FluoroCouncil
Global Industry Council
for FluoroTechnology

Guidance for Best Environmental Practices (BEP) for the Global Apparel Industry

Including Focus on Fluorinated Repellent Products

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A. For Textile Mills and Finishers

Summary: What Best Environmental Practice (BEP) means in practical terms:

1. Raise environmental awareness with all employees
2. Follow advice of the Safety Data Sheet (SDS) and Technical Data Sheet (TDS) for the product
3. Use the product only if necessary to obtain effects desired
4. Use only what you need: work with the chemical supplier to set the amount
5. Mix only what will be used in the scheduled run
6. Schedule runs to avoid bath changes; batch changes waste liquors
7. Reuse/recycle residual liquors/surplus of liquors if this can be done without jeopardizing quality; consult your supplier
8. Maintain all equipment in excellent working condition and conduct periodic operations audits
9. Optimize drying and curing conditions in the stenter frame
10. Dispose of chemicals appropriately
11. Consider additional opportunities to minimize waste and emissions

Background and Introduction

Fluorinated repellent products provide stain, oil and water repellency on fabrics. These fluorinated repellent products, including durable water repellents (DWRs), are usually applied in combination with other finishing auxiliaries by a pad-dry-cure process. In many cases they are applied with “extenders” which can be other repellents themselves (e.g., hydrocarbons such as waxes) or crosslinkers (e.g., melamine and isocyanate or blocked isocyanates). The use of these “extenders” enhances repellent performance and allows a reduction in the required amount of fluorochemical, with a corresponding reduction in costs for this treatment. While these chemistries perform well on garments and equipment, they may be harmful if released to the environment. This document is intended to provide an overview of Best Environmental Practices (BEP) to help mills and finishers minimize waste and environmental release, and keep the products on the textile. Product specific steps provided by the manufacturer and legal requirements override the practices offered here, so always verify with your specific supplier what steps are appropriate to take at your facility.

Some of the guidance contained in this document includes safety information. Please note and understand that this is not a safety manual. Each mill and finisher develops its own safety program with reference to applicable legal requirements and specialized safety literature and materials.

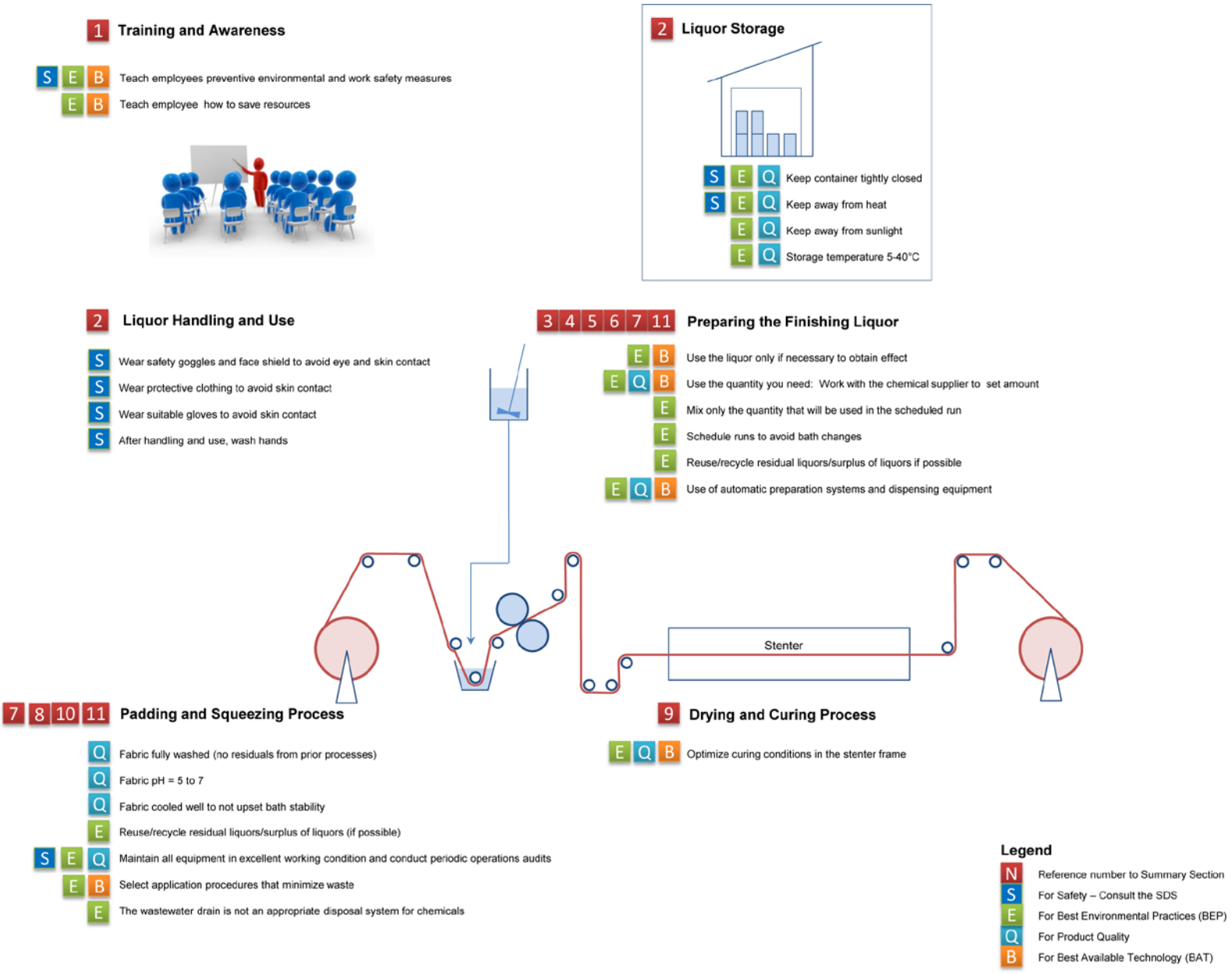

Figure 1: Overview of Best Environmental Practices (BEP) when using fluorinated repellent products in the textile industry (numbers refer to summary section on page 1).

Easy Steps to Implement Best Environmental Practice (BEP)

The following schematic[1] provides an overview of basic actions to be considered for a Best Environmental Practice (BEP) of fluorinated DWR products.

1. Raise environmental awareness with all employees

- Teach employees preventive environmental and work safety measures, as well as measures for saving resources at the company.
- Combine with safety training and/or include in other employee training programs.
- Tailor employee training to specific roles, and the following is a list of possible topics to include:
    - chemicals (receiving, storage and handling)
    - raw materials
    - energy
    - water
    - processes (measurement capability)
    - equipment/machinery
- Provide copies of SDSs to all employees and train them to be familiar with the information provided for all chemicals to be handled.

2. Follow advice of the Safety Data Sheet (SDS) and Technical Data Sheet (TDS) for the product

- Make all safety data sheets (SDS) for all chemicals used and stored available, up-to-date and easily accessible. A chemical may not be on site without a copy of its SDS on site.
- Before handling any chemical, review the SDS carefully. The employee can receive the following information from the SDS:
    - Section 2 “Hazard Identification”
    - Section 4 “First Aid Measures”
    - Section 5 “Firefighting Measures”
    - Section 6 “Accidental Release Measures”
    - Section 7 “Handling and Storage”
    - Section 8 “Exposure Controls/Personal Protection”
    - Section 9 “Physical and Chemical Properties”
    - Section 10 “Stability and Reactivity”
    - Section 13 “Disposal Considerations”
- Store all chemicals in accordance with SDS instructions (see SDS “Section 7”).
- Check the integrity of all areas where chemicals are stored or where a leak is possible, so that leaking chemicals cannot enter the groundwater or the sewer.
- Reject dented or leaking containers upon delivery.
- Review the Technical Data Sheet (TDS) for information on optimized recipes and best suited auxiliaries.

[1] These principles fully apply to foam application technologies as well.

3. **Use the product only if necessary to obtain effects desired**
    - Use fluorinated repellent only when specified, or when high performance water repellency, or the combination of water/oil, or oil repellency alone is required.
    - Avoid CMR and PBT substances, and substances which can degrade to CMR and PBT substances (see SDS Section 2, 11 and 12).
    - If possible, consider using chemicals and auxiliary materials with good biodegradability/bioelimination properties, low human and eco toxicity, low volatility and odor intensity (see SDS Sections 11 and 12).

4. **Use only what you need: work with the chemical supplier to set the amount**
    - Use proper type and quantity of auxiliaries. Improper use can result in overuse of fluorinated repellent to compensate for the wetting or softening effect of the surfactant itself.
    - Check recipes regularly in order to identify and avoid unnecessary chemical volumes.
    - Pay attention to water quality (e.g., pH, water hardness, suspended solids) to avoid loss in DWR performance, and thereby avoid overuse of the finishing chemicals, or scrap or rework of the fabric.

5. **Mix only what will be used in the scheduled run**
    - Minimize the use of all chemicals and auxiliary materials.
    - Measure, mix and dose chemicals carefully to avoid losses.
    - Minimize residual liquor by calculating exactly how much liquor has to be prepared.

6. **Schedule runs to avoid bath changes and wasted liquors**
    - Optimize process sequences in production to minimize waste in between runs.

7. **Reuse/recycle residual liquors/surplus of liquors if this can be done without jeopardizing quality**
    - Re-using process liquors has to be done VERY CAREFULLY to avoid causing quality issues that could lead to off-quality goods production. The material supplier can be consulted to test whether re-use is possible.

8. **Maintain all equipment in excellent working condition and conduct periodic operations audits**
    - Optimized process runs and well maintained equipment reduce waste.
    - Maintain machinery, pumps and piping thoroughly and check for leaks. Consider checking systems for heating medium and chemical dispensing systems too.
    - Consider a written maintenance plan and execute it for regular maintenance. Such a plan may include, but is not limited to, the following:
        - Include all components of the machinery such as pumps, valves, level setters, pressure and flow controls in the maintenance plan.
        - Check and clean filters regularly.
        - Calibrate measuring devices, for example, measuring and dosage systems for chemicals and thermometers.
        - Clean and maintain thermal treatment equipment (such as stenters) at regular intervals.
        - Remove residue from the waste air channels and deposits from the burner air intake pipes.
        - Document all work activities.
    - Consider carrying out a mass balance check for both the site as well as each individual production process, as knowing where each chemical goes is the best way to ensure optimal use of raw materials.

9. Optimize drying and curing conditions in the stenter frame

- High quality, first pass yield of the fabric depends on optimized conditions in the stenter frame.
- Minimize energy consumption in stenter frames by:
  - using mechanical dewatering equipment to reduce water content of the fabric
  - optimizing exhaust airflow through the oven, automatically maintaining exhaust humidity, considering the time taken to reach equilibrium conditions
  - installing heat recovery systems
  - insulating systems to reduce heat loss
  - cleaning and adjusting burners in directly heated stenter frames
- Standard good practices for reduction of volatile organic compound emissions and energy recovery of exhaust air are applicable for fluorinated repellents. Work with the machine supplier for details. For example, a combination of condensation and wet scrubbing followed by electrostatic precipitation (ESP) or the use of thermal combustion with energy recovery on the curing/drying frame/stenters may be used.

10. Dispose of chemicals appropriately

- The wastewater drain is never an appropriate disposal system for chemicals such as residual pad bath liquor.
- Collect liquors containing fluorinated repellent for separate treatment, including the rinsing bath from cleaning the application system. Consult SDS Section 13 for guidance.
- Reuse residual pad bath liquor if possible and appropriate (see Section 7 above).
- Minimize waste water by minimizing change overs and collect all wash/rinse water before and after each run.

11. Additional opportunities to minimize waste and emissions

- Use of displacers in the padding device (Foulard) reduces required liquor volume.
- Automated dosing systems with integrated self-learning systems minimize waste by:
  - Computing exact pick-up and liquor consumption
  - Mixing only what will be used in the scheduled run
- Low add-on techniques (such as foam applicators) minimize chemical consumption.
- Where possible, use direct piping into the bath for each of the chemicals to be used so that the chemicals are not pre-mixed before being introduced into the applicator or machine, and there is no need to clean containers, pumps and pipes before the next step.
- Check the input and output flows of the individual processes. Determine the input and output mass flows for both the site as a whole and each individual production process. Implement a product input check that takes account of raw materials, chemicals, dyes and auxiliary materials, etc.
- Employ improved measurement and control equipment, for example for temperature, chemical addition, retention time, moisture (in dryers).
- Where possible, consider a combination of condensation and scrubbing followed by electrostatic precipitation (ESP) or the use of thermal combustion with energy recovery on the curing/drying frame/stenters used in processing the fabric.
- Where possible, consider treatment in wet scrubbers, absorbers, separation via low temperature condensation or combustion to reduce the release of volatile organic compounds from the framing/stenter process.
- Where possible, consider exhaust air treatment for emissions-relevant processes.

B. For Packagers, Brands and Retailers

Guidance on questions to ask your suppliers so you know you are receiving goods finished using Best Available Technology (BAT) and Best Environmental Practices (BEP) for DWR.[2]

Both suppliers and regulators are transitioning from traditional long-chain polymeric products to short-chain polymeric products (i.e. the Best Available Technology (BAT)), yet both type of products are on the market. In order to make sure your suppliers are utilizing short-chain products (i.e., the BAT) and follow Best Environmental Practices (the BEP), gathering the following information will be helpful before sourcing fabric/finished goods:

To assess that the Best Available Technology (BAT) is used:

1. Chemical Supplier Name
2. Fluorinated DWR Product Trade Name
3. What is the DWR Product's technology platform?
4. Is the Product based on long-chain[3] or short-chain technology?
5. If it is long-chain, provide a list of short-chain alternatives with similar performance
6. Is the DWR Product compliant with the US EPA 2010/15 stewardship program and the EU REACH marketing and use restrictions for PFOS, PFOA and related substances?
7. Is the DWR product registered on the following inventories:
   - US EPA TSCA inventory by filing of a Pre-Manufacturing Notification (PMN) or
   - Canadian Domestic Substances List (DSL) or
   - NICNAS (Australia) or
   - REACH compliant
8. Do you have mammalian toxicity data for the DWR Product?
9. Do you have aquatic toxicity, bioaccumulation and environmental fate data for the DWR Product?

To assess that Best Environmental Practices (BEP) are utilized:

1. Has the DWR Product been assessed by a third party such as bluesign technologies and is it registered in the bluesign® bluefinder, a search engine for bluesign® approved textile auxiliaries and dyes? Has the DWR Product been assessed in Finished Product such as Oeko-tex® STeP Certification?
2. Has your supplier implemented the guidance given in Section A. of this document?
3. Can your supplier verify that Best Environmental Practices are being followed in their facilities?

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[2] This list of "best practice questions" is very close to the list developed by the OIA DWR Task Force for brands to ask chemical suppliers

[3] OECD defines long chain per- or polyfluorinated substances as:

- "Perfluorocarboxylic acids (PFCAs) with carbon chain lengths C8 and higher, including perfluorooctanoic acid (PFOA);
- Perfluoroalkyl sulfonates (PFSAs) with carbon chain lengths C6 and higher, including perfluorohexane sulfonic acid (PFHxS) and perfluorooctane sulfonate (PFOS); and
- Precursors of these substances that may be produced or present in products. For definition purposes "precursor" means a substance that has been recognized as having the potential to degrade to perfluorocarboxylic acids with a carbon chain length of C8 and higher (including PFOA) or perfluoroalkyl sulfonates with a carbon chain length of C6 of higher (including PFHxS and PFOS)."

Precursors, PFCAs and/or PFSAs may be present as an impurity in commercial fluorinated polymeric repellent products.

Legal Notice

The Guidance for Best Environmental Practices (BEP) for Fluorinated Repellent Products in the Global Apparel Industry was prepared by the FluoroCouncil. It is intended to provide general information to persons who may use, handle, or dispose of fluorinated repellent products in the textile industry. It is not intended to serve as a substitute for in-depth training or specific handling or storage requirements, nor is it designed or intended to define or create legal rights or obligations. It is not intended to be a "how-to" manual, nor is it a prescriptive guide. All persons involved in using, handling and disposing of fluorinated repellent products have an independent obligation to ascertain that their actions are in compliance with current federal, state and local laws and regulations and should consult with legal counsel concerning such matters. The guidance is necessarily general in nature and individual companies may vary their approach with respect to particular practices based on specific factual circumstance, the practicality and effectiveness of particular actions and economic and technological feasibility. Any mention of specific products or third parties in this document is for illustration purposes only and is not intended as a recommendation or endorsement of such products or services by the FluoroCouncil. Items in this document may be trademarked, which may or may not be noted in this document.

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References:

In developing this guidance, the following documents were consulted:

- European Commission, "Integrated Pollution Prevention and Control (IPPC) Reference Document on Best Available Techniques for the Textiles Industry" July 2003 (http://eippcb.jrc.ec.europa.eu/reference/BREF/txt_bref_0703.pdf)
- Umwelt Bundes Amt, "Environmental Standards in the Textile and Shoe Sector" May 2012 (http://www.umweltbundesamt.de/publikationen/environmental-standards-in-textile-shoe-sector)
- bluesign (http://www.bluesign.com/)
- Outdoor Industry Association's Chemicals Management Module (http://www.outdoorindustry.org/responsibility/chemicals/cmpilot.html) and the Sustainable Apparel Coalition's Higg Index (http://www.apparelcoalition.org/higgindex/)

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