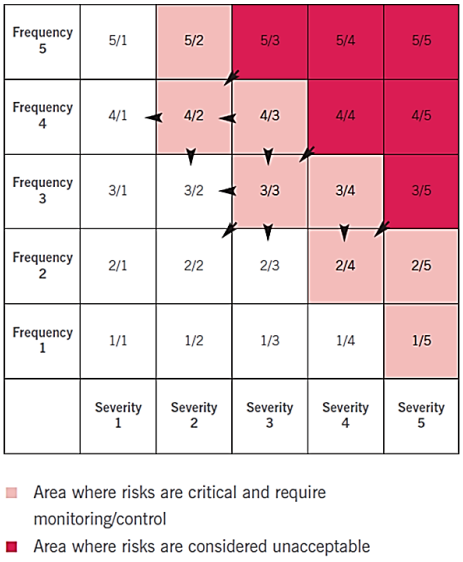


Figure 4 – Risk matrix for risk assessment (Example) Source: UNEP Responsible Production Toolkit

2.2.1. Substitution of hazardous substances

While retaining performance and economic feasibility, chemicals of concern should be replaced with safer alternatives. However, to avoid regretful substitutes, the proposed alternative must be assessed scientifically and transparently. The following steps are suggested for alternative assessment.

A. *Identification of Hazards and Properties:* The risks, functions, and performance characteristics of the chemical that will be substituted should be defined. It should be examined whether a substitution could necessitate a change in application circumstances, such as pH, temperature, or equipment.

B. *Setting the Substitution Criteria:* The criteria for excluding substitutes that aren't as safe or as safe as the original should be described. The public databases should be used to create a list of compounds of concern or those on regulatory 'blacklists'.

C. *Searching for Alternatives:* The company should look for alternatives that have already been adopted using different sources. An example of online resource for searching

alternatives is the ZDHC gateway which is a database of commercial chemical formulations verified for conformance to the ZDHC MRSL through third-party certifications. The company should also check with the chemical supplier(s) to see whether they manufacture and sell safer alternatives.

D. *Comparing Alternatives:* All alternatives should be evaluated using the same procedure and the same substitution criteria. A cost-benefit analysis should be performed and the option that best fits the problem's nature and scope should be chosen. There are many tools available for comparing alternatives such as the Column Model developed by the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA). Other resources include, but not limited to Greenscreen, SUBSPORT, or Toxics Use Reduction Institute (TURI).

E. *Pilot Trials:* On a small-scale trial, the safer option should be tested, and the adjustments needed to the process and equipment should be implemented. The performance, quality, and impact on employees should be examined. It should be checked if there are any potential concerns in other areas.

F. *Implementation in Bulk:* Pilot trials should be scaled up for implementation in production. During installation, any changes in risk or performance should be kept track of. Input from stakeholders should be collected and adjustments should be made as needed.

G. Where the use of hazardous substances cannot be prevented immediately, the employer shall resort to the use of other control measures as outlined in the subsequent sections.

3. Storage of Hazardous Substances

3.1. Applying good chemical storage practices

Relevance: Part-II, Rule 21: Storage, Rule 24: Packing and labelling

Hazardous Substances (typically chemicals) are often stored in several locations in the industry including main stores, sub-stores close to production and in bulk storage areas for commodity chemicals. The storage area should be designed in accordance with established criteria such as Punjab Hazardous Substances Rules 2022. Important aspects to consider during planning a storage system are discussed below:

A. Hazardous substances should be stored under conditions specific to their inherent properties and characteristics to ensure safety. Chemicals with typical properties and characteristics that are relevant include:

   a) flammable liquids
   b) flammable gases
   c) toxic chemicals/substances
   d) corrosive chemicals/substances
   e) chemicals/substances that emit highly toxic fumes in the event of a fire
   f) chemicals/substances which, in contact with water, give off flammable gas
   g) oxidising chemicals/substances
   h) explosives
   i) unstable chemicals/substances
   j) flammable solids
   k) compressed gases

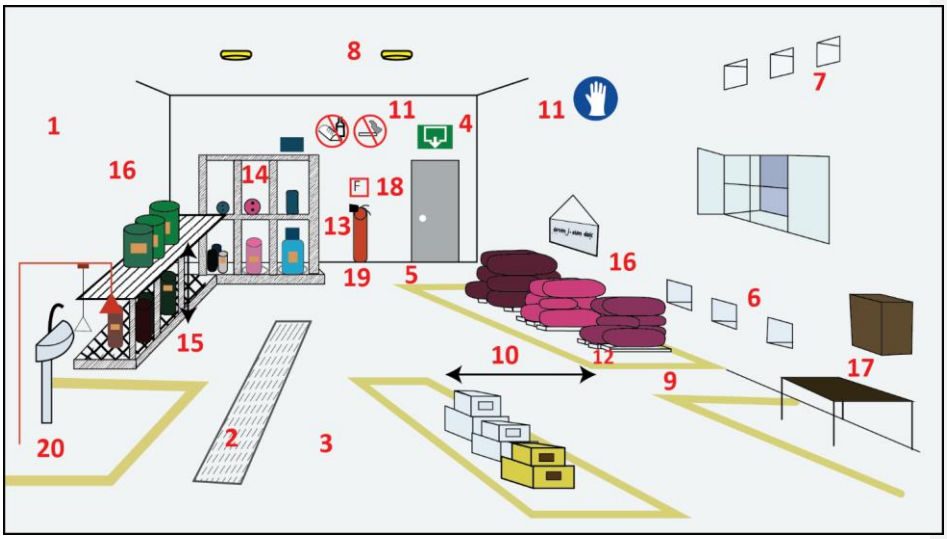


Figure 5: Model layout of a chemical storage facility. The numbers in parenthesis are explained in the following sections. (Source: REMC Toolkit)

B. It is recommended that the chemical/hazardous substance store is physically separated from production areas, occupied buildings. Other storage areas (e.g. raw material, semi-finished, finished products), workshops or areas with potential sources of ignition (e.g. generator, boiler, electrical transformers, and control panels). The location should be selected in such a way that the store may not be subjected to flooding. (1)[1]

C. The floor of the store should be flat to allow easy handling of chemical containers with trolleys, forklifts; and non-permeable to prevent contamination of soil and groundwater. Outside ramp is recommended for the elevated storage location, and mezzanine floors (2) should be provided with a hoisting arrangement to avoid manual handling (3).

D. The storage should have separate unobstructed and clearly marked (4) emergency exits. The main doors should be lockable and unauthorized personnel must be prevented from entering the chemical store. In addition, signboards should be placed outside the entrances, clearly marking the building or areas as chemical stores and prohibiting unauthorized entry (5).

E. Adequate exhaust vents at floor and ceiling level should be available to maintain temperature and humidity and to allow possible air contaminants (heavy and light vapours, dust) to be removed from the storage area (6,7).

F. Electrical installation (8) inside the store (e.g. switches, panels, light fittings, cables) should be insulated and be “explosion-proof”. Ideally, switches are placed outside the chemical store.

[1] Numbers in front of each sentence represent the number labels in the figure of Model Layout of a chemical storage facility.

G. Different areas are clearly designated for the storage of the different chemicals/substances (9). The designated storage areas should be separated (10) from each other to allow for easy movement of personnel and movement devices (e.g. trolley, forklift). These passageways and aisles should be marked. Recommended width of passageways/aisles: 0.8 meters (about 2 feet) for persons, 2 meters (6 feet) for trolleys and forklifts.

H. There should be adequate precautionary and warning signs in the chemical store to create awareness and provide guidance on preventive (e.g., no smoking, not eating, no open flames) and precautionary measures (e.g., type of PPE to be used) (11).

I. Powdered chemicals stored in bags should not be stored on the floor directly to protect against ground humidity. Placement on pallets (12) will allow for easy movement of chemicals with trolleys or forklifts.

J. Containers with liquid substances (for any with more than 5 litres) should be kept in catchpits (trays) and/or areas with structural secondary containments. If not otherwise regulated, such secondary containment system should have sufficient capacity to contain at least 110% of the volume of the largest container stored (13).

   a) International Finance Corporation (IFC) has published General EHS guidelines including explanation of secondary containment which suggest, *"Appropriate secondary containment structures consist of berms, dikes, or walls capable of containing the larger of 110% of the largest tank or 25% of the combined tank volumes in areas with above-ground tanks with a total storage volume equal or greater than 1,000 liters and will be made of impervious, chemically resistant material. Secondary containment design should also consider means to prevent contact between incompatible materials in the event of a release"*. The reason for a larger containment is that in case of full spill, there might be some foam over the spilled liquid and in some cases fire resistant foam might be sprayed over spilled chemical to avoid catching fire. The containment must be able to hold that foam as well.

   b) Factories having shortage of storage space may store chemicals in storage racks considering the compatibility requirements, storage conditions recommended in safety data sheet, storage conditions recommended by package manufacturer, and guidelines provided by regulation or other subscribed standards. Specific precautions must be taken to eliminate chances of falling chemical containers from height; and considering ergonomics of chemical handlers. The secondary containment in such case may be built in following ways;

      a. Built-into the storage rack below each section to hold spilled chemical as per above mentioned quantity ratios

      b. If chemicals are placed on ground, facilities may provide a smaller containment (~50% volume) below the storage points which flow into a larger containment pit which fulfils the requirement of quantity ratios mentioned above. In such case, it is utmost important to ensure that this containment pit is (i) not connected to any drain including that of wastewater treatment plant, (ii) spillages of only compatible chemicals can flow into a specific containment, (iii) the flow passage and containments are impervious and impermeable, (iv) the spilled materials are not flammable, explosive, combustibles, oxidisers or volatile in liquid and vapour forms.

K. In earthquake prone areas, shelves should have raised edges or rim guards (minimum height 5 cm) to prevent containers from falling off the shelves. Cords can be used for added security.

L. Accidental contact between incompatible chemicals/substances can result in fire, explosion and/or formation of highly toxic or otherwise dangerous mixtures. Therefore, such contact must be prevented through segregation (14), either by storing in separate areas or by structural separation (e.g., divider walls, separate storage area). A chemical segregation chart can be seen in Figure 6. By comparing labels or hazard classes as per GHS, for two types of chemicals, the compatibility can be identified in the matrix. For example, Isolate chemicals, keep separate from, keep apart from or maybe kept together. Another example of segregation chart from Technical Rules TRGS 510 by the German Federal Institute for Occupational Safety and Health on storage of hazardous substances (see figure 6) can be referred for clustering of different hazardous chemicals as shown below. The following steps should be followed to use the chart:

   a) Check safety data sheet for respective information to identify the storage classes of the substances in hand
   b) Consult the chart for information on compatibility
   c) In yellow boxes, refer to the technical rules (TRGS 510) for specific further guidance in the respective subsections indicated by the number in the yellow box.

M. When chemicals are stored on racks and shelves, it is vital to ensure that the quantity stored does not exceed the recommended structural capacity of the shelves and racks. Heavier chemical containers, particularly those containing liquid chemicals, should be stored at the floor level, and the lighter ones can be stored on higher shelves (15). Storage cabinets, if in use, are of approved quality, lockable and clearly labelled with the hazard class of the chemicals.

N. Each chemical container should clearly be labelled, while each designated chemical storage area should also be labelled, indicating at least one type of chemical family and hazards classification (16). An example layout of a storage area indicating designated areas of chemicals with its specific storage classes can be seen in Figure 9. Storage class can be found in the safety data sheet.

O. No containers should be stored outside the designated areas or in designated passageways. The chemical containers should be kept closed all the time other than dispensing a chemical.

P. Reference information of all chemicals/substances stored (e.g., a set of safety data sheets) are kept for ready reference in the chemical store. In an emergency, these provide valuable and often life-saving information to emergency personnel (first aid, doctor, firefighter) (17).

Q. Fire extinguisher, suitable for the type of chemicals/substances stored, should be kept ready in easily and clearly marked locations. In addition, suitable fire extinguishers should be placed outside the chemical store as well (18,19).

R. Apart from first aid box, a washing facility, eye/face rinsing station or safety shower should be available in or near the chemical store for personal hygiene (after handling chemicals) and emergencies(17,20).

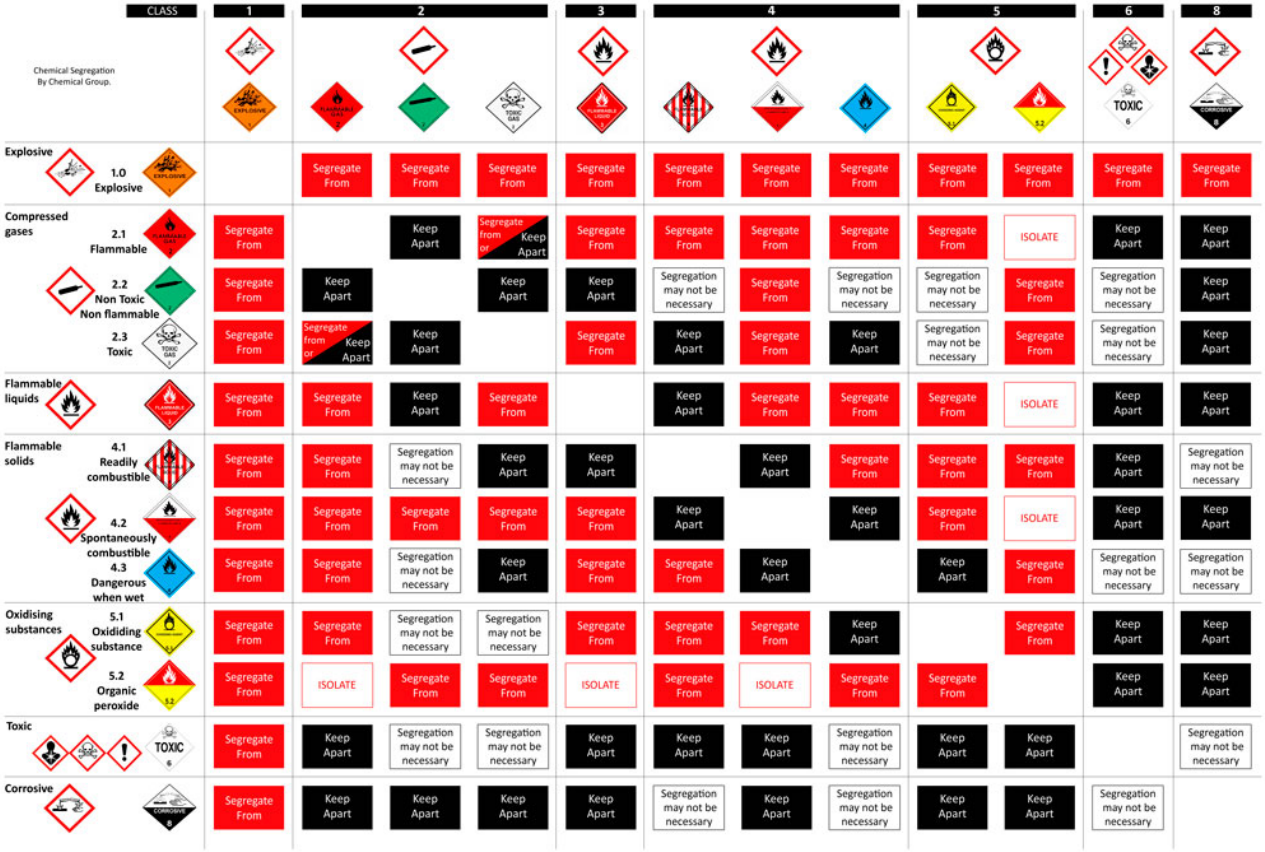


Figure 6: Chemical Segregation chart (Source: REMC Toolkit)

Storage class		10-13	13	12	11	10	8 B	8 A	7	6.2	6.1 D	6.1 C	6.1 B	6.1 A	5.2	5.1 C	5.1 B	5.1 A	4.3	4.2	4.1 B	4.1 A	3	2 B	2 A	1
Explosive substances	1																									1
Gases	2 A	2			2			2								1								2	3	
Aerosol packages	2 B															1										
Flammable liquids	3	6			6						6						4									
Other explosive substances	4.1 A	1		1	1	1	1	1							1						1	1				
Flammable solid or desensitizing explosive substances	4.1 B										6			4	1		4		6	6						
Pyrophorio or self-igniting substances	4.2	6			6	6	6	6			6	6							6							
Substances producing oxydizing gases with water	4.3	6		6	6	6	6	6			6	6														
Highly oxydizing substances	5.1 A																									
Oxydizing substances	5.1 B	7			7	7		7			6	6	4	4		1										
Ammonium nitrate and mixtunes containing ammonium nitrate	5.1 C	1	1	1	1	1	1	1								1										
Organic peroxydes and self-reactive substances	5.2	1			1	1																				
Combustible, acutely toxic substances	6.1 A	5			5																					
Non-combustible acutely toxic substances	6.1 B	5			5																					
Combustible acutely toxic or chronic substances	6.1 C																									
Non-combustible acutely toxic substances or substances with chronic effects	6.1 D																									
Infectious substances	6.2																									
Radioactive substances	7								1																	
Combustible corrosive substances	8 A																									
Non-combustible corrosive substances	8 B																									
Combustible liquids	10																									
Combustible solids	11																									
Non-combustible liquids	12																									
Non-combustible solids	13																									
Other combustible and non-combustible substances	10-13																									

Separate storage is required

Joint storage permitted

Number

Joint storage is only permitted with restrictions

Figure 7 Joint storage table according to storage class (Source: TRGS 510, BAUA, Germany)

Figure 8: Common good storage management practices (Example) (Source: e-REMC materials by Deutsche Gesellschaft für Internationale Zusamm

enarbeit (GIZ))

S. Spill control material (absorbent material, waste receptacles, emergency personal protective equipment) should be kept available and should be selected as per the recommendations in the safety data sheets. Any spills or leaks should be cleaned up immediately, and chemical rundowns into sinks, floors or stormwater drains should be prevented.

T. Prior to storing chemicals in the chemical storage facility, the following steps should be followed:

a) consult chemical inventory on all chemicals to be kept in the storage area.

b) consult the safety data sheets or technical guidance sheets regarding the storage recommendations, compatibility with other chemicals.

c) prepare a chemical storage plan accordingly.

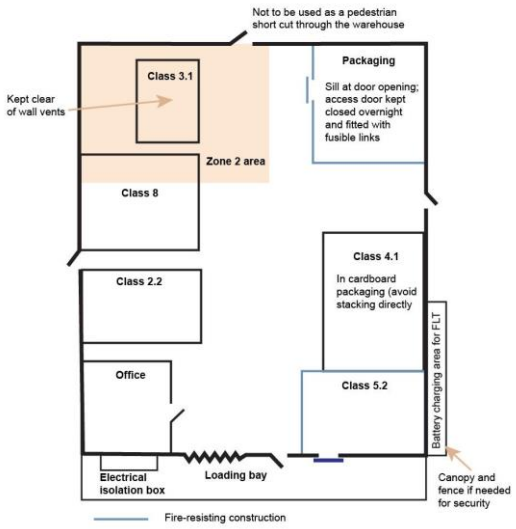


Figure 9 – An example of Storage layout plan assigning areas for different types of chemical storage classes

Source: HSE, UK

Quick check on storage layout

- ☐ Storage layout and siting of stores prepared in advance/available
- ☐ Areas for storage and movement assigned, considering
  - 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

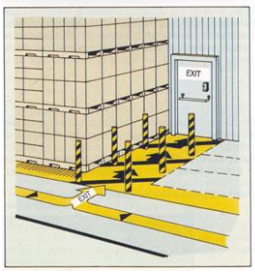
3.2. Applying practices in onsite and offsite transport of chemicals and chemical waste

A. Hazardous substances may be transferred to or from work areas through pipelines or conveyors or by using forklift trucks, trolleys, or wheelbarrows. Before transport, the SDS of the substance should be checked to understand the properties, safety concerns and precautions such as PPE safeguards.

B. The quantity, nature, integrity and protection of the packaging and containers used in transport, including pipelines, should be checked beforehand.

C. Substances transported by forklift truck should have warning labels, maximum load capacity information and maximum speed limit displayed.

D. Hazardous substance/ Chemical transporting vehicles (e.g. forklift trucks) should travel on clearly marked passageways (i.e. aisles), of adequate width to reduce the possibility of collision and spillage.



Quick check for transport using fork-lifts

- Safe practices in securing loading of containers and cylinders (special attention protection of valves!) established and applied
- Maximum loading limits were established and followed
- Smooth and wide enough passageways available to avoid excessive shocks or local stress on containers
- Speed limits for forklifts established and enforced
- Forklifts to be equipped with a fire extinguisher and an electrically conductive strip for earthing static electricity
- Special training and instructions provided to operators of transport vehicles (such as speed limits, maximum loads, internal transport routes)

Figure 10 – Safe practices in the use of forklifts

Source: GIZe-REMC materials by Deutsche Gesellschaf für Internationale Zusammenarbeit (GIZ)

E. Hazardous substance containers should be handled carefully to avoid falling off the vehicle and from being subjected to rough usage, excessive shocks or local stress. Excessive shaking of liquid chemicals should be avoided to prevent leaking due to over volatilisation.

F. Containers for flammable liquids should be specially constructed with spring-located caps and flame arresters in their spouts. The transfer of flammable liquids should only be conducted in well-ventilated areas with the containers earthed and bonded.

G. Certain chemicals may be conveyed through pipe systems inside the facility. A standard colour coding system should be established to allow everybody in the facility to identify what the respective pipe may contain.

H. Adequate preparation should be made to address any emergency such as fire or spillage. For example, vehicle/forklift can be equipped with a fire extinguisher and an electrically conductive strip for earthing static electricity.

I. Special training and instructions should be provided to drivers/operators of transport vehicles, especially the ones who are involved in long range transport from/ to the facility.

This training should include standard operating procedures for loading and unloading, safety precautions during driving and stoppage, and emergency responses in case of any accidents.

J. During loading and unloading operation the vehicle engine shall be stopped. The vehicle should be securely and efficiently stopped, and no movement of the vehicle should be allowed. The drivers should not leave the vehicle so as to take any appropriate action in case of an emergency.

K. Chemical waste should be stored in a safe place before transportation. The storage area should be large enough to hold quantities of hazardous waste generated between the usual pick-up dates or further scheduled times of disposal for the hazardous waste. This area should be protected from sun and rain and leaching into the soil should be avoided.

L. Hazardous waste should be transported in a properly sealed container with clear labelling of the compound and relevant safety warnings.

M. The waste transportation process, transporting vehicles and training for the appropriate personnel should be similar to the hazardous chemicals transportation guidelines as discussed before.

4. Safe Handling of Hazardous Substances

Relevance: Part-II, Rule 22: Handling

4.1. Controlling hazards to health

A. The facility should make sure that all workers are protected against the risk of injury or diseases from substances hazardous to health.

B. Worker should not be exposed to substances hazardous to health, to an extent which exceeds exposure limits or other exposure criteria for the evaluation and control of the working environment established by the national authority

C. The control measures to provide protection for workers could be any combination of the measures outlines the following sections.

4.1.1. Use of good design and installation practices and engineering controls

A. The basic principle of the installation practices and engineering controls is to isolate people from the hazardous substances or reduce exposure to them. For this purpose, the factory should consider applying the following control measures:

a) Using totally enclosed process and handling systems

b) Segregating hazardous process from the operators or from other processes

c) Using plant process or work systems which minimize generation of, or suppress or contain hazardous dust, fumes, vapors and which limit the area of contamination in the event of spills leaks or accidental releases

d) Installing and using particular enclosure, with local exhaust ventilation (LEV) connected to ducting systems which guide the exhaust air away from the work area and/or to a collection or treatment device (e.g., air scrubber)

e) Providing sufficient general ventilation (engineered and natural) to ensure proper air change ratios in work areas to prevent built-up of contamination in the air. Refer to the national regulation regarding required or recommended air change ratios.

B. Ensure good installation practices and engineering controls in line with section 8 of GHS compliant SDS and the technical data sheets and guidance by chemical suppliers.

C. Monitor the effectiveness of the engineering controls with proper procedure and testing.

D. Ensure that workers in work areas with such engineering controls are trained and instructed on how to use the engineering controls, understand any limitations of the same and report any malfunctioning.

4.1.2.Use of safe work systems and practices

A. In support of the engineering controls, factory shall implement administrative control measures to reduce the number of workers exposed and manage their way of working with chemicals.

B. These measures shall be related to changes in work procedures such as written safety policies, rules, supervision, schedules, and training with the goal of reducing the duration, frequency, and severity of exposure to hazardous chemicals or situations.

C. Administrative controls should include but are not limited to.

a) Reducing the number of workers exposed and limiting access to non-essential areas or areas with hazardous substances present or being used (e.g., preventing unauthorized access to chemical stores, chemical mixing areas, chemical waste handling and treatment areas, laboratories)

b) Restricting the task to workers only who are proven to be competent or qualified to perform the work.

c) Reducing the period of exposure of workers by rotating workers between tasks and/or specifying extended periods of breaks over a workday.

d) Reassigning female pregnant workers to tasks or work areas not involving handling of hazardous chemicals

e) Ensuring regular cleaning of contaminated walls, surfaces etc.

f) Limiting the quantities of hazardous chemical products stored and the provision of segregated storage areas for hazardous chemicals

g) Conducting regular training and providing instructions to workers on hazards and safe handling of chemical products, understanding and reading labels and hazard symbols, spill management procedures, and/or PPE use and create awareness about the hazard of chemicals.

h) Creating awareness about chemical hazards and good work practices (e.g., chemical safety posters, work instructions, warning signs)

4.1.3.Use of personal protective and hygiene measures

A. If engineering control and administrative controls are not enough, the factory shall provide suitable personal protection equipment (PPE) in line with section 8 of the GHS aligned standard SDS to eliminate or minimize risk or threat to health.

B. PPEs shall be used for protection against accidents and incidents that may occur despite appropriate exposure control systems and operational procedures.

C. PPE shall be selected based on hazard/risk assessment that identifies the specific chemical or physical hazards associated with the specific work tasks

D. A designated person shall be selected and put in charge of maintaining a proper inventory of PPE and map locations/processes/tasks requiring the use of PPE

E. Make sure that the selected PPE is suitable for its purpose and fits the workers. For this purpose, PPE should be made available in different sizes.

F. Make sure that a sufficient supply of PPE is readily available for the workers.

G. Provide the workers with adequate instructions about the proper use of PPE in the workplace.

H. Provide training to the new workers about PPE before joining at the workplace. And training shall also be provided to the regular workers for new chemicals or processes applied at the factory. Records of such training must be maintained.

I. Amongst others, the training on PPE may cover the following topics:

a) When and how to use PPE
b) How to take care of PPE after every use
c) How to clean and maintain personal protective equipment and clothing properly
d) Where and how to store it safely to prevent contamination
e) How to check PPE for its functionality and based on the calculation of the time interval where the PPE is being exposed
f) How to dispose of PPE after use

J. Provide supervision to ensure that the PPE is properly used. Managers and supervisors should adhere to the same PPE use requirements when they are exposed to the specific workplace risk that requires the PPE´s use for protection.

K. Ensure that any outside persons (e.g. visitors, inspectors, contractors) are briefed on the need for PPE beforehand.

L. Standard PPE signage shall be used as a vital communication tool in areas where handling chemicals takes place to inform workers and outside persons to use the right PPE.

M. All PPE that is necessary for safety in the use of chemicals should be provided and maintained by the employer without cost to the workers.

4.1.4.Cleaning and maintenance of personal protective equipment and clothing

A. PPE shall not be used longer than the time indicated by the producer. It is recommended that the employer maintains a PPE replacement schedule for planning the supply of PPE and communicated the same to the designated supervisory personnel to track and monitor.

B. Respiratory protective equipment, other than one-shift disposable respirators, should be cleaned, disinfected and examined after each use.

C. Keep a record of the cleaning, disinfecting and examination of such respiratory protective equipment, and of its conditions and any defect, in accordance with national law or good practices.

D. Provide for the laundering, cleaning, disinfection and examination of protective clothing or equipment which have been used and may be contaminated by chemicals hazardous to health.

E. Prohibit any PPEs or protective clothing that is contaminated and hazardous to health for further laundering, cleaning or keeping at workers´ homes.

4.1.5.Welfare facilities and personal hygiene measures

A. Adequate washing facilities shall be provided to enable workers to meet standards of personal hygiene consistent with the adequate control of exposure and need to avoid the spread of chemicals hazardous to health.

B. The washing facilities should be conveniently accessible but situated so that they do not themselves become contaminated from the workplace.

C. The type of washing facilities should be related to the nature and degree of exposure.

D. Changing facilities shall also be situated and designed to prevent the spread of contamination from protective clothing to personal clothing and from one facility to another.

E. To reduce the risk of ingesting hazardous substances, workers shall not eat, chew, drink or smoke in any work area which is contaminated by such chemicals. This shall be communicated as part of safety training, work instructions and appropriate signages.

4.2. Controlling flammable, dangerously reactive or explosive substances

4.2.1. Good design and installation practice

A. The prevention of fire is the core principle of fire management, and the factory shall perform the following steps to prevent fire incidents:

a) Ventilation of areas with flammable substance to reduce possible accumulation of dangerous concentrations
b) Removal of possible ignition sources like sparks, flames, burning tobacco or hot surfaces.
c) Assignment of hazard zones with flammable chemicals using labels with warning signs.
d) Substitution or elimination of flammable chemicals
e) Containment (flammable substances shall be kept in suitable containers)
f) Segregation of incompatible chemicals according to the compatibility chart with walls, floors, shelves, and fittings made of suitable materials
g) Storage of containers with flammable chemicals away from doors Keeping the flammable chemical storage area dry, cool, out of direct sunlight, and away from steam pipes, boilers or other heat sources.

B. In case of managing flammable substances, facility shall at all times:

a) Allow only trained, authorized people into storage areas

b) Keep the amount of flammable chemicals in storage as small as possible.

c) Inspect storage areas regularly for any deficiencies including damaged or leaking containers and poor housekeeping.

d) Correct all deficiencies as soon as possible.

4.2.2.Use of safe work systems and practices

A. Where practicable, the weighed powder like chemicals shall be mixed manually with water to a slurry or paste before transfer to the mixing tank to avoid the creation of dust clouds.

B. Flammable chemicals shall be removed from the storage area during maintenance work (e.g. welding). If removal of flammable chemicals is not possible, maintenance staff shall be closely instructed and supervised during their work.

C. Ensure the handling of flammable chemicals in a dry and chemically inert atmosphere where adequate ventilation is provided.

D. Identify the areas where hazardous explosive atmospheres may occur and classify into zones based on their likelihood and persistence. This is known as *Hazardous Area Classification*.

The classifications may be:

a) Zone 0: That part of a hazardous area in which an explosive atmosphere is continuously present, or present for long periods, or frequently.

b) Zone 1: That part of a hazardous area in which an explosive atmosphere is likely to occur occasionally in normal operation.

c) Zone 2: That part of a hazardous area in which an explosive atmosphere is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

4.3. In-process measures for reducing the environmental impact of chemicals

A. Establish chemical use parameters before placing an order. This will minimize waste by purchasing chemicals in the container size that permits maximum consumption.

B. Avoid stockpiling of common hazardous substances / chemical products. Stockpiling involves the purchasing or accumulation of chemicals in large quantities for use longer than needed. This practice usually jeopardizes the chemicals' properties over a period of time. Also, many chemical suppliers offer "just in time" orders, allowing the purchaser to take advantage of bulk pricing.

C. Replace faulty or damaged caps and lids of hazardous substance containers at the storage. This will safeguard against the effects of air and moisture contamination.

D. Using automatic and semi-automatic weighing, dissolving, measuring and dispensing systems for precise delivery of textile chemicals and dyestuff to the production machines may result in significant reduction of risks and environmental impacts.

E. Adapt the best available techniques (BATs) that control consumption of hazardous substances, require low-liquor ratio application, enable liquid removal and recovery in processes.

F. Substitute hazardous chemicals with less-hazardous ones and use available alternative chemicals for the hazardous ones.

G. Adapt best available techniques that can enable factories to reuse process chemicals. For example, using Cyclodextrins (CD) to encapsulate the direct dyes contained in the wastewater to recover and reuse them.

H. Apply sectoral benchmarking on a regular basis in their process.

I. A Standard Operating Procedures (SOP) for maintenance of machineries and housekeeping must be adapted by the factory which shall incorporate procedures for:

   a) Identification of machinery, components and equipment not performing at optimum
   b) operating conditions and a record of this maintained as suggested in figure 37 below
   c) Planned replacement of machinery, components, PPE, equipment, First-Aid box components, spill kits and stores materials as per their expiry date
   d) Maintaining machinery and equipment servicing records
   e) Determining chemical containers in poor condition or without labels or expired
   f) Chemical clean-out and safe disposal of unused, rejected chemical products
   g) Regular review of emergency response measures such as eyewash and body
   h) showers, exit signs, assembly points, exit pathways, fire safety and First-Aid boxes

5. Preparing and responding to emergencies relating hazardous substances

5.1. Planning and preparing for emergencies

A. Create a formal Emergency Response Procedure. After a thorough review, this shall include crisis planning in the event of a fire, chemical leaks, spills and splashes, and other medical emergencies. It could also include plans for dealing with damage to structures and people caused by large external disasters like earthquakes, flooding, civil unrest, tsunamis, or industrial gas releases.

B. These scenarios shall at least include (i) accidental on and offsite releases during storage, transport, handling, and disposal of chemicals (such as leaks and spills, the release of untreated wastewater due to break-down of effluent treatment plant) (ii) fire and explosions involving chemicals and (iii) medical emergencies involving exposure to chemicals at the workplace or in confined spaces.

C. For each of the emergency scenarios identified, decide on and select measures to eliminate or reduce the probability of such emergencies happening as well as to prepare to respond to such emergencies. These shall include the preparation of an onsite emergency response plan (ERP) and making available necessary emergency response provisions.

D. Emergency response arrangements shall reflect the corresponding recommendations for emergency measures and provisions as instructed in the SDS; in particular, section 4 on first aid measures, section 5 on fire-fighting measures and section 6 on accidental release measures.

E. As part of the emergency preparedness measures, all workers shall be trained in the relevant procedures by the competent trainers. This shall at least include training and drills on

   a) Arrangements for raising alarms
   b) Arrangements for calling appropriate emergency assistance (onsite, offsite) in event of a fire or medical emergency
   c) The use of appropriate PPEs and its limitations in emergency situations
   d) The evacuation of the work areas, premises and establishment, and the location of emergency exits, escape routes and assembly points
   e) Taking action to minimize the chemical incidents (e.g., Tackling fire, controlling leaks and spills, emergency shut-downs, removal of certain chemicals in case of a fire, providing and initiating basic first aid measures).

F. Emergency related training shall be part of every worker´s induction and (at least) annual refresher trainings and put on the training record.

G. If there is a possibility that emergency situations may affect people and property outside the facility, the facility shall take steps to establish appropriate procedures on consultation

with the national or local authorities and emergency services. For further reference see Bangladesh National Building Code (BNBC), ILO code of practice on Prevention of major industrial accidents as well as UNEP handbook on Awareness and preparedness of emergencies at local level (APELL).

H. For possible emergencies, an 'Emergency Response Team' with specified roles and tasks shall be developed. The names and phone numbers of the team members shall be displayed prominently throughout the facility. A 'Command and Coordination' structure shall be in place, with individuals trained in emergency protocols and mitigation.

5.2. Dealing with fire and explosions

A. Fire alarm systems (both sound and light) should be available in the factory and these must be distinct from other alarms and notification systems.

B. Suitable and adequate fire-fighting equipment should be available on-site transport and storage. Basic requirements are also discussed in BNBC 2020.

C. Portable fire-fighting extinguishers (suitable for types of fire Class A, B, C or D) should be available for first-stage fire-fighting purposes, and the extinguishing medium should be selected as a result of the assessment of risks and control measures.

D. Fire-fighting and fire-protection equipment should be maintained in full working order, which should be ensured by regular inspection.

E. Automatic sprinkler system should be available at the place where flammable chemicals are stored.

F. There should be emergency lights and emergency exit signs as well as "No Smoking" signs within the factory.

G. Sand buckets, hydrants and fire hoses should be available at chemical stores and other high-risk areas in the factory.

H. Adequate drainage from the workplace should be provided to deal with water used for fire protection and fire-fighting to minimize environmental damage. Interceptors or special drainage systems, particularly at large installations, should be provided to minimize the risk of contamination of local water courses.

I. Fire-proof electrical wiring cables should be used to avoid short-circuit and explosion-proof lighting should be installed in chemical stores

J. Regular fire drills and training of staff on use of fire equipment and evacuation methodology should be given to workers about the hazards of fires involving chemicals and the appropriate precautions to be taken. The training, instruction and information provided should include:

   a) not putting themselves unnecessarily at risk

b) when and where to raise the alarm
c) the use of firefighting and fire protection equipment, for workers expected to use it
d) the toxic nature of the fumes given off and first-aid measures
e) the proper use of appropriate personal protective equipment
f) evacuation procedures
g) the circumstances in which workers should not attempt to deal with a fire themselves but should evacuate the area and call specialist trained fire-fighters

K. Adequate information to enable adequate precautions to be taken should be given to trained fire-fighters and other emergency responders coming from offsite about the nature of the chemical fire and its hazards.

5.3. Dealing with spills and leaks

A. Spillage can happen occasionally in the industries during handling and transportation. Spillages can be prevented by:

a) Checking containers on delivery for any cracks or damage before storage
b) Ensuring safe handling practices (such as mechanised or manually driven trolleys) for internal movement of chemical containers
c) Proper stacking of containers in slotted angle racks in the chemical stores to prevent their falling over

B. In case of any spillage of hazardous substances, following facilities should be available to contain the spillage in line with the recommendations of the corresponding SDS:

a) A secondary containment for chemical containers to arrest the spread of spillage
b) A standard spill control kits containing sawdust, sand or any other absorbent container to absorb the liquid spill, broom, shovel and gloves, an empty container marked “Hazardous Waste” and a trolley to keep these items (for taking them quickly to the spillage place).
c) Safety Data Sheet (SDS) and manufacturer’s instructions describing the corrective action
d) Personal protective equipment to be used during clean-up.

C. The following procedure can be followed to contain any spillage of hazardous substances:

1. The spillage incident should be communicated to the stores in-charge person.
2. The ‘Spill Kit’ should be moved to the place of spillage as soon as possible.
3. Sand or other absorbent material should be sprinkled around the outskirts of the spill area to stop the flow or spread, in case of a liquid spill.
4. Absorbent material should be sprinkled on the complete area of the spill to absorb the spill.
5. The broom and shovel should be used to collect the material containing the spilled chemical, using protective gloves.

6. The collected waste should be transferred to the plastic container marked “hazardous waste”.
7. The spilled waste should be sent to hazardous waste storage area for disposal to an authorized third-party waste contractor.
8. Spills should not be washed away with water. If liquid spills enter drains, these should be connected to the effluent treatment plant.
9. The spill kit should be returned to the allocated place at the stores.

D. Standard procedures for reporting and response to (minor and major) chemical spills and leaks, including assignment of roles and responsibilities should be ready beforehand.

E. As part of the preparations, the management should establish and implement in-house training program to deal with chemical spillage. Such a training program may include the following:

   a) arrangements for raising the alarm
   b) calling on the appropriate emergency assistance
   c) use of appropriate personal protective equipment (and its limitations) while dealing with the emergencies
   d) actions to evacuate anyone in immediate danger
   e) the provision of life-saving first aid
   f) the use of specialized equipment and materials including first-aid, fire-fighting, and spill and leak control equipment;
   g) actions to minimize the magnitude of the incident
   h) actions to evacuate adjacent premises when necessary

F. In case of any solid chemical spills, that should not be wash away and should be removed in dry form. Solid contaminated material should be collected in “old-open Top drums” until final disposal. Finally, it should be disposed according to the manufacturer’s suggestion.

5.4. Dealing with medical emergencies involving hazardous substances

A. The possible medical emergency situations in the workplace should be assessed in advance using the information in the SDS and chemical inventory and areas with risk of medical emergencies in the factory be mapped out.

B. Adequate first-aid arrangements should be available in the workplace that considers the hazardous chemicals used at work, ease of communications, and the emergency services and facilities available, corresponding to the recommendations in the SDS.

C. Trained personnel for rendering first aid should be readily available at all times during the use of (hazardous) chemicals at work. Trained personnel include persons trained in first aid, registered nurses or medical practitioners.

D. Where hazardous substances are used, first-aiders should be trained as regards:

a) the hazards associated with the chemicals and how to protect themselves from these hazards;

b) how to take effective action immediately;

c) any relevant procedures associated with sending a casualty to further medical treatment (e.g., hospital)

E. Assess the first-aid needs taking into account (i) possible number of employees affected at a time, (ii) the nature of the work activity (iii) the size of the factory and distribution of workers at the factory, (iv) the situation of the work activity/factory in relation to the nearest hospital or emergency medical services that may be required.

F. The first equipment and facilities (such as first-aid boxes, eye wash stations and emergency showers) should be appropriate for dealing with the chemical hazards encountered in the use of chemicals at work as well as in line with the recommendations of the chemical´s SDS.

G. Any first-aid box should contain at minimum bandages and/or dressings, antiseptic cream or spray and disinfectant liquid, sterile gauze pads and cotton swab or cotton wool, burns dressing and gel, adhesive tape and scissors, disposable gloves and pain killer medicine. Additional provisions should be included if so, recommended by the SDS of chemicals used in the respective area.

H. For first-aid measures, factory should follow the below steps:

a) Identify and train first-aid Personnel from the staff

b) Display the names and photos of the trained staff prominently at key locations

c) Ensure that at least one trained staff member is present on each work shift

d) Clearly mark where the first-aid box is placed and ensure that this is not locked and is easily accessible to workers

e) Inspect the first-aid box at least monthly, replace used or expired items and update the inspection tag

f) Provide written first-aid instructions in local language near the first-aid box

g) Display the contact details of ambulance providers and nearest hospital or central emergency number

h) Where possible, provide a medical room to which a member of staff can be moved to await doctor or ambulance

i) Place an incident logbook next to the First-Aid box to record any incidents

I. Where recommended by the SDS, eye wash and body shower stations should be installed at key locations such as in the chemical stores and production areas with proper signages for easy identification to allow for immediate cleansing eyes or skin affected by any splashes of hazardous substances.

 	Requirements as per ANSI Z358.1-2014 (Example) Safety shower - 75 liters/minute at 2 bars Eye-wash station - 1.5 liters/minute at 2 bars Combined interrupted flow of a minimum of 15 minutes

Figure 12 – Safety shower/emergency eye wash station

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

J. Refer to the following guidelines to determine the location and arrangement of eye wash and body shower stations:

a) Eye wash units and body showers both should be located within 10 seconds (or approximately 55 feet) of unimpeded travel distance from any work areas where corrosive material hazard is prevalent or, as recommended by a physician or appropriate official.

b) These should be placed in a well-lit area and identified with signage.

c) These should be located on the same floor level as the hazard area

d) Eye wash units and body showers should have adequate continuous supply of water at the right temperature and pressure.

e) The proper functioning of the eye wash units and body showers should be verified at the beginning of each shift.

6. Treatment and Disposal of Hazardous Substances

Relevance: Part-II, Rule 19: Treatment and Disposal of hazardous substance, Rule 20: Disposal of Packing Material

6.1. General Principles

A. At the end of a manufacturing process (especially in textile and apparel industry) a large amount of wastewater is discharged. If the discharged water is not properly treated, it poses a threat to the environment. Water that has been used for manufacturing processes and no longer meets the quality standard for beneficial use is consider as industrial wastewater.

B. This guideline is applicable to all factories with direct discharge, indirect discharge, and onsite Zero Liquid Discharge (ZLD) treatment plants.

C. Treatment sludge is the residual solid, semisolid, or slurry material produced as a by-product of wastewater treatment processes, including septic/ sewage and ZLD systems.

D. Treatment sludge could potentially contain high levels of chemicals and requires proper handling and disposal. The sludge disposal must meet all local requirements. Proper safety protocols need to be followed when handling and transporting sludge.

6.2. Managing chemical containing wastewater and treatment sludge

A. Each facility must, at a minimum:

   a) Be compliant with applicable wastewater and sludge discharge permits.
   b) Ensure there are no unpermitted bypasses for untreated wastewater around wastewater treatment systems.
   c) Follow generally accepted process engineering best practices with respect to wastewater treatment and overall facility water efficiency management.
   d) Not dilute wastewater discharge with incoming water or cleaner wastewater to achieve conformance to concentration-based discharge limits.
   e) Properly classify sludge produced from a wastewater treatment plant as per hazard properties
   f) Ensures treatment sludge is properly treated and disposed of.

B. Ensure the treatment of wastewater thereby maintaining the conventional parameter limits including temperature, pH, biological oxygen demand (BOD), or chemical oxygen demand (COD), Dissolved Oxygen (DO), Total Dissolve Solids (TDS) and others according to Punjab Environmental Quality Standards (PEQS).

Kommentiert [3]: Do we have these for wastewater?

Kommentiert [HK4R3]: This table refers to "Guideline for setting up common effluent treatment plants in Punjab Pakistan", GIZ, Pakistan-German Textile Cluster

Table 1: Punjab Environmental Quality Standards, PEQS (2016) For Municipal and Liquid Industrial Effluent

Punjab Environmental Quality Standards, PEQS (2016) For Municipal and Liquid Industrial Effluent (Mg/L, Unless Otherwise Defined)			
No.	**Parameters**	**Into Inland Waters**	**Into Sewage Treatment**
1	Temperature or Temperature Increase	≤3C	≤3C
2	pH Value (H+)	6-9	6-9
3	Biological Oxygen Demand (BOD5) at 20 0C	80	250
4	Chemical Oxygen Demand (COD)	150	400
5	Total Suspended Solids (TSS)	200	400
6	Total Dissolved Solids (TDS)	3500	3500
7	Grease and Oil	10	10
8	Phenolic Compounds (as phenol)	0.1	0.3
9	Chloride (as Cl-)	1000	1000
10	Fluoride (as F-)	10	10
11	Cyanide (as CN-) total	1.0	1.0
12	An-ionic detergents (as MBAs)	20	20
13	Sulfate (SO2-4)	600	1000
14	Sulfide (S2--)	1.0	1.0
15	Ammonia (NH3)	40	40
16	Pesticide	0.15	0.15
17	Cadmium (Cd)	0.1	0.1
18	Chromium (trivalent and hexavalent)	1.0	1.0
19	Copper (Cu)	1,0	1,0
20	Lead (Pb)	0.5	0.5
21	Mercury (Hg)	0.01	0.01
22	Selenium (Se)	0.5	0.5
23	Nickel (Ni)	1.0	1.0
24	Silver (Ag)	1.0	1.0
25	Total Toxic metals	2.0	2.0
26	Zinc (Zn)	5.0	5.0
27	Arsenic (As)	1.0	1.0
28	Barium (Ba)	1.5	1.5
29	Iron (Fe)	8.0	8.0
30	Manganese (Mn)	1.5	1.5
31	Boron (B)	6.0	6.0
32	Chlorine (Cl2)	1.0	1.0

C. The facility shall ensure to have qualified personnel to monitor, manage and maintain the wastewater treatment plant. A facility shall establish an in-house testing lab or use an external laboratory service to monitor and record at the minimum the daily frequency parameters.

D. To ensure proper planning and operation of the wastewater and sludge management processes, personnel in charge of the wastewater and sludge treatment should have access to the SDS as well as be informed about production in order to assess possible wastewater load arising from the use of the chemicals and plan the wastewater treatment processes.

E. To ensure consistency between sampling events each facility shall develop written procedures that clearly identify and document the sampling points, sampling

methodologies and reporting frequency to meet the expectations. Documentation shall include:

a) Written description of sampling procedures
b) Photographs of the sampling location
c) Posted signs at the sample locations identifying the points as sample points

F. Facility shall carry out pre-treatment of sludge and ensure the parameter limits of sludge according to the Punjab Environmental Quality Standards (PEQS) before disposing.

Kommentiert [5]: Do we have these for sludge?

G. Sludge must be disposed of through a qualified/ authorized waste contractor. Proper waste disposal documentation, including a copy of the license of the authorized waste contractor, shall be kept on record by the facility.

H. The facility shall take best available techniques (BATs) (e.g., substitution of environmentally hazardous chemicals, full or partial recovery of chemicals) into consideration for reducing hazard level and load of the facility´s wastewater.

I. The applicability of such BATs should be assessed as part of the development of a sludge management plan, aiming to minimize pollutants at the source and apply suitable recycling and recovery technologies where possible.

J. With regard to monitoring and recording of wastewater and sludge, the facility in addition shall also take into account of other than the stipulation as per the national regulatory and standards requirements, such as for example supply chain requirements (e.g., wastewater testing and reporting as per ZDHC).

6.3. Managing solid hazardous waste

A. In order to plan and manage chemical waste in a systematic manner, it is recommended that the facility establishes and maintains a waste inventory which lists all wastes (including chemical wastes) generated in the facility, thereby recording type, quantity and hazard characteristics of waste as well as location of waste generation and waste disposal method.

B. Every facility should classify its solid waste as hazardous or non-hazardous. Hazardous waste needs to be collected and disposed of in accordance with applicable regulations.

C. A systematic separation of hazardous and non-hazardous waste at source and during disposal shall be consequently applied to avoid cross-contamination of solid waste. Mixing of hazardous and non-hazardous waste will result in the classification of the combined waste as hazardous waste.

D. The list of hazardous waste can include, but is not limited to the following:

a) Used chemical drums and containers
b) Residual chemical waste from manufacturing processes
c) Film and printing frame
d) Expired/ unused chemicals

e) Compressed gas cylinders (refrigerants, Argon gas, LPG cylinders, etc.)
f) Contaminated materials (oily rags, cleaning cloth, spill control absorbents etc.)
g) Decommissioned equipment (contaminated parts, electronic waste)
h) Batteries
i) Fluorescent light bulb
j) Ink cartridges
k) Waste oil and grease (from cooking or boilers)
l) Electronic waste
m) Combustion residuals (fly ash and bottom ash/coal slag)
n) Plastic

E. Non-hazardous waste is the type of waste that does not pose any risk to human health and environment. The list of such waste can include, but is not limited to the following:

a) Materials (fabric waste)
b) Rubber
c) Metals
d) Paper/Cardboard
e) Glass
f) Domestic wastes (food, yard waste)

F. A facility shall manage its waste according to following steps:

a) Systematically identify and quantify all types of solid wastes in the manufacturing facility.
b) Identify, separate, and classify hazardous waste.
c) Create a waste inventory table for offsite treatment and disposal.
d) Set up a dedicated waste yard to store all waste, segregated as per materials and hazard properties.
e) Conduct a yearly waste audit and plan actions to reduce waste generation.

G. In case of storing hazardous solid waste, facility shall consider the following steps and practices:

a) Keep the waste store locked, preventing access by any unauthorized personnel.
b) Provide adequate ventilation where volatile waste is being stored
c) Construct secondary containment systems with materials appropriate for the waste being contained and adequate to prevent loss to the environment
d) Ensure impermeable surface in storage area
e) Use proper signage indicating chemical hazards and recommended good practices (e.g., recommended PPE)
f) Label hazardous waste containers to clearly identify content and associated chemical hazards

g) Keep ready spill clean-up equipment and proper PPE at the waste yard

h) Avoid burning any hazardous waste within or outside the facility, as the burning process may result in release of toxic by-products such as dioxins, furans, and persistent organic pollutants.

Follow the recommended precautions for storage of hazardous waste in the below figure:

Quick check for safe waste storage and handling

- Designated onsite storage areas for hazardous wastes of (i) sufficient size and (ii) separated, protected and (iii) in clearly marked location available
- Procedure and instructions for safe handling of empty chemical containers established and communicated to the concerned personnel
- Thorough cleaning before storage or disposal carried out with the wash water being discharged to wastewater treatment device
- Procedures in place to prevent reuse of empty chemical containers for the storage of drink/food items
- Possibility of returning containers to the chemical supplier considered
- Registered/qualified waste service provider for final disposal engaged

Figure 13 – Good practices in waste storage

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

6.4. Controlling releases of chemicals and other hazardous substances into the air

A. Various manufacturing processes involving hazardous substances may lead to the generation of air pollution. Guidelines for air emission management include the following:

a) Identify all sources and types of air pollutants generated and released from a facility operation and processes.

b) Create an air emission inventory including annual pollution load.

c) Check all permits, authorisations, laws, regulations, and standards required with regards to air emissions.

d) Track pollutant emission quantities and compliance with Punjab Environment Quality Standards (PEQS) and other applicable limits (e.g., requirements of export market).

e) Monitor the emission through an available online monitoring system or through a third-party approved laboratory.

f) Install appropriate control measures to meet the applicable requirements.
g) Carry out regular maintenance of control equipment to ensure their working order.
h) Perform third-party checks for all types at regular intervals to ensure compliance and
i) to identify opportunities for improvement.
j) Strive for continual improvement on air emission beyond compliance for process
k) modification, new machinery, chemical substitution, etc.

B. The reduction and control of air emission from the processes and operations are achieved through various emission control devices available. The following table outline few devices and their specific goals.

Table 2: Examples of air emission control devices

Type of emission control device	Goal
Cyclone precipitator	to remove particulate matter from exhaust gases
Electrostatic precipitator (ESP)	to reduce particulate emissions from boilers, kilns, engines, etc.
Baghouse / Bag-filter	particulate control
Scrubbers	to reduce pollutants such as particulate and Sox emissions.
Activated carbon adsorption	to remove organic compounds (such as VOCs)

Collection media must be considered as hazardous waste as well and treated or disposed of accordingly.

7. Annexes

7.1. Annex 1 - List of relevant national legislation, regulations, guidelines and standards pertaining to various aspects of managing hazardous substances

Kommentiert [6]: To be updated by Arjmand

7.2. Annex 2 - List of relevant international reference standards

European Integrated Pollution Prevention and Control Bureau (EIPPCB) - Best Available Techniques (BAT) reference document in the textile industry	https://eippcb.jrc.ec.europa.eu/reference/textiles-industry
Umweltbundesamt (Germany) - Environmental standards in the textile and shoe sector – A Guideline on the Basis of the BREFs – Best Available Techniques Reference Documents of the EU	https://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/4289.pdf
BAUA (German Federal Institute for Occupational Safety and Health) - Technical Rules for Hazardous Substances (TRGS)	https://www.baua.de/EN/Service/Legislative-texts-and-technical-rules/Rules/TRGS/TRGS.html
United Nations Economic Commission for Europe (UNECE) - Globally Harmonized System of Classification and Labelling of Chemicals (GHS)	https://unece.org/about-ghs
Chemical Risk Assessment: Overview and Examples	http://www.chemsafetypro.com/Topics/CRA/introduction_to_chemical_risk_assessment_overview_principles.html#:~:text=Chemical%20Risk%20Assessment%3A%20Purpose%2C%20Procedure,of%20both%20hazard%20and%20exposure
OECD Due Diligence Guidance for Responsible Supply Chains in the Garment & Footwear Sector	http://dx.doi.org/10.1787/9789264290587-en

Sustainable Apparel Coalition (SAC) Higg FEM 3.0 – Chemical management	https://howtohigg.org/fem-landing/chemical-management-2020/
International Labour Organisation (ILO) - C170 - Chemicals Convention, 1990 (No. 170)	www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_INSTRUMENT_ID:312315
International Labour Organisation (ILO) - R177 - Chemicals Recommendation, 1990 (No. 177)	https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:55:0:::55:P55_TYPE,P55_LANG,P55_DOCUMENT,P55_NODE:REC,en,R177,/Document
International Labour Organisation (ILO) - Safety in the use of chemicals at work. An ILO code of practice	www.ilo.org/public/libdoc/ilo/1993/93B09_147_engl.pdf
Zero Discharge of Hazardous Chemicals (ZDHC)	
● ZDHC Chemical Management System	https://www.roadmaptozero.com/process
● ZDHC Manufacturing Restricted Substances List (MRSL)	https://www.roadmaptozero.com/input
● ZDHC Wastewater and Sludge Laboratory Sampling and Analysis Plan (SAP)	https://downloads.roadmaptozero.com/output/Sampling-and-Analysis-Plan
● ZDHC Technical Industry Guide	https://www.roadmaptozero.com/process
● ZDHC Wastewater Guidelines version 1.1	https://www.roadmaptozero.com/post/updated-zdhc-wastewater-guidelines-v1-1-released?locale=en
bluesign SYSTEM SUBSTANCES LIST (BSSL)	https://www.bluesign.com/downloads/bssl/2021/bssl_v11.0.pdf
European Chemical Agency (ECHA) - REACH	https://echa.europa.eu/
Stockholm Convention on Persistent organic Pollutants (POPs)	www.pops.int
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	www.basel.int
Strategic Approach to International Chemicals Management (SAICM)	www.saicm.org

7.3. Annex 3 - List of relevant guidance references and training materials, including links.

COSHH e-tool	www.hse.gov.uk/coshh/essentials/coshh-tool.htm
Easy-to-use Workplace Control Scheme for Hazardous Substances (EMKG) – Federal Institute for Occupational Safety and Health, Germany	www.baua.de/EN/Topics/Work-design/Hazardous-substances/EMKG/Easy-to-use-workplace-control-scheme-EMKG_node.html

European Union DG for the Environment - EMAS "easy" for small and medium enterprises	https://op.europa.eu/en/publication-detail/-/publication/a46da1ae-edee-47aa-b871-d13baa946379
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	
• GIZ Basic Training Module for Chemical Management in textile wet processes	www.sia-toolbox.net/solution/basic-training-module-chemical-management-textile-wet-processes
• GIZ Advanced Training Module for Chemical Management in textile wet processes	www.sia-toolbox.net/solution/advanced-training-program-chemical-management-textile-wet-processes
• GIZ Digital Solutions for Substitution of Hazardous Chemicals in the Fashion Supply Chain initiative materials	Xxxx (Link will be provided)
• GIZ Resource Efficient Management of Chemicals in textile and leather sector companies (REMC), 2017	www.sia-toolbox.net/solution/resource-efficient-management-chemicals-textile-and-leather-sector-companies
Substitution Support Portal	www.subsport.eu
The International Chemical Secretariat (ChemSec) -	https://chemsec.org/
• ChemcSec SIN List	https://chemsec.org/business-tool/sin-list/
• ChemSec Textile Guide	https://chemsec.org/business-tool/textile-guide/
International Labour Organisation (ILO)	
• Chemical Safety Training Modules	www.ilo.org/legacy/english/protection/safework/cis/products/safetytm/index.htm
• Safety and health in the use of chemicals at work	www.ilo.org/global/topics/safety-and-health-at-work/resources-library/training/WCMS_183524/lang--en/index.htm

Kommentiert [7]: Arjmand to update

7.4. Annex 4 - Proposed templates and forms

- Hazardous Substances Inventory List
- Hazardous waste inventory
- Health Check-up Record
- Chemical Accident and Incident Logbook
- Training record
- Training Participants' Record

7.4.1. Hazardous Substances Inventory List (HSIL)

This is the minimum recommended information in an HSIL. Please refer to the relevant section of this document for detailed guidance.

Factory Location:

Location:

Updated by: **Date:**

Area/ Process	Chemical/ Trade name	Manufacturer name	Formulator /Supplier name	Purchase information			CAS/ EC number	MRSL/RSL compliant (Yes/No)	SDS available (Yes/ No)	Function/ Use of the chemical	R-phrases/ Hazard statement	Hazard type			PPE required (as per SDS)	Storage condition (as per SDS)	Chemical In-stock	Chemical Used
				Date of purchase	Date of expiration	Batch/Lot number						P	H	E				

7.4.2.Hazardous Waste Inventory

Factory Name:

Location:

Updated by: **Date:**

Waste Name	Waste Type (Solid/ Chemical)	Category (Sludge)			Hazardous/Non-hazardous	Hazard Statement	Hazard Type			Storage Location	Stock Quantity (Kg/L/Pcs)	Disposal Quantity (Kg/L/Pcs)	Disposal Method (According to regulations)	Date of Disposal (onsite)/ date of transfer to disposal facility	Disposal Vendor Name & Contacts
		A	B	C			P	H	E						

7.4.3.Health Check-up Record Template

Factory Name:

Location:

No. of person checked-up: **Total Clinically fit:** **Total Clinically unfit:**

Updated by: **Date:**

Date	Name of Employee	Department	Designation	Attended physicians (Name, Designation, Contact)	Check-up description (Tests performed, diagnosis, etc)	Result summary (Test results, disease diagnosed)	Clinical fitness (Fit/Unfit)	Actions for remedy	Physician's signature	Physician's remarks

7.4.4.Chemical Accident and Incident Logbook

Description of the accident/incident:

Sl	**Victim's info**		**Accident/ Incident info**		**Accident/Incident detail**			**Treatment info**	
	Name		Date		Severity (tick)		Affected organ of victim person	Death (Yes/No)	Hospital/ Clinic where treatment taken place	Doctor/Assistant conducting the treatment
	ID		Time		high					
	Section		Location		medium					
	Designation		Brief description:		low					
	How much percentage of earning capability worker has lost due to the accident/incident									
	Date of return to the workplace									
	How much time/day worker had to be absent due to the accident/incident									
	Compensation that has been given from company									

7.4.5.Training Record

Factory Name:

Location:

Updated by: **Date:**

Training Title	Date of training	Training Duration	Trainer Name	Training Provider Organization, address and contact	Location of Training	No. of Participants	Trainees' Assessment (Yes/No)

7.4.6.Training Participants' Record

Factory Name:

Training Title:

Date: **Duration:**

No. of Participants: **Location:**

Trainer Name & Designation:

Participant's Name	ID Card No.	Designation	Department	Years in the Factory	Signature

7.4.7.Emergency Plan

Source: UNEP Responsible Production Guidance and Toolkit

PRELIMINARY STEPS
PRELIMINARY STEP 1: REVIEW THE HAZARDS YOU HAVE IDENTIFIED
▪ Refer to the list of hazards and hazard hotspots you have developed
PRELIMINARY STEP 2: CHECK WHO YOUR POTENTIAL STAKEHOLDERS MAY BE IN AN EMERGENCY
▪ Identify those stakeholders that should be involved in the development of an integrated emergency plan (on-site and off-site).
PRELIMINARY STEP 3: REVIEW EXISTING EMERGENCY PROCEDURES AND PLANS
▪ Assess the emergency procedures already in place at your site.
▪ Identify existing community emergency plans, as well as common emergencies practices/procedures/plans shared with neighbour companies.
▪ Check for the existence of emergency procedures and/or plans of your contractors, suppliers, and transporters.
PRELIMINARY STEP 4: RAISE AWARENESS AND COMMITMENT TO THE APELL PROCESS
▪ Develop familiarity with the APELL process **www.unep.fr/scp/sp/process**
▪ Raise awareness among your stakeholders and gain commitment through internal company seminars and community workshops.
▪ Establish an informal Co-ordinating Group to get planning and communication underway.
▪ Run an internal company seminar, as this may be the best way to ensure there is adequate management understanding of the need, benefits and risks of launching an APELL process and to ensure that resources are available to do it properly.
▪ The internal company seminar should cover, in a preliminary way, such things as:
● the operation's hazards and potential risks
● some accident scenarios and their potential consequences
● regulatory or code requirements
● vulnerable communities
● adequacy of current plans

● the APELL process
▪ Raise awareness and gain commitment in the community by conducting an APELL workshop involving the relevant stakeholders.
▪ Establish an APELL Coordinating Group involving representatives of the relevant stakeholders (you should have been able to identify who your stakeholders are by applying the tools in Section 2)
THE 10-STEP APPROACH OF THE FORMAL APELL PROCESS
STEP 1: IDENTIFY EMERGENCY RESPONSE PARTICIPANTS AND ESTABLISH THEIR ROLES, RESOURCES AND CONCERNS
▪ Compile a list of potential emergency response participants.
▪ Obtain copies of existing emergency plans and review these to identify any further emergency response agencies and participants.
▪ Establish concerns, e.g. about deficiencies in resources or weaknesses in response capabilities.
▪ Prepare a brief description (perhaps a spreadsheet) of all emergency participants, their roles and resources, e.g. personnel, equipment, special knowledge, facilities, etc. Pay particular attention to understanding and documenting the boundaries between the different providers, gaps, overlaps and any unclear roles and responsibilities.
STEP 2: EVALUATE THE RISKS AND HAZARDS THAT MAY RESULT IN EMERGENCY SITUATIONS IN THE COMMUNITY AND DEFINE OPTIONS FOR RISK REDUCTION
▪ Possible accidents should be identified, along with the probability of their occurrence and possible consequences. This enables scenarios to be constructed and priorities to be set for planning purposes. Simultaneously, apparent risk reduction options should be defined and pursued at this stage.
▪ The Co-ordinating Group should oversee the compilation of a list of hazards and potential risks. For this, information already available on hazard hotspots and related risks should be used (refer to the tools applied on Section 1)
▪ Work must be done to explore and comprehend the range of hazards which exist, in addition to focusing on the obvious, and in relying in the information already collected by applying other tools. For comprehensive hazard identification, available information on hazard hotspots should be completed through joint exercises involving all stakeholders aimed at identifying chemical hot spots along transport routes. This will allow to better identify and understand chemical hazards and risks associated to transportation, and to produce a comprehensive community hazard map with the participation of all the relevant stakeholders.
▪ Assess the potential severity of the impact, for each possible accident, e.g.:
● the size and nature of potential area affected
● number of people at risk

● type of risk (physical harm, toxic, chronic)
● long term effects
● impacts on environmentally sensitive areas
● consequential secondary risks and impacts
● the probability of occurrence should be assessed. Points to consider include: ▪ probability of individual events ▪ probability of simultaneous events ▪ complications from unique environmental considerations
▪ The Co-ordinating Group should agree on key scenarios that could reasonably be expected to occur or that the community is most concerned about and use these in the planning process.
▪ As the hazards are identified and their probability and consequences are examined, some areas of risk may be identified that can be readily eliminated or cost-effectively pursued. Appropriate action should be taken as soon as possible, and the chemical control action plans developed by applying Tool 3.4 above should be updated.
STEP 3: HAVE PARTICIPANTS REVIEW THEIR OWN EMERGENCY PLAN, INCLUDING COMMUNICATIONS, FOR ADEQUACY RELATIVE TO A COORDINATED RESPONSE
▪ Contact the participants identified in Step 1, outline the priority emergency scenario(s) and ask them to evaluate their plans against these scenarios.
▪ The Co-ordinating Group should review the results of the separate evaluations to determine the overall strengths and weaknesses of the current status of a coordinated emergency response.
STEP 4: IDENTIFY THE REQUIRED RESPONSE TASKS NOT COVERED BY EXISTING PLANS
▪ From the reviews carried out in Steps 2 and 3 it can be determined whether existing emergency plans adequately address the identified risks and emergency scenarios. Additional tasks that need to be undertaken to complete or improve the plan can be identified. This step requires a thorough definition of what more must be done, with input from emergency response participants and Coordinating Group members.
▪ Identify missing or weak elements or tasks not being covered by any group, in the context of an integrated response.
▪ Determine the importance of these elements to the function of the participant (e.g. the fire service may not have the proper equipment to fight some chemical fires; correct antidotes may not be available at nearby hospital, etc).
▪ Inter-relationships, responsibilities and communication plans are key items for the Coordinating Group to discuss. For an effective integrated response, the importance of establishing a clear command structure cannot be overstated.

STEP 5: MATCH TASKS TO RESOURCES AVAILABLE FROM THE IDENTIFIED PARTICIPANTS
▪ Each task defined in Step 4 must be assigned by the Co-ordinating Group to the participant who can best address that aspect.
▪ Assigning the tasks should take into account authority, jurisdiction, expertise or resources.
▪ Evaluate each of the required extra tasks separately and, using the list of participants from Step 1, determine who is most likely to be able to complete the task. Assess benefits or problems associated with a particular participant completing a particular task.
▪ Discuss the tasks with the participant to determine willingness to undertake it and their resources and experience that will ensure the task is completed, or identify problems that may make it inappropriate or difficult for them to do so.
▪ Determine if any new tasks, problems or constraints will arise as a consequence of completing those already identified.
▪ Monitor the successful completion of each task.
STEP 6: MAKE CHANGES NECESSARY TO IMPROVE EXISTING EMERGENCY PLANS, INTEGRATE THEM INTO AN OVERALL COMMUNITY PLAN AND GAIN AGREEMENT
▪ By completing Steps 4 and 5, all resource-related problems should be identified and resolved.
▪ Integrating the plans will reveal overlapping responsibilities and complex interfaces between agencies
▪ Prepare a draft integrated plan
▪ Ensure that the newly developed plan is consistent with any regional disaster plan; also ensure its consistency with legislation and any codes that are relevant to emergency planning and community engagement.
▪ Check that the plan is robust in relation to all previously identified risks and emergency scenarios and in relation to response tasks, resources, roles and accountabilities, etc., to ensure there are no weak components.
▪ Conduct a role-playing exercise to test the plan, with key participants describing how they would respond to a variety of different emergency scenarios.
▪ Identify any weaknesses in the plan and, if necessary, repeat the steps above to resolve these problems
▪ Revise the plan as often as necessary until all deficiencies are eliminated and the members of the Co-ordinating Group agree it is appropriate and workable.
▪ Ensure that any individual plans that the various providers and organizations may retain to focus their own particular responses are retrofitted to the integrated plan and that inconsistencies are not allowed to creep in

STEP 7: COMMIT THE INTEGRATED COMMUNITY PLAN TO WRITING AND OBTAIN ENDORSEMENT FOR IT AND RELEVANT APPROVALS
▪ The integrated plan, as agreed by the Coordinating Group needs to be documented in final form and endorsed by the community, local government or other appropriate agencies.
▪ Use a small group to write the plan in its final format.
▪ Prepare a standard presentation to be given to the community, government officials or others who may have a role in its approval or implementation.
▪ Prepare notices, instructions, posters, etc. for use at the site and by other organizations and individuals.
▪ Make presentations, hold meetings and review sessions and obtain endorsement of community leaders and relevant officials.
▪ Make arrangements for any written agreements that may be necessary between participants of the APELL process, such as mutual aid, notification formats, use of the media, specialized response personnel and equipment.
▪ Agreements are also needed when private companies are to provide particular emergency assistance such as technical expertise or specialized equipment.
STEP 8: COMMUNICATE FINAL VERSION OF INTEGRATED PLAN TO PARTICIPATING GROUPS AND ENSURE THAT ALL EMERGENCY RESPONDERS ARE TRAINED
▪ Once the plan has been endorsed by those groups whose 'sign off' was appropriate or desirable, the details of it need to be communicated to the members of the emergency provider groups so that they are aware of the format of the plan, of their collective and individual responsibilities, and of any training they will require, such as the use of new equipment, new procedures, etc.
▪ Operating Procedures covering aspects of the Plan should be available to all staff that may need them.
▪ Compile a list of participating groups who will need to know more about the integrated plan.
▪ Make presentations to these groups to explain the plan, their roles and the type of training they should institute or receive.
▪ Update procedures
▪ Identify those who must be trained and update the Training Plan you developed by applying Tool 3.5 above; develop and carry out training sessions where necessary. In cases where the local authorities are not equipped to train key people, join with other stakeholders and share resources to undertake this.
▪ Ensure notices and posters are displayed in appropriate locations.
▪ Complete field exercises for hands-on training in monitoring, use of communications, traffic control, evacuation procedures, etc.
▪ Complete comprehensive workshops, including emergency scenarios, to train leaders in coordination and communication among participants.

▪ Focus on communication and media training for principal spokespersons in emergency response agencies and within the company. In some cases the media may be one of the response agencies with an important direct role as one of the emergency channels of communication to reach affected people or response providers to trigger plan actions.
STEP 9: ESTABLISH PROCEDURES FOR PERIODIC TESTING, REVIEW AND UPDATING OF THE PLAN
▪ The Co-ordinating Group should ensure that the Plan is well tested. Initial testing should take place without involving the public, to uncover deficiencies in coordination among groups and in the training that has taken place so far.
▪ Form a group to prepare a test drill scenario. The group should not include members of the emergency response group.
▪ Prepare a written scenario that identifies the objectives of the drill, components of the plan to be tested, sequence of events and simulated hazard levels.
▪ Designate a group of non-participating observers to evaluate the test drill using prepared evaluation checklists.
▪ Using appropriate local officials, media and other outlets, alert the public and all participants that a test of the plan is scheduled. It is crucial that the public does not confuse the test with the real thing, which could result in panic and a real emergency.
▪ Conduct the test using the prepared scenario.
▪ Immediately after the test, the Co-ordinating Group should hold evaluation sessions to consider the results according to the evaluation sheets and the responders' experiences.
▪ Interagency cooperation should be a particular focus of this evaluation. Assign appropriate participants to correct deficiencies and revise the plan accordingly.
▪ Prepare a guideline to ensure that the plan is regularly reviewed and updated to keep it current.
STEP 10: COMMUNICATE THE INTEGRATED PLAN TO THE GENERAL COMMUNITY
▪ Options for involving the community at large, rather than community leaders or representatives, should be pursued at every opportunity throughout the APELL process.
▪ The ultimate critical step is to ensure that each member of the community who may be affected knows what the warnings will be and what do to during an emergency, how to get additional information and when to evacuate if necessary.

▪ Prepare a standard emergency response brochure for distribution to all residents in areas that may be affected. This must be appropriate to the level of literacy of the local population—use of symbols and pictures may simplify the response actions, although this may need to be backed up by a face-to-face community education programme. The brochure may need to be available in two or more languages for some communities.
▪ Distribute the brochure by the most appropriate means, such as post, door to door delivery or at community group meetings.
▪ Prepare a standard media kit that will give emergency contact points in the company, and relevant government and other agencies, as well as providing background information and details on the operation and the emergency response plan.
▪ Conduct a media briefing session to present the kit and explain what help is needed from the media during an emergency.
▪ Build other elements of a public awareness campaign such as organizing a pool of speakers available to address local civic groups, schools, etc.
▪ Arrange for media coverage of drill and training activities.

10. References

Following references were used while preparing this self-learning/training material (alphabetical order);

1. BAuA (EMKG) Toolkit; http://www.baua.de/DE/Angebote/Publikationen/Praxis/Poster/EMKG-Expo-Tool.htm
2. Complete a Higg FEM Assessment Guide; https://howtohigg.org/fem-landing/fem-step-by-step-instructions/
3. IFC General EHS Guidelines; https://www.ifc.org/wps/wcm/connect/90231ba8-5bb3-40f4-9255-eaf723d89c32/1-5%2BHazardous%2BMaterials%2BManagement.pdf?MOD=AJPERES&CVID=ls4XLqS
4. Resource Efficient Management of Chemicals (REMC) In Textile and Leather Sector Companies by GIZ; https://www.sia-toolbox.net/solution/resource-efficient-management-chemicals-textile-and-leather-sector-companies
5. Template for Higg FEM; https://howtohigg.org/fem-landing/fem-templates/
6. The GHS Column Model 2020, IFA, https://publikationen.dguv.de/widgets/pdf/download/article/3737
7. TRGS 510 Storage of hazardous substances in non-stationary containers; https://www.baua.de/EN/Service/Legislative-texts-and-technical-rules/Rules/TRGS/TRGS-510.html
8. UK HSE Chemical warehousing: The storage of packaged dangerous substances; https://www.hse.gov.uk/pubns/books/hsg71.htm
9. UNEP Responsible Production Guidance and Toolkit