ECP

MODULE 4 :

Environmental Management

VERSION 1.0
MAY 2011

MODULE CONTENT

INTRODUCTION

Reducing the impact of Marks & Spencer products the environment is a corner stone of Plan A. Poorly managed dyehouses, printers, laundries and tanneries can be one of the biggest causes of damage to the environment and have a great effect on the availability of natural resources such as water and energy.

However, Marks & Spencer believe a well managed factory, which employs some very simple and straight forward principles can dramatically reduce its impact on the environment as well as improving its efficiency and quality of production. Some of these principles have been touched on in **Module 3: Minimum Standards and Best Practice**. Module 4 has been designed to build on the information and guidance in Module 3 and to outline the principles Marks & Spencer expect of its suppliers with regards to environmental management and minimising the use of natural resources.

The most important step for any organisation to reduce its impact on the environment is to measure its current impact. Marks & Spencer expect its suppliers to be able to measure its consumption of key natural resources such as water, electricity, fuel, dyes and chemicals. The collection of this simple information will help identify where the biggest opportunities for improvement and saving can be made.

As a minimum requirement it is mandatory that all mills in the Marks & Spencer supply chain meet the local environmental consent limits for water, air and solid waste disposal and have certificates and test results to demonstrate ongoing compliance. Marks & Spencer consider one of the most critical aspect of environmental management is for all effluent to be treated in a fully functional effluent treatment plant (ETP) before being discharged. Marks & Spencer will not do business with mills that discharge untreated effluent directly into water courses.

ISO 14001 is a very robust environmental certification and you are encouraged to consider this for your factory:
www.iso.org/iso/iso_catalogue/management_standards/iso_9000_iso_14000/iso_14000_essentials.htm

1. EFFLUENT

Minimum Standards Requirement
Untreated effluent must never be discharged
All effluent must be treated in a fully functional effluent treatment plant (ETP) before being discharged
The capacity of on-site effluent treatment plants must be sufficient to process the total factory effluent output
Chemicals must not be allowed to contaminate soil
No chemicals can be washed down surface water drains
Confirm no breaches of consent limits in past 12 months
Confirm no prosecutions in the past 12 months
Mills must be fully compliant with local and national laws and standards
Mills must measure the following parameters: COD/BOD, pH, Temperature, Offensive colour, Suspended solids, Total Dissolved Solids, Specific metals and toxins.
Treated effluent must be tested on a frequent basis in an independent laboratory and records must be available for inspection.
Records of independent test results of effluent must be retained for at least 12 months

Effluent from textile colouration is viewed as the biggest source of pollution and environmental damage in the supply chain when it is not correctly managed. The Marks & Spencer policy with regards to effluent control have been in place for many years and are designed to ensure that any mills supplying Marks & Spencer comply with the local and national laws as an absolute minimum. Marks & Spencer will not do business with any mill which discharges untreated effluent directly or indirectly into water courses (including rivers, lakes, ground water etc).

All effluent must be treated in a fully functional effluent treatment plant (ETP) before being discharged. Effluent can be treated on-site, in a communal plant or in a municipal ETP. However, the factory must clearly demonstrate how and where their effluent is being treated. If a factory is using off-site ETPs, the factory is responsible for ensuring the ETP is compliant with local, national and Marks & Spencer requirements.

Marks & Spencer do not publish one global standard for effluent treatment. However, the **minimum requirement** for any factory supplying Marks & Spencer is that they are fully compliant with their local and national laws and standards. As a minimum standard it is expected that factories take action to ensure the following effluent parameters are measured and controlled.

Parameter	What it is?	Where is it found?	How to reduce the impact
COD / BOD (Chemical / Biological Oxygen demand)	Chemicals which require oxygen to break them down. High content results in depletion of oxygen from natural water courses.	All chemicals and dyes contribute to BOD/COD. Waxes and oils removed from natural fibres and fats removed from hides have high impact.	Minimise chemical usage and select low COD/BOD alternatives where possible.
pH	Excessive acidity or alkalinity that can affect the natural balance within water courses.	Processes that use extremes of pH e.g. acidity from wool dyeing, alkalinity from reactive dyeing.	Effluent must be balanced and neutralised unless there is consent.
Temperature	Releasing excessively hot or cold effluent into natural water courses can adversely affect eco-systems.	Chillers and heating systems. Any process using or creating hot or cold water,	Temperature must be balanced – discharging boiling water or cold water is not acceptable
Offensive Colour	Colour is mainly a cosmetic problem but excessive colour can reduce the amount of light that gets to plant life – and some dyes are toxic to aquatic life	Unfixed dyes	Use higher fixation dyes and use effective colour removal in effluent treatment.
TSS (Total Suspended Solids)	Solid insoluble debris that can be ingested by aquatic species or settle as silt on river or lake beds.	Loose fibre and pumice dust	Improve dust extraction in factory processing (e.g. vacuum slots) use effective filtration as the first stage of effluent treatment
TDS (Total Dissolved Solids)	TDS is a measure of the amount of salts dissolved in effluent. This can kill many forms of life that can only survive in fresh water and have a severe impact on drinking water.	Salt from reactive dyeing.	Optimise dye methods to reduce salt consumption. Reverse osmosis is the only effective means of reducing TDS in effluent.
Specific metals and toxins	Toxins can kill wild-life and seriously affect drinking water supplies	Various contaminated textile dyes and chemicals. Mothproofing, anti-microbials	Screen dyes and chemicals for contamination. Apply known toxins from zero discharge closed loop systems

Where policing and certification of effluent controls is not implemented by local or national authorities, Marks & Spencer require mills to have their treated effluent tested on a frequent basis (preferable monthly) in an independent laboratory and records must be available for inspection.

Effluent must not be placed down surface water drains as this may bypass the ETP or contaminate the local soil or groundwater. It is not uncommon for operatives who are cleaning old chemical drums and containers to wash chemical residues down surface drains. This example of bad practice can lead to environmental hazards and put the factory in risk of prosecution and loss of Marks & Spencer business.

It is recommended that factories should ensure the total capacity and rates of effluent treatment of the ETP are in excess, or at least matching, the total discharge and rate of effluent production of the mill. If the rate of production of effluent is approaching the limit of the ETP capacity then action is required to either reduce the demand on the ETP or make investment to expand its capacity.

2. REDUCTION OF EFFLUENT LOADING

The cost of effluent treatment is related to the volume of effluent and the concentration of chemicals contained in that effluent. The best ways to reduce effluent loading, and therefore, the best ways to ensure consent limits are not breached are:

- Reduce water consumption to reduce the volume of effluent
- Reduce chemical usage and increase dye fixation to reduce the total effluent loading
- Use low impact chemicals to minimise loading for COD, BOD, TSS etc

Where technical performance is similar, it is commercially sensible to use products that are easily removed from the effluent or have the lowest contribution to COD, BOD, TSS, etc. For example, formic acid contributes less to COD than acetic acid and can be used in its place in many wet processing facilities. The use of controlled dosing and pH measurement systems will also help to minimise the total amount of acid used.

Chemical choices should not be made on the basis of biodegradability alone.

It would be irresponsible to use biodegradable products which are less effective or inconsistent in meeting the required standards, and therefore, lead to increased levels of re-dye and re-processing, with associated increased water and energy consumption.

Although colour in effluent is a largely cosmetic issue it can create an impression that effluent controls are substandard and therefore colour discharges should be avoided. Where ever possible use dyes and processes that give high levels of fixation. This not only reduces colour in the effluent, but could also help to reduce the number of wash off stages, leading to lower water consumption, improved productivity and lower costs. Bi-reactive dyes, for example have a higher affinity than average dyestuffs. As more dye adheres to the fabric, less dye is used, less auxiliary chemicals are used, less rinsing is required and the amount of colour in the effluent is reduced.

Salt is used in large quantities for reactive dyeing of cotton and it passes through effluent treatment plants into water courses without being affected. It is recommended that steps are taken to minimise salt consumption via the use of low salt reactive dyes.

One of the most important and cost effective ways to reduce effluent loading is to improve the quality and consistency of the dyeing and finishing process. This reduces the amount of unnecessary re-dyeing and re-processing, improves productivity, on time delivery and customer satisfaction.

A holistic approach to effluent management is zero 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.

Additional best practices that can be used to improve the control and treatment of effluent include:

- Maximise filtration of solid materials
- Biological treatment is an energy intensive process but the use of AC blowers rather than DC blowers can reduce energy consumption
- Carefully dose flocculants to minimise solid waste and consider non-chemical methods of colour removal such as ozone to reduce solid waste
- Avoid the use of chlorine to remove colour

3. AIR EMISSIONS

Minimum Standards Requirement
Confirm no breaches of consent limits in past 12 months
Records of independent test results must be retained for at least 12 months
Air quality must be satisfactory throughout factory
Appropriate PPE must be provided and worn

Air Emissions are often considered to be less significant than water pollution. However, climate change and the increased use of performance finishes have raised the importance of air pollution. Control of air emissions is important for both environmental and worker safety reasons, as fumes, dust and smoke can create serious health issues. It is normal for local authorities to have strict standards for air emissions and factories must be in possession of the appropriate certification to demonstrate compliance.

It is important to ensure boilers, generators and any other pieces of equipment that burn fuel meet local consent limits for air emissions. It is also important to explore how the factory can improve its efficiency to reduce the total amount of fuel used as this has a very direct impact on air emissions not to mention costs.

Fumes and particulates from the exhausts and chimneys are traditionally difficult to manage, but the development of modern scrubbers to remove noxious gases and particles can help ensure consent limits are met.

For the safety of workers air extraction devices should be employed at the source of any fumes or particulates in the factory. For example, the dust generated by brushing, sueding or the weighing of powdered dyes should be extracted at these points in the factory. All dust or particulates that are collected through extraction should be careful disposed off with other solid waste.

As highlighted in **Module 3 – worker safety,** all workers must be provided with PPE where any health risks from air emissions are identified.

4. SOLID WASTE

Minimum Standards Requirement
Confirm no breaches of consent limits in past 12 months
There must be no unauthorised burning of solid waste
Solid waste disposal must meet local authority requirements

Marks & Spencer suppliers should only send waste to disposal when all other safe opportunities for recycling and reuse have been explored. Empty chemical drums and boxes can be reused, waste fabric can be sold to textile waste processors, and solid waste from ETPs can in some areas be used as a fertilizer. However, ETP sludge can contain dangerous chemicals and its use and disposal will be subject to varying controls and permissions from the appropriate authorities must be sought before its use. If and when solid waste has to be disposed of, it must be done in accordance with the local and national regulations.

The calorific value of solid waste is relatively high and could be used as a fuel for boilers or heating systems. However, the unauthorised burning of solid waste is not permitted by Marks & Spencer as solid waste may release dangerous gases during burning that breach air consent and/or pollution regulations. Permission from the appropriate authorities must be sought before solid waste is considered as a fuel source.

5. REDUCING WATER, ENERGY AND CHEMICAL CONSUMPTION

Minimum Standards Requirement
Consumption of water, energy and chemicals is measured on an ongoing basis

There are many opportunities to reduce water, energy, chemicals and environmental impacts without making fundamental changes to dyeing, laundry, tannery and printing processes.

5.1 Reducing water consumption

Minimum Standards Requirement
Water extraction does not exceed any local or national consent agreements

There is increasing global demand on fresh water supplies and Marks & Spencer has identified water as the critical factor to tackle in reducing the impact of dyeing, printing, finishing of textiles and leather production. In some areas of the world water supplies are very scarce and there are very strict limits on the amount of water that factories can extract from rivers, lakes and boreholes. Every effort should be made to minimise water consumption.

Two key tools for managing water consumption are the water meter and Right First Time (RFT) processing.

Meters help identify the processes and activities that consume the largest amounts of water and where the biggest saving can be achieved. Water meters should be installed to monitor the total site consumption and wherever possible individual process and machine consumption.

Water meters: Essential for monitoring factory performance

Having high levels of RTF ensures that material is processed only once, and therefore, water consumption is kept to a minimum. Poor quality control and low RFT results in materials being dyed two, three or more times, resulting in a doubling or even tripling of water consumption. It is well proven that water consumption can be dramatically reduced by instigating the best practice to improve RFT.

Other determining factors for controlling water usage are liquor ratio and the number of baths used in processing. For batch processing liquor ratio can vary between 4:1 and 20:1 so for any given process the amount of water used can vary by a factor of five. Using modern machinery and lower liquor ratios are major tools for reducing water consumption. However at very low liquor ratios rinsing and washing processes are not very effective so consider using fewer baths of longer liquor ratio for effective washing. Over-flow rinsing to improve the effectiveness of a washing process uses a very high volume of fresh

water and should be avoided. In continuous processing the use of counter-flow washing is strongly recommended.

One obvious way of reducing net water consumption is to explore the feasibility of water re-cycling.

In the best dyehouses water recycling can result in no effluent discharge and approximately 90% re-use of water. For example, rinse baths can be re-used, cooling water can be recycled, as can steam condensate. Investment in reverse osmosis and evaporator equipment can prove to be effective tools in reducing water consumption.

Reverse osmosis system

5.2 Reduction in Energy Consumption

Energy is expensive and contributes to the cost of production. Just as important, most energy needs are met by burning fossil fuels which contribute to air pollution and climate change. Reducing energy consumption will save money and help protect the local and the global environment. As with water conservation, the key tools for minimising energy use are measurement and managing quality control.

Sub-metering to establish energy use throughout the factory will identify processing which consume the most power and areas where energy efficiency can be improved. Good quality control will ensure products are processed once with no need for re-processing and the associated energy use that goes with re-dyeing, re-washing etc.

As with water, energy can be recycled by using heat recovery systems, with up to 40% saving in energy use being achieved in some areas. Heat can be recovered from hot water, hot gases and even warm effluent. Heat recovery systems on new machines and boilers, and even retro fitted heat recovery systems can payback within 1 to 2 years. Also some factories use as much water for cooling as they do in process baths. Water consumption can be halved if cooling water is recycled. Pumping clean, warm cooling water down a drain is a significant waste of water and energy.

Heat recovery system

Koenig are recognised specialists in the field of heat recovery:
http://www.luwa.com/SystemKoenig/WaterHeatRecoveryMain/WaterHeatRecovery

Wet processing machines use electricity and steam. It is obvious that the longer and hotter the process the more electricity and steam that is used. To reduce energy consumption consider shorter or lower temperature processes. Drying machines, steamers and ovens use fans and blowers that consume electricity. An obvious way to reduce energy is to plan production so these machines can be switched off when they are not actively processing materials.

A significant way to reduce electricity consumption is to use AC drives for pumps, blowers, and pulleys. AC drives use approximately 20% less energy than DC drives and the payback can be less than one year.

A further energy reduction of up to 20% can be achieved by insulating all machines that contain hot water. All hot water pipes should be insulated to avoid heat losses and all leaks should be repaired to prevent wastage of water.

One of the most important ways to improve efficiency is to check all steam pipes for leaks and all steam traps for effective operation. Leaks from pipes and poorly functioning steam traps waste energy and water.

5.3 Compressed Air

It is important to ensure air compressors are appropriate to the size of demand. Oversized compressors are very inefficient and waste considerable energy and money.

Compressed air systems should be checked on an ongoing basis and all leaks repaired immediately. Use of compressed air should be regularly assessed and poor practice should be avoided at all times. For example, operatives should not use compressed air for cleaning machines. Suction cleaning using vacuums is far more effective at cleaning as well as using less energy.

Air compressor

6. BEST PRACTICES FOR ECO-FACTORIES

Marks & Spencer has developed a set of best practice guidelines for factories of any type to reduce energy and water consumption. These guidelines were a result of the Marks & Spencer sponsored eco-factory projects in the UK and Sri Lanka. The most important aspects of the best practice guidelines are:

- Maximise the use of natural light
- Use energy efficient light bulbs
- Use PIR light switches in areas that are not frequently used
- Insulate buildings to keep them cooler in summer and warmer in winter
- Use natural ventilation and minimise use of air-conditioning
- Preventative maintenance programmes to identify and fix leaks
- Turn off machines and equipment when not in use
- Train workers in the need to conserve water and energy
- Use of non return valves on steam and water pipes

Eco - factory

In addition, to this learning, Marks & Spencer have recognised the work of NRDC in developing best practice guidelines to reduce water and energy usage in textile wet processing mills. Implementation of the NRDC best practice has been proved to reduce consumption of these vital resources, as well as reduce operating costs for little or no capital investment. Where investment has been required the payback period has been less than 12 months. The NRDC 10 Best Practices to Reduce Water and Energy Use are listed below.

More information on the NDRC can be found at: **http://www.nrdc.org/default_t.asp**

6.1 Leak detection and preventive maintenance, improved cleaning

A single 2mm steam leak can result in the loss of energy equal to more than 10 tons of coal. Experts estimate that textile facilities can reduce water and energy use by as much as 10% through effective leak detection and preventative maintenance programs. It has been estimated that water and steam leaks were responsible for between 1-5% of all water and coal usage. Larger savings can be expected from improved water conservation such as turning off hoses when they are not being actively used.

6.2 Reuse of non-contact cooling water

Non-contact cooling water is high in quality and temperature and can be easily reused for other processes. In addition, non-contact cooling water's high discharge temperature (45°C) and volume adds unnecessary load to effluent treatment plants.

Install a water reuse and heat exchanger system can help make use of this water and energy resource leading to savings across the business.

6.3 Reuse of steam condensate

Textile mills rely on a large amount of saturated steam some of which will condensate into very high in temperature water of a very pure nature. The most efficient use of this condensate is to return it to the

boiler for conversion back into new steam. Even for sites which do not have their own boiler the condensate can serve as a water supply for washing or desizing. Installing pipes to capture and reuse condensate can help saving a substantial amount of energy and water.

6.4 Reuse water from pre-treatment processes

Instead of discharging water from bleaching and mercerizing machines to the effluent treatment plant it can be collected and reused for other processes. After simple treatment for removal of fibrous matter, this water usually meets the quality requirements for scouring.

6.5 Recover heat from hot rinse water

During manufacturing, large quantities of very hot water are used for rinsing. The heat from this rinse water can be captured and used to preheat the incoming water for the next rinse. A plate heat exchanger can transfer wastewater heat energy to incoming cold freshwater. This opportunity can incur a high initial cost, but in all instances the investment pays back quickly, within two and four months.

6.6 Pre-screen coal

In mills using coal fired boilers the adoption of spiral coal screen technology can increase the efficiency of the fuel by separating good quality, high calorific coal from low quality coal.

6.7 Maintain steam traps

Steam traps play an important role in maintaining the efficient flow of steam through a mill by removing moisture and preventing condensation. Therefore, they reduce heat loss and so reduce overall fuel consumption. However, poorly maintained steam traps will allow live steam to escape into the condensate system and so increase heat loss and fuel consumption. In steam systems that have not been adequately maintained, between 15% and 30% of the traps may have failed.

Regular inspection of steam traps (monthly testing is recommended) and repair or replacement of broken traps will reduce loading on the boiler and save money. In addition, steam traps should be installed at appropriate intervals (typically one about every 25 meters) from the main steam headers for most effective use.

6.8 Insulate pipes, valves, and flanges

Heat loss from pipes, valves, and flanges will waste energy and therefore money. Insulating steam pipes is inexpensive and will save money. According to industry data, one meter of un-insulated steam pipe could lose the equivalent energy of nearly three tons of coal per year.

If all steam pipelines, flanges and valves in a typical factory are well insulated, heat loss from steam pipes could be reduced by up to 90%. Routine inspection of pipe, valve, and flange insulation throughout the mill well ensure on going energy and cost savings

6.9 Recover heat from smokestacks

A boiler can produce smoke fumes at a temperature of 360°C. Often these fumes and the energy they carry are directly discharged into the atmosphere. Installing a waste heat boiler to use this heat can help reduce energy consumption, CO^2 emissions and costs. The waste heat boiler can be used to pre-heat the main boiler feed water or as a supplementary steam supply for the mill.

6.10 Electricity Saving from Compressed Air

Large amounts of compressed air are used through-out a mill for a wide range of processes. Every air line is susceptible to leakage, which can account for 20 to 75 percent of air demand in a plant where no regular maintenance is carried out. Compressed air leaks most commonly exist at threaded connection points, rubber hose connections, valves, regulators, seals, and old pneumatic equipment.

In addition, the working pressure of compressed air is often set according to the maximum pressure required by the mill. It is often possible to reduce this pressure without any negative impacts on manufacturing, which will save energy as well as reduce the volume of air loss through any remaining leaks.

Optimizing the compressed air system could save between 2 and 59 kWh per ton of production, or between 0.3%t and 3% of its total electricity use.