

Trainer Manual

The following Trainer Manual is supposed to help trainers to carry out the Basic Training Module for Chemical Management in Textile Wet Processes. It introduces scope and aim of the Training and explains how to use the Training Manual.

The Basic Training Module for Chemical Management is a one-day training aimed at decision makers and the middle management who are responsible for production in textile factories containing wet processing units. The target of the training is to create awareness and promote basic knowledge about sound chemical management in textile supply chains, with a focus on the wet processes. It, thereby, should also be seen as a preparation for potential more advanced follow-up trainings. The training is structured in a modular fashion, consisting of six modules covering all relevant aspects of the textile environmental and chemical management. Depending of the context and specific needs, it is, therefore, possible to exclude certain modules from the training. The trainings are held in a classroom format and also include practical examples and exercise to engage the participants. Participants will also receive a handout covering the whole training as well as the slides of the presentation. Additionally, there are three short videos which introduce the topic (Video1) and give an overview about how to avoid restricted Substances via MRSLs and RSLs (Video 2) and safely manage chemicals in the textile production (Video 3).

Video 1: <https://www.youtube.com/watch?v=oqQvcMKty68>

Video 2: <https://www.youtube.com/watch?v=YijxLjwvI>

Video 3: <https://www.youtube.com/watch?v=PCQTlu8r14I>

This Manual consists of all the slides of the presentation, as well as further notes which give some additional details or explanations on the content of the slides. The manual is therefore meant to guide the trainer while presenting and give some additional information which make it possible to expand certain topics of the trainings beyond the content of the slides. Nevertheless, trainers of course must already have sound expertise and up-to-date knowledge on the subject of chemical management.

For further information, visit the Website of the Partnership for Sustainable Textiles: <https://www.textilbuendnis.com/en/>

Other useful information might be also found on the website of the GIZ working group Sustainable Industrial Areas SIA: <https://www.sia-toolbox.net/home> and in the Sustainable Production Centre SPC Learning Material: <http://spc.org.pk/library-2/>

For further questions regarding the Basic Training, please contact the Partnership for Sustainable Textiles:

Rahel Lemke

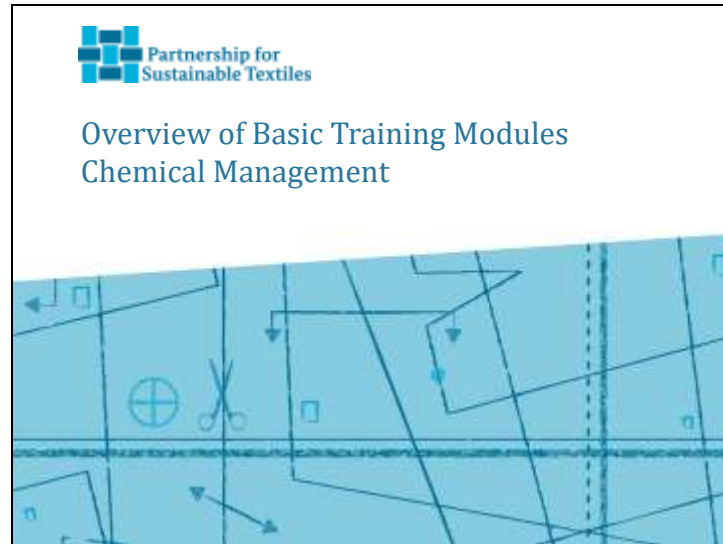
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Module 1: Chemicals in Textiles, Why You should be aware

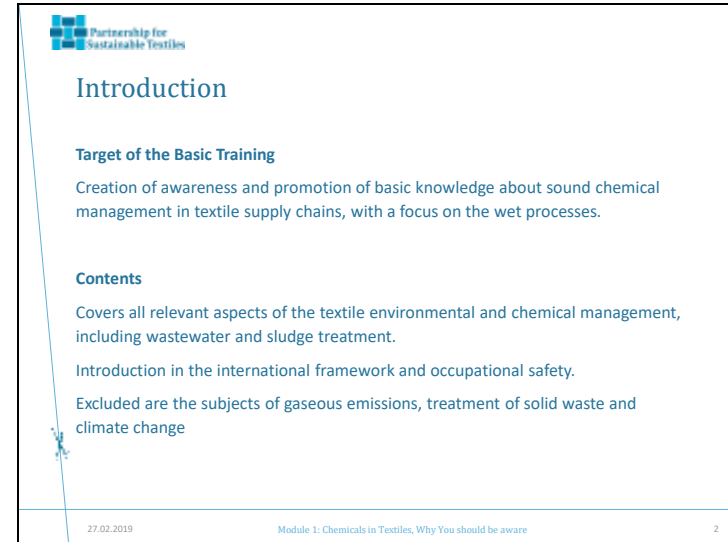
Slide 1




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Overview of Basic Training Modules Chemical Management

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Introduction

Target of the Basic Training

Creation of awareness and promotion of basic knowledge about sound chemical management in textile supply chains, with a focus on the wet processes.

Contents


Covers all relevant aspects of the textile environmental and chemical management, including wastewater and sludge treatment.

Introduction in the international framework and occupational safety.

Excluded are the subjects of gaseous emissions, treatment of solid waste and climate change

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Introduction

Target groups:

- Producers: Decision makers and middle management responsible for production, First tier providers
- Brands: Employees responsible for compliance, quality assurance, purchase and agents

→ broad impact by integration of multipliers and first-tier producers.


Modular Trainings:

- Classroom training with examples and exercises

Total time of training should not exceed one day

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Introduction

Module 1: Chemicals in Textiles	30 min
Module 2: Chemical Management	90 min
Module 3: Good Housekeeping	45 min
Module 4: Wastewater and Sludge Treatment	60 min
Module 5: Health Protection and Occupational Safety	60 min
Module 6: Risk Analysis and Action Planning	60 min
Module 7: Evaluation and Possible Next Steps	15 min
Total time:	6 h

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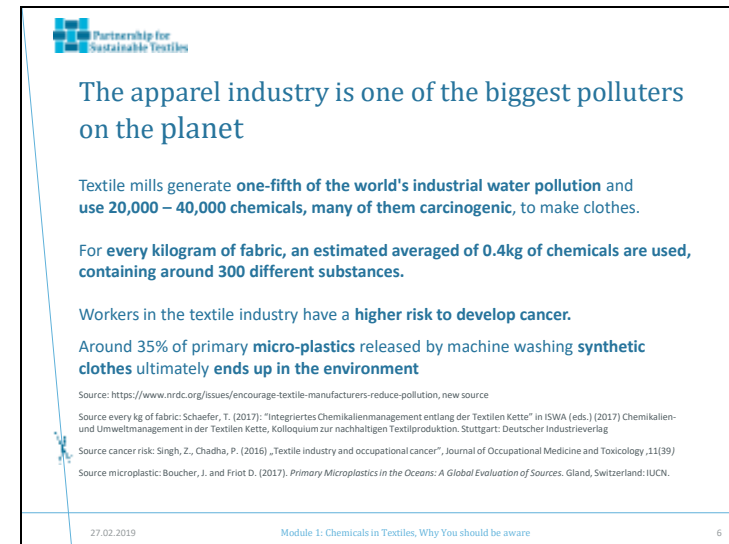


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Chemicals in textiles

Why you should be aware

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The apparel industry is one of the biggest polluters on the planet

Textile mills generate **one-fifth of the world's industrial water pollution** and use **20,000 – 40,000 chemicals**, many of them **carcinogenic**, to make clothes.

For every kilogram of fabric, an estimated averaged of **0.4kg of chemicals** are used, containing around **300 different substances**.

Workers in the textile industry have a **higher risk to develop cancer**.

Around 35% of primary **micro-plastics** released by machine washing **synthetic clothes** ultimately **ends up in the environment**

Source: <https://www.nrdc.org/issues/encourage-textile-manufacturers-reduce-pollution>, new source

Source every kg of fabric: Schaefer, T. (2017): "Integriertes Chemikalienmanagement entlang der Textilen Kette" in ISWA (eds.) (2017) Chemikalien- und Umweltmanagement in der Textilen Kette, Kolloquium zur nachhaltigen Textilproduktion. Stuttgart: Deutscher Industrieverlag

Source cancer risk: Singh, Z., Chadha, P. (2016) „Textile industry and occupational cancer“, Journal of Occupational Medicine and Toxicology ,11(39)

Source microplastic: Boucher, J. and Friot D. (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. Gland, Switzerland: IUCN.

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Source: <https://www.nrdc.org/issues/encourage-textile-manufacturers-reduce-pollution>

Source every kg of fabric: Schaefer, T. (2017): "Integriertes Chemikalienmanagement entlang der Textilen Kette" in ISWA (eds.) (2017) Chemikalien- und Umweltmanagement in der Textilen Kette, Kolloquium zur nachhaltigen Textilproduktion. Stuttgart: Deutscher Industrieverlag

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Source microplastic: Boucher, J. and Friot D. (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. Gland, Switzerland: IUCN.

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Externalisation of cost

Externalized costs are costs generated by producers but carried by society as a whole.


A textile producing factory may pollute water by dumping waste in the river without paying for it. Fifty kilometres downstream, the local government has to clean the water to use it as drinking water.

➤ Externalizing costs means companies show higher profits, but society is paying for them.

Did you know?
More and more initiatives try to help consumers to make better informed choices. One example is the **Good On You App** for consumers.
<https://goodonyou.eco/app/>
The Good On You app makes checking a brand for its impact on people, the planet and animals incredibly easy.

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Cost of inaction

There is a need to assess the cost of inaction for the textile sector!

→ It is very valuable for all industries to reduce the use of hazardous chemicals in their production and products.

Some general facts:

- One worker dies every 15 seconds from toxic exposures at work
- 2,780,000 workers globally die from unsafe or unhealthy conditions of work each year.
- Inaction by States and businesses on this global public health crisis is estimated to cost nearly 4 per cent of global gross domestic product, or virtually \$3 trillion.
- More and more companies are being sued for compensation

Sources: Hämmäläinen, P., Takala, J. and Kiat, T.B. (2017) *Global Estimates of Occupational Injuries and Work-related Illnesses*. Singapore: Workplace Safety and Health Institute
Eijkemans G. (2018) "1748 The importance of workers' health to advance the united nations sustainable development agenda" *Occup Environ Med* 75 (Supp. 2):A2

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See also new report:

Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes
<http://www.srtoxic.org/wp-content/uploads/2018/09/2018-HRC-report-on-Workers-Rights-EN.pdf>

Source Fact 1 and 2:

Hämmäläinen, P., Takala, J. and Kiat, T.B. (2017) *Global Estimates of Occupational Injuries and Work-related Illnesses*. Singapore: Workplace Safety and Health Institute

Source Fact 3:

Eijkemans G. (2018) "1748 The importance of workers' health to advance the united nations sustainable development agenda", *Occupational and Environmental Medicine*, 75(Supp. 2):A2.

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You are important!

Because it is up to you how healthy you, your employees and neighbours stay and if you continue to live in a **safe environment**

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The use of harmful chemicals in the textile sector has consequences for the environment

- Water pollution
- Pollution of soil and farmland
- Hazardous waste generation
- Pesticides used for cotton



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Psychological studies show that it is important to directly address people, to engage them for a topic. We would like to show to the trained person that his/her behaviour matters and makes a difference.

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Water pollution

- Growing cotton needs a lot of water and often used pesticides are polluting soil and groundwater
- Effluents from textile production pollute freshwater resources and eventually the ocean
- Used hazardous chemicals can even build up in the food chain



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Pollution of soil and farmland

- Hazardous chemicals in wastewater can pollute soil and farmland along rivers
- Sewage sludge containing hazardous chemicals is being applied to land as a soil supplement
- Contaminated soil can lead to contaminated food that is grown on these fields; therefore chemicals can enter the food chain

Source: Zubris, K.A.V. and Richards, B.K (2005) „Synthetic fibers as an indicator of land application of sludge“, *Environmental Pollution*, 138(2):201-11.

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Source sewage sludge: Zubris, K.A.V. and Richards, B.K (2005) „Synthetic fibers as an indicator of land application of sludge“, *Environmental Pollution*, 138(2):201-11.

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Hazardous waste

- Hazardous waste in the textile production has to be handled professionally
- It cannot be dumped on ordinary landfills or dumping sites
- The less hazardous chemicals are being used in production the less hazardous waste is generated




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What can you do to be an environmental hero?



- Use the ZDHC MRSL or other ambitious MRSL's
- Use non-hazardous chemicals as alternatives
- Go organic
- Recycle as much as you can
- Use a waste water treatment plant
- Do not dump sewage sludge or hazardous chemicals in the environment
- Safe water and energy, wherever possible

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The use of harmful chemicals in the textile sector has consequences for human health

Harmful chemicals are linked to many diseases:

Infertility	lower sperm quality
different types of cancer	neurological problems
asthma	allergies
skin problems	lung problems
heart diseases and others	

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The use of harmful chemicals in the textile sector has consequences for human health

Health consequences can occur in humans along the life-cycle of textiles:
→ farmers, workers in production and retail, in consumers, in waste handlers, and in the community around production and waste handling

Diseases can lead to death or severe ill-being. This has also negative consequences for the families, due to income loss, high medical cost etc.



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Picture – Source: REMC Company Handbook

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The use of harmful chemicals in the textile sector has consequences for human health

Some examples:

A study by the US National Institute for Occupational Safety and Health found a link in textile workers between length of exposure to formaldehyde and leukaemia deaths (Pinkerton et.al. 2004).

Women who work in textile factories and are exposed to synthetic fibres and petroleum products at work before their mid-30s seem to be most at risk of developing breast cancer later in life. For example, women working with acrylic and nylon fibres have an increased risk of developing breast cancer compared to the normal population (Labreche 2010).

A study of textile workers in Shanghai, China found an elevated risk of a spontaneously aborted first pregnancy associated with exposure to synthetic fibres and mixed synthetic and natural fibres (Wong et al 2009).

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Health problems



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Sources:

Pinkerton, L. E., Hein, M. J. and Stayner, L. T. (2004) „Mortality among a cohort of garment workers exposed to formaldehyde: an update“, *Occupational and Environmental Medicine*, 61(3):193-200.

Labrèche, F., Goldberg, M. S., Valois, M. and Nadon, L. (2010) „Postmenopausal Breast Cancer and Occupational Exposures“ *Occupational and Environmental Medicine*, 67(4):263-269

Wong, E. Y., Ray, R. M., Gao, D.L., Wernli, K. J., Li, W., Fitzgibbons, E. D., Camp, J. E., Astrakianakis, G., Heagerty, P. J., De Roos, A. J., Holt, V. L., Thomas, D. B., and Checkoway, H. (2009) “Dust and chemical exposures, and miscarriage risk among women textile workers in Shanghai, China“, *Occupational and Environmental Medicine*, 66(3):161-168

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What can you do to be a health hero?



- Train employees to handle chemicals safely
- Establish a safe storage system
- Protect especially pregnant women from hazardous chemicals
- Implement OSH (ventilation system, protection gear etc.)
- Substitute and eliminate hazardous chemicals in your production
- Go organic
- Minimise waste

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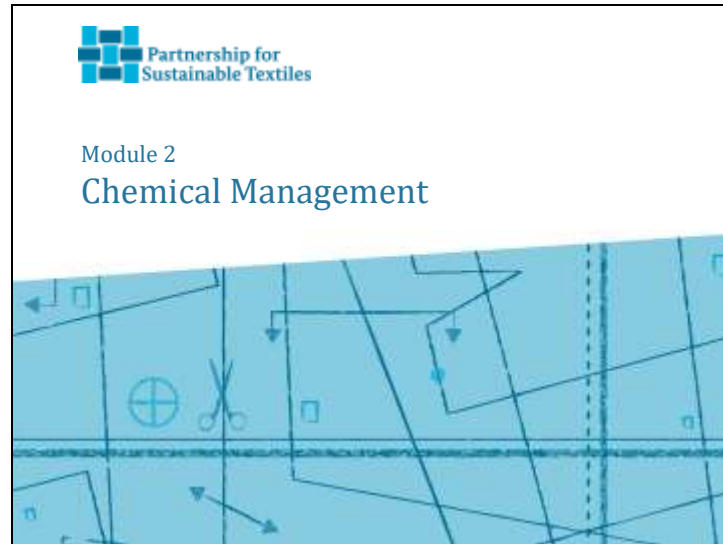
General Information and Useful Tools

- Partnership of Sustainable Textiles
<https://www.textilbuendnis.com/en/>
- GIZ: Sustainable Industrial Areas SIA working group:
<https://www.sia-toolbox.net/home>
- Sustainable Production Centre:
<http://spc.org.pk/library-2/>

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Module 2: Chemical Management

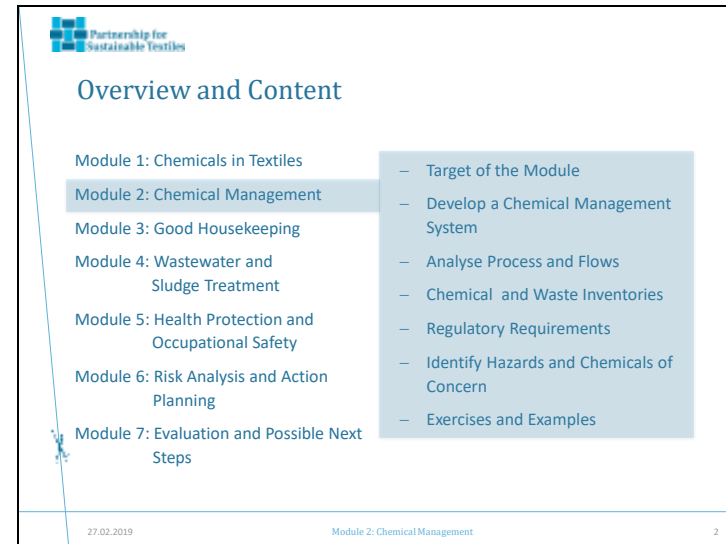
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Module 2
Chemical Management

Slide 2



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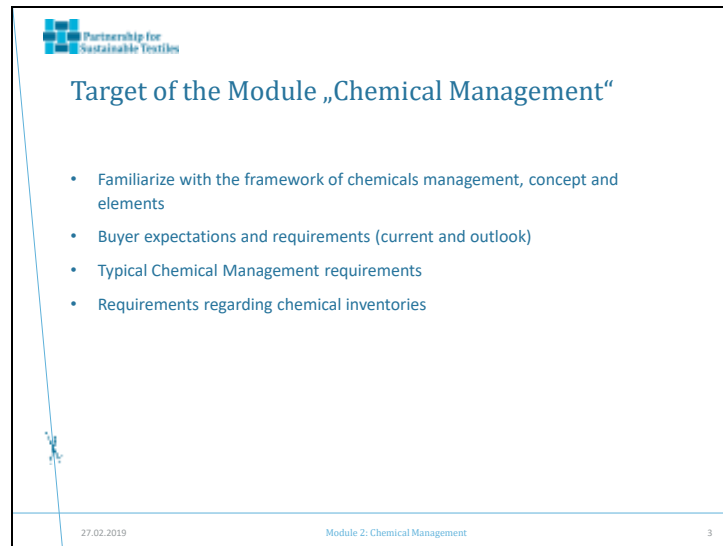
Overview and Content

- Module 1: Chemicals in Textiles
- Module 2: Chemical Management**
- Module 3: Good Housekeeping
- Module 4: Wastewater and Sludge Treatment
- Module 5: Health Protection and Occupational Safety
- Module 6: Risk Analysis and Action Planning
- Module 7: Evaluation and Possible Next Steps

- Target of the Module
- Develop a Chemical Management System
- Analyse Process and Flows
- Chemical and Waste Inventories
- Regulatory Requirements
- Identify Hazards and Chemicals of Concern
- Exercises and Examples

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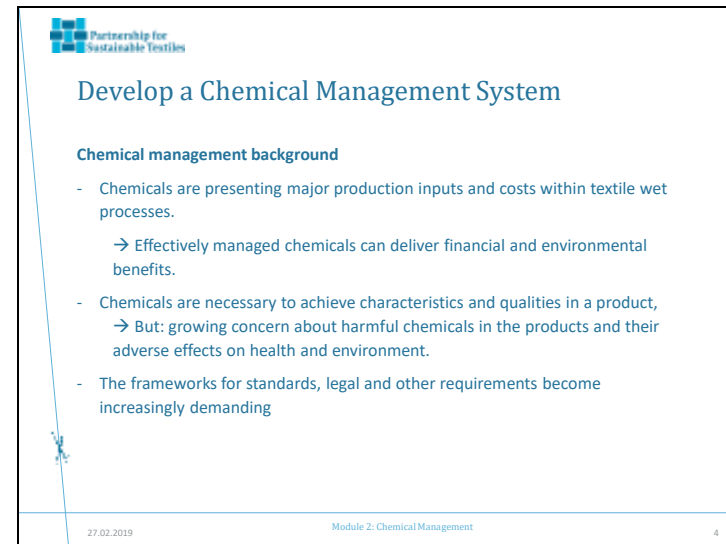
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Target of the Module „Chemical Management“

- Familiarize with the framework of chemicals management, concept and elements
- Buyer expectations and requirements (current and outlook)
- Typical Chemical Management requirements
- Requirements regarding chemical inventories

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Develop a Chemical Management System

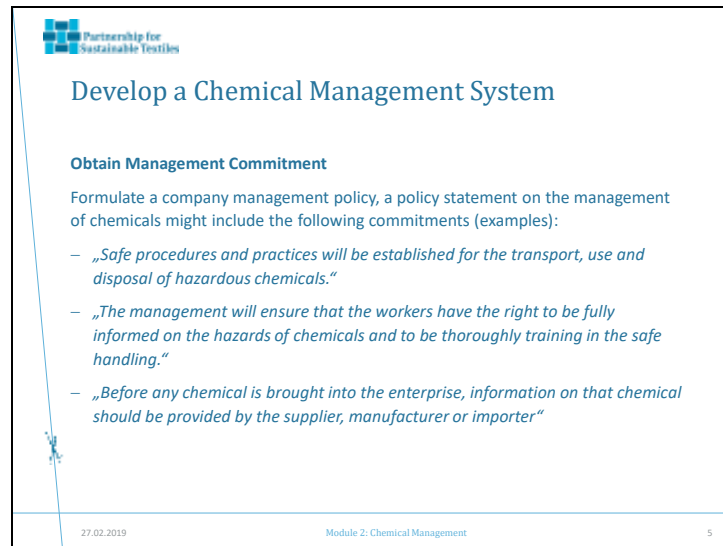
Chemical management background

- Chemicals are presenting major production inputs and costs within textile wet processes.
 - Effectively managed chemicals can deliver financial and environmental benefits.
- Chemicals are necessary to achieve characteristics and qualities in a product,
 - But: growing concern about harmful chemicals in the products and their adverse effects on health and environment.
- The frameworks for standards, legal and other requirements become increasingly demanding

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- Out of around seven million known chemical substances, more than 150.00 are used in industry in production processes. Around 8.000 commercial chemicals are hazardous.

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Develop a Chemical Management System

Obtain Management Commitment

Formulate a company management policy, a policy statement on the management of chemicals might include the following commitments (examples):

- „Safe procedures and practices will be established for the transport, use and disposal of hazardous chemicals.“
- „The management will ensure that the workers have the right to be fully informed on the hazards of chemicals and to be thoroughly training in the safe handling.“
- „Before any chemical is brought into the enterprise, information on that chemical should be provided by the supplier, manufacturer or importer“

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Develop a Chemical Management System

Elements of a sound chemical management system:


1. Chemical Management Change Team
2. Assessment of chemical management
 - Process flow
 - Regulatory Requirements
 - NPO / Waste Inventory
 - Chemical inventory
3. Identification and assessment of chemical hazards
 - Chemical Risk Assessment
 - Reducing Impacts on Human Health and Environment
 - Safety Data Sheet Management
4. Identification of chemicals and processes of concern

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Guiding questions:

- Can you describe your company policy/commitment for a chemical management programme?
- Does it include any statements in line with the examples given?
- Can you identify who is directly responsible for the implementation of the policy within the company?

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Develop a Chemical Management System

From a chemical management change team:

- Teams should not be simply formed based on one person from each department.
- A needs analysis should drive the selection of members. Smaller organizations with less resources may seek external assistance.
- Be aware that as the scope of the tasks change, so may change the team. Evolve the composition of the team to match the dynamic nature of the task.
- In larger firms, there may be different levels of teams, and different teams in operation at the same time.

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Develop a Chemical Management System

Chemical Management Change Team

Function/Department	Roles and responsibilities
Purchase	<ul style="list-style-type: none"> • Develop and implement controls of materials • maintain inventory • procure information on material hazards, environmental impacts and eco-friendly alternatives
Human Resources	<ul style="list-style-type: none"> • Define competency requirements and job descriptions for various roles in CM • Develop training programmes based on a needs analysis • Integrate the CM system into reward, discipline and appraisal systems
Maintenance	<ul style="list-style-type: none"> • Implement preventive maintenance for key equipment • Track equipment performance, cos efficiency etc. • maintain logs and inventory on equipment, machine parts, etc.
Legal/Compliance	<ul style="list-style-type: none"> • check requirements on compliance to all applicable regulations and laws • update legal documents • communicate risks of non-compliance
Finance	<ul style="list-style-type: none"> • Evaluate CM options for economic feasibility • Prepare budgets for CM options • Track data on costs incurred and benefits accrued in CM program
Engineering/ Production/EHS	<ul style="list-style-type: none"> • Implementation plans • implement CM options • carry corrective actions if required support training of line workers

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Guiding questions

- Can you name the group which takes the initiative of establishing a plan and monitor its implementation for the management of chemicals in your company?
- Can you describe the roles and responsibilities of management and workers in your company concerning the safe use of chemicals?

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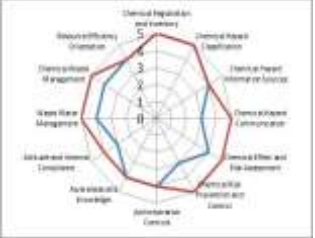
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Develop a Chemical Management System

Assessment of chemical management

As a preparatory step for the implementation of chemical management (CM), it may be helpful, if your CM team gets a quick idea of the situation and challenges at hand.

Your team can conduct a comprehensive self-assessment, for example using the ZDHC audit protocol or checklists such as in the ZDHC Chemical Management System Guidance manual.



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Alternatively, the team can carry out a preliminary assessment, using the GIZ REMC Quick-Check tool to identify and document areas of special attention. The interactive approach of the REMC quick-check tool encourages the involvement of the organisation's staff at all levels and can contribute to creating awareness and change readiness in the organisation.

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Analyse Process and Flows

- The analysis and documentation of the chemical process flows lays the groundwork for inventorying of chemicals and establishing a chemical management system.
- This also makes it easier to later identify and document hazard/risks related to entire range of production processes, products, non-product outputs (NPO) activities under the purview of the company as well as plan and monitor improvement measures.

There are two ways of documenting the chemical process flow:

1. Eco-mapping
2. Process flow diagrams

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While completing the tasks and corresponding activities, you will find answers to questions such as:

- What chemicals do we use in our company?
- Where are these chemicals present and used?
- How do these chemicals move through our company?
- Where to these chemicals and end in which form?
- What are the relevant legal and other requirements?

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Analyse Process and Flows

Example: Eco-Mapping

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Analyse Process and Flows

Example: Process Flow Diagram

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Analyse Process and Flows

How to prepare an Eco-Map:

Start with creating a facility plan that details the physical areas of the property involved in chemical storage and usage. The simplest way is to use existing plans.

Indicate and individually label all areas where chemicals are stored, handled, used as well as released (to air, water,...). It is recommended that your facility plan clearly points out:

- (a) Purchasing and delivery areas
- (b) product storage areas (main stores, sub stores, temporary storage areas),
- (c) product preparation/dosing areas,
- (d) areas with presence of chemical containing air emissions, solid waste and effluent).



In order to increase the understanding of the situation at hand and possible issues to be addressed, the eco-map can also indicate where and how chemicals are transported.

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Practical tips:

- Prepare or verify during an initial company/site walk-through
- Collect and fill in additional information, using guiding questions and observations on site
- Involve staff and workers in the preparation of the maps

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Analyse Process and Flows

The process flow diagram represents a schematic of the:

- production/process steps
- different inputs
- intermediary products
- final product
- non-product outputs (defines as materials which do not end up in the final product)

Allows to prepare mass balance and/or cost analysis as well as identify where you can encounter opportunities for cost savings.

- Draw a general outline of the production process
- Include inputs, outputs and non-product outputs
- Indicate quantities and/or value of inputs, outputs, non-product outputs as far as already known

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Draw a general outline of the production process first. You can always prepare separate and more detailed diagrams for each production steps and process. Include inputs, outputs and non-product outputs. In second step start differentiating and detailing these. Indicate quantities and/or value of inputs, outputs, non-product outputs as far as already known to you. In case of batch processes, in which the input and quantities may vary from product to product, this may not be feasible.

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Chemical and Waste Inventories

Chemical Inventory

- provides a comprehensive list of the chemicals entering your production
- In the context of resource efficient management of chemicals, the purpose of chemical inventory goes beyond warehousing requirements:
 - It serves as key reference
 - It can be used for identification and assessment of environment, health & safety hazards and risk
 - It can be used as chemical management information tool

According to ZDHC, companies should create and maintain a comprehensive list, containing following information:

- Name of the chemical
- hazard class
- container size
- locations of containers
- dates on which solutions were prepared or expire

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HOW TO PREPARE A CHEMICAL INVENTORY IN LINE WITH ZDHC REQUIREMENTS

Decide on a standard format of the enhanced chemical inventory. Appendix C of the ZDHC CMS Guidelines includes an outline of a recommended chemical inventory. You can add further columns in line with your requirements. Referring to your existing inventory or using the findings from your eco-maps and flow-diagrams, fill the information into the inventory template.

Chemicals that **MUST** be included are...

- all chemicals with hazard indication or pictogram on container label,

- all chemical materials used in laboratory, pilot facilities and other locations
- all compressed gases,
- any flammable paints, solvents, glues, fuels and other petroleum product, and
- materials that create an explosive or toxic vapor hazard to unprotected personnel during fire emergencies.

When chemicals constitute a key production input, you will most likely already maintain a record of the chemicals for purchase and stock management purposes. From your eco-maps and process flow diagrams you can retrieve information about type and location of chemicals and chemical (containing) waste, production process involving chemicals as well as about quantities of inputs and non-product outputs

In the context of resource efficient management of chemicals, the purpose of chemical inventory goes beyond warehousing requirements. The chemical inventory serves as key reference and chemical management information tool, for example to allow you to assess conformance with restricted substances lists or to report to your company stakeholders (e.g. buyers).

As per ZDHC, the company is expected to create and maintain a comprehensive chemical list, allowing all chemicals in the facility to be identified by name, also recording hazard class, container size, locations of containers and dates on which solutions were prepared or expire, if applicable and chemicals of concern for your customers. In further course, the inventory is expected to be also used for identification and assessment of environment, health & safety hazards and risk.



chemical container/package and/or in the safety data sheet. If not available, inquire with your chemical supplier or check in one of the internet based chemical data bases against the CAS number (e.g. GESTIS, see link below).

R-phrases or **risk phrases** refers to a list of abbreviated descriptions of hazardous characteristics associated with chemicals as originally defined in Annex III of European Union Directive 67/548/EEC. These risk phrases were widely used internationally, not just in Europe, and have been replaced with a more harmonized system under the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) as an internationally agreed-upon system, created by the United Nations (see H-statements)

H-statements or **hazard statements/codes** refer to a list of abbreviated descriptions of hazardous characteristics associated with chemicals as defined under the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). You should be able to find the H-statement(s) for chemicals used in your company on the

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Chemical and Waste Inventories

NPO / Waste Inventory

- Chemical process flow charts and eco-maps documents account for materials (chemicals) entering and leaving a system.
- The chemical inventory provides a comprehensive list of the chemicals entering your production.
- **Not all of these chemical inputs end up in the final product, for example for technical/production process reason, fabrics will absorb only part of a dye stuff.**

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Chemical and Waste Inventories

NPO / Waste Inventory

- Remaining chemicals (non-product outputs - NPO) leave the system as discharge into the air, water or residuals in solid or liquid form.
- According to ZDHC CMS 2.1.4.4, factories are expected to plan how and where to safely store such chemical waste as well as to document where it is generated and how it will be disposed

Figure – Non-product output flow, Source: GZ CHS

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Remaining chemicals (non-product outputs - NPO) leave the system as discharge into the air, water or residuals in solid or liquid form. According to ZDHC CMS 2.1.4.4, factories are expected to plan how and where to safely store such chemical waste as well as to document where it is generated and how it will be disposed

Practical tips:

Methodologies such as mass or material balancing which are used widely in engineering and environmental analyses, help detailing and quantifying the input, output and non-product outputs flows as well as allow putting a cost-tags to the same.

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Chemical and Waste Inventories


NPO / Waste Inventory

Information/data gathered during the process flow analysis and mass/material balancing will provide key inputs in compiling an inventory of the non-product outputs in your factory and developing a (chemical) waste management plan and/or decide on measures to reduce non-product outputs, for example:

- use of good basic manufacturing practices,
- process optimization,
- increase in chemical uptakes

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Chemical and Waste Inventories

NPO / Waste Inventory

The remaining non-product outputs need to be managed and disposed. The on-site or off-site treatment processes themselves can produce chemical containing waste, for example treatment sludge, or used air filters. (see also Module 5, Waste Water Treatment)

Waste Name	Category /Type	Source Process	Storage Area	Yearly Quantity	Associated Hazards	Disposal Method (actual/recommended)	Waste Disposal Vendor Address	License Number	License Validity Time

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Regulatory Requirements

- National legislation in the country of the company's residence
 - National requirements, state and local requirements
- Comply with and be aware of regulations outside your country, such as with those of your export markets (for example, the European chemical regulations REACH).
- Other requirements such as industry codes of practice, pledges or commitments made voluntarily by your company
- customers' requirements (e.g. supplier code of conducts).

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As per the ZDHC Chemical Management System Guidance Manual, companies are expected to establish and maintain a Standard Operating Procedures (SOP) for monitoring regulatory requirements and maintain an up-to-date inventory of legal requirements permits.

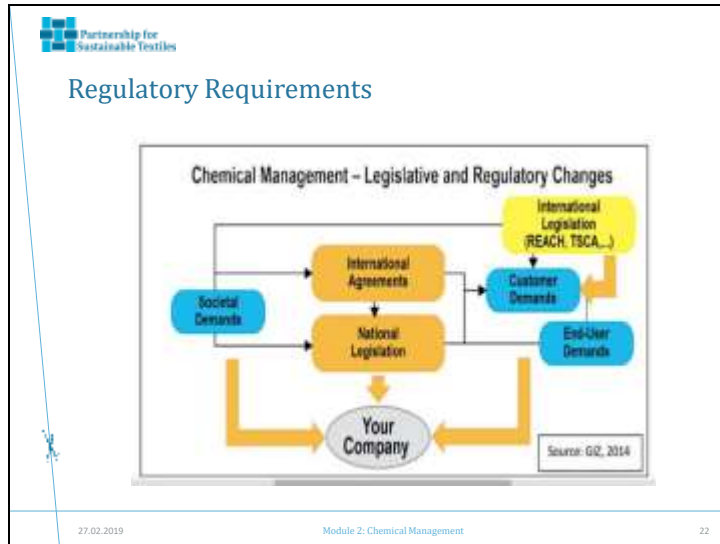
HOW TO IDENTIFY AND MONITOR REGULATIONS AND PERMITS

- Identify and state all applicable jurisdictions, regulations and permits necessary to operate (city, state and country level). Possible sources are commercial services (with updates offered on-line, on CD-ROM, or in paper form), regulatory agencies (federal, state and local), trade groups / associations, the Internet (see REACH www.echa.org), seminars and courses; newsletters /

magazines, consultants and attorneys; your customers, and chemical suppliers.

- Assign regulatory identification to a person or a team (initial and ongoing)
- Describe communication processes in case of regulatory changes and/or when permits expire, operational limits change etc.

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Regulatory Requirements

Establish and maintain a regulatory inventory

→ Because legal and other requirements change over time, your procedure should include a means to ensure that you are working with up-to-date information.

Example: Legal inventory format

No.	Title	Descriptions	Applicable to		Area of Applicability	Licenses/ Compliance Records Required	Re-viewed
			Company	Contractor /Supplier			
xxx	Environment Conservation Act 1996 (section xx)	Provides for the control of air pollution from stationary sources and motor vehicles. Also enables promulgation of regulations	✓	✓	Air emissions from plant, ...	xxx	
xxx	Environment Conservation Act 1996 (section xx)	Provides for the control of water pollution, including reference to specific discharge standards	✓		Discharge of waste water from production and other sources in the company	xxx	
xxx	Sludge ordinance	Provides for the control of management and disposal of treatment sludge	✓		Disposal of treatment sludge from ETP	xxx	

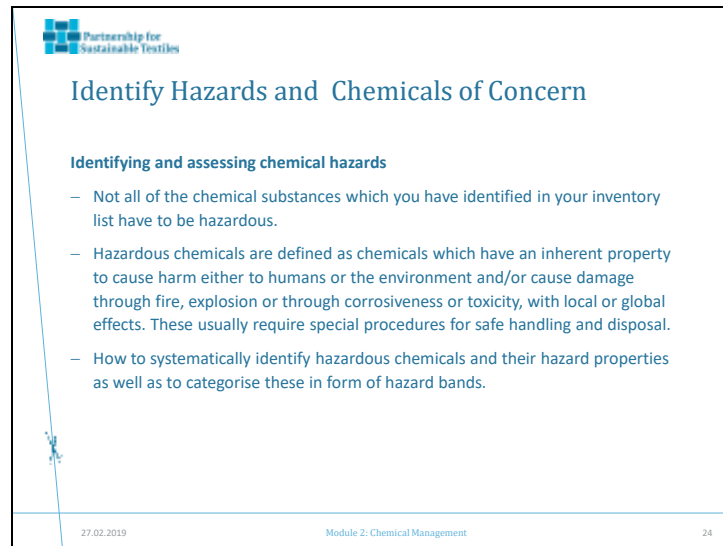
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This is not an “one time” activity. Because legal and other requirements change over time, your procedure should include a means to ensure that you are working with up-to-date information.

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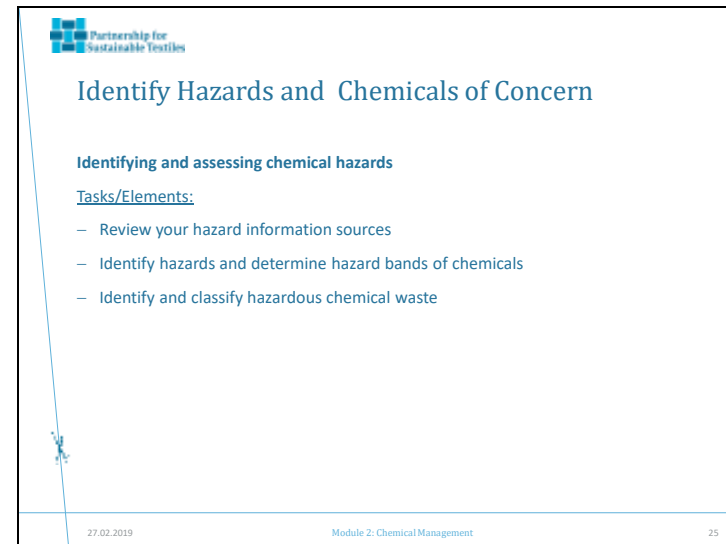
Identify Hazards and Chemicals of Concern

Identifying and assessing chemical hazards

- Not all of the chemical substances which you have identified in your inventory list have to be hazardous.
- Hazardous chemicals are defined as chemicals which have an inherent property to cause harm either to humans or the environment and/or cause damage through fire, explosion or through corrosiveness or toxicity, with local or global effects. These usually require special procedures for safe handling and disposal.
- How to systematically identify hazardous chemicals and their hazard properties as well as to categorise these in form of hazard bands.

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Identify Hazards and Chemicals of Concern

Identifying and assessing chemical hazards

Tasks/Elements:

- Review your hazard information sources
- Identify hazards and determine hazard bands of chemicals
- Identify and classify hazardous chemical waste

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This step deals with the question of how to systematically identify hazardous chemicals and their hazard properties as well as to categorise these in form of hazard bands.


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Identify Hazards and Chemicals of Concern

Review your hazard information sources


Standard chemical hazard pictograms




Chemical hazard pictograms used during transport of chemicals



Verify availability and content of chemical container/package labels



Verify availability and content of chemical safety data sheets



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Identify Hazards and Chemicals of Concern

Identify hazards and determine hazard bands of chemicals

At this point you start categorising the chemicals as being hazardous and non-hazardous by using information sources such as:

- labels
- safety data sheets
- information from chemical supplier
- other sources


As part of this process, take a closer look at the different categories and levels of hazards associated with the chemical substances and get further information on how these chemicals may affect health, safety and/or the environment.

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Practical Tip

You can retrieve information on the respective hazard classes and categories from your GHS conform safety data sheets (usually from section 2 – hazard identification or section 15 – regulatory information).

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Identify Hazards and Chemicals of Concern

Identify hazards and determine hazard bands of chemicals


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. These groups are further separated into classes of hazards

- 1 Physical: 16 classes of hazards**
- 2 Health: 9 classes of hazards**
- 3 environmental hazards: 2 classes of hazards + global warming**

In turn, each hazard class is further divided into hazard categories.

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Identify Hazards and Chemicals of Concern

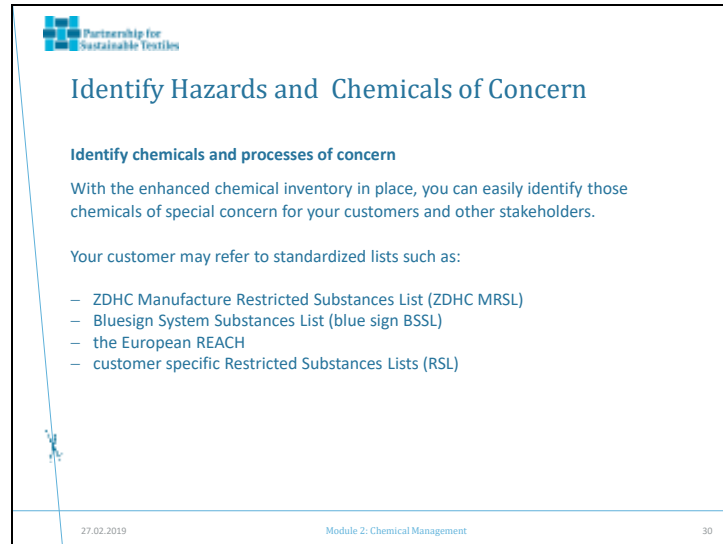
Identify hazards and determine hazard bands of chemicals

Classification of chemical hazards as per GHS system:

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	13. Oxidising liquids	3. Serious eye damage/irritation	3. Global warming effect
4. Oxidizing gases	14. Oxidising 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		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)	

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Identify Hazards and Chemicals of Concern

Identify chemicals and processes of concern

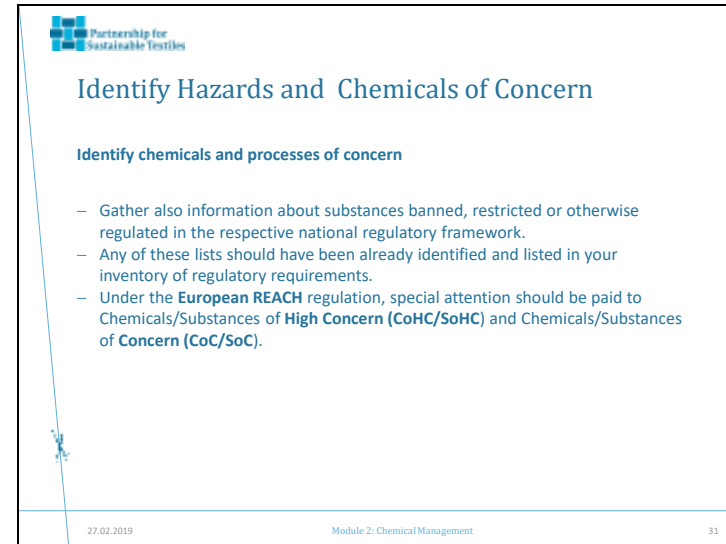
With the enhanced chemical inventory in place, you can easily identify those chemicals of special concern for your customers and other stakeholders.

Your customer may refer to standardized lists such as:

- ZDHC Manufacture Restricted Substances List (ZDHC MRSL)
- Bluesign System Substances List (blue sign BSSL)
- the European REACH
- customer specific Restricted Substances Lists (RSL)

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Identify Hazards and Chemicals of Concern

Identify chemicals and processes of concern


- Gather also information about substances banned, restricted or otherwise regulated in the respective national regulatory framework.
- Any of these lists should have been already identified and listed in your inventory of regulatory requirements.
- Under the **European REACH** regulation, special attention should be paid to Chemicals/Substances of **High Concern (CoHC/SoHC)** and Chemicals/Substances of **Concern (CoC/SoC)**.

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Guiding questions:

- Have you identified the applicable restricted substances list your organization subscribes to?
- Can you verify that you follow a process in which you regularly review the chemicals used in processes, and/or that can be found in your products, against published lists to identify chemicals of concern (e.g. REACH Substance of Very High concern, California Department of Toxic Substances Control)?
- Does your inventory table contain any chemical substances on the restricted substances list?


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Identify Hazards and Chemicals of Concern
 SUBSTANCES OF CONCERN
 Example under European REACH

Chemicals of High Concern (CoHC)	Chemicals of Concern (CoC)
<ul style="list-style-type: none"> • Carcinogenic, mutagenic or toxic to reproduction (CMR 1A or 1B) • Persistent, bio-accumulative and toxic substance (PBT per criteria according to Section 1 Annex XIII, REACH) • Endocrine disruptors or neurotoxins • Chemical whose breakdown products result in a CoHC that meets any of the preceding criteria • Found on http://sinlist.chemsec.org/ 	<ul style="list-style-type: none"> • Of moderate concern for ecotoxicity or human toxicity, but not a Chemical of High Concern (CoHC) • With GHS signal word „DANGER“ • Classified as an allergenic (respiratory or skin sensitization, Category 1, 1A and 1B; containing H334 or H317) • Classified as environmentally hazardous, long-term effects (Hazardous to the aquatic environment, chronic category 1 and 4; H410 or H413) • Found on California's Candidate list https://calsafer.dtsc.ca.gov/chemical/search.aspx

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Identify Hazards and Chemicals of Concern
Identify chemicals and processes of concerns

- Processes of concern are those areas where gaps between recommended and existing control exists as well as for which you have assigned a high-risk rating during the risk assessment process.
- As part of your organization's requirements under ZDHC, establish, document, and implement a process for verifying compliance with any such restricted substances lists. The compliance verification can be part of the purchase and audit process in your organization.
- As per these requirements, your company needs to maintain records (e.g. chemical inventory) and records indicating how you conduct the compliance verification and the results. In case such restricted substances are identified, specific action plans are to be drawn up on how to eliminate these from your production.

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Possible useful corrective actions

- Inventory
- MRSL / RSL compliance
- Chemical Management Policy
- Good Housekeeping Programme

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Literature, sources and further Reading

- GIZ: Resource Efficient Management of Chemicals in Textile and Leather Sector Companies, Company Handbook: <https://www.sia-toolbox.net/solution/resource-efficient-management-chemicals-textile-and-leather-sector-companies>
- ZDHC Chemical Management System Guidance Manual: https://www.roadmapzero.com/fileadmin/layout/media/downloads/en/CMS_EN.pdf
- ZDHC MRSL: www.roadmapzero.com/programme/manufacturing-restricted-substances-list-mrsl-conformity-guidance/
- Bluesign System Substances List: www.bluesign.com/industry/infocenter/downloads
- Chemsec's SIN List: <http://sinlist.chemsec.org/>

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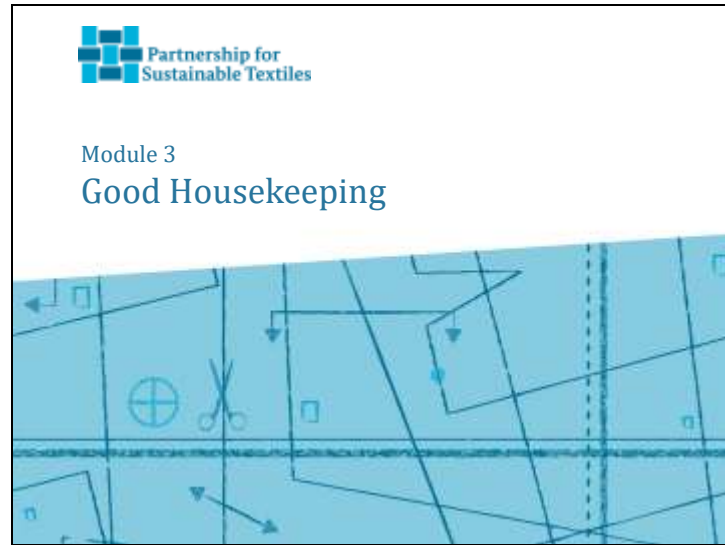
Exercise and Example

- Exercise and checklist
 - “Assessing Chemical Management: Description of the current situation in the company with regard to chemical management”* to be filled as a self assessment.
- Example of chemical management tool:
 - “SDS Quick Look”* Where to find which information in safety data sheets SDS

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Module 3: Good Housekeeping

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Slide 2

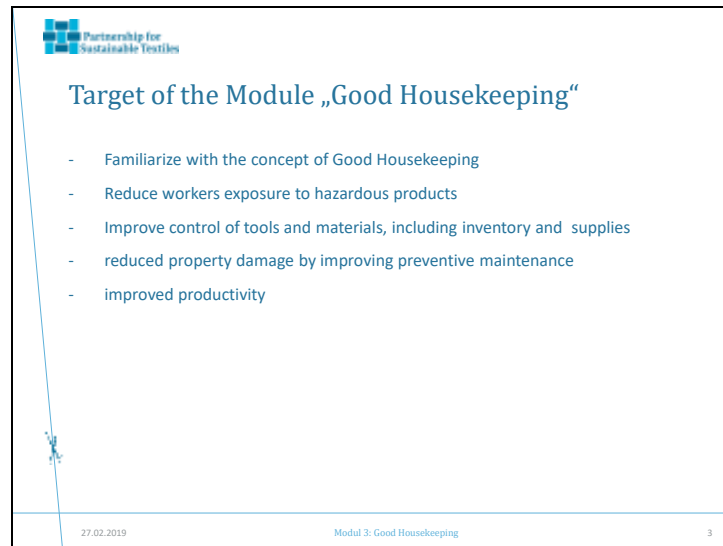
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Overview and Content

- Module 1: Chemicals in Textiles
- Module 2: Chemical Management
- Module 3: Good Housekeeping
 - Target of the Module
 - What is Good Housekeeping?
 - Good Chemical Management Practices
 - Improve Chemical Handling
 - Chemicals Labelling
 - Chemicals Storage
 - Chemicals Waste Handling
 - Exercise and Example
- Module 4: Wastewater and Sludge Treatment
- Module 5: Health Protection and Occupational Safety
- Module 6: Risk Analysis and Action Planning
- Module 7: Evaluation and Possible Next Steps

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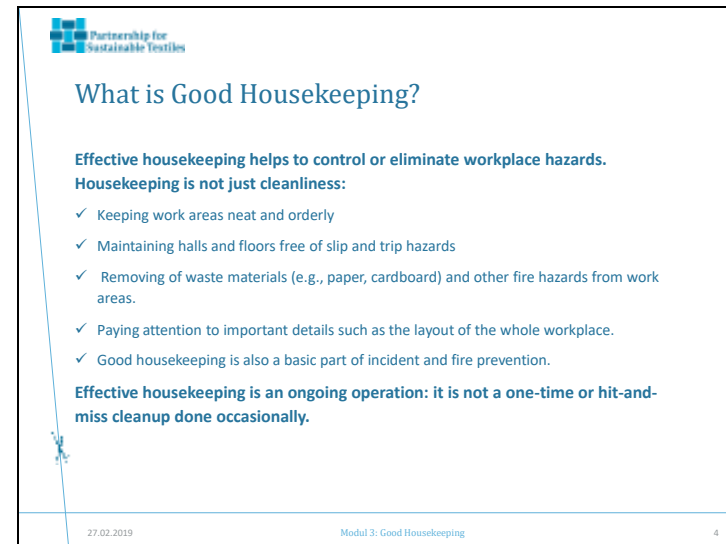
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Target of the Module „Good Housekeeping“

- Familiarize with the concept of Good Housekeeping
- Reduce workers exposure to hazardous products
- Improve control of tools and materials, including inventory and supplies
- reduced property damage by improving preventive maintenance
- improved productivity

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What is Good Housekeeping?

Effective housekeeping helps to control or eliminate workplace hazards. Housekeeping is not just cleanliness:

- ✓ Keeping work areas neat and orderly
- ✓ Maintaining halls and floors free of slip and trip hazards
- ✓ Removing of waste materials (e.g., paper, cardboard) and other fire hazards from work areas.
- ✓ Paying attention to important details such as the layout of the whole workplace.
- ✓ Good housekeeping is also a basic part of incident and fire prevention.

Effective housekeeping is an ongoing operation: it is not a one-time or hit-and-miss cleanup done occasionally.

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Effective housekeeping helps to control or eliminate workplace hazards. Poor housekeeping practices frequently contribute to incidents. If the sight of paper, debris, clutter and spills is accepted as normal, then other more serious hazards may be taken for granted.

Effective housekeeping is an ongoing operation: it is not a one-time or hit-and-miss cleanup done occasionally. Periodic "panic" cleanups are costly and ineffective in reducing incidents.

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What is Good Housekeeping?

What is the purpose of workplace housekeeping?

Poor housekeeping can be a cause of incidents, such as:

- tripping over loose objects on floors, stairs and platforms
- slipping on greasy, wet or dirty surfaces
- cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire or steel strapping

To avoid these hazards, a workplace must "maintain" order throughout a workday. Although this effort requires a great deal of management and planning, the benefits are many.

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What is Good Housekeeping?

What are some benefits of good housekeeping practices?

- Better hygienic conditions leading to improved health
- Lower worker exposures to hazardous products (E.g. dust, vapours)
- Improved productivity (tools and materials will be easy to find)
- Reduced handling to ease the flow of materials
- Decreased fire hazards
- More efficient equipment cleanup and maintenance
- Better control of tools and materials, including inventory and supplies
- Improved morale
- Reduced property damage by improving preventive maintenance
- Fewer tripping and slipping incidents in clutter-free and spill-free work areas
- Less janitorial work
- More effective use of space

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Poor housekeeping can be a cause of incidents, such as:

- tripping over loose objects on floors, stairs and platforms
- being hit by falling objects
- slipping on greasy, wet or dirty surfaces
- striking against projecting, poorly stacked items or misplaced material
- cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire or steel strapping

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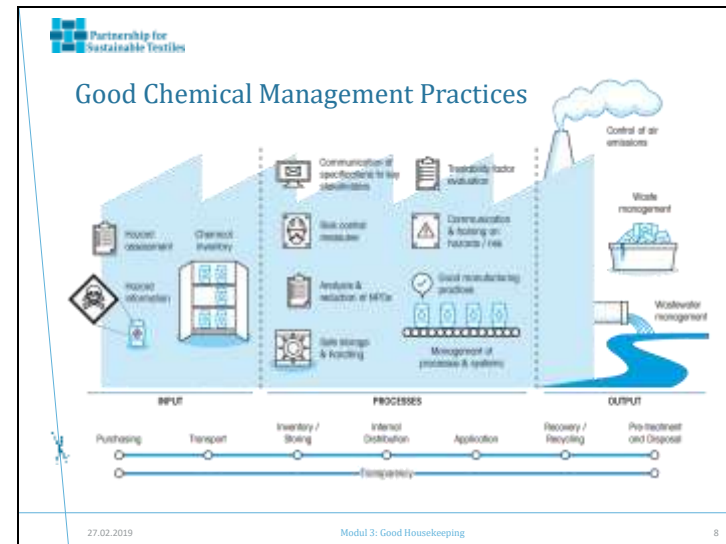
Good Chemical Management Practices

Tasks/Elements


- Establish purchase policy and practices
- Control exposure and releases
- Select and use personal protective equipment
- Provide training, procedures and instructions
- Improve chemical handling
- Safe chemical storage
- Safe chemical transport
- Plan and prepare for chemical emergencies
- Manage and dispose chemical waste

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Good Chemical Management Practices

Establish purchase policy and practices

Your company's purchasing and disposal policy is guiding you on what you can and cannot order. By eliminating the purchase of unnecessary hazardous products, you reduce the risk to workers as well as overall product costs.

SELECT AND DOCUMENT YOUR CHEMICAL SUPPLIERS

ZDHC program requirements:

- Established and implement a clearly defined process for identifying and using preferred suppliers and removing suppliers from the preferred list when appropriate.
- Listed chemical manufacturer and/or supplier should be easily retrievable from your chemical inventory.
- In the chemical inventory, the name and relevant contact details for each chemical supplier should be documented for urgent technical support or in case of emergencies (e.g. point-of-contact name, phone number and address).

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Good Chemical Management Practices

Documentation requirements for chemicals of concern

- Your company is expected to obtain and keep on record of signed and dated declarations like Certificates of Analysis (CoA), test reports etc. from your dye and chemical suppliers.
- This confirms that the formulations supplied to the facility are compliant with the relevant retailers' or the facility's own restricted substances lists RSL and/or the ZDHC Manufacture Restricted Substances List ZDHC MRSL.



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Consider legal, safety, ZDHC MRSL and brand MRSL and RSL requirements prior to the purchase of the substances.

SELECT AND DOCUMENT YOUR CHEMICAL SUPPLIERS

According to the ZDHC program requirements, your company is expected prove that you have established and implement a clearly defined process for identifying and using preferred suppliers and removing suppliers from the preferred list when appropriate. Such list chemical manufacturer and/or supplier should be easily retrievable from your chemical inventory, in which you are expected to document the name and relevant contact details for each chemical supplier for urgent technical support or in case of emergencies (e.g. point-of-contact name, phone number and address).

For further details, take a look at ZDHC CMS 2.3.1 Chemical Purchasing Policy Considerations.

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Good Chemical Management Practices


Documentation requirements for chemicals of concern

Make sure that:

- Your chemical suppliers ALWAYS provides a current Safety Data Sheet for each chemical formulation, so you can review the SDS for chemicals listed in the MRSL
- If the formulation has not already been assessed, verify whether you can obtain a third-party testing or certification from third party certification body or recognized laboratory (as per ISO 17025) to assure MRSL or RSL compliance of the formulation.
- First party conformance declarations includes the supplier contact information, a unique formulation/ batch identification, a statement of what the formulation conforms to, and clear indications of the limitations of this conformance declaration.

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Good Chemical Management Practices

Control exposure and releases

- Reduce the risk that a hazardous chemical can come in contact with the worker or the environment to the lowest possible level. Also consider that it could produce fire or an explosion.
- Better than reducing the risk is eliminating the risk altogether by avoiding or substituting the hazardous chemical or, as an alternative, to improve the operation process.
- To minimize risks, usually a multi-point strategy of controls can be used to prevent and reduce the possibility and thus the risk of accidents, health impacts, fire or explosion and adverse effects on the environment.

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Good Chemical Management Practices

Elements of Good Housekeeping in textile wet processes:

- ✓ Chemicals handling
- ✓ Chemicals labeling
- ✓ Chemicals Storage
- ✓ Use of chemicals
- ✓ Chemicals waste handling

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Improve Chemical Handling

Transport of Chemicals:

Take a look at following areas:

Transport of chemicals and chemical waste to/from your company

2. Receiving and unloading of chemicals
3. Internal transport and conveyance of chemicals and waste (e.g. transport to warehouse, from warehouse to production areas, within production areas,...)





Source: ILO-CIS

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For the establishment of procedures and practices on the safe transport of chemicals (and waste) take a look at following areas

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Improve Chemical Handling

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

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




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

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Good housekeeping (or “good and basic general practices”) refer to a number of practical measures, often based on common sense, that your company can implement to improve productivity, obtain cost savings, and reduce environment, health & safety impacts of your production. “Good housekeeping” is more of a habit than a technique.

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Improve Chemical Handling

Ensure adherence to simple day-by-day practices:


- ✓ Repair all broken seals of chemical containers to avoid vapours from escaping.
- ✓ Ensure that the lids of all chemical containers are tightly closed.
- ✓ Inspect packaging of materials to make sure that it is not damaged during delivery and storage.
- ✓ Return poorly packaged and/or deteriorated chemicals to suppliers. Apply storage practices to avoid waste of chemical due to spoilage during storage or exceeding of shelf life

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Ensure adherence to simple day-by-day practices:


- Apply first, first storage practices to avoid waste of chemical due to spoilage during storage or exceeding of shelf life.

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Improve Chemical Handling

- ✓ Regularly inspect and keep the storage area clean to avoid any contamination of materials.
- ✓ Immediately clean up any spillage to pre-vent accidental mixtures that could lead to ignition or explosion
- ✓ Instruct workers to avoid using the same tools (e.g. cups, scoops, buckets) for measuring and removing different materials in order to avoid contaminating stored chemicals



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Improve Chemical Handling

Pay attention to equipment maintenance and operations audit

Take a closer look in your company:

- Are the machinery, pumps and pipework (including abatement systems) well maintained and free from leaks?
- Are regular maintenance schedules established, with all procedures documented?



Attending to leaking valves and pipe connections of a chemical dosing system

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Improve chemical handling

Pay particular attention to the following areas:

Machinery checking

- Are the most significant components of the machinery like pumps, valves, level switches and pressure and flow regulators included in a maintenance checklist?

Leak control

- Are audits conducted and reporting systems in place for broken and leaking pipes, drums, pumps and valves, not only in the water system but also from the oil heat transfer and chemicals dispensing systems

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Chemicals Labelling

Standard chemical hazard pictograms

In 1992, the United Nations initiated steps in 1992 to harmonize the labelling and classification systems into an internationally agreed-upon system, the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Since 2015 an increasing number of countries has been adopting GHS.



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Which pictograms do you come across in your company?
Does your company already use GHS conform hazard pictograms?


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Chemicals Labelling

Chemical hazard pictograms used during transport of chemicals

In addition to the GHS type pictograms, symbols as defined under the United Nations Committee for the Transport of Dangerous Goods are in use for purpose of identifying hazard properties of chemicals during transport



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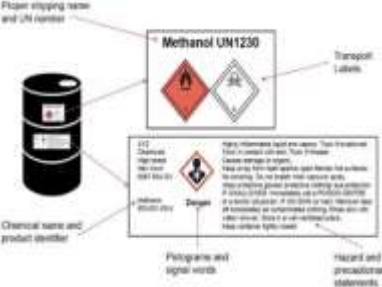
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Chemicals Labelling


Verify availability and content of chemical container/package labels

Check whether the labels on the chemical containers and packages you receive and use in your organization contain the elements as shown in the graphic.



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Are the chemical containers you receive in your company labelled with any pictograms?

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Chemicals Storage


Ventilation:

- Reduction of accumulation of dust or vapours.
- Controlled temperature and humidity.
- Combination of roof and wall ventilation.




Floors:

- Impermeable to liquids.
- Made from concrete and sealed with resin.
- Resistance against organic solvents.
- Smooth surface, but not slippery.
- Free from cracks to allow for easy cleaning.



Layout

- Plan storage layout.
- Assign areas for storage and movement.
- Use colour markings.
- Allow for storage on pallets for easier rearrangement .



Consult the SDS or chemical suppliers for recommended storage conditions.

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STRUCTURE, LAYOUT AND SIZE OF CHEMICAL STORE

Adequate storage facilities are a pre-requisite for safe storage. Check your local regulations for specific requirements regarding factors location, structural make, fire resistance and protection.

No. 18* - Generally it is recommended that the chemical 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.

No. 1 - The floor of the chemical store is flat (to allow easy handling of chemical containers with trolleys, forklifts,..) and non-permeable to prevent contamination of soil and ground-water from chemical spills. In case of an

elevated location the storage areas is accessible by outside ramps; mezzanine floors are provided with a hoisting arrangement to minimize need of manual handling.

No. 2 – The store has at least separate unobstructed and clearly marked (no. 6) emergency exits. However, at all times, unauthorized personnel must be prevented from entering the chemical store. The main doors should lockable. In addition, signboards are placed outside the entrances, clearly marking the building or areas as chemical store and prohibiting unauthorized entry.

No 13 - Electrical installation inside the chemical store (e.g. switches, panels, light fittings, cables) are insulated and be “explosion proof”. Ideally, switches are placed outside the chemical store. Regular and emergency lights are available and sufficient to allow for easy identification of chemicals.

No 15 and 16 - Exhaust vents at floor and ceiling level help to maintain temperature and humidity at recommended levels and allow possible air contaminants (heavy and light vapors, dusts) to removed from the storage area.

For placing the chemicals in your chemical store, group chemicals according to their type and compatibility (see next page on checking compatibility). Also take into consideration maximum permissible or recommended quantities for certain classes of chemicals.

No. 3 – Different areas are clearly designated for the storage of the different chemicals.

No. 12 – The designated storage areas are separated from each other to allow for easy movement of personnel and movement devices (e.g. trolley, forklift). This movement areas are clearly marked. Recommended width of passageways: 0.8 meters (about 2 feet) for persons, 2 meters (6 feet) for trolleys and forklifts.

No. 3 - Avoid the storage of powered chemicals which are kept in bags directly on the floor to protect against ground humidity. Placement on pallets will allow for easy movement of chemicals with trolleys or forklifts.

No. 9 – Containers with liquid chemical (for any with more than 5 liters) are kept in catch-pits (trays) and/or areas with structural secondary containments. If not otherwise regulated, such secondary containment system should have sufficient capacity to contain at least 100% of the volume of the largest container stored.

No. 14 - Racks and shelves increase the available storage space. Make sure that the quantity store that way does not exceed the recommended structural capacity of the shelves and rack system. Considering ergonomic aspects, smaller and lighter chemical containers (with for powdered chemicals) can be stored on higher shelves. Heavier chemical containers, particularly those containing liquid chemicals should be stored at the floor level.

No. 10 - For clear identification of the chemicals, make sure that each chemical container is clearly labelled (see section 3.1 GHS labelling). In addition, each designated chemical storage area is labelled indicating at least type of chemical family and hazards classification.

Storage cabinets, if in use, are of approved quality, lockable and clearly labelled with the hazard class of the chemicals.

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Chemicals Storage: compatibility check

			C	XI	Xn	T	T+	F	F+	O	E
			🔥	☠️	☠️	☠️	☠️	🔥	🔥	🔥	🔥
			☠️	☠️	☠️	☠️	☠️	☠️	☠️	☠️	☠️
			☠️	☠️	☠️	☠️	☠️	☠️	☠️	☠️	☠️
C	🔥	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
XI	☠️	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Xn	☠️	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
T	☠️	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
T+	☠️	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
F	🔥	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
F+	🔥	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
O	🔥	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
E	🔥	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
☑️	🔥	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
⊙	🔥	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
✖️	🔥	☠️	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢

C Corrosive
 XI Irritant
 Xn Harmful
 T Toxic
 T+ Highly toxic
 F Flammable
 F+ Highly flammable
 O Oxidizing
 E Explosive
 ☑️ Are allowed to be stored together
 ⊙ Are allowed to be stored together, subject to special precautions
 ✖️ Are not allowed to be stored together

Reference

27.02.2019 Modul 3: Good Housekeeping 25

Slide 26

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Chemicals Waste Handling


Hazardous waste management should be part of the overall chemicals management in your company

- Prevents harm to the environment and human health.
- Relevant for all the people working in your company and especially to the staff involved in handling hazardous waste on-site before it is handed over to a hazardous waste transporter.

Based on the waste inventory your company now needs to decide how to manage the different types of wastes generated. The various control measures will result in a change of the waste composition and characteristics.

27.02.2019 Modul 3: Good Housekeeping 26

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Chemicals Waste Handling

Possible sources of chemical waste in your company

- Off-specification, unwanted or spilt raw material
- Raw materials or items which are used in a process but not consumed by that process
- Materials resulting from process start-ups
- Unwanted by-products from a process
- Results of process malfunctions / poor control
- Material resulting from process shut down
- Materials resulting from routine in-situ maintenance of the process equipment
- Sludges from waste water treatment plants and air emissions control residues

27.02.2019 Modul 3: Good Housekeeping 27

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Possible Useful Corrective Actions

- Establish purchase policy and practices
- Improve chemical handling
- Provide training, standard operation procedures and instructions

27.02.2019 Modul 3: Good Housekeeping 28

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Literature, Sources and Further Reading

- Training kit of the International Labour Organization (ILO): International Chemical Control Toolkit:
http://www.ilo.org/legacy/english/protection/safework/ctrl_banding/toolkit/icct
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27.02.2019 Modul 3: Good Housekeeping 29

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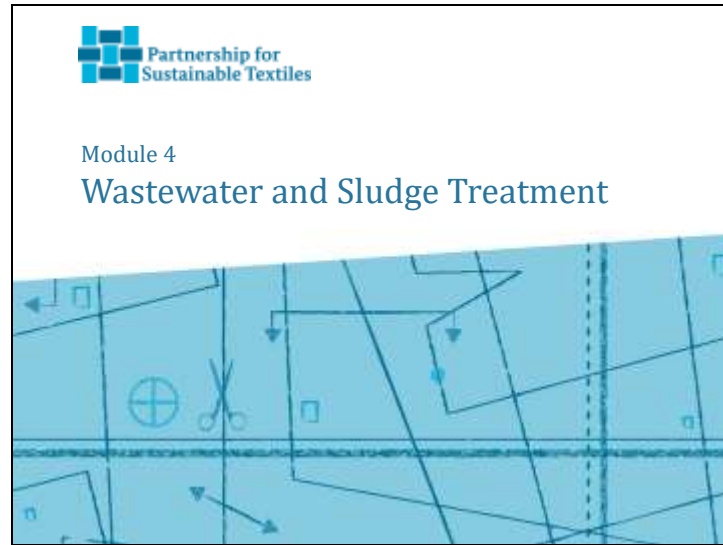
Exercise and Example

- Exercise/self assessment:
“What Chemical Management Means in Practical Terms in your company – Foundational Level “
- Example:
“Checklist - Safe Chemical Storage“

27.02.2019 Modul 3: Good Housekeeping 30

Module 4: Wastewater and Sludge Treatment

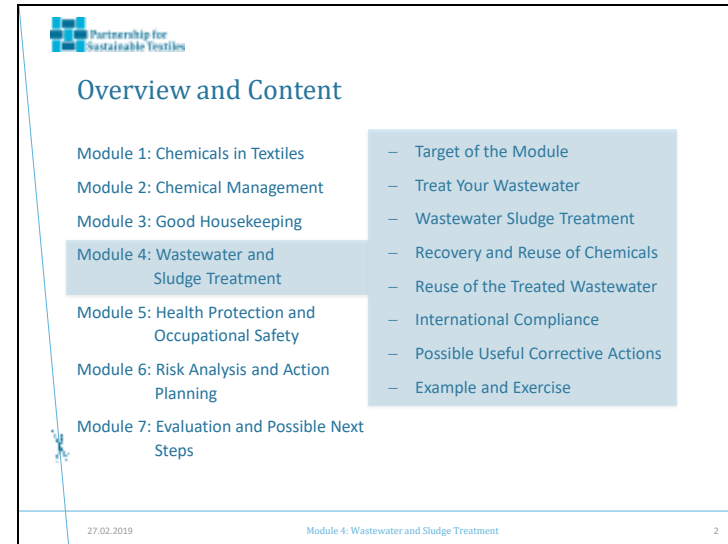
Slide 1



Partnership for Sustainable Textiles

Module 4
Wastewater and Sludge Treatment

Slide 2



Partnership for Sustainable Textiles


Overview and Content

- Module 1: Chemicals in Textiles
- Module 2: Chemical Management
- Module 3: Good Housekeeping
- Module 4: Wastewater and Sludge Treatment**
- Module 5: Health Protection and Occupational Safety
- Module 6: Risk Analysis and Action Planning
- Module 7: Evaluation and Possible Next Steps

- Target of the Module
- Treat Your Wastewater
- Wastewater Sludge Treatment
- Recovery and Reuse of Chemicals
- Reuse of the Treated Wastewater
- International Compliance
- Possible Useful Corrective Actions
- Example and Exercise

27.02.2019 Module 4: Wastewater and Sludge Treatment 2

Slide 3




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Target of the Module „Wastewater- and Sludge Treatment“

- The textile industry uses vast quantities of water and discharges significant volumes of wastewater. This water consumption and discharge increase the problems of water scarcity and pollution of the waterbodies in the producing countries.
- The actual challenges in the in-house water management of the producing textile factories cannot be solved by end-of-pipe solutions alone.
- Production integrated solutions of the entire water management in the textile wet processes are in demand to reduce the water consumption as well as the emission load of the effluent.

27.02.2019 Module 4: Wastewater and Sludge Treatment 3

Slide 4



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Treat Your Wastewater

- The textile manufacturing processes require large amounts of water. Not all of the chemicals added to the float end up in the final product, but get discharged with the used process water.
- Depending on the type and concentration of the chemicals in the waste water, these chemicals, if not treated, contaminate surface and ground water, affect the aquatic life, and pose health hazards to those who use the water from such water bodies.

Video Wastewater Treatment (CITA):
http://chemicals.cita.org.hk/mod/mediagallery/cita_video_item.php?g=2 & video_id=10048

27.02.2019 Module 4: Wastewater and Sludge Treatment 4

Slide 5




Treat Your Wastewater

Take a quick look

- ✓ Does your company have an in-house effluent treatment plant (ETP) or is connected to an external one e.g. common effluent treatment plant (CETP)?
- ✓ Does your company have a valid environmental license to operate?
- ✓ Does the ETP/CETP comply consistently with wastewater discharge permits at all times?
- ✓ Is your ETP operated by qualified personnel?
- ✓ Is your ETP operating continuously?

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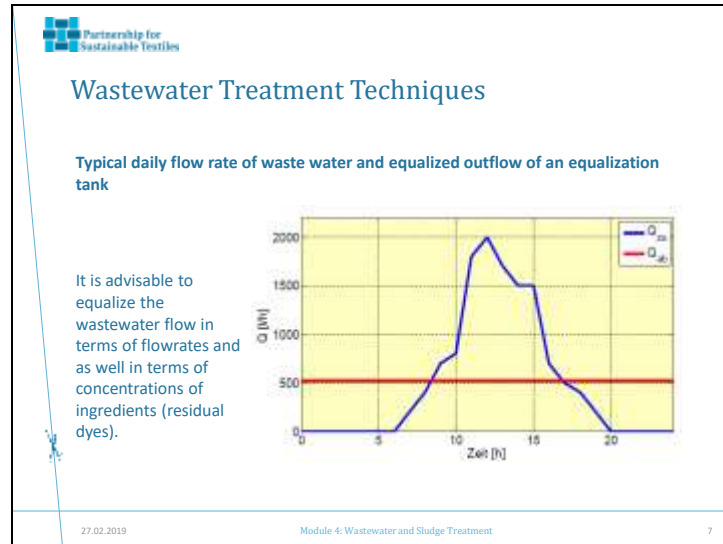


Treat Your Wastewater

Wastewater Quantity Benchmarks	l/kg
Wool scouring	2 - 6
Yarn finishing (wool)	35 - 45
Yarn finishing (cotton)	100 - 120
Yarn finishing (synthetic fibres)	65 - 85
Finishing of knitted fabrics (wool)	60 - 70
Finishing of knitted fabrics (cotton)	60 - 136
Finishing of knitted fabrics (synthetic fibres)	35 - 80
Finishing of woven fabric (wool)	70 - 140
Finishing of woven fabric (cotton)	50 - 70
Finishing of woven fabric (synthetic fibres)	100 – 180
Bovine leather (from raw to finished)	12 -30
Pig skin leather (from raw to finished)	32 - 69
Sheep/goat skin leather (from raw to finished)	110 – 265 per skin

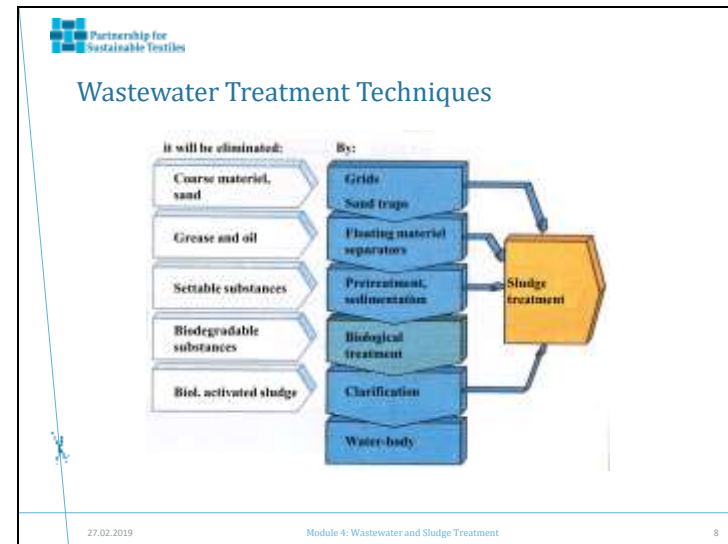
27.02.2019 Module 4: Wastewater and Sludge Treatment 6

Slide 7



Typical daily flow rate of waste water and equalized outflow of an equalization tank [Pinnekamp, 2015]

Slide 8



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Wastewater Treatment Techniques

Scheme of the common treatment of wastewater from textile industries

Mixed wastewater from textile industries are generally characterized by organic carbon-containing substances, which concentrations are slightly higher concentrated than in municipal waste water, but are more difficultly to degrade.

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Wastewater Treatment Techniques

Recommended wastewater treatment process for in-door applications

Main process	Wastewater treatment process
Pre-treatment	Equalization of flow streams + concentration neutralization
Separation of solids Mechanical or physical	Grids, sizes Sedimentation Flotation filtration
Separation of solids Chemical or and physical	Adsorption Precipitation and Flocculation Ion exchange
Degradation of substances (oxygen demanding) Biological	Aerobic Anaerobic
Degradation (reduction) of substances Chemical	Oxidation Reduction

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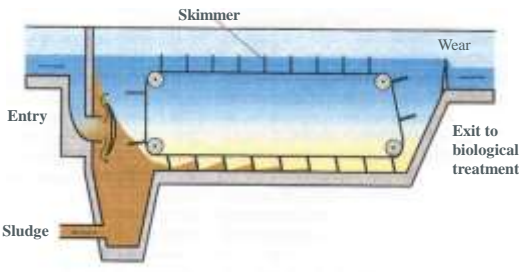
The concentrations of nitrogen and phosphorous containing substances are lower than in municipal waste water.

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Wastewater Treatment Techniques

Mechanical Treatment: Presettling tank / clarifier



Dimensioning: Presettling: 1 - 6 m³ wastewater / m² surface and hour
Clarifier: 0,4 - 2 m³ / m² surface and hour

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Wastewater Treatment Techniques



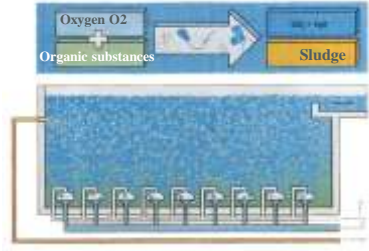
27.02.2019 Module 4: Wastewater and Sludge Treatment 12

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Wastewater Treatment Techniques

Biological Treatment: Activated Sludge Treatment



The diagram illustrates the activated sludge treatment process. At the top, a flowchart shows 'Organic substances' entering a process where 'Oxygen O2' is added, resulting in 'Sludge'. Below this, a cross-section of a wastewater treatment basin is shown with several mechanical aerators at the bottom. Arrows indicate the flow of water and sludge out of the basin.

Outlet (water and sludge)

Air entry from mechanical treatment
Activated sludge

Dimensioning: communal waste water - 2 m³ waste water / m³ basin and day

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Wastewater Treatment Techniques



A photograph showing a large industrial wastewater treatment basin. The water surface is covered with a thick layer of white foam, indicating the presence of activated sludge. Yellow handrails are visible in the foreground.

27.02.2019 Module 4: Wastewater and Sludge Treatment 14

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Wastewater Treatment Techniques

Enabling a secure and consistent treatment at the CETP

Many wastewater treatment processes, especially biological methods, require a steady flow of wastewater with stable characteristics in order to function well. Concentration peaks in particular are a danger to biological processes and can completely disrupt their treatment capabilities. Because of this reason, it is common for operators of CETPs to set quantity and quality limits to the wastewater entering their plant, according to their treatment capacity. Therefore, an open communication between the CETP operator and the companies in the industrial park is essential.


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Wastewater Sludge Treatment

- As per ZDHC your company is expected to follow generally-accepted process engineering best practices with respect to wastewater treatment and overall facility water efficiency management.
- In addition to the treatment of all wastewater and discharge as per established discharge limits/standards, special attention needs to be paid to the management of the treatment sludge.
- Textile waste water treatment generates up to 1.5 kg sludge per m³ of waste water.



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Wastewater Sludge Treatment


Depending on the concentration of certain chemicals in the sludge the same be considered as hazardous waste.

This requires the further removal and disposal of the sludge by licensed/permited and qualified third parties that have appropriate facilities to properly dispose of the sludge wastes. Only this ensures that sludge and leachates from the sludge do not adversely impact the environment.

Substitution of hazardous chemicals and application of Best Available Techniques (BAT) will help to reduced the hazard levels of treatment sludge and waste, reducing the cost for their treatment and disposal.


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Wastewater Sludge Treatment

Sludge Treatment: Concentrator



Sludge 99% water from pre settling tank or settling tank

Outlet to the activated sludge tank


Steerer

Concentrated Sludge 95% water

Scale Dry substance Concentration Dry substance


27.02.2019 Module 4: Wastewater and Sludge Treatment 18

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Wastewater Sludge Treatment

1 – 5 kg treatment sludge per m³ treated wastewater




Challenges:

- Sludge dewatering (climate, technical)
- Sludge discharge (regulations, infrastructure)

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Recover and Reuse Chemicals

A segregation of wastewater streams allows various direct recycling and recovering technologies for certain process chemicals. The application of such technologies will reduce your cost of chemicals while lowering the capital investment and operating costs for the effluent treatment.


Recycling and recovering technologies

- Recovery of alkalis from mercerizing
- Printing paste recovery from the supply system
- Recovery of sizing agents by Ultrafiltration

For further information on sector specific recycling and recovery technologies, refer to the European BREF/BATs <http://eippcb.jrc.ec.europa.eu/reference/>

27.02.2019 Module 4: Wastewater and Sludge Treatment 20

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Recover and Reuse Chemicals

Recovery of Chemicals

Many chemicals can be recovered from effluents, if the respective streams are separated before mixing with other wastewater streams.


- This leads to a lower loaded wastewater and cost savings due to the recovered chemicals.

Examples for this practice are:

- Caustic soda recovery through distillation
- Acetic acid recovery through extraction
- Precious metal recovery through electrolysis

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Reuse of the Treated Wastewater

- As the groundwater table is falling in many industrial areas of the producing countries, pumping the water to the surface and its pre-treatment becomes more expensive.
- Companies have begun on-site wastewater treatment with the goal of reusing the majority of their effluent as raw water for their processes.
- Treating and reusing some low-loaded wastewater streams can already lead to a significant reduction in water consumption and wastewater production.

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Reuse of the Treated Wastewater

Processes for reuse of the treated wastewater


ANAEROBIC TREATMENT OF DESIZING WASTEWATER

1. Desizing
2. Bleaching/ Scouring
3. Mercerization Dyeing Printing Finishing
4. Drain towards Effluent Treatment Plant

Over 50% of the total organic load is released in the wastewater system from the desizing process. However, the wastewater volume from desizing only represents about 5 % of the total wastewater volume. The combined treatment of this stream with the other wastewater streams from the textile finishing (mixed wastewater) is associated with considerable energy demand for aerobic biodegradation and high amounts of biomass produced

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Reuse of the Treated Wastewater

Energy production from highly loaded streams

- In many industrial processes, for example in paper, sugar or woven textile production, effluent streams with very high organic load (up to 30,000 mgCOD/l) are present.
- These effluent streams are often suitable for anaerobic pretreatment, which greatly reduces the COD load on downstream effluent treatment systems (i.e. CETP) while producing energy rich biogas.

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International Compliance

Due to increasing public pressure, more and more brands are demanding their producers to comply with environmental standards such as wastewater limit values: e.g. ZDHC, Oeko-Tex or GOTS. Only a fruitful collaboration between CETP operators and the producers can ensure that the effluents are complying with the standards

27.02.2019 Module 4: Wastewater and Sludge Treatment 25

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International Compliance

Move towards zero-liquid discharge (ZLD)

- The application of alternative process technologies (low-float, water-less/free) can significantly reduce the water footprint.
- Dwindling water resources, drop in ground water tables and emerging conflicts about use of remaining water sources requires the need to explore further steps
 - Partially or fully closed cycle water systems
- In several countries, textile and leather industry is already required to install zero-liquid discharge systems. A full recovery of waste water entails a full treatment and/or recovery of chemicals in the effluent. Such ZLD systems usually consist of multi-stage filtration and evaporation components.

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Summary of reasons for In-house Pre-Treatment

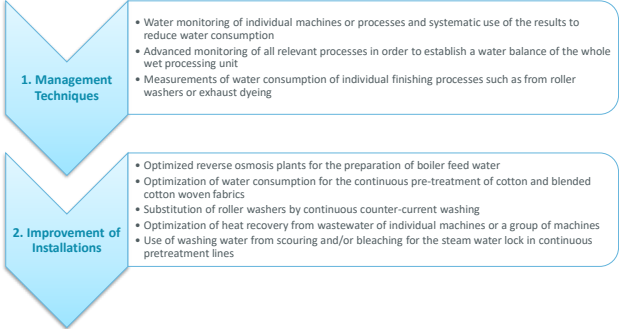
- Reason 1: Recovery of chemicals
- Reason 2: Reuse of treated Wastewater
- Reason 3: Energy production from highly loaded streams
- Reason 4: Enabling a secure and consistent Treatment at the CETP
- Reason 5: International Compliance

27.02.2019 Module 4: Wastewater and Sludge Treatment 27

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Possible Useful Corrective Actions 1



- 1. Management Techniques**
 - Water monitoring of individual machines or processes and systematic use of the results to reduce water consumption
 - Advanced monitoring of all relevant processes in order to establish a water balance of the whole wet processing unit
 - Measurements of water consumption of individual finishing processes such as from roller washers or exhaust dyeing
- 2. Improvement of Installations**
 - Optimized reverse osmosis plants for the preparation of boiler feed water
 - Optimization of water consumption for the continuous pre-treatment of cotton and blended cotton woven fabrics
 - Substitution of roller washers by continuous counter-current washing
 - Optimization of heat recovery from wastewater of individual machines or a group of machines
 - Use of washing water from scouring and/or bleaching for the steam water lock in continuous pretreatment lines

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Possible Useful Corrective Actions 2

3. Recycling of specific water streams

- Recycling of cooling water from singeing
- Recycling of cooling water from caustic soda recovery
- Recycling of steam condensate from caustic soda recovery
- Recycling of last rinsing water from mercerization
- Use of RO reject for scrubbing waste gas from coal combustion
- Recycling of cooling water from cylinder dryers

4. Improvement of recipes or usage of chemicals with better environmental properties

- Systematic listing of all chemical products used with all available environmental data and identification of the need of alternatives
- Substitution of liquid ammonia for pigment printing pastes

27.02.2019 Module 4: Wastewater and Sludge Treatment 29

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Possible Useful Corrective Actions 3

5. Pre-treatment of segregated wastewater streams and end-of-pipe wastewater

- Anaerobic pre-treatment of desizing liquors from the pre-treatment of cotton or blended cotton woven fabrics
- Adjustment of optimum conditions for biological wastewater treatment such as maximum temperature of 37°C, food-to-microorganism ratio of less than 0.15 kg BOD5/kg MLSS x d and C:N:P ratio of 100:5:1, and plough flow reactors

27.02.2019 Module 4: Wastewater and Sludge Treatment 30

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Literature, Sources and Further Reading

- ZDHC Wastewater Guideline:
https://www.roadmapzero.com/fileadmin/pdf/Files_2016/ZDHC_Wastewater_Guidelines_Print.pdf
- ZDHC Wastewater Treatment Technologies:
https://www.roadmapzero.com/fileadmin/pdf/Files_2018/Wastewater_Treatment_Technologies_for_the_Textile_Industry-FINAL.pdf
- GIZ: Guideline/Handout Wastewater Treatment for the Textile Industries in Pakistan:
<http://spc.org.pk/library-2/>
- For further information on sector specific recycling and recovery technologies, European BREF/BATs <http://eippcb.jrc.ec.europa.eu/reference/>

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Exercise and Example

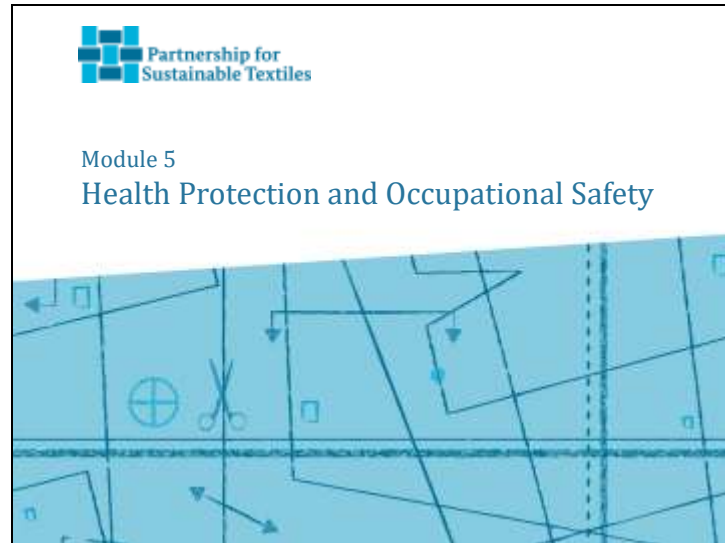
Exercise:
“Calculate water consumption and COD”

Example:
“SLUDGE MANAGEMENT PLAN”
(Applicable for all Textile industries with ETP that generates any amount of sludge)

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Module 5: Health Protection and Occupational Safety

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Partnership for Sustainable Textiles


Overview and Content

Module 1: Chemicals in Textiles
Module 2: Chemical Management
Module 3: Good Housekeeping
Module 4: Wastewater and Sludge Treatment
Module 5: Health Protection and Occupational Safety
Module 6: Risk Analysis and Action Planning
Module 7: Evaluation and Possible Next Steps

- Target of the Module
- Control Exposure and Releases
- Personal Protective Equipment
- Plan and Prepare for Emergencies
- Fire Emergencies
- Corrective Actions
- Example and Exercise

27.02.2019 Module 5: Health Protection and Occupational Safety 2

Slide 3

 Partnership for Sustainable Textiles


Target of the Module „ Health Protection and occupational safety “

This module deals with good chemical management practices concerning health and safety aspects:

- Control exposure and releases
- Select and use personal protective equipment
- Provide training, procedures and instructions
- Improve chemical handling
- Safe chemical storage
- Safe chemical transport
- Plan and prepare for chemical emergencies
- Manage and dispose chemical waste

27.02.2019 Module 5: Health Protection and Occupational Safety 3

Slide 4

 Partnership for Sustainable Textiles

Control Exposure and Releases

ELIMINATE HAZARDS THROUGH CHEMICAL AND PROCESS SUBSTITUTION –TEXTILE SECTOR (EXAMPLES)

Process	Approach
Desizing	Recovery and reuse of water-soluble synthetic sizing agents through ultrafiltration
Bleaching	Use of hydrogen peroxide instead of chlorine-based bleaches
Mercerising	Recovery and reuse of caustic soda solution from the mercerising process
Printing	- Use of optimized printing paste - Low-emission thickeners - APEO-free pigments with a high degree of bio eliminability, reduced ammonia content
Finishing	Replacement of halogen organic solvents (e.g. in stain removal and subsequent cleaning).

Source: Environmental Standards in the Textile and Shoe Sector, UBA, 2011

27.02.2019 Module 5: Health Protection and Occupational Safety 4

Source: Environmental Standards in the Textile and Shoe Sector, UBA, 2011
<https://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/4289.pdf>

Slide 5

Partnership for Sustainable Textiles

Control Exposure and Releases

Isolate hazardous chemicals and processes

For example:

- Placing your spraying operations in a separate work area which is structurally enclosed and fitted with exhaust extraction systems to remove contaminants
- Mixing of chemicals in a segregated well ventilated area
- Segregating incompatible chemicals during storage
- Segregating waste water flows with incompatible chemicals
- Keeping sources of ignition away from flammable chemicals



Source: GIZ PSES

27.02.2019 Module 5: Health Protection and Occupational Safety 5

Isolation measures aim at separating people from hazardous chemicals by distance or structural/technical barriers to prevent or minimize the chance of exposure, but also physically separating hazardous chemicals from other chemicals or installations.

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Control Exposure and Releases

Engineering control measures

For example:

- Enclosing and/or encapsulating of processes with hazard chemicals and chance of releases
- Removing chemical emissions using special drainage arrangement and local exhaust ventilation (LEV) on process machinery or at point of work
- Using drainage systems and general ventilation in work areas
- Installing secondary containments in storage areas to limit contamination in case of spills and leaks
- Using waste water treatment systems before discharging waste water


27.02.2019 Module 5: Health Protection and Occupational Safety 6

The next option in controlling exposure are engineering control measures which prevent the chance of exposure (skin contact, inhalation) and limit the area of releases. For example:

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Control Exposure and Releases



Improvement of working conditions with LEV

27.02.2019 Module 5: Health Protection and Occupational Safety 7

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Control Exposure and Releases



Fume hood for resin spraying in a denim laundry

27.02.2019 Module 5: Health Protection and Occupational Safety 8

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Control Exposure and Releases

Secondary Containment of hazardous chemicals

27.02.2019 Module 5: Health Protection and Occupational Safety 9

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Control Exposure and Releases

Special consideration for ventilation systems

- Exhaust and ventilation systems can maintain a safe atmosphere by introducing uncontaminated air or removing contaminated air
- Avoid recirculation of contaminated air
- Contaminated air removed through locally exhausted ventilation systems should be cleaned by means of scrubbing or other cleaning devices before being released into the ambient air.

Check in your company:

- ✓ Are the stack heights maintained as per local regulation?
- ✓ Are local exhaust systems connected to operational cleaning devices?
- ✓ Are there provisions to release exhaust air (luvers, vents) at the ceiling?
- ✓ Is there a chance of cross-contamination to/from other work areas, generator sets (or neighbouring factories?)

27.02.2019 Module 5: Health Protection and Occupational Safety 10

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Control Exposure and Releases

Check in your Company:

- ✓ Are the stack heights maintained as per local regulation?
- ✓ Are local exhaust systems connected to operational cleaning devices?
- ✓ Are there provisions to release exhaust air (louver, vents) at the ceiling?
- ✓ Is there a chance of cross-contamination to/from other work areas, generator sets (or neighbouring factories?)



Dust collector in dyestuff weighing area

27.02.2019 Module 5: Health Protection and Occupational Safety 11

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Personal Protective Equipment

Select and use personal protective equipment

The main purpose of personal protective equipment (PPE) is to protect employees/workers should an accident or incident occur despite appropriate management systems and operational procedures.

PPE must be provided **free of charge** to the employees who are facing hazards in their work.

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Personal Protective Equipment

Commonly, PPE includes protective clothing (e.g. overalls, aprons, footwear, gloves, chemical resistant glasses, face shields) and respirators.

Engineering controls protect everyone in the workplace; a respirator can only help the person wearing it.



PPE is the last barrier between the contaminant and you!

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Personal Protective Equipment

Find information sources and guidance on PPE

To make sure that the PPEs can effectively provide the desired protection, employees/workers need guidance on the selection and proper use of the PPEs. Such guidelines may cover the following areas:

- How to select the correct type of personal protection equipment, taking into consideration the exposure and work situation
- Clear instruction to workers on the proper use of the PPE (when, where, how)
- Guidance on storage, cleaning and maintenance of PPE
- Guidance on replacement of PPE

Video Chemical Safety & Handling Training:
http://chemicals.cita.org.hk/mod/mediagallery/cita_video_item.php?g=2&video_id=10046

The main source of information for the selection of appropriate PPEs are the safety data sheets. ► Check section 8 in the (GHS conform) safety data sheet

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Personal Protective Equipment

Ensure adequate respiratory protection

Respiratory protection equipment protect you against exposure from airborne contaminants in form of


- solid or liquid particles (dust, mist, aerosols)
- vapors
- gases by inhalation and partly eye absorption (depending on type of mask)



Disposable APR for solid and liquid particulates only!

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Personal Protection Equipment

Ensure adequate respiratory protection

- Contaminants may either directly affect the respiratory tract, or get absorbed into the body's circulatory system, resulting in systemic effects.
- Respiratory protection equipment (e.g. dust masks) purify the air you breath.
- Special case: Respiratory protection devices for use in situations with immediate danger to life and health such as in areas with oxygen-deficiency (for example in confined spaces such as tanks or vessels),
 - providing breathable air from a tank or through a supply line.

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These contaminants may either directly affect the respiratory tract, for example being irritating or impairing the lung function, or get absorbed into the body's circulatory system, resulting in systemic effects.

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

Personal Protective Equipment

Overview of basic types of respiratory protective devices

Air purifying respirators (APR) use filters (for solid and liquid particulates e.g. dust, aerosols), cartridges (for gases and vapours) or canisters (used with „gas mask“). These can only be used, if the atmospheric oxygen level remains higher than 19.5%.

If the atmospheric oxygen level drop below this level, atmosphere-supplying respirators or supplied-air respirators (SAR) need to be provided. These may be air supply units or self-contained breathing apparatus (SCBA).

Example: Assigned Protection factors (APF) of common air purifying respirators

	Paper Disposable	APF - 5
	Half-Mask	APF - 10
	Full-Face (FF)	APF - 50

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Personal Protective Equipment

Ensure adequate respiratory protection

- Be aware of the lifetime of cartridges and filters → plan for replacement!
- The lifetime of the cartridges and filters depend on intensity and conditions of use (e.g. humidity, temperature). Check also the recommended service life indicators for cartridges and canisters.
- Make users aware of how they can verify filter or cartridge break-throughs (e.g. odor, smell, irritation).
- Make sure, that replacement of PPE (Personal Protective Equipment) at recommended intervals is planned and budgeted for.

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Both disposable and reusable type of respirators are available and may come in form of quarter, half or full face masks.

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Personal Protective Equipment

Selecting respiratory protective equipment:

- Is the PPE meant for routine use or non-routine use (e.g. for escape in an emergency situation)?
- What are workplace hazards the wearer of the PPE may encounter as a consequence of wearing the PPE?
- What are the physical characteristics of the wearer?
- What is the physical demand of the work (e.g. complexity of tasks, work place temperatures and humidity)?
- What are the respirator capabilities and limitations?

Type of contaminant	Characteristics
Particulate	Fine liquid or solid particles such as dust, smoke, mist or fumes found in air or emissions
Mist	Small droplets suspended in air
Dust	Minute solid particles with diameters less than 500 micrometers
Aerosol	Collection of very small particles suspended in air. The particles can be liquid (mist) or solid (dust or fume)
Fume	Vapor carrying suspended solid particles or liquid droplets
Vapor	Vapor The gaseous form of materials that are normally liquids or solids at room temperature and pressure (e.g. steam)
Gas	Gas is one of the four major states of matter, consisting of freely moving atoms or molecules without a definite shape and without a definite volume

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Personal Protective Equipment


Train uses on respiratory protection

- Everyone who is involved in the use of respiratory protective equipment (RPE) needs to be trained. Training may be available from the supplier or manufacturer of your RPE.
 - Awareness why the respirator is being worn, which respirator should be used and how it should be worn properly.
- Training for supervisors should also cover other issues such as health hazards, work practices, use of other equipment on site and medical surveillance requirements (especially for emergency and rescue teams).
- All workers need to be trained prior to the use of a respirator.
- This training should be repeated at least once a year.

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Training may be available from the supplier or manufacturer of your RPE. A qualified person, knowledgeable of respiratory protection and workplace contaminants, must instruct supervisors as well as the person issuing respirators. Adequate training should be provided to ensure proper respirator use. It should also cover other issues such as health hazards, work practices, use of other equipment on site and medical surveillance requirements (especially for emergency and rescue teams).

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Personal Protective Equipment

Train uses on respiratory protection


Minimum content of respiratory protection training :

- What are the hazards and effects of contact with chemical?
- What are the limitations of personal protective equipment?
- When and how to use the personal protective equipment?
- When and how to clean or dispose of personal protective equipment?

Do the managers and supervisors act as role models for good personal protective practices in your company by following the same requirements?

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Personal Protective Equipment

Ensure adequate protection of skin and eyes


The safety data sheet (see section 8) will provide guidance on what type of personal protective equipment for skins and eyes may be required when handling the specific chemical.

A good safety data sheet will not only indicate the type of personal protective equipment, but also the recommended material.

The exposure to chemicals may directly affect the skin or eye, for example in case of chemicals with corrosive or irritant hazards, or result in systemic effects when absorbed through skin and eyes.

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Personal Protective Equipment

Be aware of limitations of protective materials

- Permeation rate (rate at which chemical is moving through the material)
- Breakthrough time (duration of chemical to permeate completely through the material)
- Degradation (physical deterioration of material due to contact with a chemical e.g. getting stiffer or softer, brittle, weaker,...)

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Personal Protective Equipment

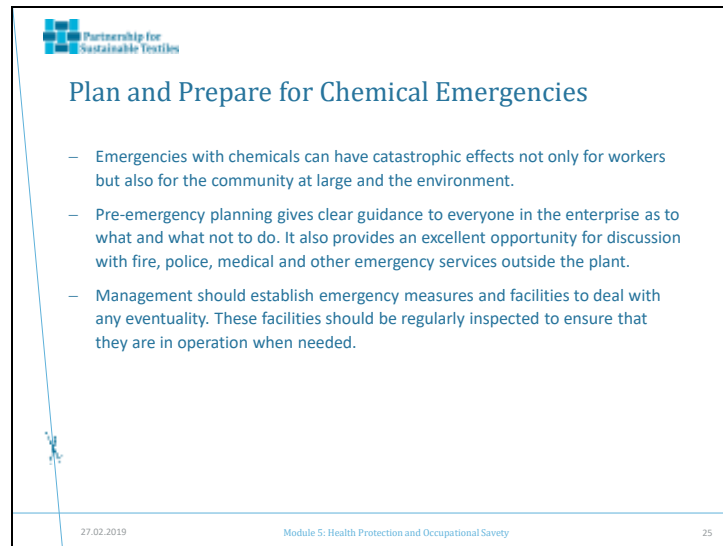
Ensure adequate protection of skin and eyes

Factors for selecting suitable skin protection:

- Check task and task requirements (flexibility, grip and touch sensitivity needed)
- Identify all hazards e.g. list of the chemicals, physical hazards (e.g. abrasion, tearing, puncture, fire/flames, temperature) as well as effects of skin exposure
- Determine type of contact (e.g., occasional contact or splash protection or continuous immersion of hands) and contact period
- Consider what hazards may be presented by the use of the protective clothing itself. For example, protective clothing can contribute to heat stress; reduced dexterity; rip or tactile functions; poor comfort; or may contribute to skin conditions.
- Consider decontamination and disposal procedures.

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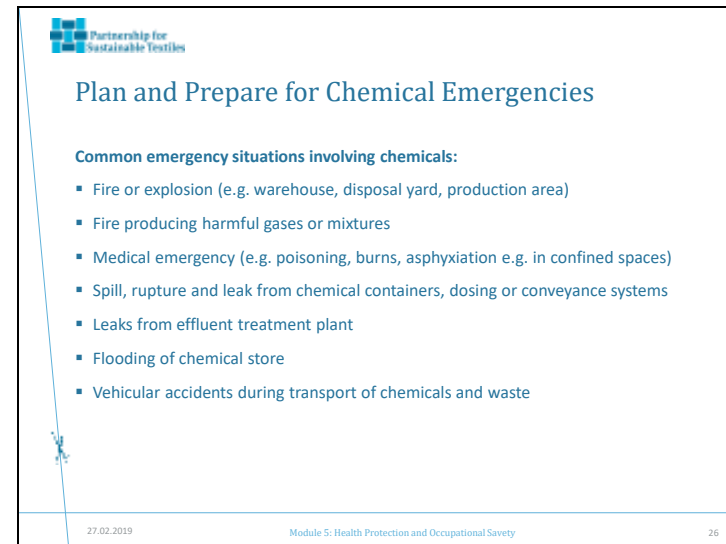
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Plan and Prepare for Chemical Emergencies

- Emergencies with chemicals can have catastrophic effects not only for workers but also for the community at large and the environment.
- Pre-emergency planning gives clear guidance to everyone in the enterprise as to what and what not to do. It also provides an excellent opportunity for discussion with fire, police, medical and other emergency services outside the plant.
- Management should establish emergency measures and facilities to deal with any eventuality. These facilities should be regularly inspected to ensure that they are in operation when needed.

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Plan and Prepare for Chemical Emergencies


Common emergency situations involving chemicals:

- Fire or explosion (e.g. warehouse, disposal yard, production area)
- Fire producing harmful gases or mixtures
- Medical emergency (e.g. poisoning, burns, asphyxiation e.g. in confined spaces)
- Spill, rupture and leak from chemical containers, dosing or conveyance systems
- Leaks from effluent treatment plant
- Flooding of chemical store
- Vehicular accidents during transport of chemicals and waste

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Management should establish emergency measures and facilities to deal with any eventuality. For example, in case of an accidental splash or contact with chemicals, emergency showers and eye-wash points should be provided in close proximity to the workstation.

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Plan and Prepare for Chemical Emergencies

Management has **a responsibility** to establish procedures to deal with emergencies and accidents that might arise from the use of hazardous chemicals at work. These procedures must be reviewed regularly and changed as appropriate when, for example:


- new chemicals are brought into the work-place
- new chemical processes are developed or existing processes are changed

To prepare for chemical emergencies, look into the requirements for the (1) prevention of and (2) response to emergency situations.

Preparation involves an assessment of where, what, and with which probability, chemical emergencies may happen.

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Plan and Prepare for Chemical Emergencies

Practical tips

As part of your emergency planning process, consider the use of or consult your eco-maps (see also module two, chemical management), in order to identify and document areas and types of possible chemical emergencies in your company.



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Chemical Fires and Explosions

The risk of a fire is based on the presence and combination of three basic factors:

- (1) the availability of fuel (differentiated by the degree of flammability of a substance)
- (2) the availability of source of ignition/heat and
- (3) the ambient conditions such as the temperature and presence of oxygen.

The control of at least one of these three factors will significantly reduce the probability of a fire, for example:

- Substitution of highly flammable substances with non-flammable ones,
- Segregation of incompatible chemicals
- Segregation of flammable materials and potential sources of ignition (e.g. no smoking rule in chemical store, placement of electrical switches outside the store)

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Chemical Fires and Explosions

Classes of fire and how to prevent them


Class A	Class B	Class C	Class D
Ordinary combustibles (wood, paper, trash, cloth)	Flammable and combustible gases and liquids	Energized electrical equipment	Combustible metals (e.g. Magnesium, titanium, potassium, sodium)
Routine housekeeping and cleaning	Good handling and storage practices	Good maintenance and prevention of misuse	Follow special advice
<ul style="list-style-type: none"> Make sure storage and working areas kept free of trash 	<ul style="list-style-type: none"> Reduce ventilation to prevent build-up flammable vapor or gas concentrations Storage of substances in tightly sealed containers Storage away from spark producing sources Limit portable storage containers to 20 liters each Avoid storage of more than 100 liters of flammable liquids inside a building unless in approved storage containers 	<ul style="list-style-type: none"> Regularly check electrical equipment. Report any hazardous conditions to your supervisor Prevent electric motors from overheating by keeping them clean and in good working order Never install a fuse rated higher than specified for a circuit Never overload wall sockets. Investigate any appliance or equipment that smells strange. This is often the first sign of a fire Use utility lights that have some type of wire guard over them. Direct contact with an uncovered light bulb can ignite combustible materials. 	

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Class C:

- Regularly check electrical equipment for old/worn wiring or broken/damaged fit-tings. Report any hazardous conditions to your supervisor
- Prevent electric motors from overheating by keeping them clean and in good working order
- Never install a fuse rated higher than specified for a circuit
- Never overload wall sockets. One outlet should have no more than two plugs Don't plug more than one heat-producing appliance into an outlet Investigate any appliance or equipment that smells strange. This is often the first sign of a fire
- Use utility lights that have some type of wire guard over them. Direct contact with an uncovered light bulb can ignite combustible materials.

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Chemical Fires and Explosions


Prevent and responding to different types of fire

Understanding some basic terminologies

- **Auto ignition temperature** means the minimum temperature required to cause self-sustained combustion, independent of any other source of heat.
- **Boiling point** means the temperature at which a liquid boils at a fixed pressure, especially under standard atmospheric conditions (liquid and vapor phases are in equilibrium with each other at a specified pressure).
- **Flashpoint** means the lowest temperature at which a liquid gives off enough vapor to form an ignitable mixture with air and burn when a source of ignition (sparks, open flames, cigarettes, etc.) is present.
- **Lower flammable limit (LFL)** means the lowest concentration of a material that will propagate a flame. The LFL is usually expressed as a percent by volume of the material in air (or other oxidant).
- **Explosive atmosphere** is an accumulation of gas, mist, dust or vapor, mixed with air, which has the potential to catch fire or explode. An explosive atmosphere does not always result in an explosion, but if an explosive atmosphere exists, there is a real danger of an explosion

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Chemical Fires and Explosions


Prevent and responding to different types of fire

- 1. Ventilation**
 - Is there plenty of fresh air where flammable liquids or gases are stored and used? Good ventilation will mean that any vapors given off from a spill, leak or release from any process, will be rapidly dispersed.
- 2. Ignition**
 - Have all the obvious ignition sources removed from the storage and handling areas. Ignition sources can be very varied and they include sparks from electrical equipment or welding and cutting tools, hot surfaces, open flames from heating equipment, smoking materials, static electricity etc.

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By applying the following principles you will be well on the way to making sure that you are working safely with flammable substances

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Chemical Fires and Explosions

Prevent and respond to different types of fire


3. Hazardous areas (zoning)

The extent of safety measures required to avoid ignition sources depends on the area in which the operation takes place. As far as the likely presence of ignitable gas/air or vapor/air mixtures is concerned, the following zones can be defined:

- **Zone 0:** Areas in which an explosive atmosphere is continually present or present for long periods of time.
- **Zone 1:** Areas in which an explosive atmosphere is likely to occur during normal operation. These conditions can prevail in the immediate vicinity of Zone 0.
- **Zone 2:** Areas in which an explosive atmosphere is unlikely to occur during normal operation and, if it occurs, will only exist for a short time. These conditions can, among others, prevail in areas surrounding Zones 0 and 1.

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Chemical Fires and Explosions


Prevent and responding to different types of fire

Using hazard zoning:

- According to the classified zones, the electrical equipment used has to be flame or explosion-proof standard.
- Electrical safety is to be maintained (i.e. adequate earthing, overload protection, equipment and wiring in good repair).
- Hot surfaces and mechanically generated sparks should be avoided in such hazardous areas.
- Auxiliary equipment (petrol or gas-driven fork-lift trucks, electrical dryers, shrink wrapping equipment with open ignition sources and battery charging stations) must not be used in hazardous areas defined as zone 0 to 2.
- Non-routine activities (maintenance work, plant clean-outs) which can produce ignition sources (e.g. welding, drilling, etc.), must be authorized by means of written work permits

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Chemical Fires and Explosions

Prevent and responding to different types of fire

- 4. Exchange (Substitution)**
 - Can you exchange a flammable substance for a less flammable one? Can you eliminate flammable substances from the process altogether? You may be able to think of other ways of carrying out the job more safely.
- 5. Containment**
 - Are your flammable substances kept in suitable containers? If you have a spill will it be contained and prevented from spreading to other parts of the working area? Use of lidded containers and spillage catchment trays, for example, can help to prevent spillages spreading. Keep absorbent material handy.
- 6. Segregation**
 - Are flammable substances stored and used well away from other processes and general storage areas? Can they be segregated by a physical barrier, wall or partition?

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Chemical Fires and Explosions

Prevent and responding to different types of fire

- Implement passive fire protection measures (selecting locations) as well as preparing structures, (e.g. evacuation routes, provision of evacuation plans, fire resistance materials and doors).
 - Check with the regulatory requirements in your location.
- Think about the flammable substances you have at the workplace and apply these principles wherever possible.
- Tell workers, and others who need to know, about the hazards and how they should control them

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Possible Useful Corrective Actions

- Initiate engineering control measures which prevent the chance of exposure (skin contact, inhalation) and limit the area of releases.
- Clear instruction to workers on the proper use of the PPE (when, where, how)
- PPE must be provided free of charge to the employees who are facing hazards in their work.
- Adequate training should be provided to ensure proper PPE use. This training should be repeated at least once a year.
- Prepare an emergency plan to give clear guidance to everyone in the enterprise as to what and what not to do in case of emergencies.

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Literature, sources and further Reading

- ZDHC Chemical Management System Guidance Manual:
https://www.roadmapzero.com/fileadmin/layout/media/downloads/en/CMS_EN.pdf
 - » ZDHC CMS 2.3 Procurement/Supplier Practices
 - » ZDHC CMS 3.5 Chemical Management Work Practices
 - » ZDHC CMS 3.6 Emergency Procedures
- GIZ: Resource Efficient Management of Chemicals in Textile and Leather Sector Companies, Company Handbook: <https://www.sia-toolbox.net/solution/resource-efficient-management-chemicals-textile-and-leather-sector-companies>
- Respiratory protective equipment at work, Guideline by HSE, UK HSG53:
<http://www.hse.gov.uk/pubns/books/hsg53.htm>
- Training kit of the International Labour Organization (ILO): International Chemical Control Toolkit: http://www.ilo.org/legacy/english/protection/safework/ctrl_banding/toolkit/icct/

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Exercise and Example

Exercise:

"Selection of PPE"

Example:

"Checklist - Emergency Preparedness Work Floor"

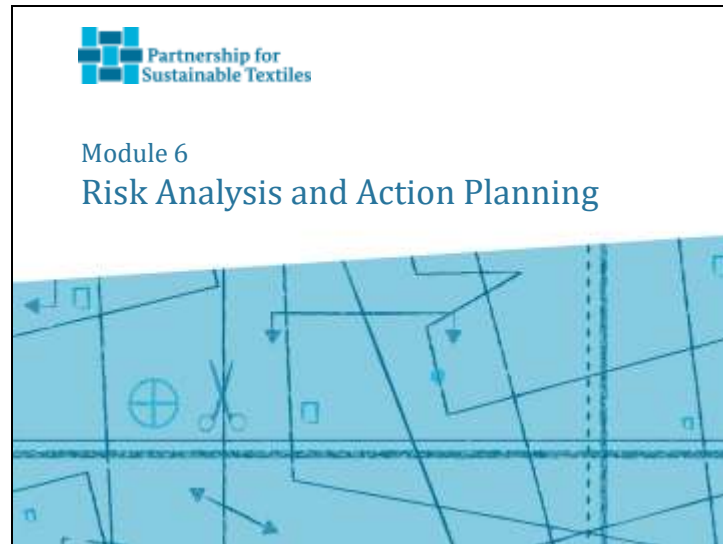
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Module 6: Risk Analysis and Action Planning

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Overview and Content

- Module 1: Chemicals in Textiles
- Module 2: Chemical Management
- Module 3: Good Housekeeping
- Module 4: Wastewater and Sludge Treatment
- Module 5: Health Protection and Occupational Safety
- Module 6: Risk Analysis and Action Planning**
 - Target of the Module
 - Hazards, Risk, and Hazardous Chemicals
 - Assessing Hazardous Chemicals
 - Performance Goals and Action Plans
 - Management Performance Indicators
 - Assign Roles and Assessing Training
 - Possible Useful Corrective Actions
 - Example and Exercise
- Module 7: Evaluation and Possible Next Steps

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Targets of the Module „ Risk Analysis and Action Planning “

- ✓ Assess and map chemical risks
- ✓ Identify chemicals and processes of concerns
- ✓ Identify gaps and losses in current processes – e.g. hotspots
- ✓ MRLS and RSL process – e.g. process for verifying compliance, update and maintenance, integration of suppliers
- ✓ Formulate performance goals and action plans
- ✓ Assign roles and responsibilities
- ✓ Assess training needs

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Hazards, Risk, and Hazardous Chemicals

A hazard is an intrinsic property of a chemical that is independent of usage, exposure or other criteria. Property examples:

- Gasoline is flammable.
- PCBs are persistent in the environment.
- Some uranium isotopes are radioactive.

The risk also considers the exposure potential when using a chemical, the engineering controls in place, PPE, etc. Thus, in general terms: Risk is a function of:

$HAZARD \times EXPOSURE = RISK$

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Chemical management is the systematic control, use, and disposal of all chemicals in a facility.

- Includes traceability of formulations, both to an SDS and back to the manufacturer.
- includes review of hazards, to improve overall safety of for workers and the facility.
- means full control of the amount of chemicals ordered, use, discharged, and disposed.

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Hazards, Risk, and Hazardous Chemicals

1. Possible ways of getting exposed to chemical substances

```
graph TD; A[Inhalation of airborne chemicals  
[gases, vapours or airborne particulates  
(dust, smokes, aerosols)]] --- B[Radiation]; B --- C[Skin contact and absorption through skin and eyes in gaseous, liquid or solid form]; B --- D[Ingestion of chemicals in liquid and solid form]; B --- E[injections];
```

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Hazards, Risk, and Hazardous Chemicals

Definition Hazardous Chemicals

Hazardous chemicals are defined as chemicals which have an inherent property to cause harm...

- ...either to humans
- ...or the environment

and/or cause damage through...

- ...fire,
- ...explosion
- ...corrosiveness or toxicity,


with local or global effects.

Reference: ZDHC Chemical Management for the Textile Industry, Module 2

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Not all of the chemical substances which you have identified in your inventory list have to be hazardous. Hazardous chemicals are defined as chemicals which have an inherent property to cause harm either to humans or the environment and/or cause damage through fire, explosion or through corrosiveness or toxicity, with local or global effects.

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Assessing Hazardous Chemicals


Assess and map chemicals

- Hazardous chemicals usually require special procedures for **safe handling** and **disposal**
- This module deals with the question of how to systematically **identify** hazardous chemicals and their hazard properties as well as to **categorise** these in form of hazard bands.

Video Risk Assessment:
http://chemicals.cita.org.hk/mod/mediagallery/cita_video_item.php?g=2 & video_id=10052

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Assessing Hazardous Chemicals


- 1. Assess and map chemical risks**

Once you have identified the process flows, taken inventory of your chemicals and wastes, and gained a better understanding of the hazard properties associated with the same, you can identify and assess their risks and possible control gaps.
- 2. Identify chemicals and processes of concerns**

The hazard analysis and classification provides answer on what intrinsic hazard properties may be associated with the chemical substances used or present in your production. The question whether and to which extent the use of this chemical will result in actual negative impact, harm to health, environment and/or damage to property is answered with the help of a risk assessment.

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Assessing Hazardous Chemicals

Questions for a chemical Risk assessment

- 1. What potential exposure may occur?**
 - Use chemical inventory, consider all persons who may be affected
 - Review PPE in use, is it appropriate?
 - Review environmental controls to ensure they are adequate
- 2. What hazards are indicated for the chemicals?**
 - Information can be found on packaging labels, from SDS, supplier or specialist in your factory

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Assessing Hazardous Chemicals

Questions for a chemical Risk assessment

- 3. What activities can give rise to exposure?**
 - When is it possible for Spills or splashes to occur?
 - Are there steps in the process that increase the potential for exposure? Can these steps be eliminated or changed?
- 4. What risks need to be controlled?**
 - Significance depends on duration and frequency of exposure as well as the concentration of the involved substances.

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Assessing Hazardous Chemicals

Identify chemicals and processes of concern

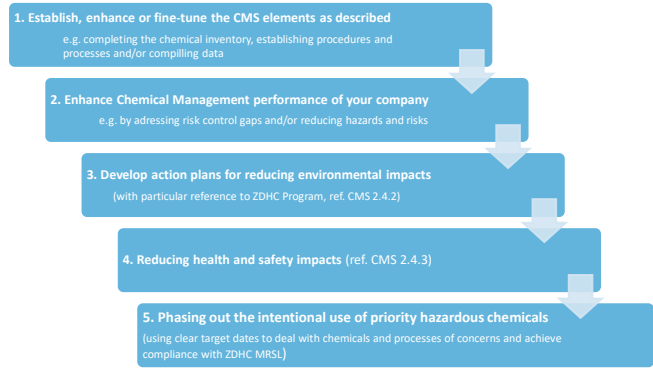
- Processes where gaps between recommended and existing control exists as well as processes for which you have assigned a high-risk rating during the risk assessment process.
- As part of your organization's requirements under ZDHC, establish, document, and implement a process
 - verifying compliance restricted substances lists.
- Your company needs to maintain records (e.g. chemical inventory) and indicate how you conduct the compliance verification and the results.
 - In case restricted substances are identified, specific action plans are to be drawn up on how to eliminate them from your production.

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Performance Goals and Action Plans




1. Establish, enhance or fine-tune the CMS elements as described
e.g. completing the chemical inventory, establishing procedures and processes and/or compiling data
2. Enhance Chemical Management performance of your company
e.g. by addressing risk control gaps and/or reducing hazards and risks
3. Develop action plans for reducing environmental impacts
(with particular reference to ZDHC Program, ref. CMS 2.4.2)
4. Reducing health and safety impacts (ref. CMS 2.4.3)
5. Phasing out the intentional use of priority hazardous chemicals
(using clear target dates to deal with chemicals and processes of concerns and achieve compliance with ZDHC MRSL)

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The compliance verification can be part of the purchase and audit process in your organization.

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Performance Goals and Action Plans


Define objectives and targets

Your selection of specific objectives and targets will build on the information collected in the previous steps such as:

- process flow diagrams
- chemical inventory
- map of hotspots
- hazard and risk analysis records (e.g. chemicals and process of concerns)

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Performance Goals and Action Plans

Define objectives and targets

- The objectives and targets, and subsequent your action plan, may initially focus on the establishment or fine-tuning of your basic chemical management systems elements
 - addressing “hotspots” (those areas which pose an immediate impact on health and safety, environment, costs)
- Improve systematically the performance of your company.
- Together with the key performance indicators, objectives, and selected control measures, your action plans establish the basis for implementing measures, making improvements, monitoring progress, and evaluating results.

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Management Performance Indicators

Monitoring and measuring performance will help you to:

- Compare performance over time
- Highlight improvement and organization potentials;
- Identify and follow up on targets
- Discover opportunities and cost-reduction potentials
- Communicate your results to external stakeholders
- Involve, educate and motivate staff
- Promote organizational learning
- Support decision-making by providing concise information about the current status and trends with regard to resource use and performance
- Implement environmental management systems or generate information needed for your current environmental management system

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Management Performance Indicators

The selection of (key) performance indicators helps you to:

- mark whether or not you are making wanted progress
- further define/frame objectives and targets in your action plans
- to communicate your company's performance to relevant stakeholders

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Management Performance Indicators

How and how frequently would you like to assess the performance?

- It is important that you tailor the selection of indicators to your type of operations.


Make sure that the selected indicators are:

- (a) understandable
- (b) relevant
- (c) reliable
- (d) comparable

- **These should reflect the management efforts chemical management, operational performance aspects and combine leading and lagging indicators**

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Management Performance Indicators

The right mix of indicators may reflect:

- 1. Chemical inputs**
- 2. Chemical wastes**
- 3. Chemical management efforts**
 - e.g.: number of chemical safety trainings or emergency drills conducted, percentage of safety data sheets available, number of inspections conducted
- 4. Chemical management performance**
 - e.g. number of incidences/accidents involving over period of time, incident/accident free days worked or non-product outputs reduced

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Management Performance Indicators

Indicators related to chemical inputs and waste can be

Absolute Indicators	Ratio Figures	Productivity/Intensity Indicators
<ul style="list-style-type: none">• such as total quantity of chemicals used (overall, or specific type in kg, liters per day month, year)• total amount of chemical containing waste water (hazardous/non-hazardous) generated (liters, cubic meter per day, month or year)	<ul style="list-style-type: none">• percentage of hazardous chemicals• percentage of hazardous waste	<ul style="list-style-type: none">• chemical productivity (product output per unit of chemical used) or chemical hazardous waste intensity (hazardous waste generation per unit of product output)

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Assigning Roles and Assessing Training

Assigning roles and responsibilities

In order to make the CMS operational, the company needs to:

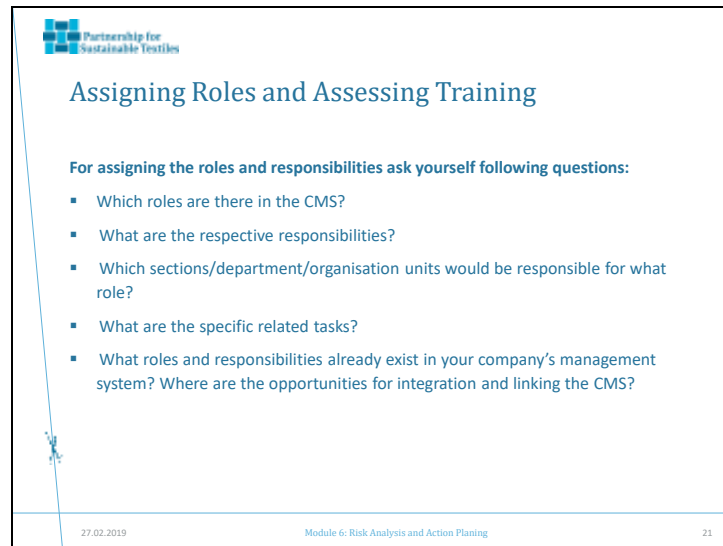
- ✓ establish an organisational structure
- ✓ clearly assign the roles and responsibilities under the CMS

Company's management will have to make available:

- human resources
- specialised skills
- organisational infrastructure
- technology
- financial resources available

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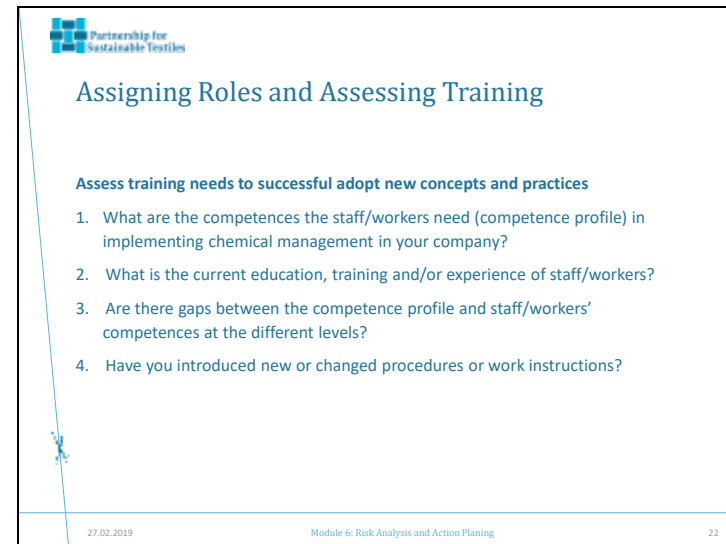
Assigning Roles and Assessing Training

For assigning the roles and responsibilities ask yourself following questions:

- Which roles are there in the CMS?
- What are the respective responsibilities?
- Which sections/department/organisation units would be responsible for what role?
- What are the specific related tasks?
- What roles and responsibilities already exist in your company's management system? Where are the opportunities for integration and linking the CMS?

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Assigning Roles and Assessing Training


Assess training needs to successful adopt new concepts and practices

1. What are the competences the staff/workers need (competence profile) in implementing chemical management in your company?
2. What is the current education, training and/or experience of staff/workers?
3. Are there gaps between the competence profile and staff/workers' competences at the different levels?
4. Have you introduced new or changed procedures or work instructions?

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The successful adoption of the new concepts and practices will largely depend on the knowledge, skills and attitude of the workforce in your company.

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Assigning Roles and Assessing Training

According to the ZDHC CMS Guideline, you have to ensure that your personnel is competent through appropriate education, training or experience on:

- Preventive environmental and work safety practices
- Saving resources
- Use of personal protective equipment
- Personal hygiene measures

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Possible Useful Corrective Actions

- ❖ Assess and map chemical risks
- ❖ Identify chemicals and processes of concern
- ❖ Decide on objectives, targets and performance indicators
- ❖ Prepare action plan with specific measures, as well as
- ❖ Set up an organizational structure
- ❖ Assess training needs and develop training plans

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Literature, Sources and Further Reading

- ZDHC Chemical Management System Guidance Manual:
https://www.roadmaptozero.com/fileadmin/layout/media/downloads/en/CMS_EN.pdf
- ZDHC CMS 2.4 Chemical Risk Assessment:
- ZDHC CMS 2.5 Chemicals and Processes of Concern
- ZDHC CMS Appendix D Risk Assessment Template

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Exercise and Example

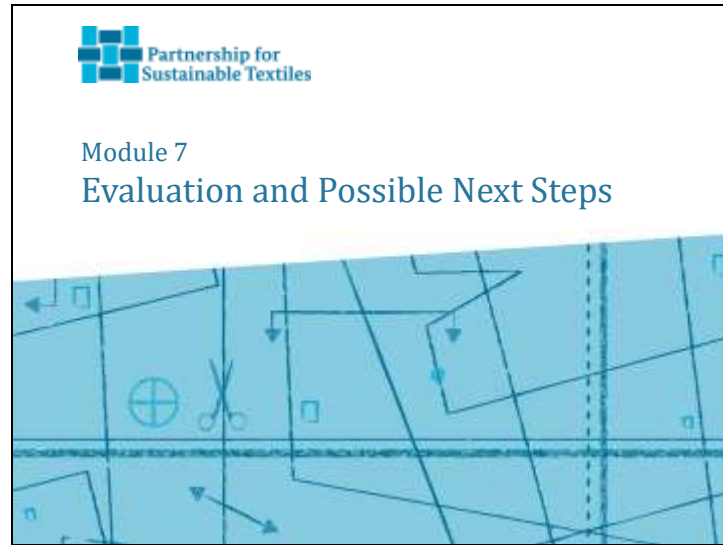
Exercise:
"ZDHC- Chemical Management Assessment Questionnaire"

Example:
"Tool - Chemical Control Action Plans"

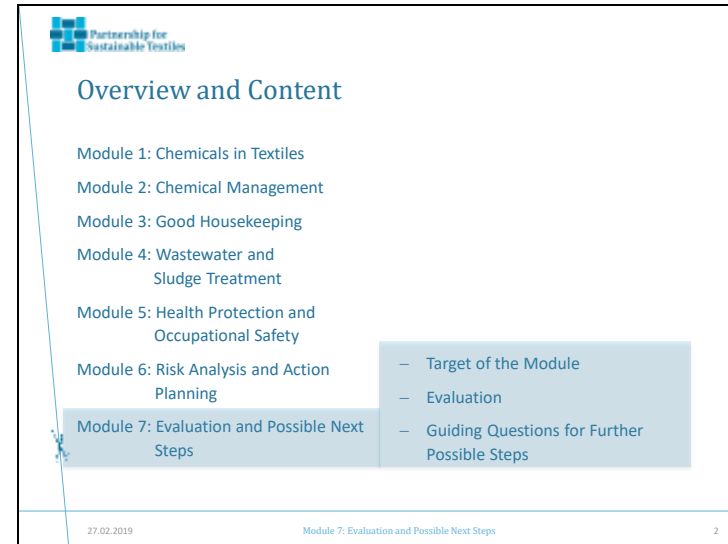
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Module 7: Evaluation and Possible Next Steps


Slide 1



Slide 2



Slide 3




Target of the Module „Evaluation and Possible Next Steps“

- This module intends to evaluate and summarize the one days training together with the participants, to identify eventual gaps from the individual expectations and further training needs.
- In this short session (around 15 minutes) the participants can also express their lessons learnt and which type of corrective action they can initiate in their respective companies.
- At the very moment the participants can identify also eventual further training needs or / and necessary technical support.

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Evaluation

Please rate the quality of this session based on the following criteria, with 1 being very poor, and 5 being excellent.

	1 very poor	2 poor	3 fair	4 good	5 excellent
Trainers facilitation skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trainers technical knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Action learning approach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relevance of practical exercises	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Opportunity for participant interaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quality of the training material	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Evaluation

Please answer the questions below, with 1 meaning not at all, and 5 meaning to a very great extent

	1 not at all	2 some extent	3 fair extent	4 great extent	5 very great extent
To what extent did the Training meet its stated learning objective?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To what extent did the Training meet your learning needs?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To what extent did the Trainers make use of the materials and handouts given for the Training?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Evaluation

Please respond to below statements, with 1 meaning strongly disagree, and 5 meaning strongly agree.

	1 strongly disagree	2 Disagree	3 Neutral	4 Agree	5 strongly agree
My technical knowledge increased as a result of the Training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My understanding of the programme increased as a result of the Training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The duration of the session was adequate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There was sufficient time for Q&A (Questions and Answers)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Guiding Questions for Further Possible Steps

- What did you like best about the Training sessions?
- How can the Training materials be improved?
- What was missing according to your expectations?
- How you can use the learned in your daily work?
- What are the corrective action measures you would like to start?

27.02.2019 Module 7: Evaluation and Possible Next Steps 7

Slide 8



Literature, Sources and Further Reading

- GIZ: Resource Efficient Management of Chemicals in Textile and Leather Sector Companies, Company Handbook: <https://www.sia-toolbox.net/solution/resource-efficient-management-chemicals-textile-and-leather-sector-companies>
- ZDHC Chemical Management System Guidelines: https://www.roadmaptozero.com/fileadmin/layout/media/downloads/en/CMS_EN.pdf
- ZDHC MRSL www.roadmaptozero.com/programme/manufacturing-restricted-substances-list-mrsl-conformity-guidance/

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