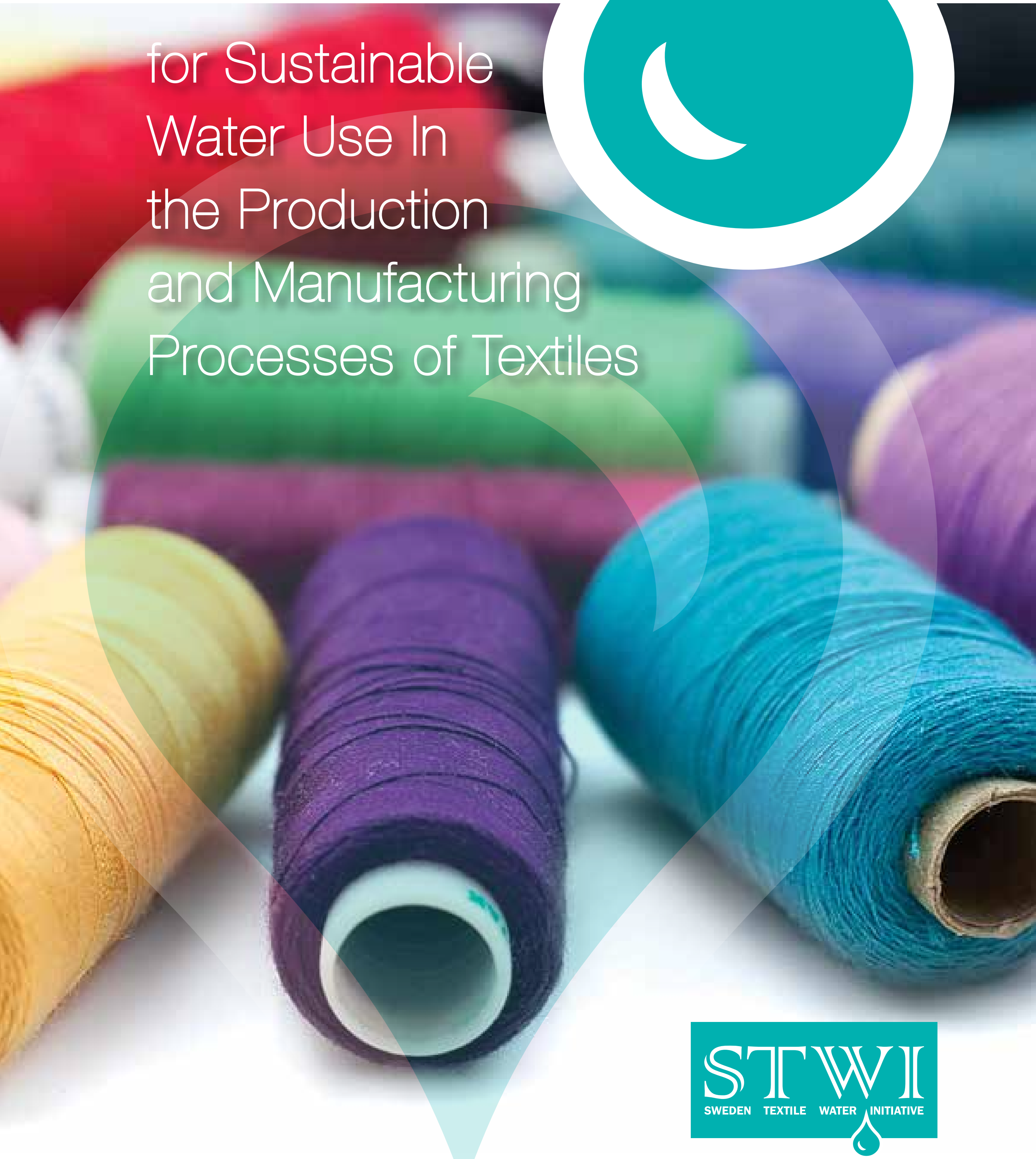
SWEDEN TEXTILE WATER INITIATIVE

GUIDELINES

for Sustainable Water Use In the Production and Manufacturing Processes of Textiles



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1 Preface

Since 2010, the Stockholm International Water Institute (SIWI) and the Swedish textile and leather sector, represented by 32 pioneering brands have been working together to understand and address water risks associated with textile and leather manufacturing processes in production countries.

The companies and SIWI launched the Swedish Textile Water Initiative (STWI) in 2010 as a learning process that has evolved through the past years towards a successful and pioneering partnership that continues to bear fruitful results on the ground. The partnership continues to show that increasing efficiency in resource use and pollution prevention creates a triple win: a win for business, a win for society and a win for the environment.

STWI continues to develop and improve its Guidelines for the Sustainable Use of Water in Manufacturing Processes, both for textiles and for leather. A key principle of these Guidelines is the value of prevention. Reducing water and chemical use early in the production process is cheaper and more productive than exclusive focus on wastewater treatment. It also means that substantial economic benefits are within easy reach for manufacturers that use water more wisely.

However, since the publishing of the STWI Guidelines in 2011, the issue of water scarcity has only been exacerbated; and the importance of disposing of water in a safe manner is increasing. These actions are being driven by local community actions, greater government enforcement of water related compliance in several parts of the globe, and pressure from global NGOs looking at this issue. That only increases the relevance and applicability of the STWI guidelines.

In this edition, published in September 2014, the guidelines are enhanced to increase their applicability to current challenges. This edition includes enhanced tools on guidelines application.

As SIWI and the STWI brands forge ahead in expanding their impact, we feel assured that the exciting journey we started in 2010 will continue at a steady pace towards the sustainable use of water resources in the textile and leather production sector.

Torgny Holmgren
Executive Director
Stockholm International Water Institute (SIWI)

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2 Introduction

Objective

In a world with declining access to finite supplies of water and natural resources, the continuous success of all companies relies on their ability to change to sustainable production practices if they are to meet the expectations of the growing number of conscientious retailers and customers. The conventional textile manufacturing process is very water-intense; the STWI Guidelines are focused on sustainable water use and are designed to support you on this journey.

This chapter explains the structure of the STWI Guidelines and how to use them in the most efficient way. It also covers the importance of involving sub-suppliers in achieving positive impacts on water resources and how to follow up on performance.

There are two parts to the STWI Guidelines. This document includes guidelines for textile production. A separate set of guidelines has also been produced for leather production. Both consist of a complete guideline document and a self-assessment questionnaire. Also available is a short version of the Guidelines, which summarizes the content of both the textile and the leather documents. A library of extensive background information has also been produced. The short version of the STWI Guidelines is freely available while the complete Guidelines and the self-assessment template are accessible to STWI members and their suppliers. Suppliers can also obtain access to documents from the library upon request to their buyer.

The STWI Guidelines have been produced during a four-year learning process by the Stockholm International Water Institute (SIWI) and representatives from all the STWI member companies: Acne, Åhléns, Boomerang, Didriksons, Ellos, Filippa K, Fjällräven, Gekås, Gina Tricot, Haglöfs, Hemtex, H&M, ICA, IKEA, Indiska, Intersport, KappAhl, KUS design, Lindex, Hestra, MQ, NilsonGroup, Nyblom Kollén, Odd Molly, RNB, Snickers workwear, Stadium, TPC Textile, Klättermusen and WeSC.

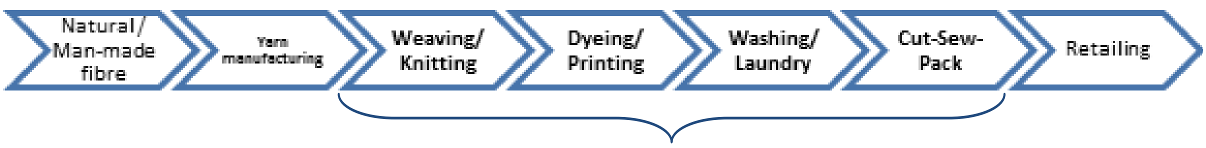
STWI would like to thank the following experts for their knowledge and support: Maria Jonstrup, Stefan Posner, and the entire cKinetics crew.

Scope

The Guidelines cover three areas: water efficiency, water pollution prevention, and wastewater. The purpose of water efficiency is to ensure that only the necessary amount of water is used in the factory, reducing the need for wastewater treatment as well as energy and water costs. The areas of water pollution prevention and wastewater aim to reduce negative health and environmental impacts from chemicals used in the production processes. They will also free up water resources and improve water quality for other water users. These Guidelines focus on the textile production process and exclude the process of making thread, whether man-made or natural, ; whether coloured or not1. (It must be stated that the creation of fibre and yarn is also water-intensive and beyond the scope of these guidelines. For natural fibre, there are several farm-level initiatives that already exist). There are many more challenges on the journey towards the -sustainable production of clothing, fabric and leather, such as raw material transportation, cleaning, recycling and several other challenges not covered by these Guidelines.

Typical textile (garment and home-textiles) manufacturing process

Typical textile (garment and home-textiles) manufacturing process



The guidelines cover water efficiency, water pollution prevention, and wastewater in the textile manufacturing process

Sub-contractors and sub-suppliers

The STWI guidelines are being promoted by brands that believe in acting responsibly and want to do so through suppliers that they have a direct relationship with i.e. Tier 1 Manufacturers. Tier 1 Manufacturers have the power to influence water use and the release of chemicals from direct operations in their own factories. They in turn are expected to initiate a dialogue with their suppliers (of fabric and components), extend influence to their operations and improve the water situation further in the supply chain. Therefore these Guidelines are a tool for the larger textile supply chain as well.

Approach taken by these guidelines

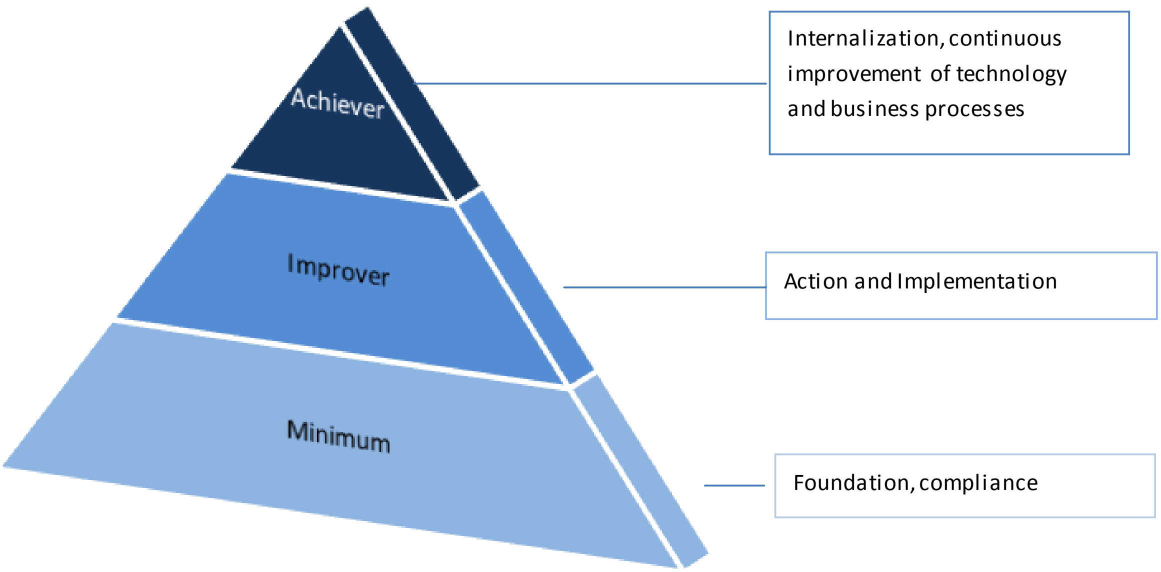
The maturity of existing legislation in the field of water varies in different parts of our world. It is a minimum requirement that all local and national legislation is fully complied with and that the producer has a good and constructive dialogue with the local authorities. Global conventions regarding the use of chemicals, such as the Stockholm Convention on Persistent Organic Pollutants (POPs)
, should also be followed.

Figure below illustrates the meaning of each level.

These Guidelines are meant to enable manufacturers to navigate a journey that seeks to use water sustainably. Compliance is a bare minimum requirement, and the aim is to drive water stewardship.

The three levels of the Guidelines

1. Level 1 Minimum is the minimum acceptable level for water management, which means that the supplier complies with legislation and has a general awareness about water issues. This is the first step towards sustainable water management. Where there are differences between the provisions of these Guidelines and national laws or other applicable standards, suppliers should adhere to the higher or more stringent requirements.
2. Level 2 Improver - A factory´s environmental performance has passed - beyond legal requirements, working methodically with water and pollution prevention action plans.
3. Level 3 Achiever - Suppliers are leaders in the field of sustainable water usage in the textile/leather industry and use Best Available Techniques (BAT) for reducing water use, re-using water and phasing out hazardous chemicals.



The purpose of the three-level structure is to facilitate continuous improvements and to allow factories at all levels of water management to use the STWI Guidelines. At each level, and increasingly at Levels 2 and 3, you will see that the improvements you have made in water management also translate into financial gains. For example, cost-savings on water and energy will be achieved through more resource-effective production and will contribute to a fast return on investments.

[2] *Stockholm Convention, http://chm.pops.int/Convention/ConventionText/tabid/2232/Default.aspx (retrieved 30 June 2014)*

Valuing water: a carrier of cost and a source of risk

In many parts of the world where textiles are manufactured, water is close to being 'free' and is priced nominally. In most factories the cost of water is 'perceived to be' <1% of the resource bill.

However a closer examination reveals that that is not the case, because almost everyone looks at the 'sourcing' cost of water. There are other ways to look at water cost:

1. **Total cost of water:** this takes into account the cost of pumping, processing and treating water. It factors in the cost of reverse osmosis (RO) systems, effluent treatment cost, the cost of electricity for pumping, etc. These costs add up, and can become 2-5% of the resource expenditure. Limiting the amount of water that needs to be moved around the system reduces this cost.
2. **'Value added' water:** this examines the relationship between water, energy and chemicals. In this case, one looks at water as a carrier of value. When 'value' has been added to water, e.g. it has been heated or it has had chemicals added to it; then that water is expensive. Hence conserving hot water (or steam) or water that has chemicals in it becomes an exciting proposition.

   Appendix 1 outlines a view of water when one looks at it as a carrier of cost. For a typical dyeing and printing unit in India, the cost per cubic meter (m3) of water that is used in processing is different from the sourcing value, and highlights a business case for the need to conserve and limit the use of water.

3. Water continues to grow scarce, forcing textile manufacturers to move location unless they can conserve it . In many cases, the textile manufacturers are sharing the same source of water with other industrial water users as well as local communities, making its availability uncertain for the long term. This is a source of risk that manufacturers need to address; they need to proactively seek a solution to use water in a sustainable manner.

How to use and implement these Guidelines

These guidelines outline (a) what needs to be done and (b) how it needs to be done.

There are three key sections in the guidelines

1. Requirements on Water Efficiency (Chapter 3)
2. Requirements on Water Pollution Prevention (Chapter 4)
3. Requirements on Wastewater (Chapter 5)

Annotation through this guideline document

Each section above has recommendations on actions based on the three different levels - Minimum, Improver or Achiever.

Each level in turn has guidance on:

1. **General** requirements which typically outline the basic requirements that need to be met at a particular level
2. **Education:** recommended actions on engaging one's employees and personnel
3. **Production:** measures related to manufacturing suggested by the guidelines
4. **Communication:** measures on recording, storing and communicating data to stakeholders

A comprehensive list of best practices and essential documents has been indicated in Appendix 9 of the guidelines.

Legend

The document is interspersed with some annotations. Whenever there is a suggested format or approach that can be adopted to implement the guidelines, that is highlighted as follows.

- **Suggested Approach/Format :** the description of the approach or format follows. All the formats are listed at the end of the document.
- Sections applicable to a part of the textile production process: While this document is applicable to the entire textile production supply chain, there are certain requirements and suggestions relevant to parts of the value chain. Such sections will have the following symbols next to them.

Management engagement and Sustainability policy

The companies that founded STWI are all committed to making a difference and contributing to a more sustainable world. The responsible and sustainable use of water is of paramount importance to that goal. This is achieved only by companies that have an engaged management and trained employees where sustainability measures are fully integrated with daily operations.

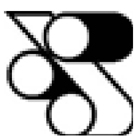
In order to successfully apply the STWI Guidelines, it is important to:

1. Appoint a responsible person with a clear mandate and resources.
2. Conduct a self-assessment to establish a base line.
3. Measure the quantity and quality of water used.
4. Set clear targets and make a time-bound plan for achieving them.
5. Involve and engage employees at all levels.
6. Understand that this is a journey of continuous improvement.

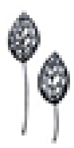
Suggested Approach/ Format

It is recommended that the producing company has a well-implemented sustainability policy and environmental management system that among other important sustainability areas covers water use. A policy for water should be guided by a systematic approach and a complete view on water usage in both quantitative and qualitative terms. The policy should also be clearly communicated both internally and externally.

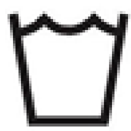
Relevant to Dyeing



Relevant to Printing



Relevant to Laundry/ washing



Relevant to Cut-Sew-Pack

Creating Plans to Implement the Guidelines and Defining Key Performance Indicators

Manufacturers with the intention of implementing the STWI guideline should look at this document in conjunction with the Self-Assessment Questionnaire; and aim to come up with a plan. Performance against the plan should then be tracked and evaluated periodically.

The process of defining plans and reviewing them periodically is a time-tested approach to a successful implementation.

In a programme launched in 2013, nearly 40 factories in India were engaged in a capacity-building effort to use water and resources sustainably. Program SWAR was promoted by three members of STWI; and co-ordinated by the Stockholm International Water Institute (SIWI).

In 2013, the goals were evaluated at macro level measuring overall reduction in resource usage. In 2014, Key Performance Indicators (KPIs) are being identified for all units: that will enable units to efficiently track their own progress towards their goals on an ongoing basis.

The following KPIs are being defined for wet-processing manufacturers:

1. Water use per unit of production (also referred to as MLR)
2. Chemical consumption per unit of production (relevant to evaluating the water-chemical nexus in wet-processing units)
3. Energy consumption per unit of production (relevant to evaluating the water-energy nexus in wet-processing units)

The following KPIs are being defined for garment manufacturers:

1. Incoming water / Operating person per day
2. Personnel water use/ Operating person per day (that excludes washing)
3. Energy consumption (including thermal) / Operating person per day
4. Chemical consumption / piece of garment
5. Toxicity level of sludge

"Management of water and waste water is extremely important in today's resource constrained times.
From a business standpoint, efficient utilization of water not only reduces the cost of resource consumption but also improves business sustainability."
Nishant Maskara, India, Supplier to STWI Brands

Photo: cKinetics

"Treatment of waste water involves energy and chemicals. Hence, managing it is important from a compliance perspective as well as from a resource conservation perspective.
Awareness of these aspects can not only give businesses economic benefits but also differentiation in a competitive market."
Pramod Mehra, India, Supplier to STWI Brands

"Water availability is going to be the biggest threat to the processing industry in the future. However, this threat also presents an opportunity for the industry to improve their awareness on this matter and explore new technologies and practices for reducing water usage and waste water generation."

Manish Gupta, India, Process House Owner, Supplier to STWI Brands

Photo: eKinetics

3 Water efficiency

A reduction in the amount of water used in a factory will reduce the cost for water as well as for wastewater treatment. It will also make more water resources available for other local users, such as households and farmers. Reduced water use also saves energy because less water needs to be heated for various processes and less water needs to be treated after use. Water use can be reduced at different levels, starting with small changes, such as turning off taps and machines when not in use or fixing leaks, to more complex changes, such as optimisation of processes utilizing water and its re-use.

Table 3.1 Specific wastewater volume for entire textile production. Reference: Bluesign®

** The table gives a brief overview, but it needs to be kept in mind that water use depends on fibre, colour, dyeing process, machinery, etc.*

SPECIFIC WASTEWATER VOLUME (L/KG TEXTILE)				
>250	200-250	150-200	100-150	50-100
Housekeeping can be improved Short term action is needed	Very high water saving potetial	Water saving potential in most cases	Potential for saving, depends on type of processes (often detailed work necessary to identify the interesting processes)	Company with good housekeeping and/or modern machines and/or processes with a low consumption

3.1 Level 1: Minimum level

The crucial measures at this level are to check for legal compliance, identify the areas that use water and understand the steps that can be taken for improvements in water efficiency. At this level the prime focus should be to correctly assess one's water withdrawal and use and make this the baseline.

GENERAL

3.1.1 Compliance with legal and buyer requirements

All applicable legal requirements should be followed. The factory should maintain a legal and compliance register.

Suggested Approach/ Format

A file that has all the requirements for compliance purposes should be maintained and kept up-to-date as required by the compliance parameters, especially on sourcing water.

3.1.2 Necessary permits available

All necessary permits should be available and up-to-date.

3.1.3 Awareness about the source of influent water

Basic awareness about the source of the inflowing water is important. This includes knowledge of what sources of water are used (surface water or groundwater), the local water situation, and who are the other users (for instance farmers or households) that are reliant on the same water source. This awareness contributes to improvement in the impact of the factory's water use on the local environment and community.

3.1.4 Drinking water

Drinking water for all factory personnel should be purified and should meet all parameters required by national legislation. In countries where there is no national standard for drinking water, the quality specified by the WHO Guidelines should be met[1].

EDUCATION

3.1.5 Education on efficient water use

All employees should be engaged through communication and education on efficient water use and correct handling of machines. At this level the management and production leaders should be educated to spread their knowledge within the factory. Educating them will help employees to make improvements and use water efficiently.

Guidelines for education:

- Educate managers and production leaders about water efficiency.
- Educate managers and production leaders about maintenance of technical equipment (machines in production as well as abatement and recovery devices).
- Develop a plan to educate all employees.

PRODUCTION

3.1.6 Control of the inflowing water

The factory should check the inflowing water. Analysis of it is crucial to assess the quality of the water and determine whether it needs to be treated before use in the processes. Polluted water can harm the processes or necessitate the use of more chemicals and water than would otherwise be needed. The analysis should be conducted regularly to ensure the high quality of the water used in the processes. Treatment processes for inflowing water should be used if the water does not meet the criteria.

3.1.7 Measurement of total water used

The total amount of water used and the total weight of textiles produced should be measured regularly to enable continuous improvements. Monthly self-assessments should be conducted to monitor water use. By keeping track of the water withdrawn and used it is possible to detect water-intensive sub-processes, locate leaks and identify where further actions should be taken. Even small leaks can account for large losses of water.

Suggested Approach/ Format

A manufacturing unit should create a water circuit (sometimes referred to as a water-balance) that outlines where water is being sourced and used. This document can be updated from time to time. An illustrated water circuit is shown in Format 1. The water circuit lists the flow of the water through the facility along with measurement/metered points. It also indicates the quantity of water flowing in each stream.

Additionally, a log book on water withdrawn and used should be regularly updated. Format 2 outlines a simple Water Reconciliation Format which indicates the opening and closing readings on water meters installed at mains as well as sub-processes.

[3] Document can be downloaded from World Health Organization: Guidelines for drinking-water quality http://www.who.int/water_sanitation_health/dwq/en/

3.1.8 Routines for efficient water use

The factory should have clear routines for handling water. By following these routines water usage can be reduced. Small changes, known as 'quick-wins', may not seem to make much of a difference but each drop saved is one less wasted. Such quick-wins can be a starting point for the factory to involve the employees in an active water efficiency plan. Machinery checking (i.e. pumps, valves, level switches) and general maintenance should be conducted at regular intervals.

Photo: Renée Andersson, Indiska

Examples of 'quick-wins'

- Turn off taps and hoses when not in use.
- Check water supply pipes e.g. diameters; avoid extremes of temperature; check for leaks.
- Repair leaks quickly.
- Turn off water-using equipment when not in use.

3.1.9 Supporting equipment

Adequate supporting equipment should be used. Having the right equipment is crucial to working efficiently. Water flow measurement equipment should be used and should be calibrated and maintained regularly.

Photo: Renée Andersson, Indiska

COMMUNICATION

3.1.10 Access to water usage data

The water usage data should be available on site. This data should be retained for at least 24-36 months. At this level the data should include both the total amount of water used domestically as well as for production.

3.2 Level 2: Improver

While at Level 1 challenges are analysed and assessed, at Level 2 specific changes are made to improve the water withdrawn and used.

GENERAL

3.2.1 Knowledge about the effects of water withdrawal

The focus of the plant should be broadened to consider how the site influences and interacts with the local environment and local communities.

3.2.2 Rainwater harvesting

Rainwater harvesting should be implemented at units where permitted by law. The system could be used to recharge the aquifer on which the unit sits and could also be used to collect water for routing into the unit. The harvesting system should be cleaned of debris on a regular basis and should be in working condition.

A little maintenance goes a long way
A rainwater harvesting system was installed in the compound of a garment unit. However, regular maintenance was not carried out on it which led to its blockage, rendering it ineffective. When the unit discovered this, they started carrying out regular maintenance on the system. They cleaned debris from the harvesting pit and made the system functional once again.. This has enabled the unit to recharge the aquifer from which they draw water. In the long term, this will reduce or at least maintain the TDS levels of their ground water.

EDUCATION

3.2.3 Education on efficient water use

All employees should be educated about efficient water use. The supervisory and managerial level should be educated about problems and solutions concerning water use at a detailed level, and informed where the most significant reductions in water usage can be made.

Guidelines for education:

- Educate all employees on water efficiency. The training should be process- and machinery-specific.

Suggested Approach/ Format
Where possible, have water efficiency introduced in the induction curriculum and ongoing training for employees. This approach may be more relevant for Cut-Sew-Pack factories that have formal training systems and also higher turnover of personnel (as compared to more up-stream manufacturers).

PRODUCTION

3.2.4 Measurement of water used in sub-processes

The amount of water used in different sub-processes should be measured regularly to enable continuous improvement. Monthly self-assessments should be conducted to check the water usage to achieve a detailed picture of where in the production water usage is highest and where it would be most beneficial to start the improvements.

Suggested Approach/ Format

Sub-metering points should be identified and linked to key water usage centres outlined from the water circuit (Format 1). Subsequently daily water reconciliation reports (format 2) should be tracked for each of the points.

3.2.5 Plan for improvements in water efficiency

A plan with clear goals for how the water used in the process can be reduced should be implemented. The plan should address the changes that are going to be made and how and when they will be made. The plan should be supported by the management of the unit.

Free water delivery test:
Every drop counts

When a manufacturing unit carried out a free water delivery test, it discovered the presence of leaks in their system. Investigation revealed that the reasons for these were:

- Unknowingly, a legacy pipeline was draining water directly into the drain i.e. water that was being pumped into the over head tank was going straight into the drain.
- Unmonitored leakages in several toilets.

By addressing these two measures alone in a single week consumption has come down, resulting in savings of about 9,700 m3 of water over a full year.

Note: Free water delivery test involves completely filling the water storage tanks at the unit on a day when the unit is not operational. The water level is recorded. On the next day, the water level is recorded again. A significant change in the water level is indicative of stray leaks in the system.

3.2.6 Water saving equipment

Water saving equipment should be identified and installed to reduce water used.

Examples of water saving equipment

- Piston taps, flow regulators, flow-meters and automatic water level controllers can be installed on processes that use water.
- Automatic switch-off trigger guns can be in stalled on hoses.
- Machines with an overflow rinsing system should be avoided to reduce water use. If these are in use, automated control systems should be installed to avoid overfilling.

3.2.7 Water re-use

Systems for water re-use should be identified and implemented to reduce water usage in the textile wet processes and at garment units.

Examples of water re-use

- Re-use steam and non-contact cooling water (for instance from singeing, air compressors and pre-shrink systems if the site has these).
- Re-use of discharge water from different processes (for example from bleaching and mercerisation processes) when applicable.
- Re-use RO reject water (explained in case below)/ETP discharge water for flushing in lavatories. This is especially relevant at garment units.

Recovering heat from water: re-use of cooling water from jacket cooling and saving steam

Many wet processing units use water for cooling processes (soft-flow, jet-dyeing, singeing, etc.). In most cases the water is recycled back into the raw-water tank; and the heat absorbed is lost.

Instead this hot water (typically between 500C and 600C) can be stored in a separate insulated tank. It can then be re-used in the dyeing/washing process where hot water is required. This in turn would reduce the steam that would otherwise have been required to heat the water, reducing the water as well as the fuel requirement.

This is an example of the water-energy nexus.

To reject or not to reject

A reverse osmosis plant produces permeate and reject water. The permeate is used for drinking, boiler feed water, washing, etc. However, the reject is typically perceived as waste and sent to the drain. Since this reject only possesses high TDS, it can be re-used for purposes where the TDS is not a concern.

In a garment unit, water usage for personnel constitutes about 60% of the water usage. Further, flushing in toilets constitutes about 80% of domestic water usage. Hence, in almost all cases, a garment unit can use the RO reject water for meeting their flushing requirement in the toilets.

In dyeing, printing and washing units: the RO reject water can be used in different ways depending on the TDS and the quality of the water. RO reject water in many cases can be mixed with raw water, which increases the raw water TDS to some extent without affecting the process. In some cases it has been used for screen washing, mixing ETP chemicals and other applications where TDS is not an issue.

3.2.8 Reduced water usage in dyeing

The supplier should take all parameters which involve water usage, energy consumption and chemical consumption into consideration. By maintaining updated information about technology developments in printing/dyeing/chemical and water issues, huge savings can be achieved financially and environmentally.

Suggestions of water saving techniques

- Dye blends of synthetic and natural fibres in same bath by (for example) changing pH.
- Use nip or U-shaft instead of padder.
- Automated dispensing systems and on-line measurement of pick-up in the feeding tanks.
- Cold pad-batch, applicable for cotton.
- Poly-functional reactive dyes/dyestuff with high affinity.
- Biodegradable complexing agents.
- High quality pigments and fixers instead of reactive prints.
- Digital printing.
- Schedule dyeing to avoid extensive cleaning (light colours before dark, etc.).
- Spin-dye/solution dye, applicable for poly ester.
- High temperature (HT)-dyeing, applicable for polyester.

For more information see Appendix 3.

3.2.9 Reduced water usage by optimisation of formulae in wet processes

Water usage can be reduced in wet processes by recording formulae and testing processes through altering certain steps that reduce water, energy and chemical usage but yield the same end result. Examples of such alterations are reduced cycle time, reduction of rinse cycles, reduction of water used in a lot, lower material-to-liquid ratio (MLR).

COMMUNICATION

3.2.10 Access to water withdrawn and usage data

What can be measured can be managed

When a manufacturing unit installed a metering system for its water withdrawal, the data revealed that the unit's water withdrawal was 110 litres per person per operating day which is almost twice the usual figure. The revelation of this fact propelled the unit to look at their water usage more closely. The unit undertook water reduction initiatives such as:

- Reusing boiler condensate
- Reusing ETP discharge for flushing
- Minimizing stray larks at taps.

The meter data was thus a trigger which helped the unit uncover the degree of inefficiency in their system. The initiatives coupled with data monitoring resulted in water withdrawn to drop to 60 litres per person per operating day which is a 45% saving in overall water withdrawn.

The water withdrawn and usage data should be available on site. At this level the data should include both the total water withdrawn and the water used in each sub-process, at least on a monthly basis. The water use should also be compared to some productivity measures.

• In the case of wet-processing units, the measure used to track product output in the factory should be used. Most knitting and laundry units measure output on a per kg basis and hence for them the amount of water per kg should be tracked. Most woven and printing units measure output on a per metre basis and hence for them 'water per metre ' should be tracked.In the case of garment manufacturers, there is significant variation in product output due to the variation in styles and products. However, there is a uniformity in input, i.e. personnel hours; and personnel deployed varies depending on production. Also, to a large extent, water is used by personnel. Hence for garment manufacturers tracking the amount of 'water per person per day' (or amount of water per person per operating hour) should be tracked.

The aim of these measures is to give manufacturers an indicator to see if they are on track or not. These key performance indicators (KPIs) should first be tracked within the facility; and later may be tracked across facilities.

Dark or Light Shades?

Wet-processing of certain shades is usually more water-intensive compared to other shades. Hence measuring the amount of water per kg (or per metre) in a wet-processing unit may not reveal an accurate picture. Manufacturers can get a better picture by tracking production of light and dark shades and, after attaching appropriate weightage, determine an 'Equivalent Wet Production'.

The idea with this concept is to give more weightage to resource-ntensive shades and less weightage to other shades; so that resource consumption per unit of production is more meaningful.

As manufacturers develop their internal capabilities, they should start developing their own metrics using 'Equivalent Wet Production'.

Dyeing of dark shades is more water-intensive. On the same lines, achieving whiteness through washing and finishing is likely to be more chemical- and water-intensive.

Photo: Renée Andersson, Indiska

3.3 Level 3: Achiever

At this level, initiative and personal engagement is the key. Forward thinking enables a Level 3 Achiever to take initiatives that go beyond what is obligated by law. Water efficiency is a part of the business plan and the supplier acts proactively.

GENERAL

3.3.1 Sustainable water withdrawal

The source of the inflowing water and the effects of water withdrawal on the surrounding area and the local community should be known. The factory should conduct a risk assessment of the effects of water withdrawal which can pose physical, regulatory and reputational risks. The risk assessment report should be available on-site. If the impact according to the risk assessment is high, water from alternative sources should be considered. If this is not possible, water-efficient processes and water re-use should be adopted where possible. Water withdrawal levels should be sustainable within the local environmental limits and the water catchment area.

Suggested Approach/ Format

A risk assessment exercise should be carried out as suggested in format 3.The mitigation and contingency plan that is produced from the format should be reviewed on a periodic basis.

EDUCATION

3.3.2 Education on water withdrawal, efficient equipment and process design

All employees should be educated about the environmental and community impact of extensive water withdrawal.

All employees involved in purchasing, engineering and design of equipment or process should be continuously educated on investments in water-efficient equipment, chemicals and production processes. Water-efficient equipment may be more expensive, but the pay-back period is short so in the long-run water and money are saved. The factory should strive to acquire new technical knowledge and implement Best Available Techniques (BAT) in Textile Industry .

PRODUCTION

3.3.3 Annual review and improvements of water efficiency targets

Water efficiency targets should be set based on improvement measures identified for water savings at the unit and their consequent saving potential. These should be reviewed at least on an annual basis to drive continuous improvement. Water use in the dyeing/printing process should be further reduced by using the most efficient dyeing methods and equipment. The supplier should make sure that he/she is up-to-date on the BAT (see Appendix 3 for examples).

3.3.4 Best Available Technique

The suppliers should make sure to have integrated the most updated and best available techniques (described in Chapter 5 in the European Commission reference document (BREF) on the best available techniques for integrated pollution prevention and control in the textile industry).

3.3.5 Reduction of water withdrawal

Leadership should take an active role to identify and invest in solutions to reduce water withdrawal and ensure that water issues are an important item on the agenda. The factory should have an action plan for investments/cost savings for all wet processes.

Examples of measures to reduce water use

- Installation of closed-loop water-cooling systems instead of open-loop systems.
- Re-use of water: It is technically possible to recycle several waste floats. However, re-use of individual floats requires a rather high level of supervision and analysis. Wastewater from some processes is relatively clean, for example water used for rinsing. These flows may be diverted and used again in other processes where the chemical composition of input water is not crucial. Soaking is such a process.
- Water can also be re-used in the same process if all of the process chemicals in the water have not been consumed.
- Actions such as these require that there is an opportunity to lead the water back into the process. In many cases, however, only minor changes in production are needed in order to be able to re-use the water from the processes. Recycling also requires monitoring to ensure that pollution levels and by-products do not accumulate in the water.

COMMUNICATION

3.3.6 Access to water withdrawn and usage data

The water withdrawn and usage data should be available on site. At this level data management should be an implemented part of the business plan. Transparency and dialogue with shareholders, buyers, suppliers and sub-contractors should be a natural part of the process. Annual reduction in water withdrawal should be analysed and shared with buyers, shareholders and sub-contractors.

4 Water pollution prevention

Chemicals can be hazardous for people working in the factory, for those wearing the garments produced, for the environment and for those living downstream of the factory. Saving in the consumption of chemicals/ auxiliaries, water and energy leads to better environmental performance by minimising the amount of solid waste as well as the ecological loads in wastewater and air emissions. It also leads to reduced costs, better relations with neighbours and authorities, and better control of the product. It thus makes it possible to achieve the product requirements of customers while creating an improved work environment. The factory is recommended to have a chemical policy endorsed by the top management and to buy dyes and chemicals from companies who can supply Material Safety Data Sheets (MSDS).

Photo: Jean Scheijen, SXC

The focus of this section of the Guidelines is the prevention of water pollution through chemical management and source control. During the dyeing process, which also includes pre- and after-wash, it is not only water that is used, but also dyestuffs and auxiliary chemicals,such as salts and acids. These are all important factors contributing to the appearance and quality of the textile. However, they also contribute to pollution of the process water.

At the time of writing these guidelines, the global garment industry is implementing a 'Roadmap to Zero' which envisages Zero Discharge of Hazardous Chemicals (ZDHC) by 2020. To achieve this there is a need to identify the prevalence of hazardous chemicals in the process and then set benchmarks for phasing them out.

Till recently, evaluation for hazardous chemicals (HCs) has only been carried out in the final products. In the last couple of years efforts have commenced to identify the occurrence of HCs in the manufacturing process. To that end preventing wastewater pollution is only going to gain prominence.

In addition to the removal of HCs in future, there is already a restriction on certain additional chemicals that should not be used. These are usually described in the form of a Restricted Substances List (RSL) that most buyers provide to their manufacturers In table 4.1 substances restricted in textile production are listed. Their main environmental impacts have also been included. The table can be used when analysing a factory's chemical use and it is required that the supplier meets the minimum level. Most of these chemicals are also restricted in the Detox campaign run by Greenpeace . The ZDHC group has also published a Manufacturing Restricted Substances List (MRSL) which is intended to be a common document to help inform suppliers about restricted substances in their manufacturing processes and products[7].

[5] The Roadmap to Zero Discharge of Hazardous Chemicals (ZDHC) envisages phasing out 11 chemical categories from the manufacturing process. These can be accessed at http://www.roadmaptozero.com/

Table 4.1 Chemical groups restricted in textile processing according to the SIWI Guidelines

1. *MaT= Minimum application Technique*
2. *nd= not detected*
3. *SVHC= Substance of very High Concern*
4. *Prohibited = Should not be used*

Substance	Main envi- ron- mental impact	Minimum level	Improver	Achiever	Recommended substitutes
PROCESSING AGENTS					
Surfactants such as alkylphenol ethoxylates (APEO), linear alkylbenzene sulfonate (LAS), cationic such as dihydrogenated tallow dimethyl ammonium chloride (DHTDMAC)	OXYGEN DEMAND ECOTOX	NO	NO	NO	Non ionic: Fatty alcohol ethoxilates. An ionic: sulphates (e.g. alcohol ethoxysulphates, alkanolamides sulphates, sulphated vegetable oils) _ carboxylates (fatty acid condensation products, alkali salts of fatty acids). cationic: betaine derivatives _ imidazolines _ modified fatty amino ethylate None of the surfactants above should be classified as severe or high environmental hazards according to table 1 and 2
Phthalates (plastizers, lubricants etc)	ECOTOX	NO SVHC	NO	NO	Depending on kind of material and required properties. • Cycloaliphatic (DINCH) • Adipates • Citrates

[6] Greenpeace website: www.greenpeace.org/international/en/campaigns/toxics/water/detox/intro/ (retrieved 30 June 2014).
[7] The Manufacturing Restricted Substances List, 2014, can be downloaded from www.roadmaptozero.com/df.php?file=pdf/MRSL.pdf (retrieved on 18 August 2014)
[8] In order to reduce pick-up, so-called minimum application techniques, (e.g. kiss-roll, spray and foaming application systems) are gaining importance as substitutes for padding systems. In addition, various techniques are available for reducing energy consumption in stenter frames (e.g. mechanical dewatering equipment to reduce water content of the incoming fabric, optimising control of exhaust airflow through the oven, installation of heat recovery systems)". Reference: http://eippcb.jrc.es/reference/BREF/txt_bref_0703.pdf

Substance	Main environ- mental impact	Minimum level	Improver	Achiever	Recommended substitutes
Complexing agents e.g Ethylene Diamine Tetra Acetate (EDTA), o-phosphates, Nitrilo Triacetate (NTA) etc	ECOTOX	No EDTA	No EDTA MAT for NTA	No EDTA MAT for NTA and o-phosphates	For softening and sizing agent removal, use amylases based enzymes. Use of sugar acylate based Sequestering agents which are biodegradable
Chlororganic and aromatic organic solvents	ECOTOX	NO	NO	NO	Water based and if not possible aliphatic solvents
Persistent sizing agents such as Polyvinylalcohol (Pva), polyacrylic (PaC)	OXYGEN DEMAND		MAT	MAT with size recovery	A recovery system that reduce the BOD impact in waste water up to 90%.
aliphatic solvents	ECOTOX		MAT	NO	Water based
Thickeners	OXYGEN DEMAND		NO persistent	NO persistent	Biodegradable natural thickening auxiliaries or highly degradable synthetic thickeners.
Salts	ELEVATED SALINITY IN GROUND WATER ECOTOX		MAT	MAT	Minimize/optimize salt use by adopting low salt / high fixation dyes for cellulosics fibers Use of salt recovery system
Urea	EUTROPHY			MAT	Minimize/ Optimize urea use.
Oils for fibre and yarn preparations (eg lubricants for microfibres) Mineral oils are persistent	OXYGEN DEMAND ECOTOX		NO persistent	NO persistent use MAT	Degradable synthetic oils, or (for integrated mills) vegetable oils without hazardous preserving agents classified as severe or high environmental hazards according to table 1 and 2.
Other Surfactants	ECOTOX		NO persistent	NO persistent use MAT	See surfactants above
SPECIALITY CHEMICALS (PROPERTY LENDING TO MATERIALS)					
Brominated and chlorinated flame retardants	ECOTOX	NO	NO	NO	Non brominated and/or chlorinated flame retardants that are not classified as severe or high environmental hazards according to table 1 and 2.
Colourants (e.g azo dyes)	SEE APPENDIX 4	NO banned aryl amine	No banned aryl amines use MAT		Colorants that are not classified as severe or high environmental hazards according to table 1 and 2.
Chlororganic carriers (e.g chlorobenzenes, chlorophenols, chloronaphtalenes)	ECOTOX	NO	NO	NO	Apply autoclaves that operate above atmospheric pressure. This excludes the use of carriers as dyeing auxiliary chemicals.

Substance	Main envi- ron- mental impact	Minimum level	Improver	Achiever	Recommended substitutes
Chlororganic biocides (triclosan, trichlorocarban, Pentachlorphenol (PCP), Tetrachlorophenols (TeCPs), Trichlorphenols (TriCPs))	ECOTOX	NO	NO	NO	Prevent conditions that are optimal for microbiological growth suc as high humiidy and simultaneously temperature ranges of 25-35 C
Short, medium and long chain chlorinated paraffins	ECOTOX	NO	NO	NO	If applied as plasticisers, Depending on kind of material and required properties. • Cycloaliphatic (DINCH) • Adipates • Citrates I f applied as lubricants use degradable synthetic oils, or (for integrated mills) vegetable oils without hazardous preserving agents classified as severe or high environmental hazards according to table 1 and 2.
Toxic metals (cadmium, lead, chromium vi, tinorganic compounds etc)	ECOTOX	No toxic heavy metals No tinorganic compounds	No toxic heavy metals No tinorganic compounds No Chromium VI	No toxic heavy metals No tinorganic compounds No Chromium VI	Use auxiliary and effect chemicals without hazardous residues classified as severe or high environmental hazards according to table 1 and 2.
Per- and polyflourinated hydrocarbons (perfluorooctane-sulfonic acid (PFOS) & perfluorooctanoic acid (PFOa))	ECOTOX	NO	NO	NO	If only water repellence is required use polydimetylsiloxanes or paraffins without hazardous residues classified as severe or high environmental hazards according to table 1 and 2. Use non FC chemistry chemicals

4.1 Level 1: Minimum level

GENERAL

4.1.1 Compliance with legal requirements

All applicable legal requirements should be followed. The factory should maintain a legal register of all requirements. Depending on which country a manufacturer is located in, these requirements can vary. Areas covered can include storage practices for chemicals, types of chemicals that can be used, and other requirements driven by chemical usage.

4.1.2 Necessary permits available

All necessary permits should be available and up-to-date. These may have to do with chemical/hazardous material storage permits, safety and fire-department permits, hazardous material disposal permits, etc.

EDUCATION

4.1.3 Education about routines for chemical usage

All employees should have appropriate education concerning handling of chemicals and auxiliaries, especially in the case of hazardous substances. The education should include:

- Understanding of the content of the Material Safety Data Sheet (MSDS).
- Awareness of how to use personal protection equipment.
- Emergency plans.

USE AND HANDLING OF PROCESS CHEMICALS

4.1.4 Restricted chemicals should not be used

Chemicals and auxiliaries that are restricted through legislation, voluntary schemes and branch recommendations should not be used.

Buyers also have their requirements, which are shared in the form of a Restricted Substances List (RSL). An RSL identifies the chemicals that a buyer will not permit in their products or in the production process, due to their potential impact on consumers, workers and the environment.

Most manufacturers work with several buyers and so receive several RSLs. These are also updated by buyers from time to time. In order to control RSLs in the production process, a manufacturer-specific RSL should be maintained based on the requirement of all the buyers that the manufacturer is working with.

This activity of preparing and updating the manufacturer-specific RSL should be repeated at least once every six months. This RSL in turn should be circulated by a manufacturer to all its suppliers; and enforced for compliance.

Garment manufacturers develop their RSLs and share them with their wet-processing suppliers. Wet-processing suppliers in turn ought to generate their own RSLs and share them with their chemical vendors.

The best practice with RSLs is to follow the strictest requirements for various chemicals across all buyers and apply this to all products, regardless of the buyer. In cases where some buyers may require certain chemicals which another buyer restricts, the manufacturer will have to decide how to act.

4.1.5 Minimisation of chemicals used

Any kind of surplus of applied chemicals should be avoided. The chemical consumption at the unit should be measured and monitored.

4.1.6 Information about raw materials

The raw material should be delivered from the supplier with information concerning the kind and amount of preparation agents, e.g. sizing agents.

Suggested Approach/ Format

Various lots of fabrics that arrive at the unit and are used there should be recorded and tracked systematically as suggested in format 4. This is particularly useful when faced with dyeing challenges, and also to trace the origin of the raw material if any restricted substances are detected in the final product.

4.1.7 Material Safety Data Sheets (MSDS) available for all chemicals

All chemicals used and stored in the production unit should have an up-to-date MSDS available. The MSDS should be in the local language(s) and readily available to employees. An overview of the format of an MSDS can be found in Appendix 5.

The MSDS) is a specific and detailed description of all the hazardous impacts associated with chemicals. Every MSDS contains 16 different sections which include health, dermal and environmental exposure impact and safety precautions to be taken when exposed or in handling and storage.

It is advisable to ask for an MSDS for each chemical used on the premises and to store a copy of it at the unit. Further, a chart should be made indicating exposure risks and Personal Protection Equipment (PPE) to be used during storage and handling of the chemicals.

4.1.8 Chemical storage and handling

A specific person should be appointed as responsible for chemicals. A register of all chemicals purchased, used and disposed of should be maintained. The chemicals should be properly handled, stored and transported according to the instructions of the MSDS. Special compartments should be used for toxic and explosive chemicals. All chemical containers should be properly labelled with chemical name and appropriate danger symbols to minimise potential risks. Containers should be checked for leakage of chemicals during storage and use. Storage space for chemicals should be located on waterproof ground/floor and in a well-ventilated area.

4.1.9 Use of adequate protection

Appropriate Personal Protection Equipment (PPE) should be used when working with chemicals. PPE includes gloves, safety goggles, masks, aprons and rubber boots, and the use should be based on a risk assessment of the chemical and process in use and the recommendations in the MSDS.

4.1.10 Emergency preparedness and response

Appropriate emergency provision should be in place at the chemicals handling and storage areas. The emergency equipment should be provided according to a risk assessment of the chemical and process and the recommendations in the MSDS. Emergency provision includes spill kit, absorbent or vermiculite, shovel, plastic bags, protective gear, secondary containment, eye wash fountains, etc.

4.1.11 Equipment

Measuring equipment and dispensing devices for chemicals should be calibrated. This ensures proper dosing, which also gives economic advantages. Vapour balancing lines should be used to transfer the displaced vapours from the container being filled to the one being emptied (for larger tanks).

4.1.12 Disposal of chemical waste

Waste chemicals should be collected and disposed of in an environmentally sound manner, in accordance with current legislation and with the information in the MSDS. Sealed and labelled containers should be used for storing surplus chemicals to guarantee that there is no leakage or scattering. Waste or unused chemicals and empty barrels/containers should be returned to the chemical supplier or a re-cycling company or a licensed waste contractor. Chemicals should not be poured into the wastewater stream or environment.

COMMUNICATION

4.1.13 Access to chemical consumption data

Chemical procurement and consumption data should be systematically recorded. This is applicable to dyes andchemicals as well as auxiliaries.

Suggested Approach/ Format

While most manufacturers keep track of chemical purchases, few keep track of chemical usage and the issue of chemicals from stores. Format 5 can be customised by a manufacturer based on the chemicals/dyes/ auxiliaries used. This format is meant to track purchases, issuance and stock, and each chemical is meant to be tracked separately. If a manufacturer is using Enterprise Resource Planning software/store management software, then this would not be required.

ERP software is a suite of applications that can be used by businesses to gather, store, analyze and manage data for decision making. ERP enables organisations to integrate various business processes such as product development, engineering, procurement and sales on one single platform.

4.2 Level 2: Improver

GENERAL

4.2.1 Best Available Technique

The factory should have a plan available, containing clear goals and routines to improve chemical management and efficiency. The factory should have achieved a major part of the European Commission reference document (BREF) on best available techniques for integrated pollution prevention and control in the textiles industry[9].

Registration, Evaluation, Assessment and Restriction of Chemicals (REACH)[10] is a regulation of the European Union (EU) that was adopted to enhance the protection of human health and the environment from the risks that can be posed by chemicals.

Classification, Labelling and Packaging (CLP)[11] is a regulation of the EU that ensures that the hazards posed by chemicals are clearly communicated to end users through clear classification and labelling of chemicals.

USE AND HANDLING OF PROCESS CHEMICALS

4.2.2 Replacement of hazardous chemicals

The factory should have initiated the replacement of hazardous chemicals with better alternatives. Chemicals with a high degree of biodegradation, low human and ecological toxicity, low volatility and low smell intensity should be preferred (see Appendix 6).

4.2.3 Minimisation and optimisation of chemicals used

The diversity and amount of chemicals should be reduced by optimisation of the formulae used in production.

In addition ongoing efforts should be made to ensure that the processes are done right first time (RFT). This requires following a process and formula diligently: Appendix 10 lists a representative process for Right First Time (RFT) in dyeing. RFT however is not only for dyeing and printing, and the principle can be applied for laundries as well.

Wet-processing in the textile industry is a complex procedure with various physico-chemical processes. Since there are many steps, there are a number of parameters in the whole process. Variations in different parameters produce various undesirable results. Right First Time has been devised as a process control mechanism for wet-processing units in the textile industry. It includes checks and balances to monitor and control important parameters like absorbency, whiteness, pH and temperature (at various steps), and the number of chemical additions etc., to name only a few.

To implement the RFT approach, a detailed root cause analysis is done based on formula and lot-wise chemical consumption data to pinpoint problematic areas. Subject Matter Experts (SMEs) are engaged to offer solution/s, and mechanisms are introduced to regularly monitor the problem areas closely.

Training and mind-set change at the factory level also play a key role in successful implementation of RFT.

[9] European Chemical Agency's website, http://echa.europa.eu/web/guest/regulations/reach/
[10] European Chemical Agency's website, http://echa.europa.eu/web/guest/regulations/reach/
[11] European Chemical Agency's website, http://echa.europa.eu/web/guest/regulations/clp/

4.2.4 Chemical handling

Systems for handling of chemicals should be operational.

Incoming dyes, chemicals and auxiliaries should be tested for strength and also to ensure that what has been received matches the requirement. A swatch of standard fabric should be dyed and compared with previous samples.

Suggested Approach/ Format

Format 6 has a suggested approach for tracking and recording the strength of incoming chemicals and dyes.

4.2.5 Equipment

A manufacturing unit should have an internal lab for checking the performance of processed fabric, incoming raw material such as dyes and chemicals, and water.

Suggested Approach/ Format

The use of the following equipment is suggested for quality control of the chemicals being used and how they are applied on the fabric:

Equipment type	Test/Measurement
pH meter	pH
Titration equipment	Hardness of water
TDS meter	TDS of water (raw water, R.O. inlet, R.O. reject, boiler feed water, blow down water)
Beaker dyeing machine	Performance of dyes
Titration equipment	Chemical strength
GSM cutter	GSM
Beaker dyeing machine	Formula generation

4.2.6 Tracking and reduction plan for chemical waste

The factory should keep track of and record the amount of chemical waste generated and set a reduction plan. They should identify the treatment and disposal methods adopted by the waste contractor. Re-use and recycling methods are preferred over incineration and landfilling.

Suggested Approach/ Format

The amount of chemical waste generated should be recorded and tracked systematically. Format 10 can be referred to for this purpose. It is also important to track the mode of disposal for this waste since it also has a cost implication for the units.

COMMUNICATION

4.2.7 Access to chemical consumption data

Key Performance Indicators on chemical usage ought to be developed; which should allow a manufacturer to track how their chemical consumption compares to their output.

4.3 level 3: Achiever

GENERAL

4.3.1 Leading practice

The factory has achieved the requirements described in the European Commission reference document (BREF) on best available techniques for integrated pollution prevention and control in the textiles industry .

USE AND HANDLING OF PROCESS CHEMICALS

4.3.2 Hazardous chemicals continuously replaced

- The factory should perform regular revisions and
- replace harmful chemicals with less harmful ones. The follow-up model for water pollution prevention in Appendix 6 can be used as guidance in this work.
- Allowed sizing agents include starch, starch derivatives, other natural substances and carboxymethylcellulose (CMC). Polyvinylalcohol (PVA) and polyacrylate (PAC) may be used for no more than 25% of the total sizing in combination with natural substances only (calculated for the chemical without water).
- Knitting/weaving oils should not contain heavy metals.

4.3.3 Knowledge of environmental characteristics of the chemicals used

The environmental characteristics of the chemicals used should be known, such as chemical oxygen demand (COD), biological oxygen demand (BOD), aquatic toxicity, degree of biodegradation/ bioelimination, content of nitrogen, phosphorous, sulphur, adsorbable organic halides (AOX) compounds, kind and amount of volatile compounds, emission factors, health and safety aspects. See table 4.1 and appendix 6.

4.3.4 Knowledge of raw materials

The raw materials should have information from the supplier concerning the kind and amount of residual monomer and the solvent content of the polymers used.

4.3.5 Plan for reduction of hazardous waste

The facility should have a hazardous waste management plan. At a minimum, the following information should be included: roles/responsibilities, hazardous waste handling and storage practices, emergency preparedness and response, training plan, inspection and maintenance records, classification and tracking of hazardous waste.

4.3.6 Equipment

Automated dosing systems should preferably be used for dosing and dispensing without spilling. These should be used with, for example, carboxylic acids, sodium hydroxide, caustic soda and bleaching agents, such as sodium hypochlorite and potassium permanganate etc.

Suitable application devices to optimise chemical use at the finishing stage should be used to prevent airborne emissions (modern spray guns including photo-electrical control, roller coating etc).

COMMUNICATION

4.3.7 Disclosure t

Units should publicly disclose data about the amount of discharge of hazardous chemicals from their facilities.

For this purpose, a pollutant release and transfer register (PRTR)[13] should be adopted by units. This will help them quantify and report the amounts of substances released to various environmental media.

5 Wastewater

Photo: Renée Andersson, Indiska

The textile industry is very water-intensive, which results in large amounts of wastewater being produced. The cost of wastewater treatment depends on the amount of water discharged. To purify water in wastewater treatment plants is expensive, and better management of wastewater can reduce costs since the purification steps may work better. To ensure efficient treatment, "end-of-pipe" solutions need to be combined with cleaner production and efficient water use. Treating water is always a cost while improving the process is an investment that can bring economic benefits over time. An advanced approach to effluent management is to aim at zero liquid discharge, or water recycling. If the treated effluent is clean enough to use in factory processing then it should not be discharged. This can reduce the cost of waste management, reduce water extraction costs and protect the local environment.

The aim of this section of the Guidelines is to explain how to achieve efficient wastewater treatment. Textile wastewater is usually very complex. It is typically alkaline (high pH) and has high COD and BOD. There are many different methods to purify wastewater from textile industries. The process that is best suited for the factory depends on the fibres and chemicals used and there is no single series of treatment methods that can be used for all types of wastewater from textile factories. Sludge is an inevitable by-product in most wastewater treatment processes, but the amount of sludge produced depends on the type of treatment used. Proper sludge disposal is very important.

The wastewater from the factory can be treated in an effluent treatment plant (ETP) on-site or off-site.

On-site ETPs are owned by the factory and located in direct connection to the factory. "Off-site ETP" is an umbrella term for common effluent treatment plants (CETP), municipal wastewater treatment plants, and publicly or privately owned treatment plants. The focus of these Guidelines is on-site ETPs and ETPs co-owned by the factory, but some basic requirements regarding discharge to off-site ETPs can be found below.

Off-site ETP

Even when treatment takes place in an off-site ETP and not in connection to the production, an initial mechanical treatment can be done on site to protect the mechanisms of the off-site ETP. In this treatment solid particles can be separated from the wastewater through screening and sedimentation. Factories that discharge industrial wastewater to an off-site ETP should at least follow the requirements listed below:

Level 1: Minimum level

- Have a current and valid permit to discharge wastewater to the off-site ETP from all applicable governing agencies.
- Comply with all off-site ETP permit requirements.
- Request and receive documentation of the off-site ETP's compliance with local, state, provincial or
- federal discharge regulations.
- Provide the name and address of the off-site ETP and arrange a visit if requested.
- Measure and document the volume of discharged wastewater.
- Make sure that the capacity of the off-site ETP covers the needs of the factory.

5.1 Level 1: Minimum level

GENERAL

5.1.1 Compliance with legal requirements

All applicable legal requirements should be followed. The factory should maintain a legal register.

Suggested Approach/ Format

A file that has all the requirements for compliance purposes should be maintained and kept up-to-date as required by the compliance parameters, especially on disposal of water. This should include the quality of the effluent permitted by the local authorities.

Copies of tests on wastewater and sludge that have been conducted in the past should be included in this register.

5.1.2 Necessary permits available

All necessary permits should be available and up-to-date.

5.1.3 Knowledge of discharge point for treated wastewater

Knowledge of the discharge point for the treated wastewater is important. It should be known which recipient receives the treated wastewater (for instance lake, river, sea or wetland) and which water users are reliant on that recipient. This knowledge contributes to a higher awareness of the impact of the factory's wastewater discharge on the local environment and community.

EDUCATION

5.1.4 Basic knowledge on operation of the ETP

The performance of the ETP depends not only on the design of the treatment process, but also on its operation and maintenance. To ensure that the ETP is run properly, the operators need to be technically competent and well-trained. The employees operating the ETP should:

- Have basic knowledge of the water flow in the factory and of the function of the different wastewater treatment steps.
- Have a relevant education and appropriate competence to make basic measurements to ensure the consistent quality of the treated water.
- Be competent to take representative samples. The sampling point and how the samples are taken are essential to obtain correct results.

Suggested Approach/ Format

Format 7 which tracks ETP maintenance should be maintained and updated once a day by the ETP operator. This would ensure preventative maintenance is occurring.

WATER

5.1.5 Connection to ETP

The factory should be connected to an ETP, which should be running continuously when the factory's wet processes are running. A flowchart indicating the water flow through the dyeing process and the ETP should exist. A wastewater emergency plan should also be available to be used in the event of a wastewater treatment plant breakdown.

5.1.6 Sufficient capacity of the ETP

The capacity of the ETP and the amount of water used in the factory should be known. Even during the peak season, the production should not exceed the capacity of the ETP or its permits and licences . The amount of wastewater should be measured daily and records kept on site. .The factory should not install piping that allows process water to bypass wastewater treatment.

5.1.7 External control

The treated wastewater should be analysed by an external laboratory as required by law. The results should not exceed legal discharge limits and should be kept on site.

If guidance from legislation is missing, at least pH, biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total dissolved solids (TDS) and temperature should be analysed by a third party on at least a quarterly basis. The third party should collect the samples at least at point 1 and 7, shown in Appendix 8. The test results should not exceed the discharge limits stated in Appendix 7. In addition to the results, the test report should include information on the test method, detection limit and lab contact info and should be kept on site in the legal register mentioned above.

5.1.8 Basic in-house analysis of the treated wastewater

At least pH, TDS, colour and temperature should be analysed on site daily. The sampling points should be at least at point 1 and 7, shown in Appendix 8, and the records should be kept on site.

5.1.9 Quality of the treated wastewater

The quality of the treated wastewater should comply with the legal requirements.

SLUDGE

5.1.10 Knowledge of the quantities of obtained sludge

The amount of sludge obtained should be measured weekly.

Suggested Approach/ Format

- Format 10 should be filled out to track the sludge quantity and its disposal

5.1.11 Sludge management

The legal requirements on sludge management and disposal should be followed. Sludge temporarily stored on-site should be tightly wrapped and be placed on a cast concrete foundation with a protecting roof.

COMMUNICATION

5.1.12 Access to water and sludge data

The water and sludge quality and quantity data should be available on -site. At this level the data should include the parameters specified by law. The monitoring data of water, sludge quality and quantity should be retained for at least 24-36 months. The composition of sludge should be regularly tested in order to check and track its toxicity.

Suggested Approach/ Format

- Format 8 should be filled out by the operator whenever dosing is carried out and for recording the quantity and quality of sludge generated
- Format 9 should be filled out to track the performance of the ETP once a day.

5.2 Level 2: Improver

GENERAL

5.2.1 Knowledge about the effects of wastewater discharge

The focus of the plant should be broadened to consider how the site influences and interacts with the local environment. The impact on the recipient that receives the discharged wastewater should be evaluated. If the results indicate that the impact is unsustainable, additional water pollution prevention and wastewater treatment measures should be employed. Knowledge of the toxicity of the pollutants in the wastewater is important. The impacts of wastewater on ecosystems and communities should be analysed.

WATER

5.2.2 Optimised wastewater treatment

The efficiency of the existing ETP should be evaluated and the treatment processes optimised to achieve the best possible treatment of the wastewater.

5.2.3 Regular monitoring of the treatment process

At least parameters such as pH, TDS, colour and temperature should be analysed on a daily basis. Additional parameters such as BOD, COD, TSS and heavy metals should be monitored monthly . The factory should also attempt to extend the analyses to include the parameters in Appendix 7. Samples should be primarily taken at the inlet and outlet of the ETP in order to evaluate the removal efficiency of the treatment process. Once a year samples could also be taken at all stages of the wastewater treatment process in order to evaluate the efficiency of individual steps (see Appendix 8). For each month the average, minimum and maximum values should be documented.

5.2.4 In-house laboratory

The factory is recommended to analyse the wastewater in a well-equipped in-house laboratory. The routines mentioned below should be followed:

- The wastewater samples should be taken and stored properly. Recommendations can be found in Appendix 9.
- The in-house lab should identify and mark the samples properly.
- Proper testing procedures and standard methods should be used. The standard methods are listed in Appendix 9.
- The in-house lab should have adequate equipment and calibrate it regularly according to the instructions provided with the equipment.
- Test reports including corrective actions should be maintained.

5.2.5 High quality of treated wastewater

The factory should strive to obtain a quality of the treated water beyond the requirements of national legislation. They should also have an action plan and be working towards further improvement of the water quality. The wastewater quality targets should be reviewed on an annual basis to drive continuous improvement.

5.2.6 Action plan for re-use of treated wastewater

The supplier should have analysed the potential for re-using the wastewater after treatment and have an action plan for implementation of methods for wastewater re-use.

If there are opportunities for recycling/re-using water within the premises they should be carried out. Some examples of these are:

1. Re-using the RO reject water or water processed by the ETP for flushing
2. Re-using the water processed by the ETP for screen washing

SLUDGE

5.2.7 Reduced sludge quantity

The wastewater treatment processes should be run in an optimal way to reduce the amount of sludge produced, without compromising the quality of the treated water. If for instance precipitation is used, the chemical dosage should be optimised according to pollutant levels.

5.2.8 Physico-chemical analysis of sludge quality

The physico-chemical properties of the sludge should be analysed regularly. The analysis should, at minimum, include: dry matter, metal and nutrient content. Appropriate routines for self-monitoring and deviation management for sludge quality should exist.

5.2.9 Sludge management

The sludge should be disposed of in a proper way, such as being taken to an approved landfill or incineration plant or being accepted by a company/agency/authority licensed to handle sludge. The sludge should be sufficiently dewatered for the current management method.

COMMUNICATION

5.2.10 Access to water and sludge quality data

All in-house test reports and external test reports should be saved and be available for review on-site. At this level the data should cover all the parameters specified by law and the following parameters: pH, BOD, COD, TSS, TDS, colour, temperature and heavy metals. The factory should also try to include the parameters in Appendix 7.

5.3 Level 3: Achiever

GENERAL

5.3.1 Sustainable wastewater discharge

Water pollution prevention and wastewater treatment measures should have been implemented so that the wastewater discharge to the recipient can be considered sustainable. This means that the recipient should remain fit for the purpose of downstream water uses (for instance drinking water, irrigation or swimming).

EDUCATION

5.3.2 Continuous education on operation of the ETP

The operators should receive regular certified education to continuously improve the wastewater treatment efficiency and sludge management. They should also be updated on best environmental practice (BEP) .

WATER

Treatment methods considered to be best practice should be used at the ETP. Separation of the wastewater streams from the different process steps could also improve treatment efficiency. Separation of highly polluted water from relatively clean water results in more effective treatment since it is possible to use optimal treatment methods instead of using one method to treat a mixture of wastewater with different characteristics. The clean streams can then be re-used with little or no treatment. This leads to economic benefits since both wastewater treatment cost and water withdrawn are reduced. This separation should also include rainwater.

5.3.4 Regular monitoring of wastewater at all stages of the treatment process

The factory should identify all the potential pollutants (arising from usage of chemicals/dyes in the unit's processes) that could be found in the wastewater streams, besides generic parameters listed under Level 2. The unit should conduct regular monitoring of the wastewater quality at all the stages of the treatment process to assess consistent quality of effluent water, and also during production peaks. The quality of the treated wastewater should exceed legal requirements and it should be clean enough to be re-used within the factory.

5.3.5 Salt separation and re-use: recycling water and aiming for Zero Liquid Discharge

Technologies for separation of salt should be in use. Separation of salt is a prerequisite for water re-use.

The salt should also be re-used within the process to as high an extent as possible.

Water that is recovered should be re-used in the process and the aim should be to strive for Zero Liquid Discharge. Progressive manufacturers have been able to realise recycling rates of over 90% and not emit any liquid discharge.

5.3.6 Annual review of wastewater quality and volume targets

Wastewater quality and volume improvement targets should be reviewed on an annual basis to drive continuous improvement. The factory should treat the wastewater and aim to re-use it in the process to achieve zero liquid discharge.

SLUDGE

5.3.7 Minimised sludge quantity

The quantities of sludge obtained should be minimised by using wastewater treatment technologies with low sludge production. The amount of sludge produced depends on the type of treatment used. Experts should be consulted on the temporary storage and management of sludge produced.

5.3.8 Physico-chemical analysis of sludge 10

In addition to regular physico-chemical analysis of the sludge, ecotoxicological tests should also be conducted. Ecotoxicological analyses should be conducted to confirm that the properties of the sludge are non-hazardous. The properties of the sludge are dependent on the chemicals used in the process: the use of less hazardous chemicals results in less hazardous sludge. The metal content of the sludge should also have been minimised by replacing chemicals with metal-free alternatives where possible. External physico-chemical and ecotoxicological analysis of sludge quality should be done at least twice a year and include analysis of dry matter, metal and nutrient content.

Photo: Renée Andersson, Indiska

[14] Guidelines on best available techniques and provisional guidance on best environmental practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: http://chm.pops.int/Portals/0/Repository/batbep_guideline08/UNEP-POPS-BATBEP- GUIDE-08-15.English.PDF (retrieved 30 June 2014).

COMMUNICATION

5.3.9 Access to water and sludge data

All in-house and external test reports should be saved and be available for review onsite. The external test reports should also be saved and sent to customers upon request together with a summary of the in-house test results for the last six months.

5.3.10 Disclosure of data on waste water discharge

Units should publicly disclose data on the quantity and quality of wastewater water discharged from their facilities. This will help show the units' intention to be transparent and their willingness to improve external stakeholder engagement.

Photo: Renée Andersson, Indiska

Appendix 1

Value of water at different stages in dyeing and printing units: The relationship between water, energy and chemicals

[15] Source: cKinetics data from Dyeing and Printing units in India.

Appendix 2

Interface with other guidelines

Textile brands and manufacturers are engaged with a number of other initiatives that also touch upon water. That is usually a part of broader environmental and social requirement that need to be met.

The STWI guidelines are designed to support and interface with other initiatives. They are meant to drive water sustainability, by leading the thinking related to water management and the risk arising tzherefrom, with a specific focus on textiles.

Subsequent versions of the STWI guidelines will seek to provide equivalence and harmonization amongst other water-related actions of global initiatives.

Industry Initiative/ Standard adopted	What it does	Water-related linkage and interfacing with STWI guidelines
Global Social Compliance Program (GSCP)	The GSCP, launched towards the end of 2006, is a business-driven programme for the continuous improvement of working and environmental conditions in global supply chains. The GSCP was created by and for global buying companies wanting to work collaboratively on improving the sustainability (social and environmental) of their often-shared supply base. The GSCP provides a global cross-industry platform to promote the exchange of knowledge and best practices in order to build comparability and transparency between existing social compliance and environmental compliance systems.	GSCP Environmental Implementation Guidelines cover water management and place specific emphasis on reduction of water consumption, wastewater generation, pollution prevention and prevention of groundwater contamination. The STWI guidelines support the implementation of the GSCP for the textile sector: providing specifics on 'how' the reduction can be achieved in water, pollution and wastewater.

Industry Initiative/ Standard adopted	What it does	Water-related linkage and interfacing with STWI guidelines
Sustainable Apparel Coalition (SAC)	SAC was conceived in 2009, by leading apparel and footwear retailers seeking to address social and environmental challenges across the value chain. In order to track the outcomes of the actions at a facility level as well as at a product level. The SAC launched the Higg Index, an 'indicator'-based tool that enables companies to evaluate material types, products, facilities and processes based on a range of environmental and social practices and product design choices. Higg Index V2.0 was released in December 2013. It is a comprehensive online system that includes indicators and metrics which incorporate social and labour indicators.	Water-related aspects are a part of the Environmental section of the Higg Index Facility Module and a part of the Environment section (Manufacturing sub-section) of the Brand Module. Some of SAC's desired outcomes are: • Improving water efficiency and re-use • Minimisation of wastewater discharge, • Minimisation of usage of chemicals. • Reducing water used for washing • Continuous engagement with manufacturers The present STWI guidelines provide guidance on how the above can be achieved along with key performance indicators relevant to different kinds of manufacturing facilities. This also helps feed into brand-level reporting.
Better Cotton Initiative (BCI)	BCI is a voluntary programme that aims to establish global principles and criteria for cotton growers and retailers. It is intended to be applied through regionally specific implementation strategies and tools and is complementary to Certified Organic and Fairtrade cotton. The BCI standard calls for phasing out Class I pesticides, ensuring water extraction doesn't have adverse effects on groundwater and water bodies, using production practices that minimize erosion, and protecting drinking water sources and other bodies of water from farm runoff. In 2013, the Better Cotton Tracer was launched which is an online tracking system for members to record all transactions of better cotton across the supply chain. The aim of the initiative is to capture 30% of global cotton production by 2020.	The emphasis is on farmers and water features as a core production principle in the standards.

Industry Initiative/ Standard adopted	What it does	Water-related linkage and interfacing with STWI guidelines
CEO Water Mandate	The CEO Water Mandate is a unique public-private initiative designed to assist companies in the development, implementation and disclosure of water sustainability policies and practices. Endorsing CEOs acknowledge that in order to operate in a more sustainable manner, and contribute to the vision of the UN Global Compact, they have a responsibility to make water resources management a priority, and to work with governments, UN agencies, non-governmental organizations and other stakeholders to address the global water challenge. The CEO Water Mandate covers six elements: Direct Operations; Supply Chain and Watershed Management; Collective Action; Public Policy; Community Engagement; and Transparency.	The emphasis is on water accounting. The Mandate further touches upon reduction of water consumption by setting targets, exploring latest technology, capacity-building across the supply chain, active contribution to formulation of government policies, education and awareness with local stakeholders and transparent communication of water data and issues. The present STWI guidelines helps signatories of the CEO Water Mandate (brands as well as manufacturers) by enabling action on water related goals set.
Apparel and Footwear International RSL Management Working Group (AFIRM)	AFIRM is a recognized global centre of excellence, providing resources for sustainable, self-governing Restricted Substances List (RSL) implementation across the apparel and footwear supply chain. The supply chain has knowledge about RSL and chemical safety, assuring that consumers and workers are safer from the impact of harmful substances and that the environment is cleaner. The main purpose of AFIRM is to provide a forum to advance the global management of restricted substances in apparel and footwear, communicate information about RSL to the supply chain, discuss concerns, and exchange ideas for improving RSL management, to ultimately elevate consumer satisfaction.	Through the focus on Restricted Substances, AFIRM recognizes the linkage between chemicals and water and consequently details the process water requirement for various chemicals and the impacts on water arising from the usage of chemicals during manufacturing of textiles and leather. The part of the STWI guidelines related to water pollution prevention (chapter 4) and wastewater (chapter 5) overlap with the AFIRM toolkit for suppliers.

Industry Initiative/ Standard adopted	What it does	Water-related linkage and interfacing with STWI guidelines
Social Accountability (SA 8000)	Social Accountability International (SAI) is a non-governmental, multi-stakeholder organization whose mission is to advance the human rights of workers around the world. SAI works to protect the integrity of workers around the world by building local capacity and developing systems of accountability through socially responsible standards. SAI established one of the world's preeminent social standards—the SA8000 standard for decent work, a tool for implementing international labour standards.	Water is not a focus. However SAI requires documentation of chemicals (especially hazardous), and encourages the replacement of harmful chemicals and awareness of health hazards arising from chemicals. This goal is supported by the STWI guidelines.
ISO 26000 Guidance on Social Responsibility	ISO 26000 provides guidance on how businesses and organisations can operate in a socially responsible way. This means acting in an ethical and transparent way that contributes to the health and welfare of society. It provides guidance rather than requirements, so it cannot provide certification, , unlike some other well-known ISO standards. Instead, it helps clarify what social responsibility is, helps businesses and organisations translate principles into effective actions and shares best practices relating to social responsibility globally. It is aimed at all types of organisation regardless of their activity, size or location.	ISO 26000 provides guidance but does not specify requirements. It has a core section on the environment, which touches on issues like pollution, sustainable resource use, climate change and protection of the environment. The STWI guidelines specify requirements on how the water-related guidance listed above can be met in the textile supply chain.

Industry Initiative/ Standard adopted	What it does	Water-related linkage and interfacing with STWI guidelines
ISO 14000 (Environmental Management)	The ISO 14000 family addresses various aspects of environmental management. It provides practical tools for companies and organisations looking to identify and control their environmental impact and constantly improve their environmental performance. ISO 14001:2004 and ISO 14004:2004 focus on environmental management systems. The other standards in the family focus on specific environmental aspects such as life cycle analysis, communication and auditing.	The STWI guidelines provide outlines for formats and systems to track water, chemicals and wastewater for the textile sector. They form prerequisites for organisations looking to set up firm-wide an Environmental Management System as listed in ISO 140001 and 14004.
CDP Water Disclosure	CDP's water questionnaire provides investors with access to material data, consistently reported, on assessment and actions that lead to more responsible use of freshwater resources. Importantly, companies' participation in CDP's water programme will help ensure the right to water for current and future generations.	For companies looking to report into CDP Water Disclosure – both for themselves and for their supply-chain -the STWI guidelines provide facility-level information that can be used to build a firm-wide view.

Appendix 3

Water efficient techniques

Dye blends of synthetic and natural fibres in same bath (for example by changing pH)
Optimise the process for dyeing blends of synthetic and natural fibres instead of using a two-bath dyeing system. For example, the same bath can be used by changing the pH.

Use nip or U-shaft instead of padder
The padder can be exchanged to minimise water usage. If it is changed to a nip or a U-shaft as an application for the dyeing liquor much less water is needed per batch.

Automated dispensing systems and on-line measurement of pick-up in the feeding tanks
Residual dyestuff can be minmised by installing automated dispensing systems together with on-line measurements of pick-up in the feeding tank. In addition to this, many new systems operate with minimised flow of rinsing water.

Cold pad-batch, applicable for cotton
Cold pad-batch is a dyeing method where dyes are embedded in the fabric using a padder. The fabric is then stored to allow complete reaction between the fabric and chemicals prior to rinse. Cold pad-batch means that the textile is rolled up on a rotating beam and left at room temperature for 8-24 hours.

Polyfunctional-reactive dyes/dyestuff with high affinity
Use of dyestuff with high affinity is beneficial because the fabric subsequently requires much less rinsing.
Bi-reactive dyes have a higher fixation to the fibre (up to 90% fixation), which makes them very cost-efficient even if they are more expensive to buy. Because more dye adheres to the fibre, less dye should need to be treated in the wastewater treatment plant.

Biodegradable complexing agents

Since only small amounts of the dyestuff affinate and much of the dye ends up in the wastewater, using biodegradable complexing agents for both pretreatment and dyeing is essential. These should be continuously updated to ensure that the safest and most effective chemicals are used. Ecologically optimised products have been developed for use in both continuous and discontinuous processes.

High quality pigments and binders instead of reactive prints

When printing, high quality pigments and binders are good alternatives to reactive prints. Pigment print requires less water than reactive print. Can be used when applicable.

Schedule the dyeing to avoid extensive cleaning (light colours before dark etc.)

Planning can save both time and money. If colours are scheduled more efficiently the requirements for extensive cleaning between dye baths can be reduced. For example, light colours can be dyed before dark colours, and multiple batches of light colours can be dyed together before dark colours are dyed.

Spin-dye/solution dye, applicable for polyester

The largest water saving for polyester can be achieved through spin-dyeing (solution dye). The fibre is dyed already during spinning, eliminating the dyeing processes completely. The colour tone is always constant for each lot of fabric. The disadvantage is the high minimum of each colour that gives a limited amount of colours to choose from. The process is advantageous when large quantities of the same colour of polyester are required. This technique saves water, time and energy. However, the technique only works on 100% polyester fabrics.

High temperature dyeing (HT-dyeing), applicable for polyester

In HT-dyeing of polyester the wastewater and off-gas is carrier-free, which reduces the amount of harmful substances.

Appendix 4

Colourants chart – processing conditions, use and impact

Colourant class	Sub-class	Textile & leather material applied	degree of fixation (%)	Main environmental impact	alerts, where legislation applies
disperse		PeS Ca PaC Pa	88-99	Carriers, reductive after	allergenic dyestuffs
				treatment (sulphur compounds)	Carcinogenic dye stuffs
Basic					Banned arylamines
(cationic)		PaC Pa, le	96-100	rnary ammonium compounds)	
acid	Standard,	Pa Si WO, le	85-98	Heavy metal content	Carcinogenic dyestuffs
	1:1 metal			in dyestuffs	Banned arylamines
	complex &		82-98		
	1:2 metal		(metal		
	complex		complex)		
Mordant		WO, le	95-98	Chrome vi	
reactive		Si WO Cell, le	55-97	Partially low fixation degree, aOx	allergenic dyestuffs
				source, low adsorption tend-	Carcinogenic dye stuffs
				ency of dyestuff hydrolysates	

Colourant class	Sub-class	Textile & leather material applied	degree of fixation (%)	Main environmental impact	alerts, where legislation applies
				in activated sludge treatment,	
				high amount of salts (sodium	
				chloride, sodium sulfate)	
direct		Pa Si WO Cell	64-96	Salt, after treatment with water	Carcinogenic dyestuffs
				toxic cationic	Banned arylamines
				Agents	
vat	Standard,	Cell	75-95	reducing agents (sulphur	
	leuco vat			compounds), partially halogen	
	ester			containing oxidizing agents	
Sulphur		Ca, Cell	60-95	Sulphur containing dyestuffs	
				and reducing agents, partially	
				halogen containing oxidizing	
				Agents	
azoic		PeS, Cell	See reactive	See reactive	Banned arylamines
(naphtol)					
Pigment	PeS Ca	100	residues		Banned arylamines

Colourant class	Sub-class	Textile & leather material applied	degree of fixation (%)	Main environmental impact	alerts, where legislation applies
	PaC Pa Si		from printing		
	WO Cell. le		process e.g		
			binders,		
			vOC etc		

Note: AOX: Adsorbable Organic Halides, PES : polyester, CA: cellulosic acetate, PAC: Polyacrylic, PA : Polyamide, Si : Silk, WO: Wool, Cell: Cel- lulosic fibres (cotton, viscose, hamp, flux etc), LE: Leather, VOC: Volatile Organic Carbon

Impurity content of metals according to The Ecological and Toxicological Association of Dyes and Organic Pigments Manufacturers (ETAD) (www.etad.com).

Appendix 5

Material Safety data Sheet (MSDS) format

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: SYNONYMS: PRODUCT CODES:

MANUFACTURER: DIVISION: ADDRESS:

EMERGENCY PHONE: CHEMTREC PHONE: OTHER CALLS:
FAX PHONE:

CHEMICAL NAME: CHEMICAL FAMILY: CHEMICAL FORMULA:

PRODUCT USE: PREPARED BY:

SECTION 1 NOTES:

SECTION 2: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: ROUTES OF ENTRY: POTENTIAL HEALTH EFFECTS
EYES:

SKIN: INGESTION: INHALATION:
ACUTE HEALTH HAZARDS: CHRONIC HEALTH HAZARDS:
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:

CARCINOGENICITY
OSHA: ACGIH: NTP: IARC:
OTHER:

SECTION 2 NOTES:

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT:

CAS NO. % WT % VOL SARA 313 REPORTABLE
ppm mg/m3
OSHA PEL-TWA:
OSHA PEL STEL :
OSHA PEL CEILING:

ACGIH TLV-TWA: ACGIH TLV STEL: ACGIH TLV CEILING:

SECTION 3 NOTES:

SECTION 4: FIRST AID MEASURES

EYES:
SKIN:
INGESTION:
INHALATION:
NOTES TO PHYSICIANS OR FIRST AID PROVIDERS:
SECTION 4 NOTES:

SECTION 5: FIRE-FIGHTING MEASURES

FLAMMABLE LIMITS IN AIR, UPPER:
(% BY VOLUME) LOWER:

FLASH POINT:
F:
C:
METHOD USED:

AUTOIGNITION TEMPERATURE:
F:
C:

NFPA HAZARD CLASSIFICATION
HEALTH:
FLAMMABILITY:
REACTIVITY:
OTHER:

HMIS HAZARD CLASSIFICATION
HEALTH:
FLAMMABILITY:
REACTIVITY:
PROTECTION:
EXTINGUISHING MEDIA:

SPECIAL FIRE FIGHTING PROCEDURES:

UNUSUAL FIRE AND EXPLOSION HAZARDS:
HAZARDOUS DECOMPOSITION PRODUCTS:
SECTION 5 NOTES:

SECTION 6: ACCIDENTAL RELEASE MEASURES

ACCIDENTAL RELEASE MEASURES:

SECTION 6 NOTES:

SECTION 7: HANDLING AND STORAGE

HANDLING AND STORAGE:
OTHER PRECAUTIONS:

SECTION 7 NOTES:

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:
VENTILATION :
RESPIRATORY PROTECTION:
EYE PROTECTION:
SKIN PROTECTION:

OTHER PROTECTIVE CLOTHING OR EQUIPMENT:
WORK HYGIENIC PRACTICES:
EXPOSURE GUIDELINES:

SECTION 8 NOTES:

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:
ODOUR:
PHYSICAL STATE:

pH AS SUPPLIED:
pH (Other):
BOILING POINT:
F:
C:
MELTING POINT:
F:
C:

FREEZING POINT:
F:
C:
VAPOUR PRESSURE (mmHg):
@
F:
C:
VAPOUR DENSITY (AIR = 1):
@
F:
C:
SPECIFIC GRAVITY (H_2O = 1):
@
F:
C:
EVAPORATION RATE:

BASIS (=1):
SOLUBILITY IN WATER:
PERCENT SOLIDS BY WEIGHT:
PERCENT VOLATILE:
BY WT/ BY VOL @
F:
C:
VOLATILE ORGANIC COMPOUNDS (VOC):

WITH WATER: LBS/GAL
WITHOUT WATER: LBS/GAL
MOLECULAR WEIGHT:
VISCOSITY:
@
F:
C:

SECTION 9 NOTES:

SECTION 10: STABILITY AND REACTIVITY

STABLE UNSTABLE

STABILITY:

CONDITIONS TO AVOID (STABILITY):
INCOMPATIBILITY (MATERIAL TO AVOID):
HAZARDOUS DECOMPOSITION OR BY-PRODUCTS:
HAZARDOUS POLYMERISATION:
CONDITIONS TO AVOID (POLYMERISATION):
SECTION 10 NOTES:

SECTION 11: TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION:

SECTION 11 NOTES:

SECTION 12: ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION:

SECTION 12 NOTES:

SECTION 13: DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD:
RCRA HAZARD CLASS:

SECTION 13 NOTES:

SECTION 14: TRANSPORT INFORMATION

US DEPARTMENT OF TRANSPORTATION
PROPER SHIPPING NAME:
HAZARD CLASS:
ID NUMBER:
PACKING GROUP:
LABEL STATEMENT:

WATER TRANSPORTATION
PROPER SHIPPING NAME:
HAZARD CLASS:
ID NUMBER:
PACKING GROUP:
LABEL STATEMENTS:

AIR TRANSPORTATION
PROPER SHIPPING NAME:
HAZARD CLASS:
ID NUMBER:
PACKING GROUP:
LABEL STATEMENTS:

OTHER AGENCIES:

SECTION 14 NOTES:

SECTION 15: REGULATORY INFORMATION

US FEDERAL REGULATIONS
TSCA (TOXIC SUBSTANCE CONTROL ACT):
CERCLA (COMPREHENSIVE RESPONSE COMPENSATION, AND LIABILITY ACT):
SARA TITLE III (SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT):
311/312 HAZARD CATEGORIES:

313 REPORTABLE INGREDIENTS: STATE REGULATIONS: INTERNATIONAL REGULATIONS:
SECTION 15 NOTES:

SECTION 16: OTHER INFORMATION

OTHER INFORMATION:
PREPARATION INFORMATION:
DISCLAIMER:

Appendix 6

Follow-up model for water pollution prevention

The follow-up model is applicable mainly for textile factories at Achiever Level. The model is described in four steps:

1. Inventory, using an inventory table, is carried out on site by internal or external employees.
2. Assessment, based on the scoring model in the table below, of the magnitude of the chemical load in effluent water is carried out by internal or external employees.
3. Classification, where the rating of producers is done by the textile retailer. This rating is based on the results from the assessment step.
4. Applicable BAT/BEP measures are taken by the textile retailer in communication with the producers concerned.

Scoring model for water pollution prevention

This model is to be used by tanneries in the replacement and assessment of new and existing chemicals. The model applies to chemical preparations used in the tannery where B. Biodegradation, C. Bioaccumulation and D. Toxicity data are obtained from the comprehensive MSDS enclosed by the chemical supplier.

Chemical properties in effluent water	Promote	Avoid	Reject
A. Discharged amount of substance - [kg/year]	< 50	50-5000	> 5000
B. Biodegradability			
– Surface water [%]	> 60	10 - 60	< 10

Chemical properties in effluent water	Promote	Avoid	Reject
– Sludge culture [%]	> 70	20 - 70	< 20
– BOd/COd [ratio]	> 0,5		< or = 0,5
C. Bioaccumulation			
(not applicable for M>1000 g/mol)			
- Bioconcentration factor [BCF]	< 100		> 100
- Pow data	< 1000		> or = 1000
- Water solubility [g/litre]	>100	0,02-100	< 0,02
d. Effect of concentration divided by effluent concentration (toxicity)	>100	10-1000	<10

How to apply the scoring model with data from a MSDS (appendix 5) – example 1:

Discharged amount of substance
A producer consumes more than 5,000 kg of substance X per year ◎ score > 5,000

Biodegradability
Biodegradability data can be found in the MSDS, section 12. It can be expressed in at least three different ways as described in the scoring model.
For instance if BOD5 = 30 mg/l and COD = 200 mg/l then the scoring is BOD5/COD = 30/200 = 0.15.

Bioaccumulation
If bioaccumulation is expressed as Pow, which is the ratio of substance X's concentration in octanol and water,if substance X's concentration is higher in octanol than in water the substance is considered as "fat" and consequently bioaccumulative. If Pow is > 1,000 then substance X is bioaccumulative and scored thereafter in the scoring model.

Effluent ecotoxicity
Effluent ecotoxicity can be found in the MSDS, section 12. It can for instance be described as EC (chronic), LC50 etc. The ecotoxicity value in MSDS section 12 is divided by the substance discharge amount,e.g. LC50 = 500. In this example the scoring is 500/5000 = 0.1.

Assume that LC50 = 2,000 mg/l and the substance discharge under section A in the scoring model is 50 kg/ year. Then the scoring effluent toxicity is 2,000/50 = 40.

Appendix 7

Target values and test methods for wastewater[16]

Parameter	Target Value	Test Method ISO, EU and national standards
pH	6-9	ISO 10523
Temperature	37°C	dIn 38404-C4
Total suspended solids (TSS)	30 mg/l	ISO 11923, dIn en 872
BOd5	30 mg/l	ISO 5815-1, -2, dIn en 1899-1
Cod	160 mg/l	ISO 6060:1989, dIn 38409-H41
Colour	150 aTMI or 150 CO-PT	en ISO 7887 target 436 nm: <7/m, 525 nm:<5/m, 620 nm: <3/m
Bacteria	400/100 ml	
Foam	no visible discharge of floatng solids or persistent foam	
Antimony	0,5 mg/l	
Cyanide	0,2 mg/l	ISO 6703-1, -2, -3, dIn 38405-d 13-1
Mercury	0,01 mg/l	ISO 5666, dIn en 4183
Cadmium	0,01 mg/l	ISO 5961, en ISO 11885
Lead	0,1 mg/l	dIn 38406, ISO 8288, en ISO 11885
Arsenic	0,01 mg/l	en ISO 11885
Copper	0,25 mg/l	dIn 38406, ISO 8288, en ISO 11885
Nickel	0,2 mg/l	dIn 38406, ISO 8288, en ISO 11885
Chromium	0,1 mg/l	dIn en 1233, ISO 9174, en ISO 11885
Cr total/ Cr vI	0,5/0,1 mg/l	
Zinc	1,0 mg/l	ISO 8288, en ISO 11885
Cobalt	0,02 mg/l	ISO 8288, en ISO 11885
Total nitrogen	10 mg/l	
Total phosphorus	2 mg/l	
Oil and grease	10 mg/l	
AOX	1 mg/l	
Pesticides	0,05-0,1 mg/l	
Phenol	0,5 mg/l	
Sulphide	1 mg/l	
Ammonia	10 mg/l	
Toxicity e.g. fish eggs (T.U 96 h)	2 nonylphenol/	
Nonylphenol / nonylphenol ethoxylate	20-100 mg/kg	

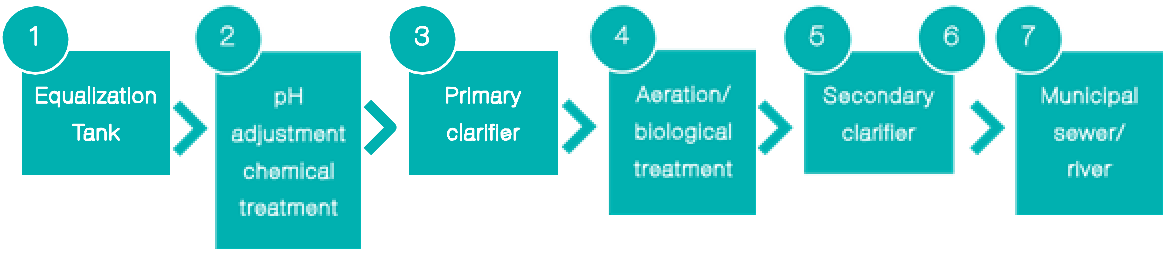
[16]Test methods are also valid for inflowing water.

Appendix 8

Minimum sampling point for wastewater treatment:

Treated effluent: the sampling point should be as close as possible to the ETP discharge point in a pit or channel, at a level about two thirds the depth of the channel.

Recommended sampling points[17]:



[17] QSE Guideline for IKEA Supply Chain 2007-08-17

Appendix 9

Handling of wastewater samples for in-house analysis [18]

Parameter	volume required (ml)	Type of container	Preser ving method	Maximum holding time
Temperature	1000	Plastic or glass	d etermine immediately on site	n one
pH	25	Plastic or glass	d etermine on site	2 hours
Colour	500	Plastic or glass	Cool to 4°C	24 hours
TSS	50	Plastic or glass	Cool to 4°C	7 days
B O d	1 0 0 0	G l a s s	Cool to near freezing	4 8 h o u r s
C O d	5 0	G l a s s	Sulphuric acid to pH<2, maintain at 4°C	2 8 d a y s
Metals	100 per metal	Plastic	n itric acid to pH<2	6 months
Mercury	500	Plastic or glass	n itric acid to pH<2	28 days (glass) 13 days (plastic)

Appendix 10

Process for Tracking Dyeing and Printing Performance (RFT)

To ensure that the actual output is closest to the desired output it is necessary to check several parameters at various stages of the process itself and also before the process is commenced. Some of the most critical parameters are:

1. Quality of water supply for liquor
2. Preparation of substrate
3. Dye-ability of substrate

It is critical to use the right lab and batch testing, methodology and chronology to achieve near-perfect dyeing in full production. The sequence of conducting the various checks is as follows.

[18] Levi's Strauss & Co – Social and Environmental Sustainability 2010

Prior to start of dyeing:

1) Uniformity of absorbency, whiteness and ph of the fabric have to be tested and uniformity is to be maintained across the lab to batch to shop floor processes.
2) Weight of the fabric, which by usual practice is assumed as greige meterage. it does not give the most accurate picture. This is because in the lab RFD (Ready For Dyeing) material is used for lab testing. The difference between the two can be 10% - 15%. The correct technique would be to measure the actual average weight of the fabric in both cases after the RFD process.
3) Weighing of dyes and chemicals:
   a. As the first phase, while calculating formulae , at least two iterations should be done to find the best combination.
   b. To ensure correct weights, calibration of the equipment is mandatory for accurate results. Depending on the value of the chemical being used, more iterations could be recommended.
4) Selection of dyes: The selection of dyes for the process in terms of strength and hue should be ac cording to the compatibility and fastness requirements. Key to these are:
   a. Moisture content of the substrate: in the case of padded operations it should be measured prior to the process, and across the process the temperature of the fabric should be main tained at a constant all across its width
   b. Dye bath additives compatibility: these should be checked for compatibility by using a blank bath with dyes and raising the temperature to the dyeing process temperatures. Any turbidity or precipitation is indicative of incompatibility.

In the dyeing process:

a. Liquor ratio: maintaining a constant MLR across all three stages (lab to batch, batch to production,
and within each process) is key to getting reproducible results.
b. pH of dye bath: this too should be maintained across all stages of the RFT sequence.
c. Machine Flow and sequence: the sequence followed and the time allocated to each sub-process should be the same at all three stages, so as to ensure consistency in performance.

The key constraints to getting lab to bulk (production) reproducibility would be experienced in the following areas:

- Mechanical restrictions: due to the difference In the size and functionality options in a lab and bulk processing machine the agitation speeds of the liquor would change, but ensuring a constant liquor ratio should solve the problem.
- Material: the material used in the lab and bulk should be exactly the same, as any change here will lead to non-reproducible shades. This is applicable to both fabric and chemicals. In the case of fabric only RFD material should be used in both situations and in the case of chemicals and dyestuffs, sample quantities should be gathered from the same batch as bulk chemicals.
- Manual measurements: If these are used, like pipettes, only calibrated equipment should be used. And only appropriate sizes of pipettes should be used, i.e. the nearest size to an actual measurable amount, so as to avoid basic equipment tolerance errors. Forexample, for 9 ml of liquid, use two pipettes of 5ml and 4 ml each. Similarly for 11 ml use 5 ml twice and one measure of 1 ml.
- Housekeeping: since lab and colour store conditions generally vary greatly in terms of location and size within the plant, good housekeeping in both is crucial for dye storage in order to protect the dyes from extreme heat and moisture.
- Formuls repetitiveness: in the case of multiple preferred formulae, each should be tested for repeatability in order to find the best.

For greater traceability of each of the above parameters and processes, the following records should be maintained on each formula/batch processed:

1. Critical Parameters for RFT

Fabric specification	Absorbency (sec)	CIE whiteness Index	pH	Moisture content(%)

2. Recipe evaluation: Colour/shade

Fabric specification	FormulaDE cmc	Visual Assessment	Correction factor	status
	Option 1 Dye A - Dye B - Dye C -			
	Option 1 Dye A - Dye B - Dye C -			
	Option 1 Dye A - Dye B - Dye C -			

3. Water quality for dyeing:

pH	Total hardness (as CaCo3)	Iron content (ppm)	Chloride (ppm)	Sulphate (ppm)

Appendix 11: List of documents to be maintained

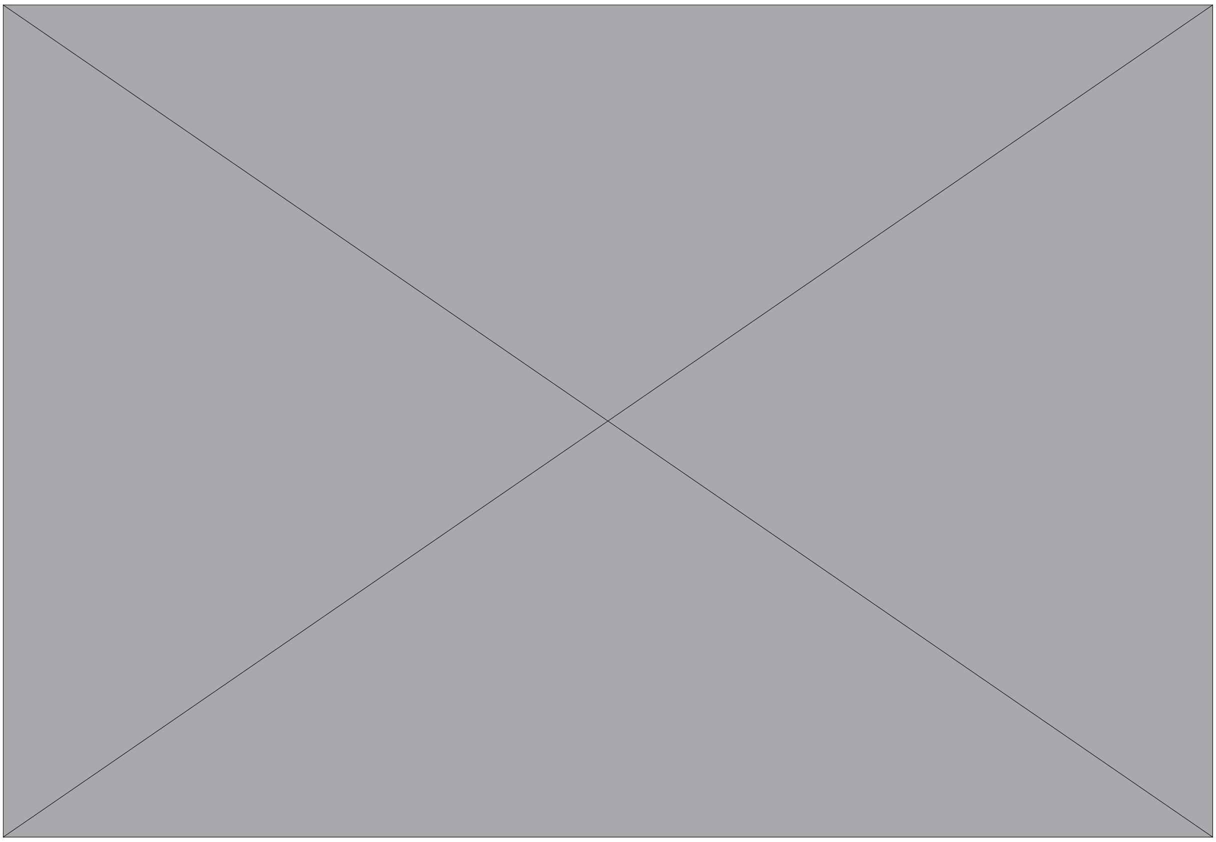
Sr No.	Document	Essential / Best Practice
1	Consent to operate from government	Essential
2	Consent for air and water	Essential
3	Licence for operating boilers	Essential
4	Licence for storing diesel	Essential
5	Permit for discharging waste water	Essential
6	Testing reports for pressure vessel (e.g. compressor)Essential	
7	Declaration for banned chemicals from supplier	Essential
8	No objection certificate from fire department	Essential
9	Environmental Statement (e.g. Form V in India)	Essential
10	Emergency Action Plan	Essential
11	Water flow diagram	Essential
12	Water balance diagram	Best practice
13	Water policy	Best practice
14	Water management plan	Best practice

Sr No.	Document	Essential / Best Practice
15	Business plan with water withdrawal data incorporated in it	Best practice
16	Action plan for re-use of water within the unit	Best practice
17	Record of sludge disposal	Essential
18	Training calendar for employees	Essential
19	Record of water usage	Best practice
20	Record of water usage per unit of production	Best practice
21	Goals for reduction in water withdrawn	Best practice
22	Maintenance schedules for machinery, equipment, etc.	Best practice
23	Water testing report: Drinking water	Essential
24	Water Testing report: ETP discharge	Essential
25	Action plan for investments/ cost savings for all wet processes	Best practice
26	Restricted Substances List from Buyers	Essential
27	Chemical policy	Best practice
28	List of chemicals with monthly consumption figures	Best practice
29	Latest MSDS	Essential
30	Risk assessment of restricted and hazardous chemicals	Essential
31	Formulae of chemicals used in processes	Best practice
32	Chemical purchase register	Best practice
33	Chemical spill plan	Essential
34	Chemical disposal register	Essential
35	Calibration of measuring equipment	Essential
36	Plan for replacement of hazardous chemicals	
37	List of solid and hazardous waste generated at unit	Essential
38	Procedure for managing solid and hazardous waste	Essential
39	Sludge testing report	Essential
40	Record for machinery breakdown along with root cause analysis, action taken and preventative measures	Best practice

Sr No.	Document	Essential / Best Practice
41	Record of Suspended Particulate Matter, NOx, SOx	Essential
42	Log for diesel consumption in generators, boilers, tumblers, etc.	Best practice
43	Register for ETP parameters covering temperature, pH, colour, smell	Essential
44	Certifications that employees have undergone	Best practice

Format 1

Water Circuit for a typical dyeing section



Format 2

Water reconciliation report

(linked to points that are metered in the factory)

Date	Inlet main			ETP			Sub-Area 1			Sub-Area 2		
	Opening Reading	Closing reading	Consumption	Opening Reading	Closing reading	Consumption	Opening Reading	Closing reading	Consumption	Opening Reading	Closing reading	Consumption

Format 3

Risk assessment template

Note:
1. Probability is rated on a score of 1 – 10.
2. Impact is rated on a score of 1 – 10.

Risk description	**Probability (A)**	**Impact (B)**	**Risk score (A X B)**	**Mitigation strategy**	**Contingency plan**
Risk 1	…..	…..	…..	…..	
Risk 2	…..	…..	…..	…..	
Risk 3	…..	…..	…..	…..	
Risk 4	…..	…..	…..	…..	

Format 4

Tracking fabric receipt and source

Tracking fabric and fabric source is useful when tracing dyeing challenges and also if any banned substances are detected in the final product. The following is a representative format:

Fabrics IN & OUT log								
Date	Party name	fabric quality	Width (inches)	Challan No.	Number of rolls/thans	Meters/ roll	Issued to dyeing	Ballance
Date	Party name	fabric quality	Width (inches)	Challan No.	Number of rolls/thans	Meters/ roll	Issued to dyeing	Ballance

Fabrics IN & OUT log								

....
Dyeing Manager

....
Manager

Format 5

Tracking chemicals, dyes and auxiliaries

Chemicals, dyes and other related auxiliaries form roughly 60% of the resource cost and keeping close tabs on their consumption is crucial. The information from this format when taken in conjunction with the Job Card and the Production Data is crucial for tracking chemical efficiency.

DYE/CHEMICALLOG BOOK							
Name of Dye/Chemical: (separate page for each dye/chemical)							
DATE	OPENING STOCK KG or LTRS	PUR-CHASE KG or LTRS	PO number	CLOSING STOCK KG or LTRS	CONSUMPTION/ ISSUED TO PRODN KG or LTRS	PRODUCTION FEQUISITION NUMBER	REMARKS

Format 5

Tracking chemicals, dyes and auxiliaries

Dye/chemical: Supplier :	Date: Challan No.:

S.No.	Parameter	Unit	Std value	Result
1.	Strength %			
2.	pH value of 1% solution			
3.	Solubility g/1			
4.	Moisture content %			

Format 7

ETP maintenance format

In addition to performance tracking, a separate maintenance log should also be maintained.
Frequency of update: once a day by the ETP operator

Equipment	Checklist	Checked on	Remarks
Screens	Installed at each inlet		
	Cleaned every 6 hrs		
Filter Press	Filter cloth washed at end of each filtration operation		
	Grease applied on the shaft (1 wk interval)		
	Grease applied at side rails (1 wk interval)		
Gear box	Oil level checked		
	Fill the required make of oil		
Oil & Grease removal traps	Scum removed manually every 12 hours		
Pumps	Greased (Y/N)		
	Any abnormal noise		
	Motor and pump coupling in proper condition		
Air blower	Belt condition – tightness/abrasion		
Scrapers for secondary clarifier	Epoxy paint		

Format 8

ETP Dosing format

Unit Name:				Date:	
Shift	Chemical Name	Quantity Added (kg)	Time (hrs)	Cumulative Daily Total (kg)	Remarks/note
Shift 1	Alum				
	Lime				
	Polyelectrolyte				
Shift 2	Alum				
	Lime				
	Polyelectrolyte				
Shift 3	Alum				
	Lime				
	Polyelectrolyte				

Format 8

Suggested effluent characteristics log book format

Date and shift	pH	Temperature (0C)	Volume of effluent discharged	TDS of effluent discharged	Colour	Turbidity	COD	Comments

format 8

Suggested effluent characteristics log book format

Name of the Unit :			
Date	Sludge generated (kg)	Sludge disposed of	
		Quantity (kg)	Name of agency picking up the sludge/ End mode of disposal of sludge (e.g. Landfilling, Incineration)

Glossary

Acid (s)	Containing acid or having the properties of an acid; that is having a pH of less than 7.
Affinity	An attraction between chemicals, which can result in formation of a bond.
Best Available Technique (BAT)	The latest stage of development of processes, of facilities or of methods of operation, which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste.
Best Environmental Practice (BEP)	A method or technique that has consistently shown results superior to those achieved with other means, and which is used as a benchmark.
Biodegradable	Substances that can be decomposed by bacteria or other organisms.
Bi-reactive dyes	Dyes containing two functional groups per dye molecule. This increases the chance of the dye attaching to the fibre, which means that less dye is required and less dye enters the effluent.
Biological oxygen demand (BOD)	Amount of oxygen needed for degradation of a compound by aerobic micro-organisms. This is a common measure for the amount of biodegradable pollutants in wastewater.
Chemical oxygen demand (COD)	Amount of oxygen needed for chemical oxidation of a compound. This test is commonly used to indirectly measure the amount of pollutants in wastewater. In contrast to BOD this test also includes non-biodegradable pollutants.
Closed-loop system	Closed system not relying on matter exchange (for instance water) outside the system.
Cold pad-batch	A method for dyeing cotton with reactive dyes, which is (relatively) more environmentally friendly due to high dye fixation and no requirement for heat. y.
Desizing	The removal of size from fabric. Size is usually added to facilitate weaving.
Ecotoxicity	Refers to the potential for biological, chemical or physical stressors to affect ecosystems. Such stressors might occur in the natural environment at densities, concentrations or levels high enough to disrupt the natural biochemistry, physiology, behaviour and interactions of the living organisms that comprise the ecosystem.
Effluent Treatment Plant(ETP).	A system that is used to treat wastewater from an industry prior to its release into the environment or its re-use.
Eutrophy	The state of a body of water that has become enriched in dissolved nutrients (such as phosphates) that stimulate the growth of aquatic plant life, usually resulting in the depletion of dissolved oxygen.
HT-dyeing	High temperature dyeing.

Incineration A treatment technique where combustion is used to destroy contamination in solid, liquid, or gaseous materials. Hazardous organic compounds are converted to ash, carbon dioxide and water. Temperatures will vary depending on the type of contamination and the contaminated material.

Inventory A complete listing of merchandise or stock on hand, work in progress, raw materials, finished goods, etc., made regularly by a business concern.

Lab dip Lab dips are done to provide a visual aid to how a colour will look when the fabric is dyed.

Landfill An engineered waste management facility at which waste is disposed of by placing it on or in land in a manner that minimises adverse human health and environmental effects.

Light box Laboratory equipment used to check dyed fabric in different light conditions such as daylight, ultraviolet light and backlight.

Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS). A document intended to provide workers and emergency personnel with procedures for handling or working with a substance in a safe manner, and includes information such as physical data (melting point, boiling point, flash point, etc.), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill-handling procedures. MSDS formats can vary from source to source within a country depending on national requirements.

Mercerisation A chemical treatment applied to cotton to increase its affinity for dyes and various chemical finishes.

Off-site effluent treatment plant (ETP) This is an umbrella term for common effluent treatment plants (CETP), municipal wastewater treatment plants and publicly or privately owned treatment plants.

On-site effluent treatment plant (ETP) An effluent treatment plant that is owned by the factory and located in direct connection to the factory.

pH A measure of the acidity or basicity of an aqueous solution.

Physico-chemical Relating to both physical and chemical properties.

Pigment print Any type of printed image that uses strictly pigments.

Pollutant Generally, any substance intruded into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Quick-win An initiative or a solution that yields rapid positive results.

Return on investment A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. To calculate the return on investment, the benefit (return) of an investment is divided by its cost; the result is expressed as a percentage or a ratio.

Reverse Osmosis (RO) : A water purification technology that is used to remove the majority of contaminants from water by pushing the water under pressure through a membrane.

Singeing The process of removing the pills and protruding fibres of the textile to produce smoothness.

Sludge A semi-solid residue from industrial wastewater or sewage treatment processes. The sludge can be a hazardous waste depending on the content of the wastewater.

Spectrometer An instrument which measures the amount of visible light absorbed by a coloured solution.

Spin-dyeing Dyeing by using a drum rotating at such a speed that textile sticks on the surface of the inner drum. Since the water is also rotating with the textile, along the edges of the drum, the textile is all the time submerged within the float, which reduces water requirements.

Storm-water run-off Water originating from rain or snowfall that flows over the ground.

Sub-process Each process step in the production and manufacturing of textiles, such as bleaching, dyeing, sizing, and rinsing.

Total suspended solids (TSS) A water quality measurement where the particulate weight obtained by separating particles from a water sample using a filter is determined.

Total dissolved solids (TDS) A water quality measurement where the combined content of all inorganic and organic substances which are small enough to pass filtration is determined.

Volatility A measure of how easily a substance evaporates at normal temperatures.

Wastewater Spent or used water from an individual home, a community, a farm, or an industry that contains dissolved or suspended matter.

Water catchment area An area of land that collects water, which drains to the lowest point in the area, which could be a lake, a reservoir , or the sea.

About the Sweden Textile Water Initiative (STWI)

The Sweden Textile Water Initiative (STWI) started in 2010 as a joint project between Swedish textile and leather retail companies, and the Stockholm International Water Institute (SIWI). As of May 2012, 32 companies have joined STWI. The project focuses on water issues in the supply chains of textile and leather retailers with the aim of contributing to wiser water management, from thread and raw hide to product.

www.stwi.se

STWI
SWEDEN TEXTILE WATER INITIATIVE