Storage of chemicals

1 Background

The safe storage of hazardous chemicals is an essential part of industrial safety and EHS management. The goal is to reduce the impact on workers and environment associated with the storage of chemicals during both normal operations and accidents. Further, an appropriate storage of chemicals ensures legal compliance and saves costs by maintaining the quality of chemicals. The document at hand shall outline the most important aspects of a chemicals storage concept and serve as guidance for correct and safe storage of chemicals.

2 Storage concept

The overall responsibility for the storage of hazardous chemicals is with the employer. Therefore, the company has to assure that an appropriate storage concept, which fits to the type and quantity of chemicals typically stored at the production site is in place. The storage concept shall follow the well-known Plan-Do-Check-Act principle and shall be subject to continual improvement.

The storage concept can be developed by the company itself. When specialized staff is missing or in cases where significant amounts of different kinds of hazardous chemicals are stored it is recommended to use external specialists.

The storage concept shall comprise – as a part of overall management system – technical and organizational measures that include:

- Correct and complete information on chemicals hazards
- Adequate input stream management
- Risk assessment for storage – implemented and up to date
- Clearly defined responsibilities
- Appropriate storage locations and storage conditions
- Appropriate co-storage/segregated storage
- Suitable emergency preparedness
- Sufficient knowledge and continuing education of workers

2.1 Correct and complete information on chemicals hazards

- Chemicals without a Safety Data Sheet (SDS) shall neither be used nor stored
- Safety Data Sheets (SDS) have to be requested from the supplier prior to purchasing/ordering pf the chemical
- A SOP for purchasing of chemicals must be in place
- Safety Data Sheets (SDS) for each chemical used shall be kept on site and located in a way workers have easy access to them
- Chemicals must be labeled according to the Globally Harmonized System for the Classification and Labeling of Chemicals (GHS), respectively its national implementation. This has to be requested from the supplier during the purchasing procedure
- A chemicals inventory list must be available at the site and kept up to date. The chemicals inventory list must include the classification of the chemicals, the storage places and the typical amount of stored chemicals as well as advices for segregated storage (compare also further information available for bluesign® system partners)

2.2 Adequate input stream management

- An approval procedure for all incoming chemicals must be develop, maintain and improve continuously
- The approval procedure shall consider a regular check whether hazardous chemicals can be substituted by less hazardous chemicals
- Incoming goods have to be checked to make sure they match the order (correct delivery? correct volume? correct and complete documentation? specifications met? Packaging/containers ok?, etc.)

2.3 Risk assessment – implemented and up to date

A proper risk assessment has to take into account all relevant risks (not only the intermediate or obvious ones). Furthermore the efficiency of the adopted safety measures has to be checked and the outcomes of the assessment as well as regular reviews have to be documented adequately (compare "Guidance sheet Risk assessment"). Besides workplace risk and environmental risks directly linked to the production site a risk assessment with focus on storage shall comprise also:

- natural hazards (earthquakes, flooding, etc.)
- off-site issues, if there is a serious risk for the surroundings (people and environment) caused by stored chemicals (often regulated by Major Accidents Hazard Regulations)
- restrictions/risks due to surrounding residential areas
- restrictions/risks due to surrounding natural protection areas

2.4 Clearly defined responsibilities

- Internal or external responsibilities for establishing, implementing and continual improvement of the storage concept have to be defined
- Responsibilities for purchasing, transport, storage and disposal of chemicals have to be clearly defined
- Only authorized persons must have access to chemicals storage areas

2.5 Appropriate storage locations and conditions

- Reception areas and interim storage (similar EHS requirements as for defined storage areas) have to be defined.
- Unloading of tank trucks and bulk chemicals transporters has to be managed appropriately (e.g. paved and defined areas with sufficient containment capacity, safety instructions on place, PPE, precautionary measure for emergency cases, clear responsibilities for internal and external workers)
- Production area shall not be used for storage of chemicals. Only daily amount of chemicals shall be kept in production areas
  An authorization concept for access to storage areas/buildings shall be developed
- Well-defined and appropriately marked storage areas/rooms shall be established.
- Storage areas and production areas shall be clearly separated
- Chemicals storage and storage of other items (solid waste, packages, etc.)shall be clearly separated
- Tanks/cylinders with flammable gases shall be safely located away from sources of heat and flammable materials and must be properly secured to prevent falling over
- Storage areas shall be clearly marked as non-smoking areas
- Maps/layout plans of storage areas/buildings shall be prepared and maintained
- In case of outdoors storage weather protection against sun, rain, wind, heat, moisture must be ensured
- Adequate air condition in storage areas must be ensured
- Adequate containments for spills and leakages must be installed.
  Containments shall be designed to hold either 10 % of the volume of all containers stored in the relevant area or 110 % of the volume of the largest container/tank. Retention measures for hazardous chemicals (double walled containers, bunded tanks, collection container, retention ponds, reservoir, use of pits) shall be available and - if appropriate - leakage control devices to prevent contamination of soil with liquid chemicals shall be installed
- To ensure that occupational exposure limits (OELs) are kept, storage areas must be well ventilated; Local Exhaust Ventilation have to be installed, esp. when powders or solvents or other low-volatile chemicals are handled
- Storage areas must be equipped with appropriate chemical resistant floors (at best by manufacturer certificate). Floor shall be free of cracks and subject to regular checks
- There must be no drainage in storage areas

- Sufficient lighting/light in storage areas must be ensured
- Slipping and tripping hazards must be avoided
- Suitable technical devices for storage and transport (e.g. lifting aids, forklifts) must be provided and maintained
- Toxic chemicals must be stored in locked areas
- Maximum floor loads, shelve loads (to avoid that racks are overloaded) as well as stacking rules (to avoid that barrels fall down and crack and/or injure workers) must be defined and indicated in a suitable way
- Suitable warning systems for cases of emergency (smoke/fire detection system) and sprinkler systems - if appropriate - must be installed and maintained
- Appropriate equipment for dosing and dispensing of chemicals (at best: automatic systems) must be provided and maintained
- Appropriate devices for the prevention of dust and spills during decanting shall be provided; appropriate vacuum cleaners must be available to handle powder spills in a safe way
- Regular preventive maintenance of the whole equipment used for storage and transport of chemicals shall be performed and documented
- If flammable chemicals are stored measures of explosion protection incl. measures against electrostatic discharge have to be applied
- Storage areas have to be inspected regularly to verify that containers are labeled correctly, containers are not leaking, good housekeeping rules are followed, containers are kept closed

2.5.1 Adequate container/tanks

- Original containers shall be used for storage as far as possible
- Breakable containers shall be avoided as far as possible
- Containers shall be kept closed wherever possible
- Liquid chemicals stored in amounts larger than 200 L shall have a secondary containment. Secondary containment is a container or other structure outside the primary container that is used to keep chemicals from leaking onto building or equipment surfaces
- All containers and tanks shall be labeled correctly according to GHS
- Any obsolete labels shall be removed from containers (including from drained containers)
- Food containers (drinking water bottles, etc.) must not be used for chemicals storage
- Containers must be made of materials suitable for the content (for tanks there shall be a manufacturer certification given)
- For tanks precautionary measures to avoid overfilling must be installed
- For underground tanks precautionary measures regarding spills, overfilling and corrosion of tank must be installed; double walled tanks are a must for hazardous chemicals including fuel; safety instructions for filling must be in place and known/followed by vehicle driver

2.5.2 Appropriate co-storage/segregated storage

The principle of segregated storage is that different hazards should be separated from each other. Dangerous goods of the same hazard class can usually be stored together, but there are exceptions. E.g. strong acids and bases are both corrosive, but react with each other. The storage concept for a specific industrial site will off course also depend on the volumes of hazardous materials present. In some cases, e.g. small amounts of acids and bases, sufficient space between containers can be safe enough. Large amounts of flammable materials however should be segregated with fire walls.
Following principles shall be followed:

- Make sure incompatible chemicals are not stored together (e.g. acids and base)
- Separate compartments for incompatible chemicals (e.g. hydrosulfite)
- Compare SDS for co-storage recommendations

Compare also further information on segregated storage available for bluesign® system partners.

2.6 Adequate workplace safety

- Work instructions (SOPs) for all storage activities shall be defined
- Sufficient space for safe operation (e.g. width of passageways) shall be available
- Well visible safety instructions shall be attached where necessary
- Eye- and emergency showers shall be installed (within 15 s walking time of places where hazardous chemicals are handled) and shall be regularly maintained
- Suitable first aid kits shall be installed in suitable locations throughout the factory in sufficient numbers and shall be regularly maintained
- Appropriate PPE (respirators, safety glasses, gloves, dust filters, etc.) must be provided to the workers (incl. training); skin contact with chemicals (esp. with sensitizing chemicals) shall be avoided; inhalation of volatile chemicals and dust shall be avoided
- Suitable fire safety equipment shall be installed and regularly maintained. Extinguishing devices have to be checked for compatibility with stored chemicals

2.7 Suitable emergency preparedness

- Spill kits, absorbing materials and neutralization materials shall be available
- Emergency drills must be conducted and documented in regular intervals
- Emergency evacuation routes and assembly points must be clearly defined and marked
- Fire-fighting plan must include storage areas and type and quantity of typically stored chemicals
- If applicable a disaster control plan must be at hand

2.8 Sufficient knowledge and continuing education of workers

- Suitable training for workers with the following focus must be developed, continuously improved and documented (keep written records):

  - good housekeeping
  - safe handling of chemicals
  - physical/chemical hazards of the chemicals they work with
  - safety instructions
  - PPE
  - correct storage of chemicals, special focus on oxidizing (e.g. peroxide) and reducing agents (e.g. hydrosulfite), acids and bases, flammable chemicals (e.g. solvents) and toxic chemicals
  - responsibilities
  - measures in case of spills and emergency
  - Educate workers periodically (e.g. once a year), as soon as new processes or chemicals are to be used as well as after incidents

3 Examples

The following examples of chemicals relevant in textile production shall show the basic principles (rules for segregated storage simplified and not exhaustive) to be regarded concerning storage:

- Storage of flammable liquids (e.g. Toluene, DMF, MEK):

  - Check/regard storage instructions in SDS
  - Do not store together with substances of other storage classes (especially not with: toxic substances, organic peroxides and self-reactive substances, oxidizing substances, self-igniting substances, gases, explosives) except non-combustible substances (liquid/solid)
  - Keep away from sources of heat/ignition
  - Keep in well ventilated place
  - Apply measures of explosion protection incl. measures against electrostatic discharge

- Storage of sodium hydrosulfite:

  - Check/regard storage instructions in SDS
  - Do not store together with substances of other storage classes (especially not with: flammables, toxic substances, oxidizing substances, organic peroxides and self-reacting substances, acids, bases, gases, explosives)
  - Keep container tightly closed
  - Protect from overheating/heating up
  - Protect from air/oxygen
  - Protect from moisture (risk of self-ignition)
  - Prevent formation of dust

- Storage of hydrogen peroxide (measures depending on concentration):

  - Check/regard storage instructions in SDS

- Do not store together with substances of other storage classes (especially not with flammables, pyrophoric substances, organic peroxides, acids, bases, gases, explosives) except non-combustible substances (liquid/solid)
- Place fragile vessels in break-proof outer vessels
- Do not keep the container sealed gas-tight
- Maximum filling 90%
- Keep away from sources of heat/ignition
- Keep in well ventilated place
- Only manufacturers or specialists can mount the tank units
- The vessels must have equipment for the temperature measurement preferably with alarm
- The vessels must be equipped with a venting device protected against dust and splashing water
- Catch pans must be equipped with an water tap so that in an emergency case is water available to dilute and rinse away the peroxide
- Protect from exposure to sunlight
- Keep away from organic matter

Storage of sodium hydroxide:

- Check/regard storage instructions in SDS
- Do not store together with: oxidizing substances, organic peroxides, acids
- Keep container tightly closed
- Recommended storage at room temperature
- Store in a dry place
- Do not use any metal containers

Storage of acetic acid:

- Check/regard storage instructions in SDS
- Do not store together with substances of other storage classes (especially not with: flammables, pyrophoric substances, toxic substances, oxidizing substances, organic peroxides and self-reactive substances, acids, bases, gases, explosives)
- Use breakable containers only up to 5 liters content
- Keep container tightly closed
- Recommended storage at room temperature
- Keep container in a well-ventilated place
- Store smaller vessels in cabinets with collecting tubs
- Protect from overheating/heating up

Storage of dyestuffs:

- Check/regard storage instructions in SDS
- Separate from other chemicals storage areas/rooms
- Keep container tightly closed
- Apply dust control measures
- Control temperature and humidity