Apparel Care and
the Environment

Alternative Technologies and Labeling

Session II

Textile Care Research Programs in Germany

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I have prepared my presentation with four parts: marketing data, environmental regulations, the present situation in Germany, and current and new research programs.

Marketing Data

The domestic care of apparel in Germany is about 90 percent home laundered and only 10 percent dry cleaned, wet cleaned, or washed via professional textile care. That means about 200 million articles are cleaned every year in the dry cleaning industry, or an average of 2.5 articles per capita. We also have about 2-3 kilograms of textiles per capita per year. In terms of the composition of the care properties, about 30 percent are washable and can be dry cleaned, and about 70 percent are dry clean only.

In the development of the net sales of the German dry cleaning industry, there was a decline from 1990 to 1995. I think in the United States it's similar to the German situation. In Germany, expenditure per capita for dry cleaning services is about $13. We must ask what is the reason for this decline. The first question to ask is what has happened to the average disposable income people in Germany have to spend on things such as dry cleaning services. There has been a decline in average disposable income since 1992, so people have less money for dry cleaning services.

Another question is how have clothing habits changed (if at all) in the past few years. Slide 6 shows the development of clothing habits and the percentage or average values for formal clothing and casual clothing. From 1986 to 1996 there was a strong decline in the purchase of formal clothing and an increase in the purchase of casual clothing. Casual clothing is more washable and involves more domestic care. To summarize this market data, there are three important possible reasons for decline in per capita expenditure for dry cleaning services: (1) decline in disposable income per capita caused by a declining economy, (2) change in clothing habits, and (3) change in the development of apparel construction.

Environmental Regulations

It is important to look at these regulations because the industry has had to invest money, and will have to invest money in the next few years to protect the environment. The two most important regulations are the Clean Air Act (similar to the Clean Air Act in the United States and Canada) and the Water Resources Acts (also similar). Slide 11 shows the dry cleaning industry and dry cleaning plants, different parts of which are regulated by different acts. The Clean Air Act regulates the machine, condensation in the machine, and the still. One difference between German and U.S. regulations, is that in Germany we have to put diffusion barriers at the wall and at the ceilings to protect the adjacent rooms from the impact of solvents such as perchloroethylene (perc). All other aspects are similar to the regulations in the United States. The Water Resources Act regulates the handling of the waste, the contact water treatment, and the figures for the drains.

The Present Situation in Germany

The following types of solvents are used: water (for washing and wet cleaning), organic solvents, perc, and petroleum solvents. In Germany as well as in the

United States, we are also doing research on carbon dioxide. With regard to wet cleaning, we have a special problem in Germany. About 30 percent of the apparel which comes to the dry cleaner every year is washable. The washability is expressed by a care labeling symbol and the dry cleaner sees that the garment can be washed. For 70 percent of the apparel there is no label that indicates that the garment can be washed, and therefore, 70 percent is dry cleaned. In reality, within this 70 percent of articles which are dry cleaned are a lot of articles which could be wet cleaned but not washed. But the dry cleaners do not know which articles can be wet cleaned. If the cleaner wet cleaned such an article and damage occured, the dry cleaner would have to take responsibility for these damages and pay for them. If the care label indicated that these pieces could be wet cleaned, then about 20 percent of apparel could be wet cleaned by the dry cleaning industry. That means that indication of wet cleanability is essential for progress in wet cleaning all over the world. We would then only have 50 percent of apparel that would have to be dry cleaned. Perhaps we can reduce this amount by new constructions in the textile apparels.

Current and New Research Programs

When I prepared my presentation for today last week in Germany, I collected all the programs, all the research objectives we had in Germany from our colleagues in Krefeld, in industry, at Kreussler, at Hohenstein, and other places. I had a list of programs with very awfully long titles. Instead of telling you all these titles, I tried to make three groups of programs. I thought it would be a good idea to take the color of these solvents to indicate the groups. But unfortunately, all solvents are colorless. So, I looked for another color. I decided the solvents have psychological colors and not real colors. I developed the following colors and I hope you will all agree with me. The first is a Green Program that means water. And the second will be Red for perc. So with perc as a Red program, and petroleum solvents as a Yellow Program, the mixture is an Orange Program. The Blue Program is liquid or supercritical carbon dioxide.

The Green Program

The Green Program studies the applicability of water-based cleaning procedures. Despite the care labeling problem, we have two directions in which to do research work. The first one is properties of the clothing in harmony with care properties; this is a task for the apparel industry. The other one is the treatment of clothing in dry cleaning plants—the improvement of wet cleaning technology. In regards to the harmonization of care properties, in cooperation with the apparel industry, we have to select the fabrics with regard to colorfastness, shrinkage, and surface properties. We also have to select linings, interlinings, threads, and accessories, and we have to modify design and perhaps workmanship by manufacturing the textiles for the consumer. As an example of our current research work under the Green Program, slide 19 shows two samples before and after each garment was wet cleaned seven or eight times. There was a shrinkage of the shape of the woolen garment. However, if there was an antifelting finish on this material, then the shrinkage could be avoided, or it would have been only 1 or 2 percent. Slide 20 shows a picture under the microscope of the difference between wool with and without antifelting finish. You can see the scales very sharply defined on the wool fiber and you can see a very thin layer of resin on the surface of the wool that helps it to endure the mechanical friction during the wet cleaning procedure and helps avoid the shrinkage and the felting of wool.

Another example that is very important for the development of wet cleaning is a problem with the shrinkage of rayon. If rayon has a resin finish on it, the shrinkage is very small. In regard to the clothing in dry cleaning plants, the reduction of impact on textiles and the optimization of soil removal are very important to the dry cleaner. Adequate finish processes for wet cleaned garments are also very important for the practical work in dry cleaning installations. I have one example that indicates the necessity for international cooperation. Slide 23 shows results from a round robin trial in Europe. The trial was for professional wet cleaning. It was a process for sensitive garments and they used different types of machines with different kinds of mechanical action but the same program. In one of the machines the shrinkage was 1 percent, in another it was 2 percent and both machines were operated according to the sensitive garments process. That means we have to standardize the procedures in the machines and the test methods.

The Orange Program

Perc

The hope here is to reduce the emissions in the atmosphere and ground water. The sources for emissions into air are the dry cleaning machine and the still and these are regulated by the Clean Air Act. The Water Resources Act regulates waste water and contact water management. The current research strives to develop cost effective devices to measure the concentration of perc within the dry cleaning machine. This

process must be better controlled and the final goal is a self-controlling machine. If there are any leaks in the machine, devices must tell the dry cleaner to repair the machines. The aim is to produce very cheap devices to indicate such leaks. The second objective of research is the reduction of residual perc in cleaned garments. I will give you an example of this problem. Retension of adhesives in fusible interlinings is different. Polyester and polyamide interlinings were tested for retention of perc. Slide 21 shows that two of these linings, #2 and #5 have the highest retention rate, about three or four times higher than one of the other samples. We recommend that the apparel industry not use #2 and #5. We recommend the use of interlinings that are not able to retain the perc. So, there is a tight connection between the apparel industry and the dry cleaning research facilities.

Petroleum Solvents

We have three important research directions: control of the safety aspects under practical conditions in the dry cleaning industry, minimization of the fire hazards of petroleum solvents, improvement of the energy balance by combination of distillation with absorption systems. One of these programs could be very interesting to the dry cleaners here in the room. We have a test panel of 210 machines in 180 plants. The solvents used are isoparaffins in different modifications, and the test parameters are flash point, boiling range, flash point decreasing and halogenated solvents, fatty acids, nonvolatile residue, and color.

The Blue Program

For carbon dioxide, we have a similar test program as you have in the United States and I think it would be good to have tight cooperation in the work. The approach, at the moment, in Germany is relatively wide and we are trying to find more applications for carbon dioxide than only the dry cleaning industry. It is important to study the fundamental impacts on textiles on the practical condition and the scientific research programs and then develop cost effective cleaning systems consisting of a drum, filtration unit, recovering units, and measurement devices. I know that you have in your country a machine which is new to the practice. One of the most important research goals is the improvement of cleaning efficiency. We are studying whether to use liquid carbon dioxide since all the organic solvents use a small amount of water to remove the water soluble soils. Perchloroethylene, hydrocarbon, and especially carbon dioxide in liquid form only can dissolve oil and fatty dirt from the garment but not salt and other polar substances. So we have to add 1 or 2 percent of water in order to dissolve these water soluble parts.

Perhaps, it's a long way to the Blue Program or a short way. Many people do not believe that it is possible to clean garments in carbon dioxide. For those people who ask if it is possible, I'll leave you with a quote from Geraldine Ferraro, "It was not so long ago that people thought semiconductors were part-time orchestra leaders and microchips were very, very small snack foods."

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TEXTILE CARE RESEARCH PROGRAMS IN GERMANY

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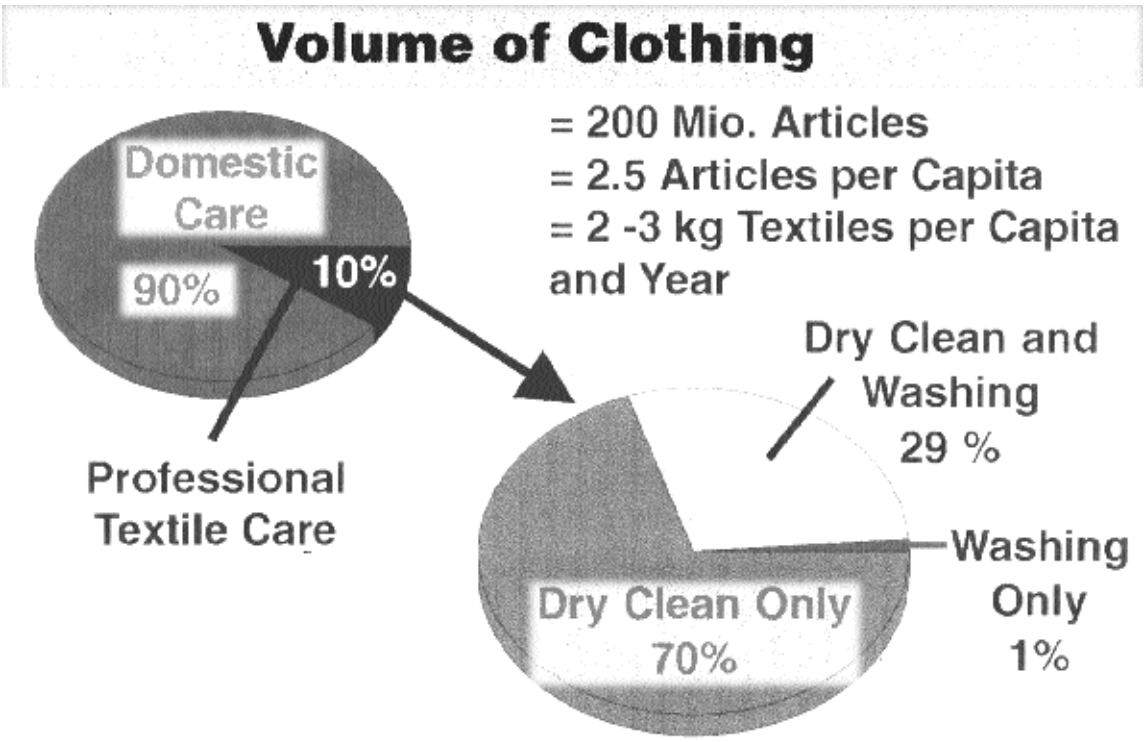
Volume of Clothing
= 200 Mio. Articles
= 2.5 Articles per Capita
= 2 -3 kg Textiles per Capita and Year
Domestic Care
90%
10%
Professional Textile Care
Dry Clean and Washing
29 %
Washing Only
1%
Dry Clean Only
70%

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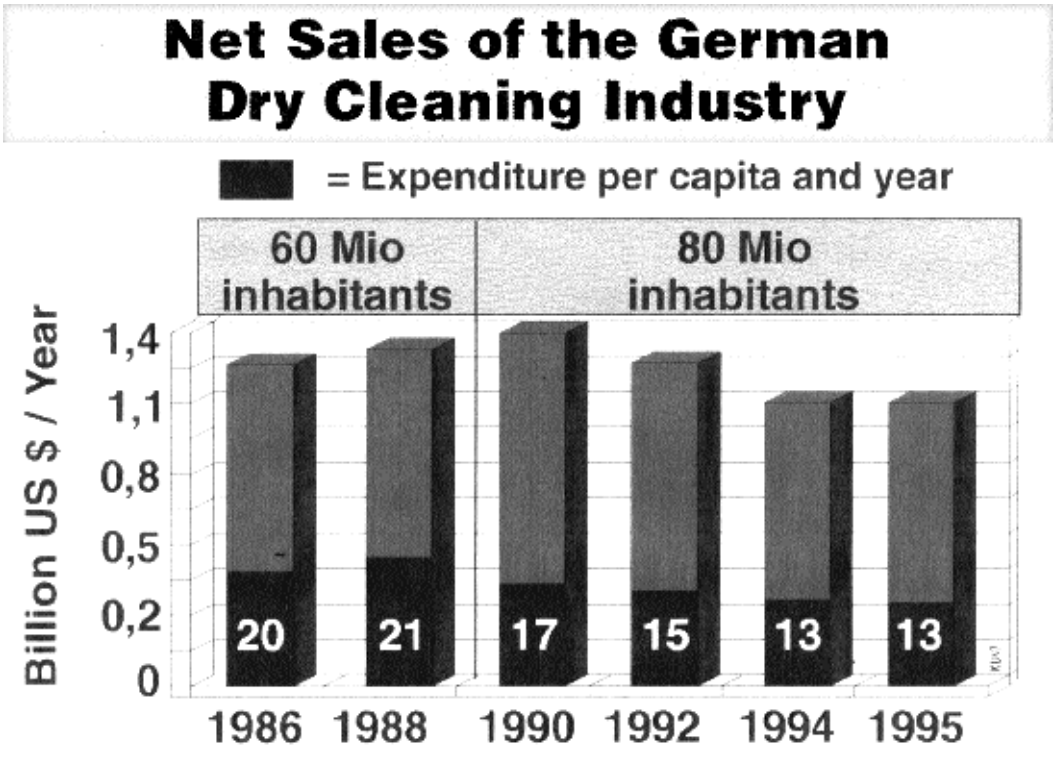
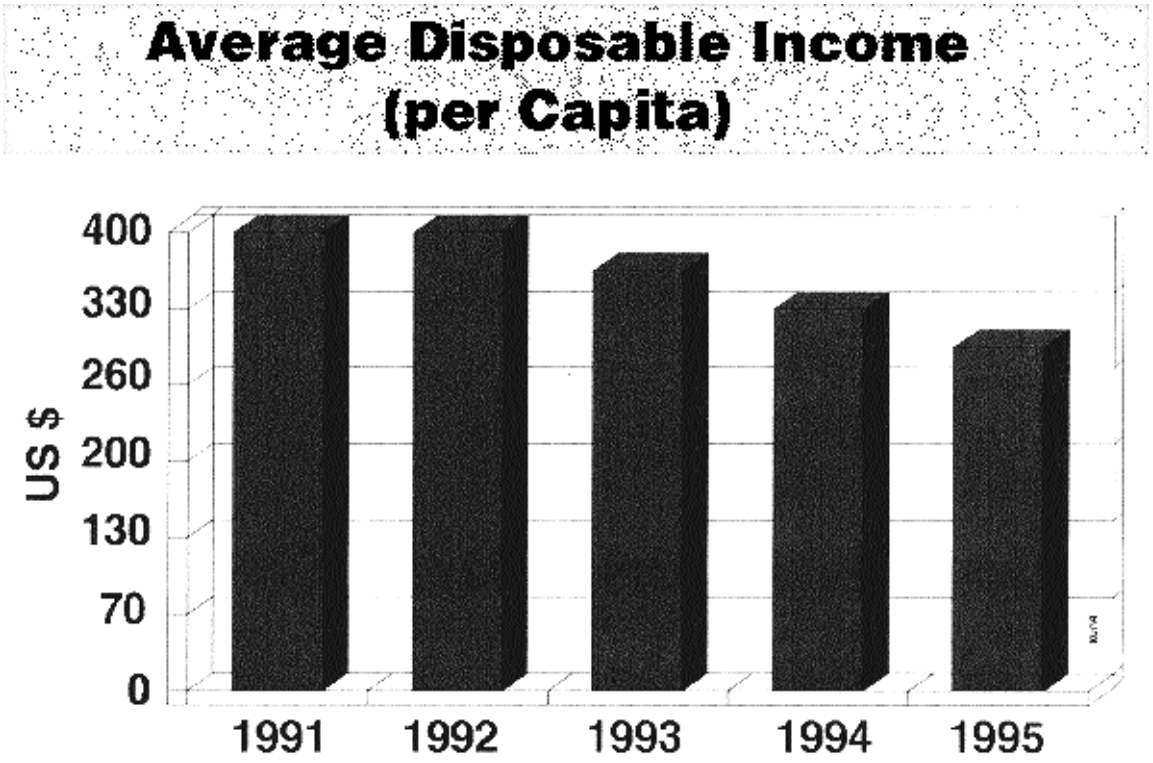

Net Sales of the German Dry Cleaning Industry
= Expenditure per capita and year
60 Mio inhabitants
80 Mio inhabitants
Billion US $ / Year
1,4
1,1
0,8
0,5
0,2
0
20
21
17
15
13
13
1986
1988
1990
1992
1994
1995

5


Average Disposable Income
(per Capita)
US $
400
330
260
200
130
70
0
1991
1992
1993
1994
1995

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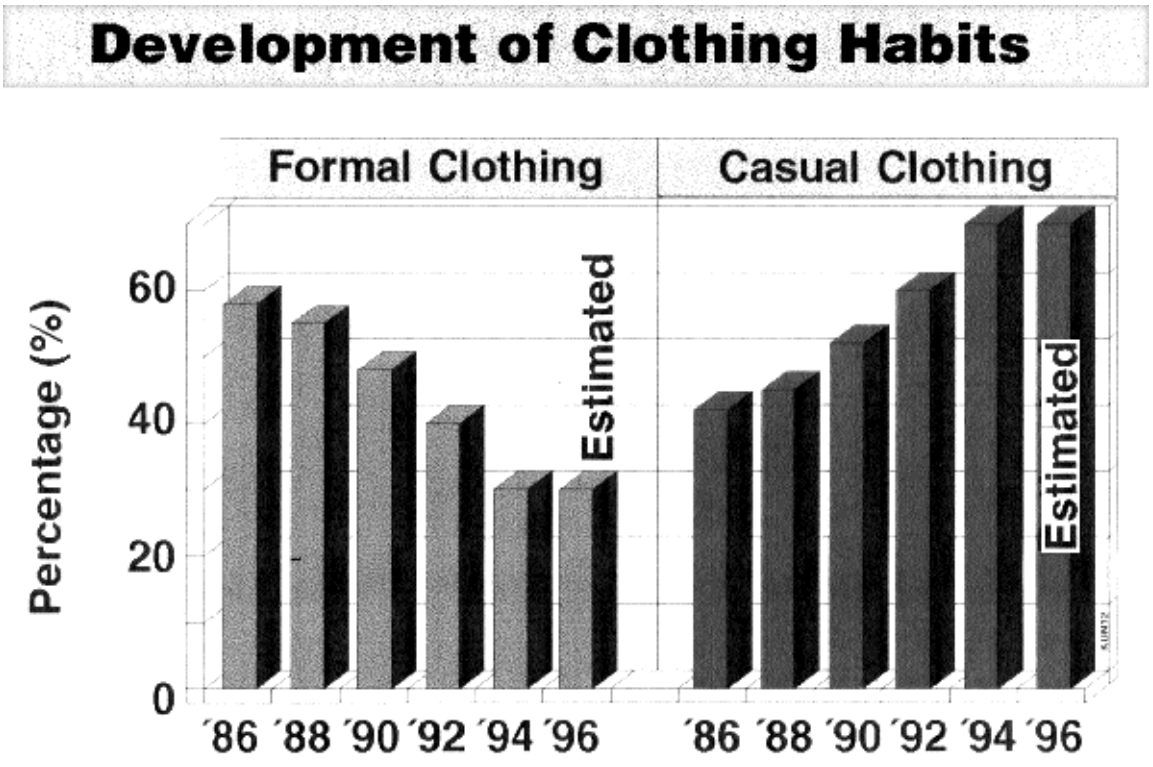
Development of Clothing Habits
Formal Clothing
Casual Clothing
Percentage (%)
60
40
20
0
Estimated
Estimated
´86 ´88 ´90 ´92 ´94 ´96
´86 ´88 ´90 ´92 ´94 ´96

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Possible Reasons for Decline in Expenditure per Capita for Dry Cleaning Services

- Decline in disposable per capita income (caused by declining economy)
- Change in clothing habits
- Development of apparel

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Environmental Regulations for the Drycleaning Industry

- Clean Air Act
- Water Resources Act

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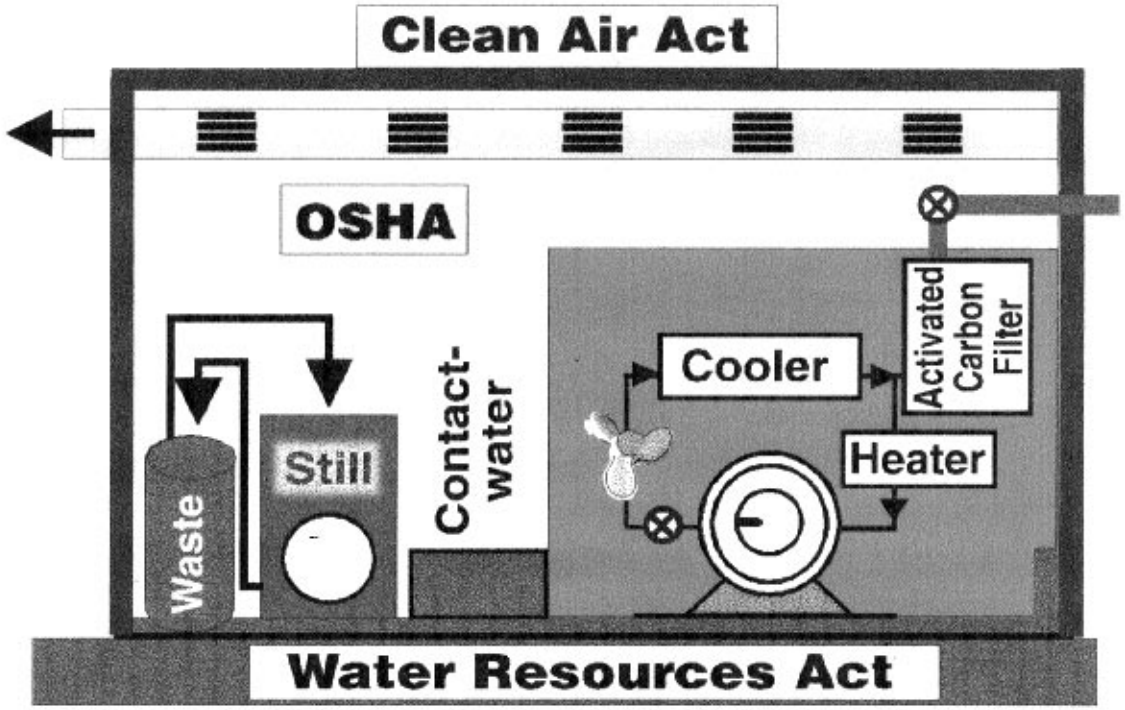

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A Market Data

B Environmental Regulations

C Present Situation

D Current and New Research Programs

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Present Situation "Solvents" in Dry Cleaning Industry

Water	Perchloroethylene	Carbon Dioxide
Washing Wet Cleaning	Dry Cleaning	in Development
	Petroleum Solvent	
	Dry Cleaning	

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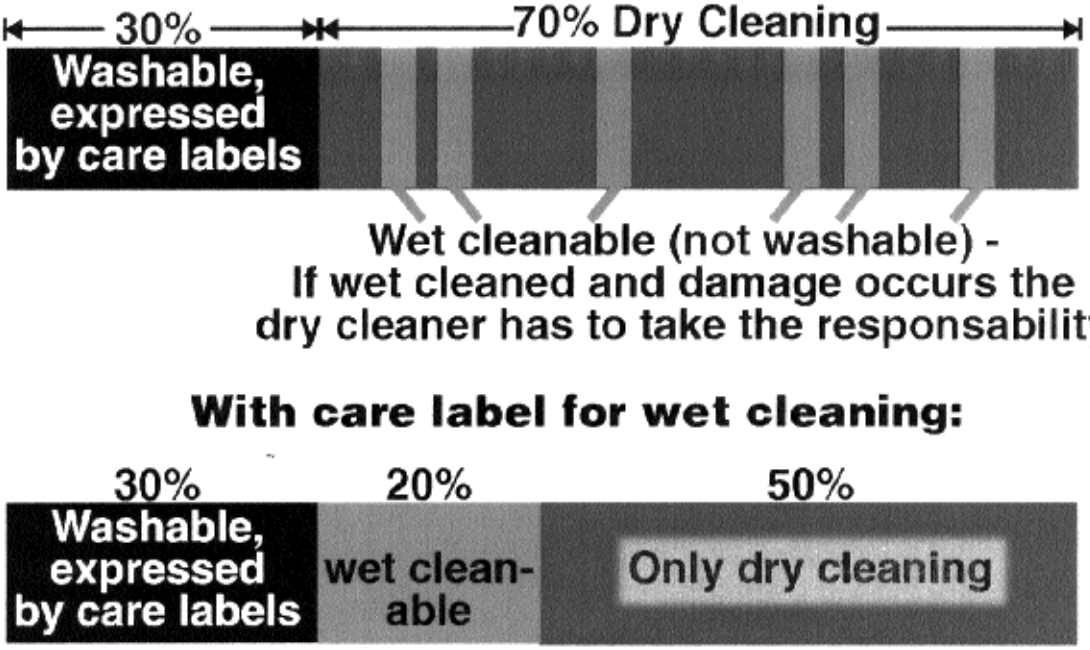
Present Situation "Wet Cleaning"



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Research Programs

Green Program:
- Water

Orange Program:
- Organic solvents
  - Perchloroethylene
  - Petroleum Solvents

Blue Program:
- Liquid / supercritical carbon dioxide

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Green Program

Scope:
Extension of the applicability of water based cleaning procedures

Properties of the Clothing	Treatment of Clothing in Dry Cleaning Plants
Harmonization of care properties	Improvement of wet cleaning technology

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Green Program

Harmonization of Care Properties in Cooperation with Apparel Industry

- Selection of fabrics in regard to color fastness, shrinkage and surface properties
- Selection of linings, interlinings, thread and accessories
- Design and workmanship

Period: 1996 and 1997

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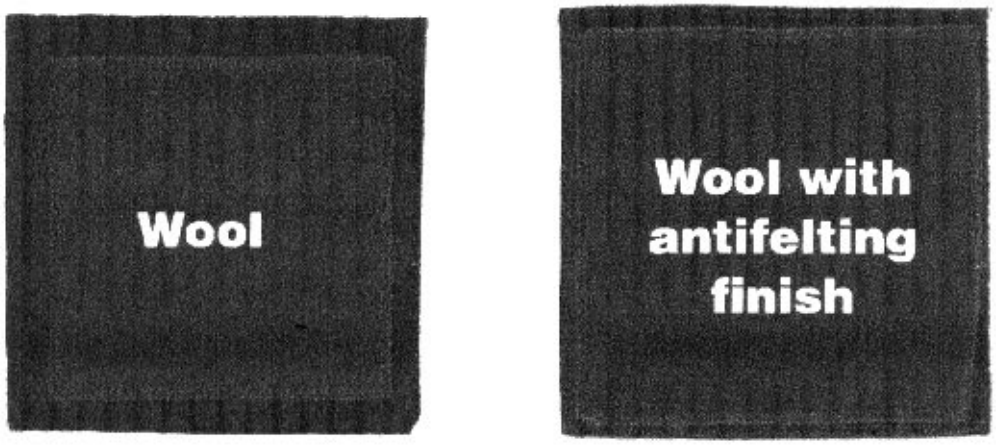
Green Program

Example



Before and after wet cleaning

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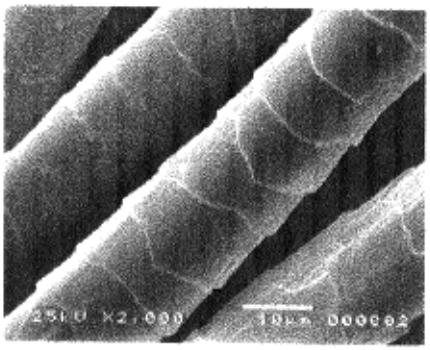
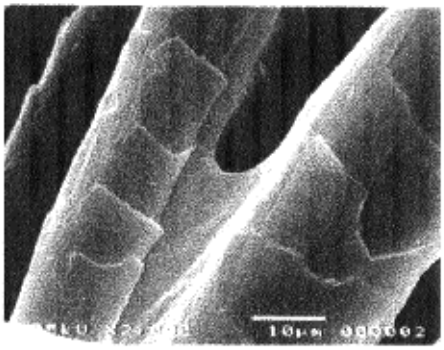
Green Program

Scanning Elektron Microscope

Magnification: x 2000



Wool without antifelting finish



Wool with antifelting finish

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Green Program

Example

Before and after wet cleaning

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Green Program

Treatment of Clothing in Dry Cleaning Plants

- Reduction of impact on textiles
- Optimization of soil removal
- Adequate finishing processes for wet cleaned garments

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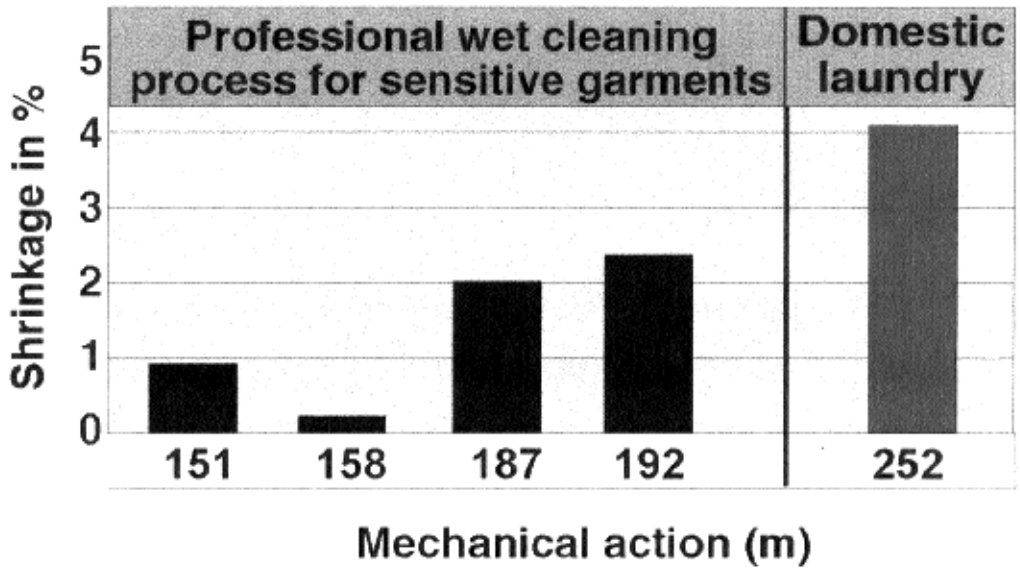
Green Program

Example



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Orange Program

Organic Solvents - Perchloroethylene -

Scope:
Reduction of emission into the atmosphere and ground water

Sources for Emission

Dry Cleaning Machine Still	Waste Contact Water
Regulated by Clean Air Act	Regulated by Water Resources Act

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Orange Program

Organic Solvents - Perchloroethylene -

Current Research:

- Development of cost effective devices to measure the concentration of perchloro-ethylene within the dry cleaning machine
- Reduction of residual perchloroethylene in cleaned garments

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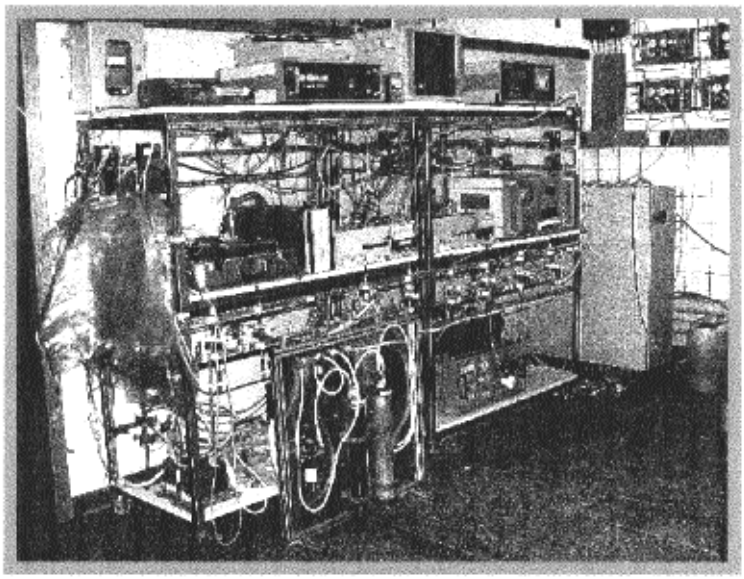
Orange Program

Organic Solvents - Perchloroethylene - Example



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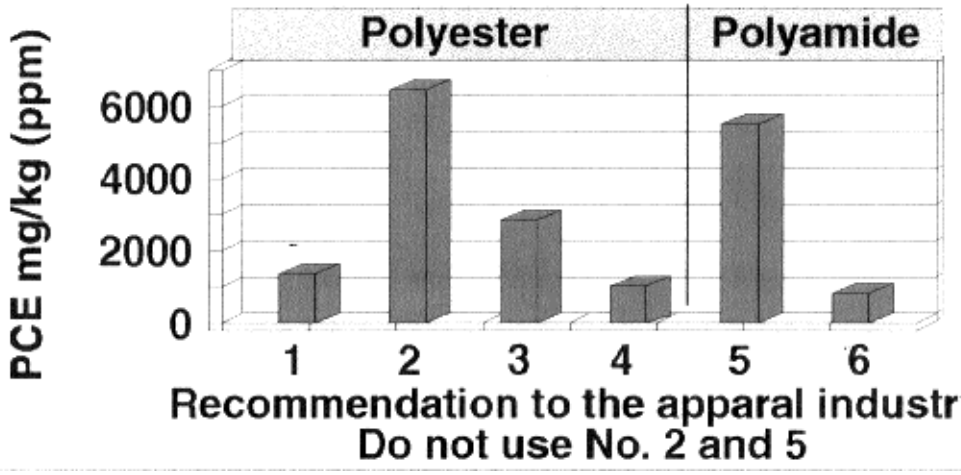
Orange Program

Organic Solvents - Perchloroethylene - Example

Residual Perchloroethylene in Cleaned Garments:

Retention of adhesives in fusible interlinings



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Orange Program

Organic Solvents - Petroleum Solvents -

Current Research:

- Controlling of safety aspects under practical conditions in the dry cleaning industry
- Minimizing of the fire hazard of petroleum solvents
- Improvement of energy balance by combination of distillation with adsorption systems

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Orange Program

Organic Solvents - Petroleum Solvents -

Controlling of Safety Aspects:

Test Pannel:	210 machines in 180 plants
Solvents:	Isoparaffins in different modifications
Test Parameters:	Flash point, boiling range, flash point decreasing and halogenated solvents, fatty acids, non-volatile residue, color

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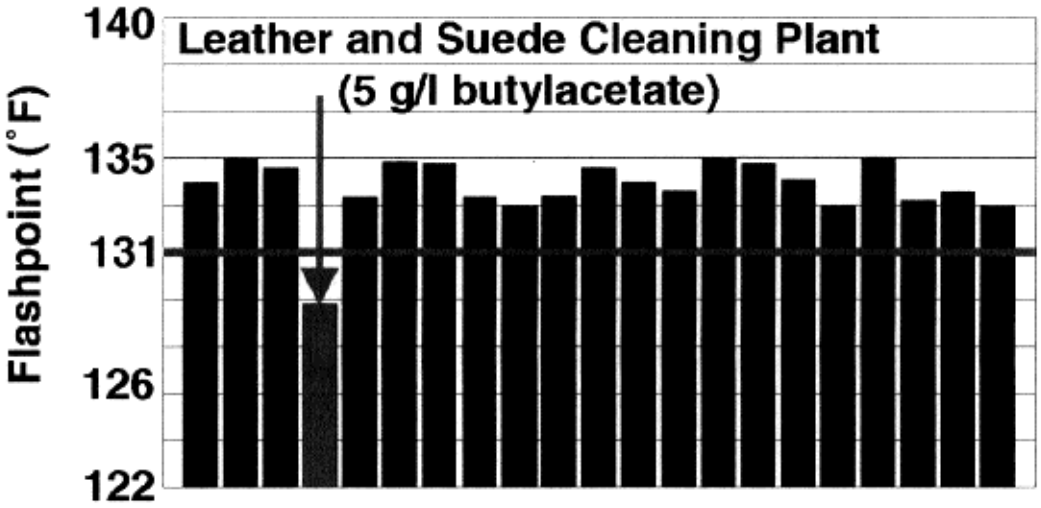
Orange Program

Organic Solvents - Petroleum Solvent - Example



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Blue Program

Liquid Supercritical Carbon Dioxide

Current Research:

- Research on fundamental facts of the impact of CO_2 on apparel under practical conditions
- Development of a cost effective cleaning system consisting of drum, filtration unit, recovering unit and measurement devices
- Improvement of cleaning efficiency of the liquid resp. supercritical carbon dioxide

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Blue Program

"It was not so long ago that people thought semiconductors were part-time orchestra leaders and microchips were very, very small snack foods."

Geraldine Ferraro

Textile Care Technology Spectra and Care Labeling Issues

Manfred Wentz

American Association of Textile Chemists and Colorists and Fabricare Legislative and Regulatory Education Organization

Dr. Wentz is Corporate Vice President of Research and Development and Environmental Affairs at R.R. Street & Co., Inc. in Naperville, Illinois. As a stakeholder in the U.S. Environmental Protection Agency's (EPA's) Design for the Environment Program Dry Cleaning Project, he co-chairs EPA's Dry Cleaning Technical Working Group for Cleaner Technology Substitutes Assessment. Dr. Wentz earned a Ph.D. in Fiber and Polymer in Science from North Carolina State University and a Professional Textile Chemistry and Engineering degree from the Technical Academy in Hohenstein, Germany.

Introduction

Apparel and textiles fulfill essential functional and aesthetic needs. Social-psychological, physiological, physical, cultural, and economic parameters traditionally influence apparel selection, purchasing, and wearing decisions. As we become more aware of the impact of our activities on the environment, questions about the interface between apparel and the environment are raised and enter into the decision-making process.

Apparel and textiles are soiled during normal use. Economic realities require that apparel and textiles be cleaned and refurbished for reuse without substantially altering their functional and aesthetic properties. Consumers have the choice to clean and refurbish apparel at home or have it done in professional cleaning establishments. It is essential that available cleaning processes maintain or restore the desirable and functional attributes of the textiles. This is the joint responsibility and opportunity of the textile and apparel industry, the textile care industry, and the consumer.

The Federal Trade Commission (FTC) promulgated a trade regulation rule on the care labeling of textile wearing and certain piece goods in 1971 and amended it in 1983. The rule requires that apparel items have a permanent care label that provides written information about their regular care. The purpose of the rule is to give the consumer accurate care information to extend the useful life of a garment.

The formation of the North American Free Trade Agreement between the United States, Canada, and Mexico provided the stimulus for using care symbols instead of words. The American Society for Testing and Materials has developed laundering and dry cleaning symbols which the FTC is about to implement. FTC's current rule requires that manufacturers and importers of textile wearing apparel have a reasonable basis and reliable evidence in support of care instructions. Both subjective and objective selection criteria are allowed.

This presentation outlines the complexity of textile care and addresses the difficulties encountered in defining reliable care instructions. Conceptual textile care spectra for nonaqueous and aqueous cleaning processes will be presented and technology options, cleaning mechanisms, textile property issues, and garment damage potentials will be discussed.

Discussion of Textile Care Process Spectra

Textile Care Process Spectrum: Technology Options

At the Hamilton Environmental Summit in 1993, textile cleaning was redefined as a generic process. This redefinition dispels the paradigm that dry cleaning means cleaning in percholoroethylene (perc) only. To initiate textile cleaning, we must break the soil-textile interaction forces to loosen and transport the heterogeneous soils away from the textiles. It does not matter if the medium is a liquid, a gas, or even a solid. We must be able to purify and reuse the chosen medium. The soils should be concentrated for proper disposal, preferably as nonhazardous waste. But what is more important, the process must clean clothes to satisfy consumer needs, and it must be economically feasible and environmentally acceptable. Today, let

us consider two practical boundary technologies: nonaqueous and aqueous cleaning.

Nonaqueous Textile Cleaning

There will always be a need for a nonaqueous textile cleaning technology. It is dictated by the properties of textiles and soils, but the medium does not have to be perchloroethylene only. We know that perchloroethylene is a proven medium for professional textile cleaning. Any other nonpolar media, such as petroleum, carbon dioxide, or other nonpolar liquids, which meet the textile cleaning performance requirements, could be chosen.

Aqueous Textile Cleaning

At the other end of the spectrum is aqueous cleaning. We showed that the advanced professional wet cleaning technology makes it feasible to clean many textiles that are traditionally cleaned in nonaqueous media. The challenge for our industry is to prove that this professional aqueous cleaning technology offers sufficient advantages to consumers so that they do not do more wetcleaning at home.

Textile Care Process Spectrum: Cleaning Mechanism

Colloid chemistry in nonaqueous and aqueous media allows satisfactory textile cleaning. The mechanisms which govern polar, nonpolar, and particulate soil removal are reasonably understood for both media. We know that polar soils are more easily removed in water than in nonpolar solvents and that nonpolar soils are more easily removed in nonaqueous solvents. Professional textile cleaners can optimize soil removal if they have access to both media.

Textile Care Process Spectrum: Textile Properties

The structure and properties of fibers, yarns, fabrics, and colorants ultimately determine which cleaning process is best for them. Professional cleaners cannot change textile properties, but they must know as much as possible about them in order to choose the best textile cleaning process. The spectrum of textile properties dictates which cleaning process technology (nonaqueous or aqueous) is best to maintain desirable textile attributes.

Textile Care Process Spectrum: Preferred Methods for Garments

Based on field studies, we established preferred methods for cleaning specific garments. Tailored or structured garments and high fashion items often have linings, interfacing, trims, and other accessories or have complex design features. They often behave differently in the same cleaning medium. Damage to these items is less likely to occur in nonaqueous media than in aqueous cleaning media. Thus, these garments are best cleaned in a nonaqueous media. Many garments, such as overcoats, trousers, raincoats, parkas, or sweaters may be cleaned in either media. Shirts, blankets, sleeping bags, and linens are best wetcleaned. Occasionally, excessive polar or nonpolar soiling dictates and overrides textile cleaning media selection criteria.

Textile Care Process Spectrum: Garment Damage Potential

A deviation from care label instructions increases the risk of garment failure. We do not recommend it, but each operator, of course, has the option to ignore care instructions. But if the cleaner damages a garments, they will be responsible for it. The potential damage to garments during cleaning is generally higher with aqueous media than with nonaqueous media. This fact is the major reason why dry cleaning is so highly utilized. Often, manufacturers low-label their garments as “Dry Clean Only” to reduce garment damage and to ensure customer satisfaction during the use of their products. I would now like to discuss the more important types of garment damage that can occur.

Practical Shrinkage Potential

When garments shrink more than 2 or 3 percent, the garments do not fit well anymore and consumers will notice it. Shrinkage can occur during the cleaning, drying, or finishing process. The new wet cleaning technology optimizes and controls the well-known process parameters to reduce shrinkage: time, mechanical action, heat, and chemistry. Practicing textile care specialists classify shrinkage into two categories: felting and relaxation.

Felting Shrinkage: This type of shrinkage is unique to wool because wool fibers have surface scales that cause differential friction effects. When wool fibers swell, as they do in water, the scales expand and are lifted. This increases differential friction between fibers and interlocks and compacts them which causes felting shrinkage. It is possible to reduce but not eliminate the felting potential of wool with process additives that lower interfiber friction and reduce fiber swelling.

Relaxation Shrinkage: During fabric and garment manufacturing, textiles are often stretched, shaped, and dried under tension. This causes latent stresses at

the macroscopic level (between fibers and yarns) and at the microscopic level (within the fiber morphology). The macroscopic stresses are generally relaxed by mechanical action that allows movement between fibers and yarns. Microscopic stress is released by plasticization. Plasticization occurs when fibers swell in a liquid medium or when excessive energy (heat) is applied during drying. Either action lowers the cohesive energy between amorphous polymer segments and causes relaxation within the fiber matrix, leading to shrinkage.

Theoretical Aspects of Shrinkage

Like all processes in nature, shrinkage is governed by the potential that it can occur (thermodynamic) and by the rate at which it can occur (kinetics). These aspects are fundamental issues in polymer science and have been studied and documented extensively for natural and synthetic fibrous polymers.

Thermodynamics theory predicts that there is a balance between cohesive energy and entropy when a process is at equilibrium. The cohesive energy between molecules retains the shape and dimension of a fibrous polymer solid, while the entropy opens it and allows the segmental relaxation that leads to shrinkage. This balance establishes the fibrous shape and stability that is disturbed and temporally fixed into a non-equilibrium position during textile and garment manufacturing.

When fibers swell in a liquid or are heated above their glass transition temperature during cleaning or drying in air, cohesive energy force weakens and entropy forces dominate. This relaxes the morphology and the fibers shrink. But because polymeric fibers are visco-elastic, the thermodynamically feasible end points are not reached instantaneously. Under these conditions, the kinetics of the process will determine the dimensional properties of fibers. Therefore, we can only delay relaxation shrinkage during textile cleaning, we cannot stop it.

The practical consequence is that relaxation shrinkage takes time and occurs cumulatively over several cleaning cycles. All textile cleaning professionals are very familiar with the phenomenon and know it as progressive shrinkage. If we can find a cleaning and finishing process that delays perceivable relaxation shrinkage long enough to exceed a garment's life cycle, consumers will be satisfied. Nonaqueous cleaning does this readily, but it is much more difficult to manage with aqueous cleaning.

The research efforts and assessment of the feasibility of professional wetcleaning within the Research Committee RA-43 of the American Association of Textile Chemists and Colorists will focus on practical and fundamental principles of shrinkage. This will allow us to establish fundamental guidelines for shrinkage prediction and control.

Potential Appearance and Tactile Changes

Consumers purchase new textiles based on visual and tactile perception. Cleaning experts strive to retain or restore the physical properties that cause the desirable sensory attributes of textiles triggering positive purchasing decisions. This means to retain the original colors, textures, and finishes during cleaning, or to restore them if undesirable changes have occurred. Again, it is easier to retain these properties during nonaqueous cleaning than during aqueous cleaning.

Claims that dye bleeding and staining can be prevented need to be verified. While it is possible to control selective colorant removal and staining, the diverse nature and properties of colorants and textiles suggest that it will be difficult to live up to such a broad claim. The real issue here is proper dyeing and colorfastness evaluation during textile manufacturing. Textile and apparel manufacturers, retailers, and textile care specialists must work together to establish quality and test protocols that predict satisfactory cleaning performance of textiles.

Most dry cleaners use fabric finishes to restore or improve the hand and feel of drycleaned fabrics. Fabric finishes for aqueous cleaning are also available to achieve the same desirable effects.

Summary

1. Textile care professional need access to nonaqueous and aqueous cleaning technologies.
2. Care label instructions can be derived from objective national and international test methods.
3. Conceptual textile care spectra for nonaqueous and aqueous processes can assist in selecting proper textile cleaning processes.
4. Garment shrinkage potential can be explained by considering practical and theoretical principles.
5. National and international organizations coordinate their efforts to establish objective test methods for care label instructions.
6. It is necessary to work closely with all members of the apparel industry to optimize garment performance as new textile care processes emerge.

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Textile Care Spectra & Care Labeling

Dr. Manfred Wentz

Apparel Care and The Environment
Washington, DC
September 9-10, 1996

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Criteria for Selection and Use of Clothing:

- Social - Psychological
- Aesthetic
- Cultural
- Physical
- Economics

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Traditional Criteria Expanded:

- Care Requirements:
  - home laundering
  - drycleaning
  - professional wetcleaning
- Environmental Concerns

4

All Members of Apparel Chain Affected:

- Fiber, Yarn & Fabric Producers
- Apparel Manufacturers
- Retail Industry
- Textile Care Industry

5

Care Labeling Rule Requirements:

- Care labels must give full instructions for at least one satisfactory method of care
- Must give warning about any part of the recommended care method that would harm the garment

6

Care Labeling Rule Requirements *(continued)*:

- State when there is no method for cleaning without damage
- Must have a reasonable basis for care instructions

7

Reasonable Basis Requirement for Care Labeling:

- Reliable Evidence That:
  - product not harmed after repeated cleanings as recommended
  - product was harmed when cleaned by method warned against

8

Reasonable Basis Requirement for Care Labeling *(continued)*:

- Reliable Evidence That:
  - product was successfully tested
  - technical literature, experience or expertise supports care instructions
  - other evidence

9

Care Label Instructions Can Be:

- Subjective
- Objective

10

Care Label Instructions Based on Subjective Judgments:

- Risky, more likely to be wrong
- Relatively inexpensive
- Method of choice for short runs
- Low labeling more likely

11

Based on Objective Testing:

- More reliable if done right
- Relatively expensive
- Method of choice for long runs
- Low labeling less likely

12

Objective Test Methods Available:

- American Association of Textile Chemists & Colorists *(AATCC)*
- American Society for Testing & Materials *(ASTM)*
- International Organization for Standardization *(IOS)*

13

Textile Care Process Options:

- Non-Aqueous Cleaning
  - non-polar solvents
- Aqueous Cleaning
  - polar solvent

14

Requirements for Any Textile Cleaning Process:

- Must Clean Clothes Satisfactorily
- Must Extend Useful Life of Garments
- Must be Economically Feasible
- Must be Environmentally Acceptable

15

Textile Care Process Spectra:

- Technology Options
- Cleaning Mechanism
- Textile Property Issues
- Preferred Methods for Garments
- Garment Damage Potential

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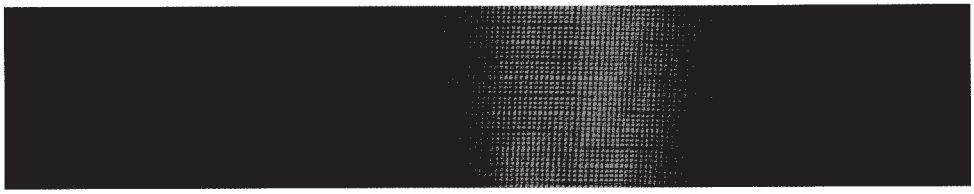
Textile Care Process Spectrum
Technology Options



Non-aqueous Cleaning
- Perc
- Petroleum
- Carbon Dioxide (?)
- Others (?)

Aqueous Cleaning
- Manual
- Machine
  - Household
  - Commercial

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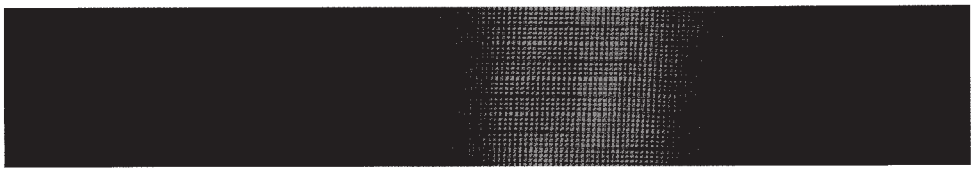
Textile Care Process Spectrum
Cleaning Mechanism

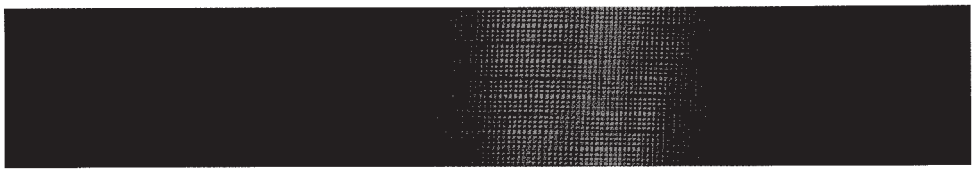


Non-aqueous Cleaning *Aqueous Cleaning*

Solubilization	**Water Soluble (polar) Soil**	Solution
Solution	**Oil Soluble (non-polar) Soil**	Solubilization
Suspension	**Particulate (solid) Soil**	Suspension

18

Textile Care Process Spectrum
Textile Property Issues



Non-aqueous Cleaning *Aqueous Cleaning*

Hydrophilic	**Fibers**	Hydrophobic
Low twist	**Yarns**	High twist
Low count	**Fabrics**	High count
Polar	**Colorants**	Non-polar

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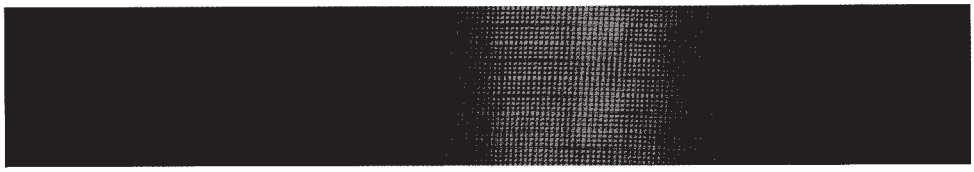
Textile Care Process Spectrum
Preferred Methods for Garments

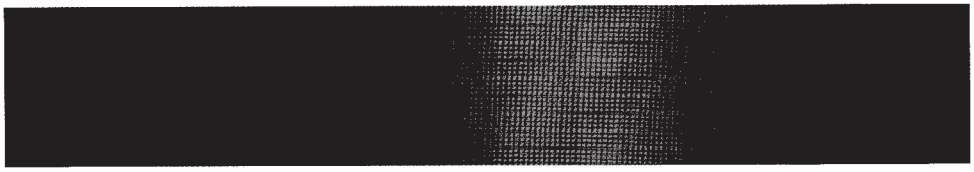


Non-aqueous Cleaning ⟷ *Aqueous Cleaning*

Men's Suits	**Overcoats**	Parkas	**Shirts**
Women's Suits	**Trousers**	Windbreakers	**Blankets**
Tailored Jackets	**Dresses**	Raincoats	**Sleeping Bags**
Fashion Items	**Skirts**	Sweaters	**Linens**

20

Textile Care Process Spectrum
Garment Damage Potential



Non-aqueous Cleaning *Aqueous Cleaning*

Shrinkage Potential

Low ⟷ High

Potential Appearance Change

Low ⟷ High

Potential Tactile Change

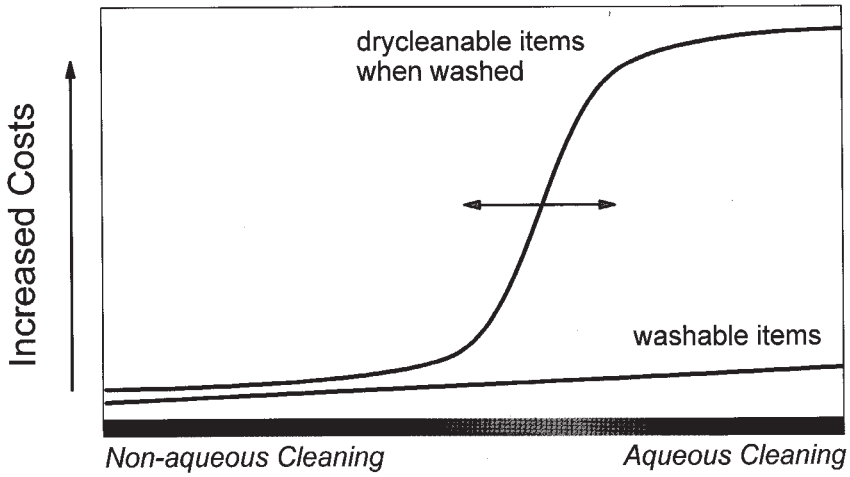
Low ⟷ High

Care Label

Dryclean Only ⟷ Do not dryclean

21

Textile Care Process Spectrum
Finishing Costs



22

Mechanisms of Shrinkage

- Felting
- Relaxation
- Thermal

23

Felting Shrinkage

- Mechanism
  - scales of wool cause differential friction
  - leads to interlocking and felting of fibers
- Minimization
  - lower inter-fiber friction with additives
  - reduce mechanical action

24

Relaxation Shrinkage

- Mechanism
  - water plasticizes fiber structure
  - releases latent tension in fibers and yarns
- Minimization
  - can only be delayed, not stopped
  - reduce mechanical actions

25

Thermal Shrinkage

- Mechanism
  - heat plasticizes hydrophobic fiber structure
  - releases latent tension in fibers and yarns
- Minimization
  - keep all process temperatures below glass transition temperature

26

Color Fastness of Textiles:

- Mode of Application (dyeing, printing)
- Solubility Properties of Colorant
- Dye Transfer Potential

27

Conclusions:

- Textile care professional need access to non-aqueous and aqueous cleaning technologies
- Care label instructions can be derived from objective national and international test methods

28

Conclusions *(continued)*:

- Conceptual textile care spectra for non-aqueous and aqueous processes can assist in selecting proper textile cleaning processes
- Garment shrinkage potential can be explained by considering practical and theoretical principals

29

Conclusions *(continued)*:

- It is necessary to work closely with all members of the apparel chain to optimize garment performance as new textile care processes emerge
- National & international organizations coordinate their efforts to establish objective test methods for care label instructions

Report of Professional Wet Cleaning in Europe

Kaspar D. Hasenclever

Kreussler Chemical Manufacturing Company, Weisbaden, Germany

Mr. Hasenclever is Managing Director of Kreussler, a chemical manufacturing company in Germany. He is chairman of the scientific advisory board of the Laundry Research Institute, Krefeld and member of the DIN Committee of Standardization. Mr. Hasenclever works in research and development of detergents and textile chemicals as well as in process technology for laundry and dry cleaning. Mr. Hasenclever has a Diploma in Engineering in Textile Chemistry from the Textile Engineering School at Krefeld, Germany.

When dry cleaning was discovered some 120 years ago, neither manmade fibers nor dimensionally stabilizing finishing processes were available. Dye fastness was poor, sewing techniques and garment construction gave little consideration to aftercare, and fashion was not anywhere near as user-oriented as today. This is not to mention the then-current laundry equipment technology, processes, and the standard detergent—soap.

For a great proportion of textiles in general use, washing would spell complete ruin. The discovery of dry cleaning thus meant progress and provided an answer to textile care problems. With the application of modern technology, today's textile items are closely oriented to serviceability. Choice of material, design, cut, dyes, wear-comfort, and aftercare methods all meet the needs of the user. Textile retailers and manufacturers research such aspects very thoroughly, in order to offer attractive incentives for purchase of new textile items. Simple problem-free care possibilities are an important consideration.

The selling point of "easy-care" calls for textiles to be cleanable with normal domestic methods. This is the reason why only a minority of outerwear textiles today are not washable. This proportion too, is continuously getting smaller since trends are towards the natural looking fabrics, ecological labeling, and protection of the environment.

With most garments, the textile care industry is in competition with domestic alternatives and has to rival its quality features, efficiency, acceptance, and availability. During the past 10 years, the textile care industry has constantly decreased its share of the outerwear market. The new wet cleaning technology offers the industry an opportunity to regain its ability to compete in the areas of quality, material conformity, efficiency, and acceptability. Looked at in this way, the use of wet cleaning in textile care is of vital importance for future development in this sector.

Soiling

In central Europe, outerwear is mostly soiled by air pollution, body excretions, foodstuffs, and direct dirt contact. Slide 1 provides data about approximate distribution of quantities, components and solubility.

Slide 1

Slide 1 shows that only about 10 percent of soiling on outerwear is soluble only in solvents. Some 40 percent is water-soluble, and the greater proportion consists of pigments. Thus it already becomes clear how advantageous a combination of water and surfactants is for removal of soiling from textiles and how much more demanding are the conditions for using solvents. In order to remove water-soluble straining during cleaning with solvents, the addition of water as well as detergent is necessary. At the same time that these water additions are active in cleaning, they also cause natural fibers to swell and so increase risk of shrinkage.

Slide 2

Slide 2 shows the absorption of moisture by fabrics depending on the relative humidity as well as the swelling produced as the maximal cross-section increases.

The most interesting aspect is the difference in water content of the fibers between that at 90 percent relative

humidity and the maximum value. It is here that the fundamental difference lies between wet cleaning and use of solvents, at least when "water-based soiling" (meaning soiling from body excretions, food, drink etc.) has to be removed with solvents.

Water absorption by textiles in solvents is directly proportional to the relative humidity in the air space of a dry cleaning machine. Immediately after one employs water additions of as little as 1 percent to 1.5 percent of the weight of work, this results in relative humidity of 85-90 percent which then leads to corresponding fiber swelling. This is to say that fiber swelling occurs even with the use of solvents. At 90 percent relative humidity, it is only a little below the maximum swelling for viscose, silk, cotton, and acetate.

Wet Cleaning as a New Processing Technique

In December 1991, during a trade press conference at Kreussler in Wiesbaden, the **LANADOL process** based on Kreussler patents was introduced jointly by Miele and Kreussler.

In November 1993, this new technology was honored with an award for innovation by the Hesse Minister of Economies, Technology, and Transport. Based on the experience of more than 500 users of wet cleaning machines, one can make the following comparisons with solvent processes:

- Better cleaning effects.
- Clearer colors.
- Fresher smell for cleaned work.
- Lower costs.
- Enhanced service capability.
- Unanimous acceptance by customers.
- Greater risks with "non-washables."
- Increased finishing requirements for multi-layer garments.
- Longer completion time.

The majority of companies where wet cleaning machines are installed also operate solvent cleaning in parallel. During the summertime approximately 50-70 percent of garments can be wetcleaned without risks. During winter, that rate drops to 30-50 percent. The other articles—mainly suits and costumes—will be processed using solvent. The advantages of wet cleaning include lower investment and processing expenditure, better cleaning quality, and higher customer satisfaction.

Approximately a third of the 500 plants using wet cleaning, use the process exclusively to handle those articles which present problems when treated in solvent: microporous membrane fabrics, sports and rain-protective clothing, very heavily soiled articles, or special classifications. Although such items comprise only some 30 percent of the total intake, this option saves about 50 percent of the solvent, because the portion of the workload which is being wetcleaned is that which would otherwise be responsible for particularly high solvent loss.

Of those cleaners using wet cleaning, only a minority are working exclusively with these process and thus no longer use solvents. In some cases, occasional items considered risky will be drycleaned by a co-operative companies, but most of the time the cleaners can cope on their own. Most of the cleaners working in this way report reduced costs and increasing demand.

Slide 3

This gives an impression, about the proportion of wet cleaning, which is already realized at European textile cleaners. But the possibility of wet cleaning is much more. Slide 4 shows the kind of garments people normally wear or use. The slide shows the preference of the best cleaning method—wet cleaning or dry cleaning.

Slide 4

The result: most of the garments of the day-by-day use are better wetcleaned than drycleaned.

Primary Needs

Textile cleaning is necessary in terms of hygiene and attractiveness, but is irksome because of the effort and expenditure involved. The primary needs are cleanliness, shape, and finish. With easy-care textiles, cleanliness can to a large extent be achieved in the household without difficulties. Shaping and finishing are sometimes very laborious. It is here that the usefulness of professional cleaning becomes evident. Conventional professional cleaning processes using solvents have system-related advantages as far as shape and finish are concerned but disadvantages with cleanliness and hygiene aspects.

This gap is closed by wet cleaning. In cleanliness and hygiene, it is equal to the high standard of house-

hold care, while for shape and finish it offers all the advantages of professional cleaning to the customer.

Service Range Profile in Textile Cleaning

Compared with easy-care processes in domestic washing machines, wet cleaning offers considerable advantages. The mechanical stress is clearly less. In addition to comprehensive cleaning efficiency, the chemicals which are used provide considerable fiber protection, color stabilization, and retexturing, and give an anti-electrostatic finish. With appropriate electronic control of dryers, the maintenance of form and shape in easy-care textiles is ensured so that finishing effort is lower, even in comparison with a solvent process.

For this category of easy-care textiles, wet cleaning offers considerable qualitative advantages compared with domestic care; costs are also clearly lower compared to conventional solvent processing.

Wet Cleaning therefore provides an opportunity to widen the range of services for the textile care trade. This would involve introducing a special service of easy-care articles, in addition to the established cleaning of high-value garments which are not washable and thus justify the appropriate expenditure and costs. Only in this way could a clearly lower price level be achieved that would be attractive to customers on a cost basis.

Opportunities for Wet Cleaning

Anyone who raises the question of what proportion of garments handed in for cleaning can be processed with wet cleaning and what proportion must be cleaned in solvent, has not fully understood either the challenge to the cleaning industry's future or the opportunities of wet cleaning. As a new processing method, wet cleaning must be viewed as dynamic, not static. It offers an extension to professional dry cleaning's capacity.

A wet cleaning installation provides the capability for a complete processing spectrum ranging from silk articles, knitted wool garments, practically all trousers and skirts, all easy-care articles, jeans, household textiles, bed linen, pillows, shirts, towels, and table linen.

Wet cleaning therefore broadens the profile of services from pure dry cleaning of conventional outerwear to the comprehensive handling of all cleaning requirements for private households. This brings new customer contacts. This in turn leads to greater volume. It takes the cleaner out of a narrow niche into becoming a general provider of services for customers' textile needs. It should furthermore be taken into consideration that competitively priced processing of easy-care textiles will also inevitably lead to increased turnover in conventional dry cleaning work.

Why not offer a special service for easy-care goods with new approaches and precisely tailored pieces, to entice people who are using their household washing machines to return once more to the trade. If such customers find satisfaction they will come back and bring their conventional clothing—in addition—for cleaning.

Such consistent use of wet cleaning demands completely new thinking from the dry cleaner, however. It is thus quite possible to break up present structures and win new customers. We must be aware, however, that these "new" customers also need new reasons to have their cleaning done. In addition to gains in quality of life and free time, arguments can be based on care for the environment and on textiles retaining their value. In practical terms, professional wet cleaning is more effective than home processing, while offering a guarantee of safety and efficiency through specialist processing techniques and trained operators.

From this standpoint, wet cleaning is also an entrepreneurial challenge. Even without an appropriate care symbol for wet cleaning an absolute imperative we must not forget that commercial textile cleaning offers advantages, even for easy-care textiles. Why should we not take up this market actively?

1

Table 1
Average soiling of garments in Europe

Soil type	Proportion	Solubility	Components
Pigments	50 %	not	dust, soot, metaloxides, rub-off, pollen, aerosols
Polar subst.	30 %	water	sugar, salt, drinks, body excretions
Polymers	10 %	water	starch, albumen, milk, food
Oils/Fats	10 %	solvents	skin grease, resin, wax, oils, fats

2

Table 2
Water content in Textile fabrics dependent on relative humidity

Fibre	relative humidity			swelling
	70%	90%	max.	
viscose	14,1%	23,5%	24,8%	115%
wool	15,6%	22,2%	28,7%	39%
silk	11,2%	16,2%	17,7%	31%
cotton	8,1%	11,8%	12,9%	43%
acetate	5,4%	8,5%	9,3%	62%
polyamide	5,1%	7,5%	8,5%	11%
acrylic	2,1%	4,0%	4,8%	9%
polyester	0,5%	0,6%	0,7%	0%

3

Table 3
Proportion of Wet Cleaning in European Textile Care

Proportion	kind of garments	Users
20 - 30%	"washable" textiles	50%
35 - 50%	easy finishing	35%
70 - 80%	no high risks	15%

4

Table 4
Preference of Cleaning Method dependent on Kind of Garments

better for dry cleaning	SUITS WOOLEN JACKETS COSTUMES WOOLEN COATS
equal dry/wet clean	TROUSERS SKIRTS DRESSES PULLOVERS COATS
better for wet cleaning	RAINCOATS ANORAKS SPORTSWEAR JACKETS BLOUSES JEANS
new business	SHIRTS TABLE LINEN BED LINEN DUVETS PILLOWS

Report on the European Wet Cleaning Committee

Walther A. J. L. den Otter

TNO Cleaning Research Techniques Institute, Delft, The Netherlands

Mr. den Otter is Manager of the Dry Cleaning Department at the Cleaning Techniques Institute. He is developing alternative cleaning methods for dry cleaning, as well as cleanup methods for soil and ground-water pollution. In adition, he serves in a workgroup of the Dutch Ministry formulating the update of the General Administrative Order (Dutch Environmental Act) involving safe working conditions for the Dutch dry cleaning industry. Mr. den Otter holds Engineering and Physical Chemistry degrees from a technical college in Amsterdam.

I have been a research manager and senior adviser at the TNO Cleaning Techniques Research Institute in Delft, The Netherlands for 26 years. Wet cleaning has been one of the major areas of our activities, and will continue to be so in the near future.

Throughout Europe, discussions have been taking place about wet cleaning. IDRC (a collaborative bond of European institutes for dry cleaning) and CINET (an international committee on textile care), has discussed this subject extensively. The heart of the matter is how to show consumers that garments have to be treated by a professional wet cleaner; it is absolutely necessary to distinguish between washing and wet cleaning.

The members of IDRC and CINET unanimously agree an adequate care label must therefore be developed. Efforts to produce a wet cleaning label, and a test method which satisfies the demands of wet cleaning, have to be discussed at a national and international level.

In order to create a professional platform for European discussions and decisions, British, Dutch, German, and Swedish research institutes organized a summit held in Delft on October 23, 1995. At this summit, after intensive discussions of all technical possibilities and operational requirements, the European Wet Cleaning Committee (EWCC) was founded. In addition to providing a professional platform, EWCC's aim is to establish wet cleaning as an adequate cleaning method in the field of dry cleaning, without the risk of textile damage. The founding members of the EWCC are the European members of the IDRC, members of CINET, and the European Manufacturers Council (a group of manufacturers of special innovative textiles and garments). EWCC associated members include manufacturers of wet cleaning machines/systems, supplier of detergents, and companies which can contribute technical and organizational expertise. The founding of EWCC created a professional platform on which factual and objective discussions and preparations for the wet cleaning care label can take place.

One of the aims of EWCC is the development of an official, accepted care label symbol indicating that a garment can be wet cleaned. In order to create this care label symbol, a test method must be defined. This test method would be used to test garments to see if they can be wet cleaned safely. If the garments pass this test, they can obtain the wet cleaning care symbol.

At the moment, a label for wet cleaning has been determined by GINETEX for three categories: normal, gentle, and very gentle processes. For the label to be used, a test method is required. For this test method to be established, a round robin trial (RRT) is necessary.

An RRT is a test in which different laboratories participate in order to discover the reliability and reproducibility of the specific test method. Most RRT's are performed more than once, since during the process of a trial, improvements in the test method will emerge. In the case of EWCC's RRT, the draft test method had already gone through a first trial to optimize the method.

The 11 participants of EWCC's RRT are:

- *Research institutes:* FCRA (United Kingdom), Forschungstitut Hohenstein (Germany), IFP-TEFO (Sweden), TNO Cleaning Research Techniques Institute (The Netherlands), WFK Forschunginstitut fur Reinigungstechnologie (Germany).

- *Machine/system manufacturers:* Electrolux (Sweden), John Laithwaite Association (United Kingdom), Miele & Cie. Professional (Germany).
- *Detergent and agent suppliers:* Busing & Fasch (Germany), Kreussler (Germany), Chemische Fabrik Seitz (Germany).

In the first EWCC RRT, two processes were tested: a gentle process for sensitive materials and a very gentle process for very sensitive materials. The RRT tested the dimensional change that occurs with wet cleaning. The 11 participants of the RRT used five different types of machine systems (Miele, Electrolux, Boewe, Aquatex, and Ipso). Each type of machine has different processes and mechanical actions. In the RRT, it must be proved that the same results can be obtained with different machines and program designs. To limit the number of variables in the RRT, process parameters were fixed: washing and drying times and temperatures, liquid ratio, loading ratio, ballast and detergent.

The gentle process was:

wash	pre wash	30°C	5 min.
	pump off		
	main wash	30°C	10 min.
	spin		
	rinse	cold	5 min.
	pump off		
	spin		
drying	inlet temperature	60°C	
	drying to 12-15 percent residual moisture		

The liquid ratio had to be 5 liters-per-kilogram (kg) load and the loading ratio 1 kg load in 25 liters volume.

The very gentle process was:

wash	main wash	30°C	10 min.
	spin		
	rinse	cold	5 min.
	pump off		
	spin		
drying	inlet temperature	40°C	2 min.

The liquid and loading ratios of the very gentle process were the same as in the gentle process.

To determine shrinkage, the processes were performed on an untreated woven wool fabric of the International Wool Secretariat (IWS) called A1 wool. This wool is especially prone to shrinkage, therefore differences between processes can be seen easily. Of course, such wool will not be used for garment manufacturing. The shrinkage in the test method is measured relative to a household washing process. The aim of the first RRT was for the gentle wet cleaning process to have a 60 percent shrinkage rate as compared to home laundering, and for the very gentle process to have shrinkage rates of 30 percent. The shrinkage rate is determined after one to five complete (washing and drying) wet cleaning cycles.

Slide 6 shows the results of the RRT for the gentle process. In this figure, the results of the participants with similar machines are grouped together. The results are given for each of five (and in some cases six) complete wet cleaning cycles. The shrinkage listed in Slide 6 is the area felting shrinkage of the IWS wool test pieces. The x-axis represents the different laboratories and the y-axis the percent of area felting shrinkage.

One laboratory had very high shrinkage values. In evaluating the process parameters, it became clear that the cause for this high level of shrinkage was that the rinsing part of the process was carried out without detergent and the mechanical action in this particular process (pumping off) was very high. These results show two important parameters for wet cleaning which negatively influence shrinkage. Slide 7 shows the same type of figure for the very gentle process.

These results show us that in order to receive low shrinkage levels, special attention must be given to the performance of the wet cleaning process; washing without special settings and additives results in a much higher shrinkage level.

An inventory of the process conditions of the different participants revealed a number of differences in the process conditions. These differences may be the reason for the variations in results. The first difference is the type of machines used. However, there are still differences in the results from the same type of machine.

Causes for these differences might be:

- The mechanical action during washing.
- Rinsing with or without detergent.
- The centrifugation speed.
- To reach the goal of 12-15 percent residual moisture, drying time for different participants ranged from 4.5 to 11 minutes.
- The hardness of the water at different sites varied from 1 to 20 degrees DH (A German method for measuring hardness).

As this was the first RRT and there were many possible causes for differences in results, the participants were all satisfied with the results. They laid the groundwork for a second RRT which is more defined than the first. For example, in the gentle process in the second RRT, drying time is restricted to a maximum of

7 minutes (in case a 12 to 15 percent residual moisture has not been reached), with 5 minutes being the preferred amount of time. The pH and the hardness of the water will be measured, and the amount of detergent is specified more precisely. The detergent used in the RRT is a solid and becomes a liquid by warming it to 25-30°C. In the first RRT, we noticed variations in the way detergent was used. One participant dissolved the detergent in water. Others heated the detergent and poured it into the detergent hopper. For the second RRT, detergent will be dissolved in 25-30°C water and the detergent hopper will be rinsed with warm water.

During the wet cleaning process, shrinkage occurs during the washing cycle as well as the drying cycle. In the first RRT, a few of the participants measured shrinkage after the washing and drying parts of the process separately. Approximately 75-95 percent of the total shrinkage occurs in the washing part of the wet cleaning process, if the settings for drying are installed well.

Another result of the first EWCC RRT was the shrinkage of a gentle wet cleaning process was only approximately 50 percent of the shrinkage resulting from household washing machines. For a very gentle wet cleaning process, it was only about 25 percent. That's why there's an urgent need to distinguish between washing and wet cleaning.

The results of the first RRT allowed the EWCC to optimize the test method for wet cleaning for the second RRT, which will lead to the development of a care label symbol for wet cleaning.

The manual of the second RRT specifies

Composition of the ballast:	50 percent PES/50 percent CO
Reference material:	A1/SM 12
Number of Reference Pieces:	3 x 8 gentle process; 3 x 4 very gentle process
Preparation of Reference Pieces:	IEC 456, sections 5.6.1.1. and 5.6.4.2
Water:	softened water (hardness and pH to be measured)
Detergent:	2.0 g/l of C13 oxoalcohol 7EO (Lutensol A07/BASF)/ one in each bath
Measurement:	• IEC 456, section 5.6.5.1.3.5 (under water) • after each washing and drying cycle • eight washing and drying cycles gentle process—four pieces after washing and four after washing and drying very gentle process—four pieces after washing and drying
Aim:	shrinkage values set at (50 + 5) percent gentle and (25 + 2.5) percent very gentle
Calibration Procedure:	after five working cycles ISO 6330 program 7A in reference machine WASCATOR FOM 71
Deviation:	each deviation from test conditions must be registered

This second RRT is planned to be carried out in the fall of 1996 in order to gather enough data for the International Organization for Standards meeting in early 1998. EWCC wants to cooperate with the North American Institutes in the United States and Canada in order to get an international test method and labeling as soon as possible. EWCC welcomed North American delegates to the June meeting at Hohenstein this year and is looking forward to cooperation which benefits all parties.

1

EWCC
European Wet Cleaning Committee

- IDRC Research Institute
  France, Germany, The Netherlands, Sweden, United Kingdom
- CINET
  International Committee of Textile Care
- DTB
  European Textile Manufacturers Council
- Associated Members
  - Machine/system manufacturers
  - Suppliers detergents, agents etc.
  - Technical and organizing contributions attributing companies

2

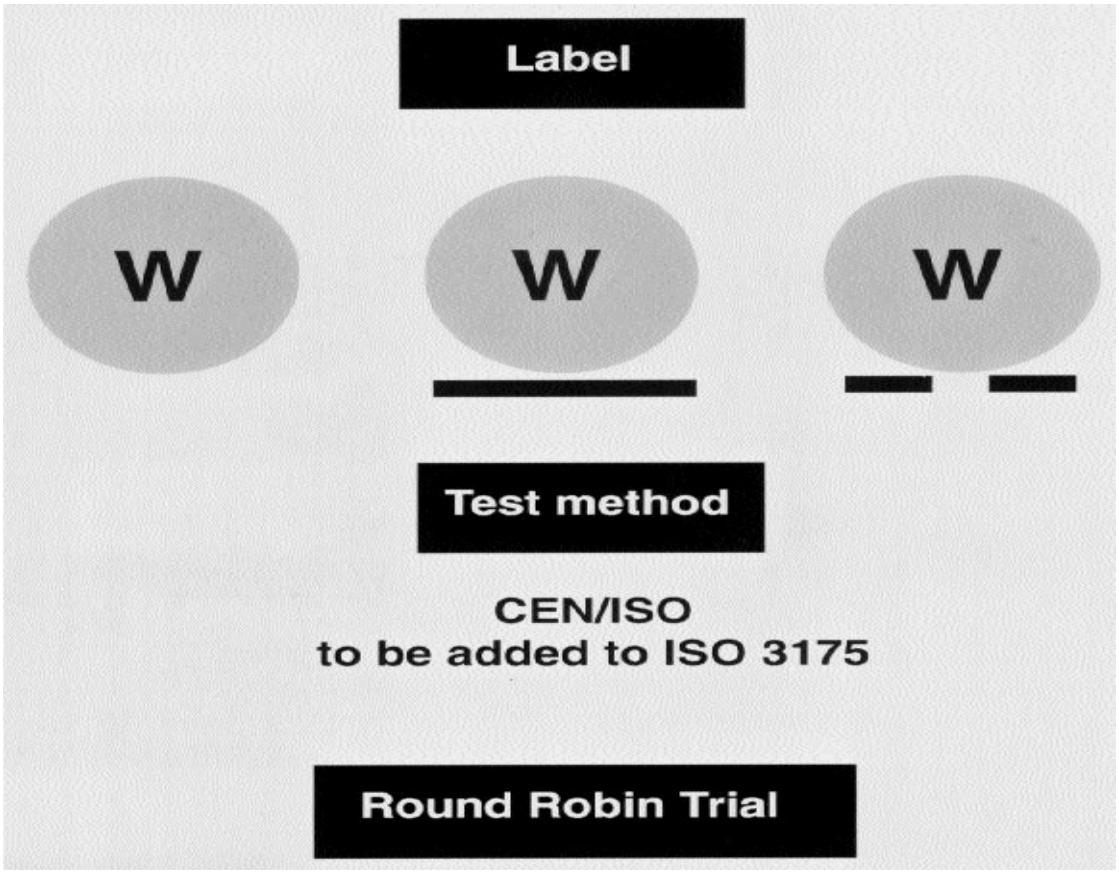
Aims of EWCC

- To assist and support the cleaner to do a good job
- To develop test methods for wet cleaning cleaning efficiency, dimensional stability, colour fastness
- To propose a care label system for wet cleaning

In general:

Establishing the wet cleaning processes to an adequate cleaning method in the field of dry cleaning with no risks of textile damages for the cleaner

3



4

Round Robin Trial

- 11 Laboratories
  FCRA, Hollenstein, IFP-TEPO, IR-TNO, WFK, Electrolux, JLA, Miele, BuFA, Kreussler, Seitz
- 5 different types of machines
  (different processes)
- Process parameters
  washing times, temperatures, drying temperature, drying time, liquid ratio, loading ratio, detergent

Objective:

Development of a test method for wet cleaning to become a correlabel symbol for wet cleaning

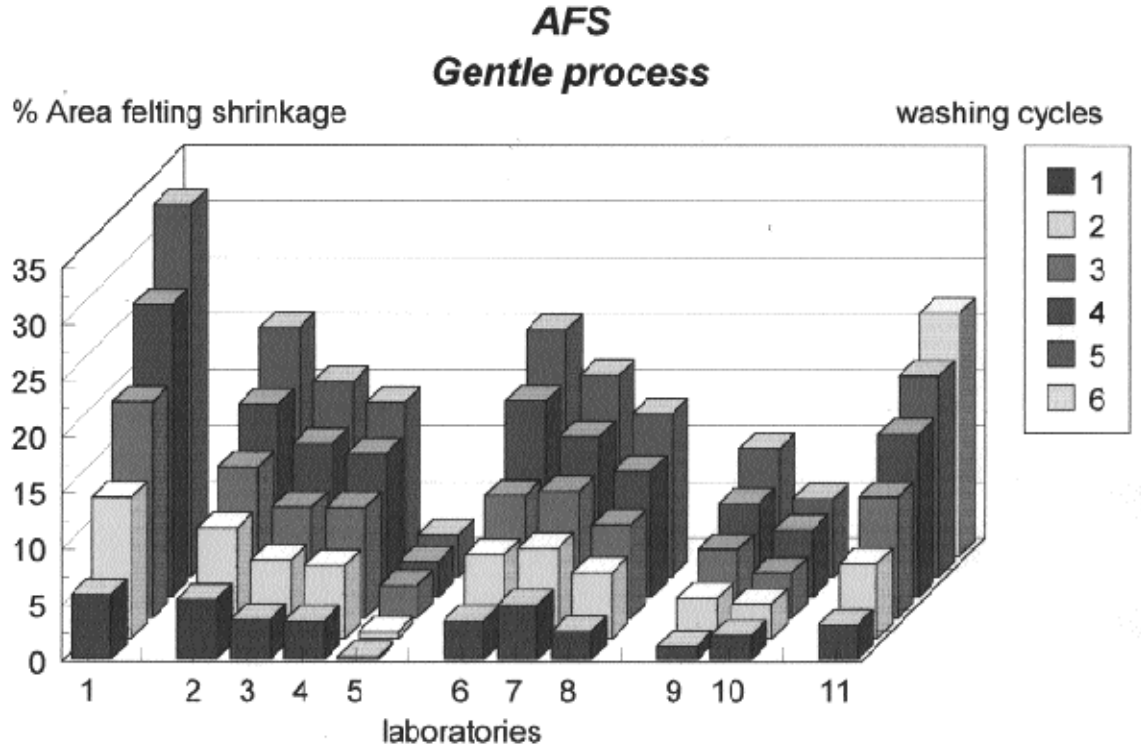
5

2 processes: Gentle
Very Gentle

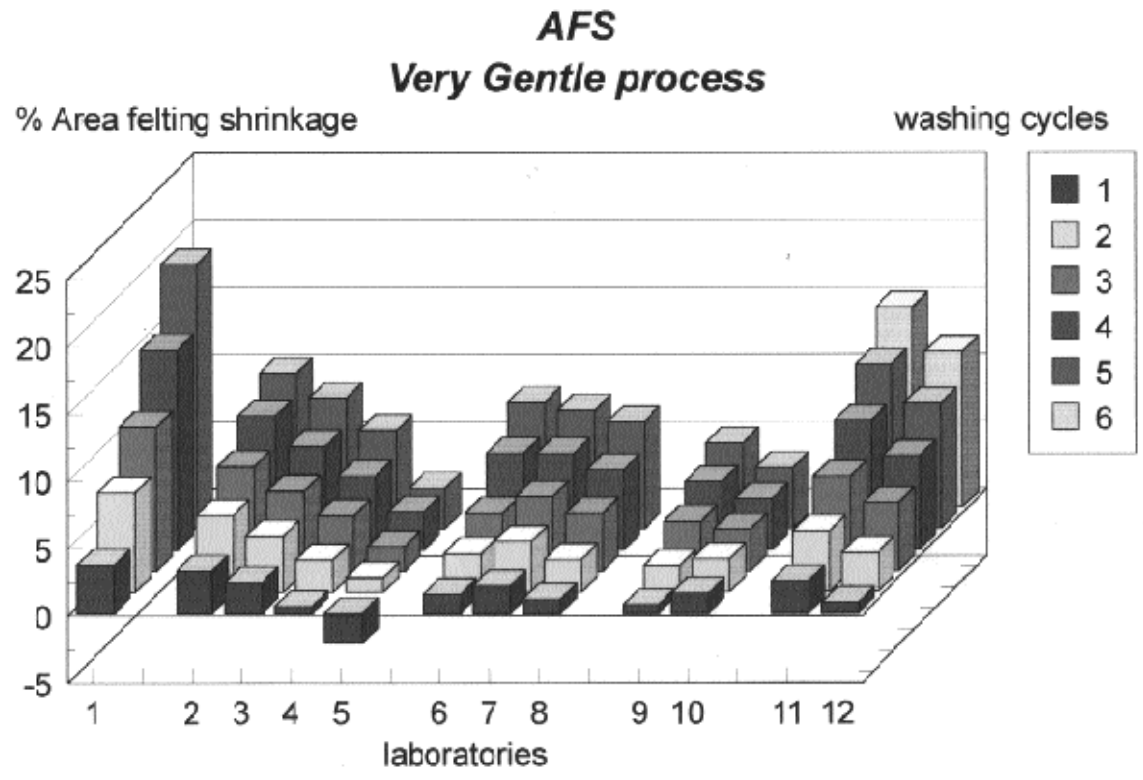
		Gentle	Very gentle
washing	pre-wash	30° C, 5 min.	-
	pump off		-
	main wash	30°C, 10 min.	30°C, 10 min.
	spin		
	rinse	cold, 5 min.	cold, 5 min.
	pump off		
	spin		
drying	inlet temp.	60°C	40°C
	drying time	to 12-15 % residual moisture	2 min.

Liquid ratio 1 : 5
Loading ratio 1 : 25

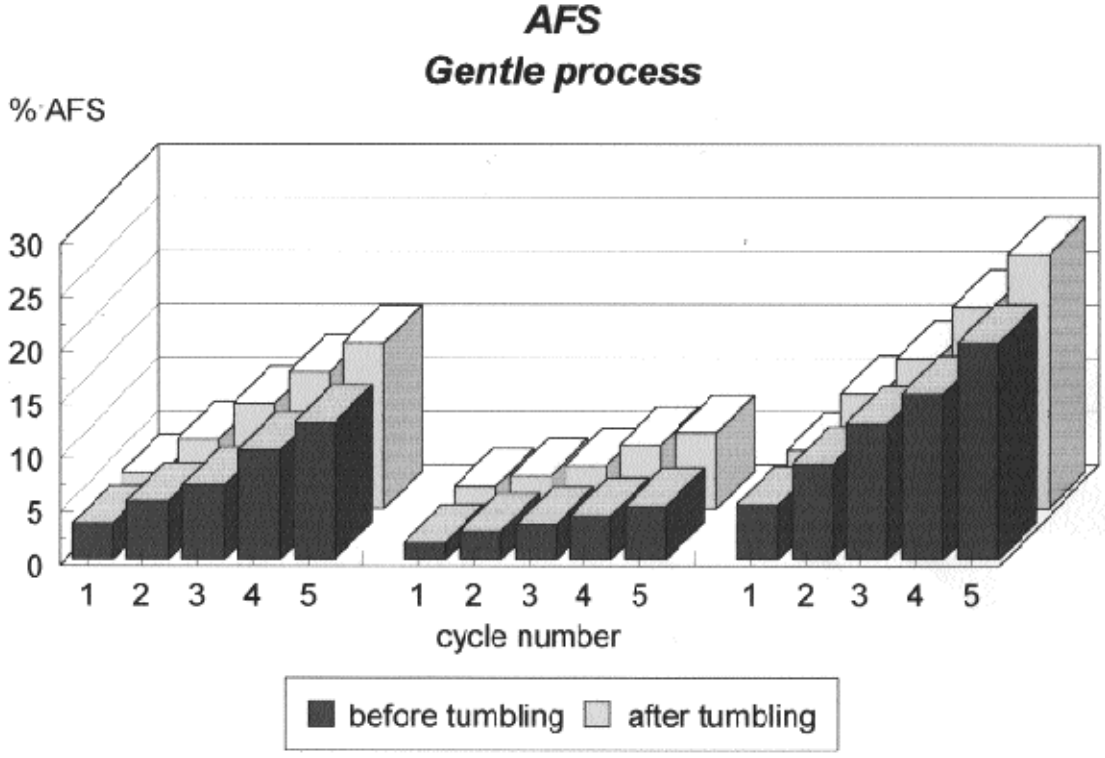
6



7


AFS
Very Gentle process
% Area felting shrinkage
washing cycles
1
2
3
4
5
6
25
20
15
10
5
0
-5
1 2 3 4 5 6 7 8 9 10 11 12
laboratories

8


AFS
Gentle process
% AFS
30
25
20
15
10
5
0
1 2 3 4 5 1 2 3 4 5 1 2 3 4 5
cycle number
before tumbling
after tumbling

9

Manual 2nd RRT

- Composition of the ballast
- Reference material
- Number of reference pieces
- Preparation of reference pieces
- Processes
- Water
- Detergent
- Measurement
- Aim
- Calibration procedures
- Deviation

Status of the European (International) Care Labeling

Helmut Kruessmann

GINETEX-wfk, Krefeld, Germany

Dr. Kruessmann is Scientific Director and General Manager of the Research Institute for Cleaning Technology. The Institute develops methods to reduce environmental impacts from dry cleaning processes and establishes performance testing methods for textile care. He also serves as Executive Vice President of the International Cleaning and Care Research Association, which coordinates research on dry cleaning. Dr. Kruessmann holds a Ph.D. in Textile Chemistry from Aachen Polytechnical University, Germany.

I was asked to tell a little bit about the status of European care labeling. The European GINETEX care labeling system has been accepted by a majority of the countries of the world as an international care labeling code. The care label itself was introduced in Europe about 1950. It originated in The Netherlands and then spread to France and the other European countries as a voluntary service to the consumers offered by the textile and apparel industry. It's not regulated by government. It's a voluntary service. To control the correct application, the care labeling code was protected by an international trademark. The ownership of this international trademark belongs GINETEX. GINETEX itself grants the ownership to the national bodies. The reason for this is to control its correct use. If you have no governmental regulation, then you have to have someone to control it. We thought it was best to have the industry and the consumer organizations do the controlling themselves. One big advantage is, if technology develops, it takes us just a few months to change our labeling system. We just need a meeting of the board to decide, we don't need any changes in governmental regulations or laws.

There were two discussion points for the basics of this care labeling system. One was optimum process, but when you discuss optimum care process, you need to discuss optimum to what. Optimum cleaning is always a problem for the lifetime of a textile, and sometimes this is a problem with environmental impact. GINETEX decided on a maximum process. Even with a maximum process, however, there are problems with material changes ranging from bleeding of color to irreversible damage to the textiles.

The next thing was it was produced by the textile chain. The textile and apparel manufacturer can and will, for cost reasons, only apply a very limited variety of care label combinations. The number of choices or symbols, therefore, has to be reduced to the lowest possible level. Each symbol has to be based on a testing procedure in order to verify the correctness of the choice. The reason we could have a small number of symbols was that we omitted all the general information. For instance, you can give general information, such as if you have a loose structure, then you have to dry flat. Or if you have a colored fabric, it's better to dry in the shade, or turn it inside out during washing. So all this information is just given as general information to the consumer and not given as a label, as the information is true for almost everything.

Slide 3 shows the resulting care labels. The first is the washing symbol, which is a little bit different from the washing symbol in the United States. It's only a washing symbol for home laundry. This is advice to the consumer, not including the industrial launderer. The industrial launderer can use it as additional advice according to his own knowledge and experience as a professional for how to treat fabrics. Two additional symbols were also used. One is the bar under it for a gentle cycle, and the broken bar for a very gentle cycle, which actually is only used for the wool wash cycle. Then a hand-wash symbol. We have included at the moment five temperatures. It is still being discussed whether two temperatures should be deleted from the process, as only the remaining temperatures cause irreversible damage.

The second symbol on Slide 3 is a chlorine bleach symbol, as oxygen bleach was a general technique in Europe. The ironing symbol has three different possibilities. The dry cleaning symbol is also a little bit different from the American type. We only have one restriction, which is symbolized by a bar under the symbol. Our experience shows us that a dry cleaner has only two processes, one for regular work and one

for sensitive work. Actual restrictions are then water, mechanical action, and/or temperature in drying.

Finally, we have the tumble drying symbol. We think natural drying methods are well known to the consumer, and you can give information in the general form, for instance, dry flat or dry in the shade.

To summarize, we have a system on a voluntary basis and we have a system that is registered as a trademark. Now let's turn to alternatives techniques. Available alternative techniques are hydrocarbon solvents, wet cleaning and perhaps liquid or supercritical CO_2. For hydrocarbon solvents we normally do not have a big problem, as the hydrocarbon already is labeled with F. The only difference is with modern, explosion-proof machines and modern solvents. There might be some problems with the drying temperature and the drying time, as drying temperature is a little bit higher, approximately 60°C compared to the labeling of the mild process which has 40°C. This will be discussed by GINETEX in the future.

Now let's turn to wet cleaning, which was the major part of this discussion. We had no care labels for the wet cleaning process. The wet cleaning process was introduced in 1991. Even before the official introduction of this process, the discussion about introducing the wet cleaning symbols started in GINETEX. It is important when introducing a new care symbol that we have an internationally accepted care technique. That was not realized when the discussion started. When wet cleaning started in 1991, it was not internationally accepted. The second point is that we should have an internationally accepted test method. And the third point is the integration into the registered trademark. That is only true for GINETEX countries, but it raises some difficulties that we will discuss later on.

Three proposals for labeling of wet cleaning within the limitations of the trademark were discussed. One proposal is for the alternative use of dry and wet clean symbols, two symbols, allowing both possibilities. The second proposal was the application of a modified washtub as a symbol for wet clean. A problem with this is the consumers' trial-and-error practice which will lead to home laundry and perhaps to liability risks. And of course you can understand that the dry cleaning industry doesn't want this possibility, as it would promote home laundry. If professional cleaning is done according to the state-of-the-art, it is always more environmentally friendly than the home laundering process. So even from an environmental standpoint, labeling should not be going in this direction. This is especially true for the American type of washing machines which use quite more water and energy for washing than the European type of machines. The third proposal was for information in addition to the registered trademark, either by words (but you have a language barrier in Europe), an additional symbol outside the care label, a combination of symbols and language, or a new extra symbolization.

These were the three possibilities discussed, and the decision was rather simple. The decision was to include it into the normal dry cleaning labeling. The reason for this was that the consumer should get the right information that he should bring this kind of article to the professional dry cleaner. If you create an extra symbol, you need extra information which would confuse the consumer. It has to go to the same shop but the cleaning method is identified by an additional symbol.

The wet clean classification would have three symbols. A normal W is used for washable articles, washable textiles or apparel, that, for performance reasons, should be professionally wet cleaned. This was what Kaspar Hasenclever mentioned, to invite the consumer to bring more articles to be professional wet cleaned. The second symbol is for gentle process. This was mentioned for "do not wash" articles according to the International Organization for Standards (ISO) 6330 test. The third one was a very gentle process for articles that also could not be washed according to ISO 6330, but have a higher sensitivity towards mechanical action as defined by the standards. Examples for the one bar process given here are normal wool articles. Examples for the very gentle process are angora, silks, and similar very sensitive articles.

We have one problem within our GINETEX system. This was very elegantly solved. Given that there are only two possibilities of registered symbol combination—they allow only one symbol for each treatment—what do you do when you have dry cleanable and wet cleanable articles? The decision made here was rather simple. As I already told you, the W was introduced to label wet cleaning. If an article can be either dry cleaned or wet cleaned, then the dry clean symbol has a priority. The reason for this is 95 or 90 percent of all dry cleaners still have perchloroethylene cleaning, and they should have the priority information. The W is put in a circle under the dry cleaning symbol outside the combination. If an article is not dry cleanable, then the W can be put in the normal combination.

We already discussed the test methods. As I said, if there are no accepted test methods, then there is no label. We need the accepted test methods, reasonable evidence for the correctness of the label chosen, and why an article is sensitive towards wet cleaning. Wet cleaning is the interaction of washing in detergents. These can already be tested by conventional methods, ISO 105 or ISO 6330. But there are a lot of articles that are sensitive because of the interaction of water, detergent, and mechanical action. The testing, therefore, has

been done under wet clean conditions. A novel testing procedure has been developed. Round robin tests are carried out. The momentary situation is that the test procedure or the demand for this test procedure has been brought in by the British Standard Organization to send to the European Standard Organization (CEN), which finances research programs. They proposed a new work item on wet cleaning testing in April 1996. At the wfk a group has been developing a testing procedure for over a year. This proposal was accepted by the German Standard Organization and sent to CEN. CEN transferred this proposal to the ISO T3-38-SC2. We hope the proposal will be discussed by the professional cleaning group during the next meeting to be accepted as a new work item for ISO.

1

Helmut Kruessmann
wfk-Research Institute for Cleaning Technology
GINETEX Technical Commission

STATUS OF THE EUROPEAN (International) CARE LABELING

Apparel Care and The Environment
Alternative Technologies and Labeling
Washington D.C., Sept. 9/10, 1998

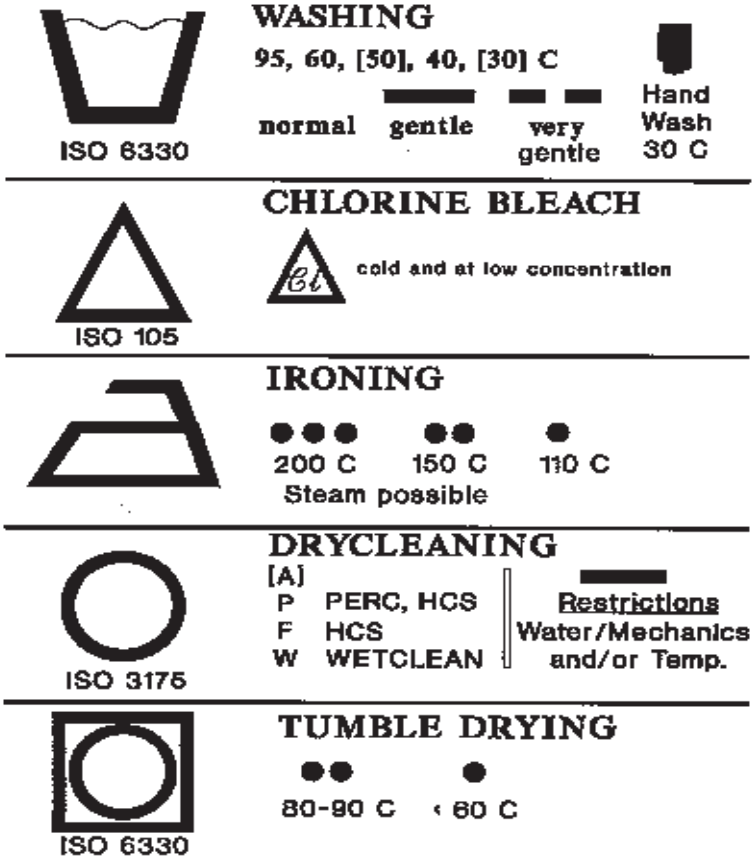
2

wfk

History of the Symposium/Ginetex Care Labeling System

- Care Labeling was Introduced around 1950 as a Voluntary Service to the Consumers by the Textile and Apparel Industry
- To Control the Correct Application it was Protected by an International Trademark Registration in Geneva

3



4

Care Labeling and the Textile Chain

- The Textile and Apparel Manufacturer Can and Will for cost reasons only apply a very limited variety of care label combinations
- The number of choices [SYMBOLS] therefore has to be reduced to the lowest possible level
- Each symbol has to be based on a testing procedure in order to verify the correctness of the choice

5

Basics for Care-Labeling

- OPTIMUM Process

  Environment
  Convenience for the Consumer
  Cleanliness
  Lifetime of Textiles

- MAXIMUM Process

  Material Changes ➡ all
  ➡ irreversible damage

6

Basics of ISO/GINETEX Care-Labeling

The Care-Treatment of

- Maximum Severity

a Textile/Garment Can Withstand without

- Irreversible Damage

7

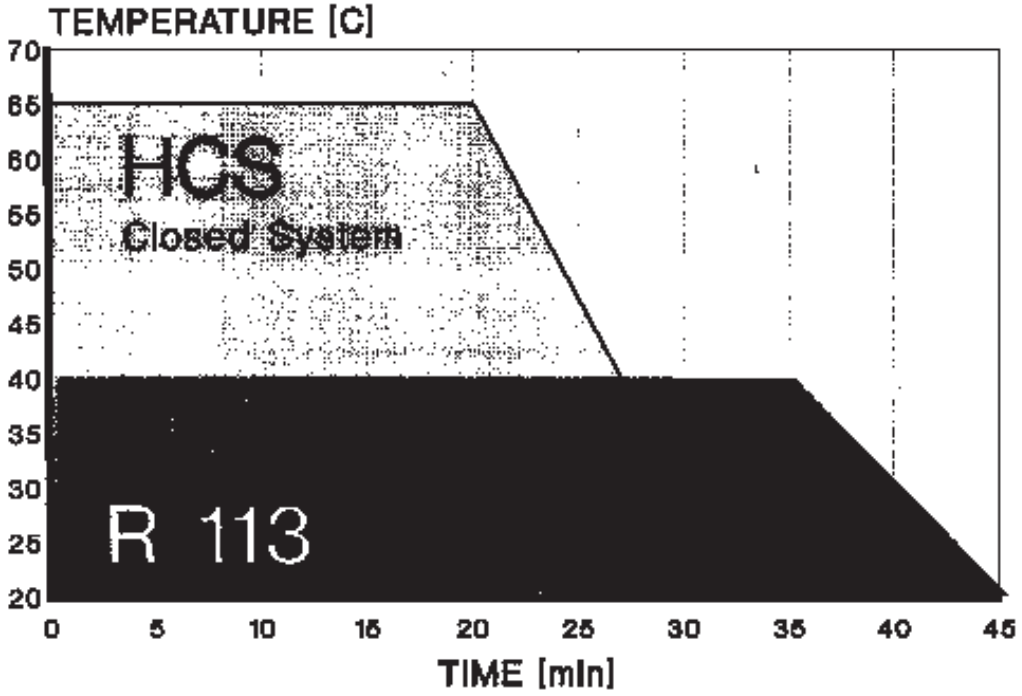
"Available" Alternatives in "Dry"cleaning

- Hydrocarbon Solvents (HCS)
- WETCLEAN

[- Liquid/Supercritical Carbon Dioxide]

8

Time/Temperature-Diagram of F-Processes Applying R113 and HCS



9

BASICS
for the Introduction of a
Care Symbol

☑ Internationally accepted technique

☑ Internationally accepted test method

☑ Integration into the Registered Trademark (GINETEX countries)

10

Proposals for a Labeling of WETCLEAN within the Limitations of the Trademark

1. Alternative Use of Dry- or Wetclean Symbol
   What is with Wet- and Drycleanable Goods
2. Application of a Modified Wash Tub Symbol for Wetclean
   Consumers' Trial-&-Error Practice will lead to Home Laundering; Liability Risks
3. Information Additional to the Registered Trademark
   - By Wordings (Language Problem)
   - Additional Symbol Outside Care Label Combination
   - Extra Symbolisation (Extra Trademark)

11

wfk Decisions of Ginetex Conseil (3/1996) with Regard to Wetcleaning Symbolisation

1. The circle with a W shall be introduced to label WETCLEAN with three severity levels
2. If an article can either be drycleaned or wetcleaned then the dryclean symbol has the priority in the registered combination. The W then shall be put in a circle under the drycleaning symbol outside the combination
3. If an article is not drycleanable, then the W may be used in the circle within the registered combination

12

wfk Classification of Textiles and Apparel into the 3 Levels of Severity of Symbols

1. normal (W)
   Washable textiles and apparel which for performance reasons preferably should be professionally wetcleaned (size, complicated structures, finish)
2. gentle (W)
   "DO-NOT-WASH"-articles according to ISO 6330 because of sensitivity towards mechanical action as defined by the standard (normal woolens)
3. very gentle (W)
   "DO-NOT-WASH"-articles according to ISO 6330 because of high sensitivity towards mechanical action as defined by the standard (angora, silks)

13

Another BASIC CONDITION

NO ACCEPTED TEST METHOD

=

NO LABEL

Reasonable Evidence for the Correctness of the Label Chosen

14

WETCLEAN PROCEDURES

	Procedure	normal	gentle	very gentle
WASH	Wash Temperature [C]	40 - 95	30	20 - 30
	Load Factor [kg/L]	1:25	1:25	1:40
	Liquor Ratio [L/kg]	5	5	5
	Wash Time [min]	15	10	10
	Mechanical Action	normal	gentle	very gentle
	Rinses (No./Temp.)	2/cold	1/cold**	1/cold**
DRY	Inlet-Temperature*[C]	80	60	60
	Endpoint Moisture [%]	< 8	12-15	
	Drying Time [min]			2

* preheating to 60/40 C
** adding 2,5 g/L detergent

15

Maximum Shrinkage Requirements for the different sensitivity levels

Process	Relative shrinkage [%]
normal	no requirements
gentle	60
very gentle	20

The shrinkage of the A1 test monitors should not exceed the above relative values compared to the A7 wool wash program of ISO 6330.
The test procedure is described in IEC 456.
The figures are still in discussion

16

- **Calibration Process**
  Calibration of the IWS A1 test monitor according to IEC 456 in the reference washing machine according to ISO 6330

- **Normalisation Process**
  Validisation of the gentle and very gentle process (washing and tumble drying) using the calibrated monitors

- **Wetcleaning Procedure (TEST)**
  includes washing and pre-drying or drying according to the definitions of the test procedure for the care label and the finishing process as appropriate for the specimen tested

17

wfk

Status of the Situation for a Testing Procedure Concerning Wetcleanability of Textiles

- Positive Vote by CEN on a BSI Paper Proposing a NWIP on Wetclean Testing Procedure [4/96]
- German Proposal for a Testing Procedure for Wetclenable Articles Sent to CEN [5/96]
  prepared by an International Working Group
- Transfer of the German Proposal to ISO TC38 SC2 as a Consequence of the Vienna Agreement [5/96]

18

TRADEMARK PROBLEMS in Care Labeling

1. Care labels can only be used with the permission of GINETEX
2. GINETEX will only allow the use of the registered trademarks
3. There are only two registered symbol combinations. They allow only <u>one</u> symbol for each treatment.

19

wfk Permitted Symbol Combinations

1. 

neither dry- nor wetcleaning

2. 

only wetcleaning/no drycleaning

3. 

only drycleaning/no wetcleaning

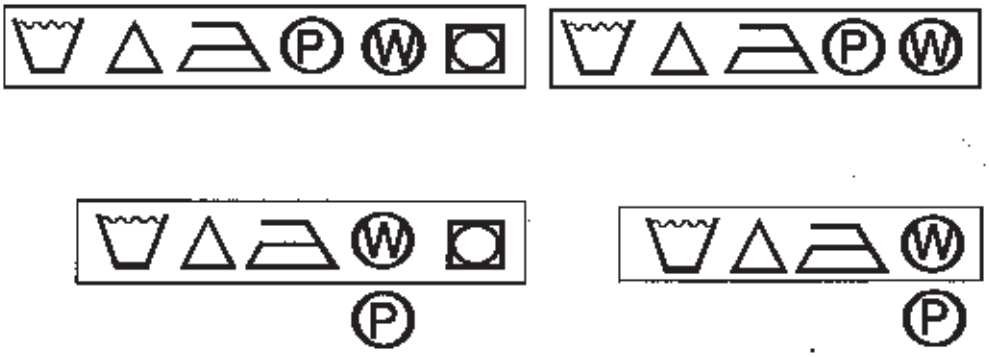
4. 

dry- and wetcleaning

20

wfk Not Permitted Symbol Combinations

dry- and wetcleaning



21

RESEARCH in the WETCLEAN Field

- **Pre-Research Work:**

  Defect Analysis and Fault Localisation after Wetclean

  WETCLEAN Technical Plant in Dresden/ wfk and Institute for Textile and Apparel Technology of the Technical University Dresden

1. **Production Requirements for Wetcleanable Apparel / Part I: Career Apparel**

   Institute for Textile and Apparel Technology /Technical University Dresden Approved

2. **Improvement of Cleaning Performance by Process Optimization**

   wfk and Partners (CRAFT, Phase 1) filed

3. **Optimization of Finishing Technology after Wetcleaning**

   Institute for Textile and Apparel Technology Dresden / wfk filed

22

wfk "Dry"cleaning Symbols and the Technical Description of Processes

	PERC		HCS		WETCLEAN		
	Ⓟ	Ⓟ	Ⓕ	Ⓕ	Ⓦ	Ⓦ	Ⓦ
Washing							
temp./ C	33	33	33	33	30-90	30	20
time/min	20	10	20	10	15	10	10
load L/kg	20	30	20	30	25	25	40
Water	yes	no	yes	no			
Level					5	5	5
Drying							
temp./ C	60	40	60	40	80	60	60
moisture%					< 8	15	
time/min							2
Action	normal	gentle	normal	gentle	normal	gentle	very gentle

Results and Conclusions From Wet Cleaning Demonstration Projects

Jo Patton

Center for Neighborhood Technology

Ms. Patton is Coordinator of the Center for Neighborhood Technology's (CNT's) Sustainable Manufacturing and Recycling Program, which helps small businesses comply with environmental regulations through recycling and pollution prevention. In her current position at CNT, Ms. Patton serves as Project Manager for the Alternative Clothes Cleaning Demonstration Project, which she developed. Ms. Patton earned a B.A. in Latin American Studies from the University of Illinois-Chicago.

Introduction

In 1992, the U. S. Environmental Protection Agency (EPA) initiated a partnership with the dry cleaning industry and others to address ways to reduce exposure to perchloroethylene (perc), the solvent used by 90 percent of U.S. dry cleaners. This partnership provided a springboard for a variety of research projects on alternative technologies and substitute solvents.

One alternative identified early in this process was wet cleaning, a range of techniques and technologies that use water as the primary solvent to clean clothes labeled "dry clean only." Several of the research projects designed to evaluate wet cleaning are being conducted in real world commercial settings. This paper describes these research projects and summarizes some preliminary findings.

Center for Neighborhood Technology Research

The Center for Neighborhood Technology (CNT) is an independent, nonprofit research and technical assistance organization with a tradition of working with industry partners to find practical solutions to environmental problems. Through funding from EPA, CNT initiated the Alternative Clothes Cleaning Demonstration Project with the goal of evaluating the performance and commercial viability of wet cleaning. This CNT research project includes the design, monitoring, and evaluation of all aspects of a commercial clothes cleaning shop using only wet cleaning (called The Greener Cleaner) and data collection at two shops relying on both water and traditional dry cleaning solvents.

CNT designed The Greener Cleaner to mirror an average commercial dry cleaning operation in volume and rates as well as fabric, fiber, and garment types cleaned. The difference is that all items brought in for cleaning are wet cleaned. The shop has a wet cleaning system manufactured by Wascator in Sweden and distributed by Aqua Clean Systems, Inc. in the United States. The demonstration shop is privately owned and a lease agreement ensured CNT control of all testing and demonstration aspects of the shop's operation to carry out the research.

Evaluate the Performance of Wet Cleaning

The project gathered and compiled data regarding cleaning performance over time and with a full range of fabrics. Two test protocols were developed that address critical performance issues for tests on separate groups of garments.

The first test "Wet Cleaning: Performance on Full Range of Typically Dry Cleaned Garments" includes documentation of all garments cleaned at the shop, assessment of customer satisfaction, and intensive evaluations of a random sample of garments cleaned at The Greener Cleaner. During the course of the 12 months of research, the demonstration shop wet cleaned 31,734 items. Of those garments, 60 percent were of fabric types often labeled "dry clean only"—wool, silk, rayon, and linen.

To assess customer satisfaction, two telephone surveys of The Greener Cleaner's customers were performed by an independent survey firm. The first survey of 203 customers was conducted in November 1995, and the second, of 100 customers, was conducted

in June 1996. Results were consistent between the two surveys with 86 percent of customers rating the shop's overall service as "excellent" or "good" in the first survey and 87 percent responding positively in the second. Similarly, 85 percent of respondents in the first survey and 84 percent in the second said they would recommend The Greener Cleaner to a friend. Several questions were added to the second survey to gauge customers' knowledge of and attitude toward wet cleaning. The following question and responses indicate the extent to which environmental concerns played a part in customers' initial interest.

"Why did you first take your clothes to The Greener Cleaner?"

Concern about the environment	64 percent
Convenient location / parking	18 percent
Curious	16 percent
Other	14 percent
Reputation for quality service	11 percent

In another measurement of customer satisfaction, shop records on customers indicate a steadily increasing base of return customers. In September 1995, repeat customers represented 60 percent of total visits for the month. By April 1996, that figure was 81 percent.

The first test also included intensive evaluations by independent evaluators of a random sample of garments cleaned at The Greener Cleaner. Results of the intensive evaluations of 460 garments, conducted on the garments before and after cleaning, indicated that a majority of the garments were cleaned and finished satisfactorily. A central concern is the dimensional change noted in sample garments. Of the woven garments evaluated, 62 percent had shrinkage or stretching within the acceptable rate of 0-2 percent. Shrinkage or stretching in the range of 2-4 percent was measured in 27 percent of the woven garments, and 11 percent with over 4 percent shrinkage or stretching. Shrinkage and stretching in the knit garments was greater, with 21 percent measured with over 6 percent shrinkage and 15 percent with stretching over 6 percent.

The second test, "Comparative Analysis of Wet Cleaning and Dry Cleaning Performance After Repeated Cleanings," compares the performance of wet cleaning and dry cleaning on 52 sets of three identical garments. All the test garments specified dry cleaning in their care instructions and many were selected as likely "problem garments" for wet cleaning. In each set, one garment was wet cleaned, one dry cleaned and the third was stored and used as the control.

These garments were evaluated after being worn repeatedly and cleaned six times. In 13 sets, evaluators judged the general appearance of the dry cleaned garment to be better than the wet cleaned garment. In two sets, evaluators judged the general appearance of the wet cleaned garment to be better than the dry cleaned garment. On color change, evaluators rated seven wet cleaned garments and eight dry cleaned garments to have unacceptable color change.

As had been noted in the evaluations of customer clothes, dimensional change was far greater in knits than in woven garments for both wet and dry cleaned garments. A total of 16 dry cleaned woven garments and 15 wet cleaned woven garments had shrinkage within the acceptable 0-2 percent range. However, while there is little difference in shrinkage within this range, the difference in the upper ranges of shrinkage is significant. None of the dry cleaned woven garments had shrinkage of 6 percent or greater, while four of the wet cleaned garments did.

Monitoring Wet Cleaning Processes Under Field Conditions

Systematic observation of the shops has provided a basis for process evaluation including work flow, plant layout, water and energy use, and identifying process inefficiencies. In addition, several hundred cleaning professionals have taken advantage of the opportunity to tour the shop during business hours, watch the wet cleaning process from start to finish, and interview shop personnel.

Research on the volume and quality of water discharge from The Greener Cleaner was done in partnership with the Illinois Hazardous Waste Research and Information Center and the Metropolitan Water Reclamation District. Water testing was conducted for 3 days during which time volume was monitored and a composite sample was taken each day. Each sample underwent comprehensive lab analysis, with the following results:

- The pH of the wastewater was neutral.
- The biochemical demand was no higher than typical residential wastewater.
- The phosphorus concentration was approximately one-tenth that of typical residential wastewater.
- There were no significant concentrations of metals or toxic chemicals.

Experiences in Two "Mixed" Wet/Dry Shops

CNT is also conducting research at two other commercial sites. These are professional garment cleaning businesses in which a significant percentage of garments are wet cleaned and the remaining portions are cleaned off site in traditional dry cleaning solvents.

One of these sites is a small shop in Florida that uses two Kenmore washing machines manufactured by Sears in the United States for home use. The move to wet cleaning at Orange Blossom Garment Care was driven by necessity. When concern regarding the environmental impacts of the solvent Valclene prompted the phase out of this solvent, Orange Blossom owner Ruth Wedenburg decided to maximizes her usage of her two washing machines rather than invest in new perc or petroleum equipment. During the research period, Orange Blossom wet cleaned 43 percent of total customer garments, laundered an additional 44 percent of shirts, and had the remaining 13 percent dry cleaned off site. Seventy-seven percent of the wet cleaned garments had care instructions specifying dry cleaning.

Located in Bettendorf, Iowa, Brix Cleaners was purchased by its current owner in January 1996. They use the Aquatex system developed by JLS with the washer / extractor manufactured in Belgium by IPSO and the dryer manufactured in the United States by American Dryer Corporation. This system is distributed in the United States and Mexico by Iowa Techniques, Inc. The new shop owner purchased the Aquatex with the goal of wet cleaning approximately 80 percent of their customers' garments by the end of 1996. During the research period in June the shop wet cleaned 43 percent of the total 1,846 garments cleaned.

University of California-Los Angeles

Pollution Prevention Education and Research Center

Last year, the University of California-Los Angeles (UCLA) through its Pollution Prevention Education and Research Center, initiated a wet cleaning research and demonstration project that parallels the Center for Neighborhood Technology project. It is focused on a private wet cleaning operation, Cleaner by Nature, which includes both a drop-off store, located in Santa Monica, California and a plant, located in Los Angeles. The business opened in February of this year.

UCLA is measuring performance at Cleaner by Nature using test protocols developed in cooperation with CNT. This will provide a broader data set upon which to draw conclusions regarding many aspect of wet cleaning performance. In addition, UCLA will be comparing the environmental impacts such as chemical, energy, and water use, of a wet cleaning shop to a typical dry cleaning shop. UCLA has also developed a partnership with the Korean Youth Community Center which will help disseminate research findings within the Korean dry cleaning community, which is approximately 30 percent of the total industry. An interim report of research findings will be available this month, and the final report is scheduled for release in spring of 1997.

University of Massachusetts-Lowell

Toxics Use Reduction Institute

The Toxics Use Reduction Institute (TURI), located at the University of Massachusetts-Lowell, has been involved in the evaluation of wet cleaning for 4 years. It is developing a training program for the wet cleaning process that will include the development of a training manual. In addition, TURI is working closely with a professional garment cleaning business, Utopia Cleaners, that has recently replaced its dry cleaning machine with wet cleaning equipment. This shop is part of the recently-launched TURI Cleaner Technology Demonstration Sites Program. It will provide further research data on wet cleaning as well as an opportunity for dry cleaners and others to observe the operation.

Conclusion

Many have asked, "Is wet cleaning the answer?" The answer depends on the question. If the question is "is wet cleaning a 100 percent drop-in replacement for traditional dry cleaning solvents?" the answer is no. If the question is "can wet cleaning safety clean a significant percentage of clothes now considered 'dry clean only'?" the answer is yes.

While the CNT research has raised many new questions that will require further research, several conclusions can be made. A significant portion of garments now cleaned in traditional dry cleaning solvents can be safely wet cleaned. Given the variables that effect performance, however, it will be difficult to develop a simple guide, appropriate for use in commercial cleaning shops, indicating which garments can be easily wet cleaned. In both performance and commercial viability wet cleaning has demonstrated enough promise to warrant increased investment in research and development, accessible training programs, and a concerted effort to reshape U. S. care labeling rules.

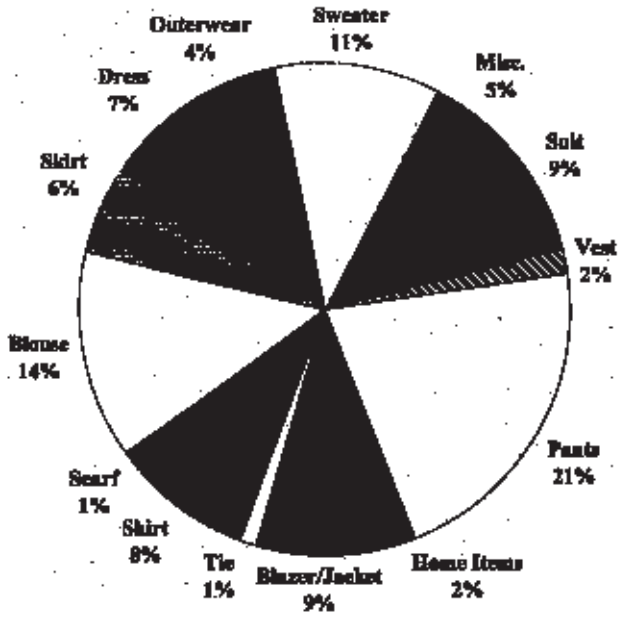
1

Total Garments at the Greener Cleaner
(May 11, 1995 - May 11, 1996)

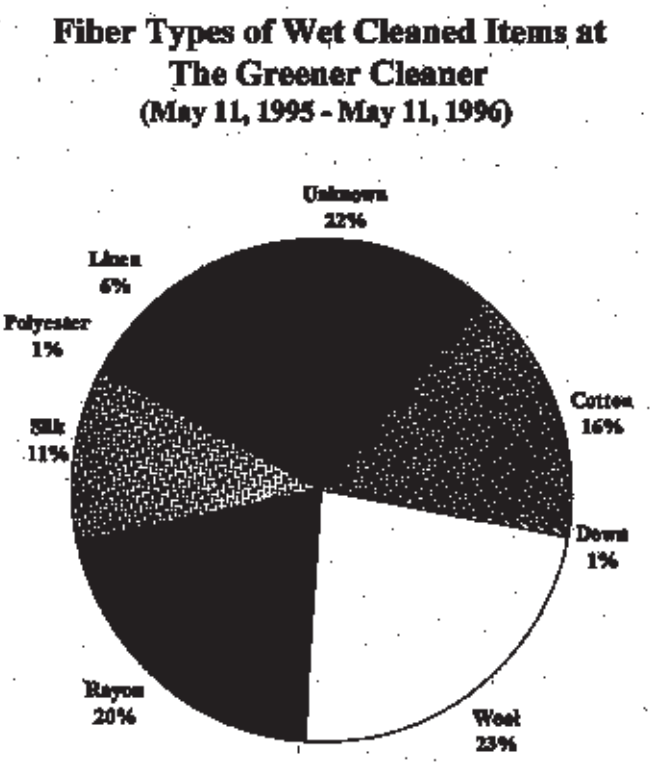
	721	1688	2305	2560	2986	3277	2518	2711	2656	2660	2867	3410	1375	31734
	6	2	6	11	17	13	6	10	10	13	11	13	8	126
	216	316	477	576	721	995	906	896	866	822	950	1039	438	9218
	943	2006	2788	3147	3724	4285	3430	3617	3532	3495	3828	4462	1821	41878
	2	2	4	5	2	3	3	2	2	0	0	4	0	29

2

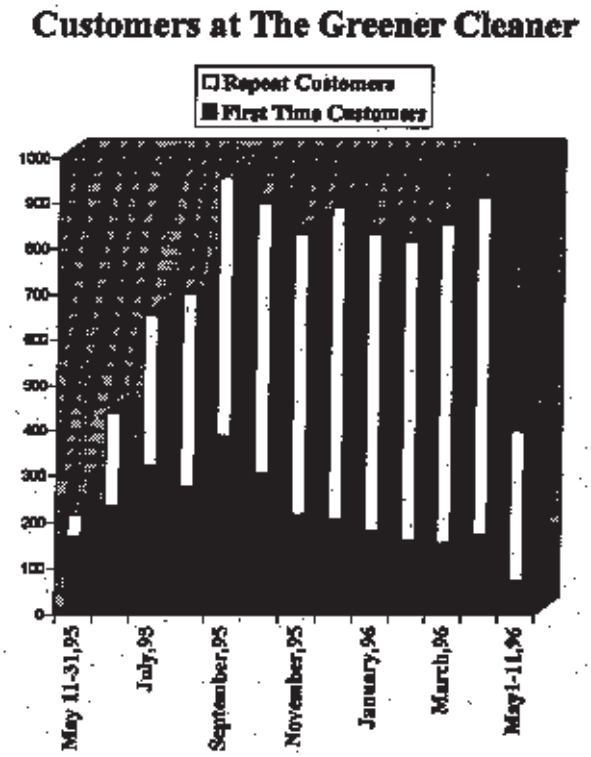
Garment Types of Wet Cleaned Items at The Greener Cleaner
(May 11, 1995 - May 11, 1996)



3

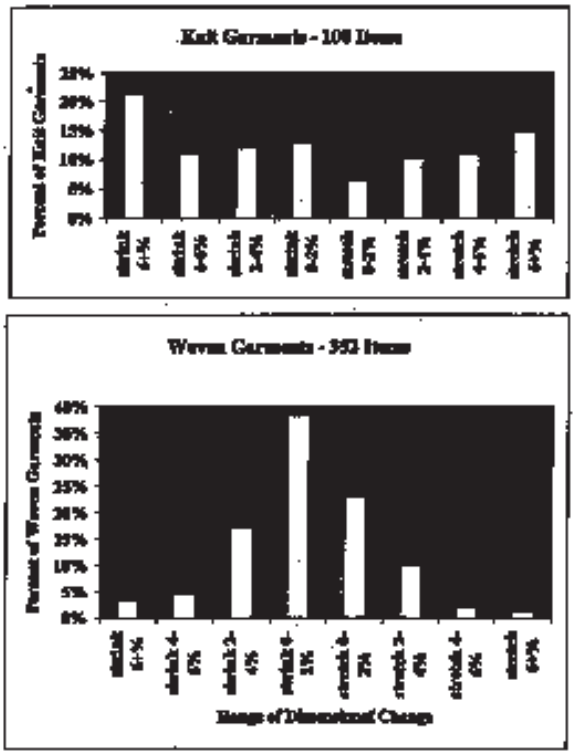

Fiber Types of Wet Cleaned Items at
The Greener Cleaner
(May 11, 1995 - May 11, 1996)
Unknown
22%
Linen
6%
Polyester
1%
Silk
11%
Cotton
16%
Down
1%
Rayon
20%
Wool
23%

4


Customers at The Greener Cleaner
Repeat Customers
First Time Customers
1000
900
800
700
600
500
400
300
200
100
0
May 11-31,95
July,95
September,95
November,95
January,96
March,96
May1-11,96

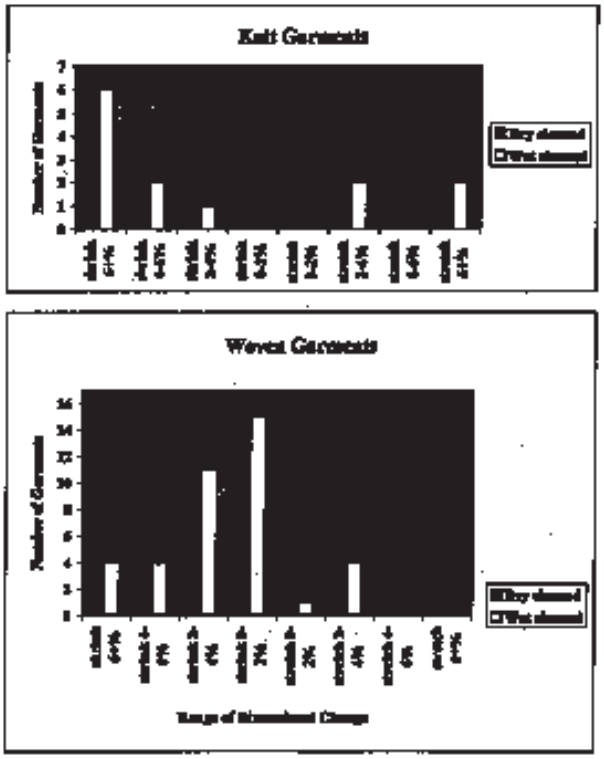
5

Maximum Dimensional Change
for Test Sample Garments
(All Wet Cleaned - 460 Items)



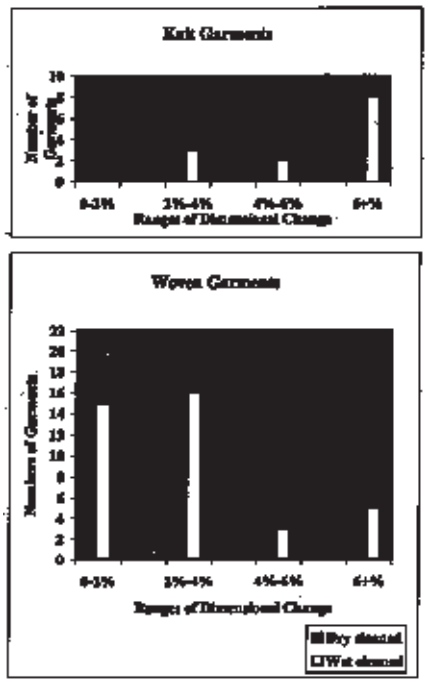
6

Maximum Dimensional Change
for Identical Test Garments
(52 Sets)



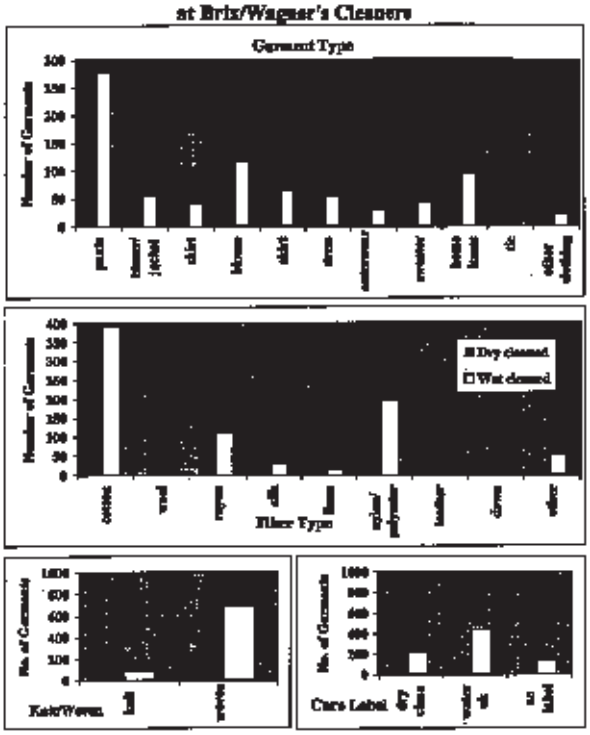
7

Maximum Dimensional Change for Identical Test Garments

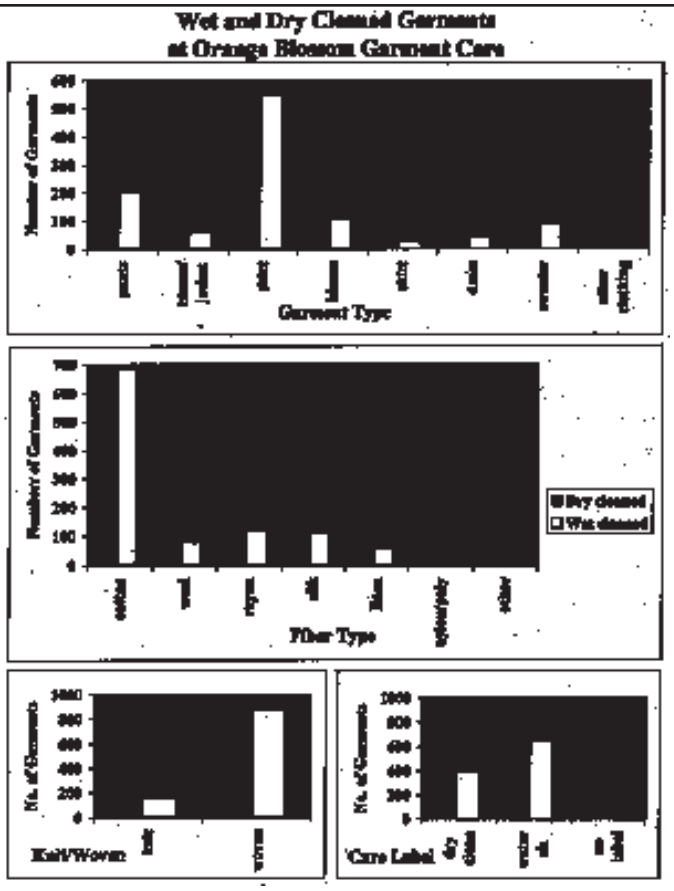


8

Wet and Dry Cleaned Garments at Brix/Wagner's Cleaners



9


Wet and Dry Cleaned Garments
at Orange Blossom Garment Care
Garment Type
Fiber Type
Dry cleaned
Wet cleaned
Knit/Woven
Care Label

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Summary of Discussion

Session II

Dr. Manfred Wentz of Fabricare Legislative and Regulatory Education Organization (FLARE) / American Association of Textile Chemists and Colorists (AATCC) opened the discussion and asked for questions about textile care technology development. He asked that specific questions about care labeling (with the exception of questions for Helmut Kruessman) be reserved for the following day's discussion.

Jack Weinberg of Greenpeace questioned Dr. Wentz's conclusion that aqueous and non-aqueous cleaning of garments will always be with us. He pointed out that aqueous systems are relatively new and there may also be changes in garment construction, in fabric manufacture, and in customer demand. Mr. Weinberg indicated that he didn't believe that the case has yet been made that non-aqueous systems are going to be with us forever.

Dr. Wentz replied that in the recent Canadian study he mentioned they pushed the envelope as far as they could on the basis of value judgments and experience and were able to wet clean 75 percent of the garments entering into that plant. Dr. Wentz continued, saying that unless social engineering is instituted, limiting consumer's choices by saying "you can't have this anymore," than indeed there has to be a co-existence between non-aqueous and aqueous cleaning. The reason for this is the properties of the textile and the dyes and construction of the garments.

Mr. Weinberg reiterated his points: (1) in terms of the study in Canada, it was built into the design of the study that non-aqueous cleaning would still be necessarily. It wasn't the conclusion of the study, but merely the value judgments that were brought to it. (2) The conclusions presented by Dr. Wentz are based more on the opinion of the presenter than on the academic material presented in the speech.

Dr. Wentz said he would throw the ball in Mr. Weinberg's court and challenge him to prove that you can wet clean everything. Dr. Wentz added that in terms of the common goal of reducing the impact of our action on the environment, he is convinced that we can do better and we are doing better.

Diane Weiser, President of Ecomat cleaners and laundromat franchise, asked the European speakers what the current status is in Europe of perchloroethylene (perc) and other solvents in terms of either being controlled or phased out or neither.

Dr. Josef Kurz, from Hohenstein Institute, Germany, replied that perc is very well controlled by the authorities, and the dry cleaners have invested a lot of money to comply with these regulations. Wet cleaning is improving and is a very good supplement for the non-aqueous treatment in the dry cleaning industry. Dr. Kurz said he is convinced that all the dry cleaners have accepted wet cleaning as a supplement to the solvent treatment, but sometimes they have not had enough courage to use wet cleaning because of the risk of damages.

Summary of Discussion
Session II (Continued)

Ms. Weiser asked if in Germany they have cleaners in buildings where they also have residential tenants living.

Dr. Kurz replied that they do.

Jodie Siegel from the University of Massachusetts-Lowell Toxics Use Reduction Institute, had a question for Walther den Otter about the round robin trial test methods. She noted that the temperature used for the gentle and very gentle processes were 60°C and 40°C which translates to 140°F and 104°F respectively. Ms. Siegel asked why they are using such high temperatures. The experience that she has had in the United States with wet cleaning is that people are not using such high temperatures.

Walther den Otter said those temperatures were used for the drying part of the process, not the washing.

Ms. Seigel asked what washing temperatures they used.

Mr. den Otter replied 30°C.

Ms. Siegel remarked that that is still higher than what we use in the United States

Dr. Wentz said he thinks it's very common to have 30°C as a basis for washing sensitive items.

Bill Seitz of the Neighborhood Cleaners Association-International pointed out that 30°C converts into about 85-86°F, which is cool.

Ms. Siegel said that is considered a warm wash, not a cold wash.

Mr. Seitz replied that it's a cool wash, not a cold wash, and not a hot wash.

Connie Vecellio of the Federal Trade Commission (FTC) said the Care Labeling Rule defines 30°C as cold water.

Dr. Wentz added that the AATCC's test methods book has a whole outline of the definition of these temperatures. One of the problems is that with lower temperatures, certain fats and oils are very difficult to remove so from a cleaning perspective higher temperatures are better.

Helmut Kruessman of the Research Institute for Cleaning Technology, said that the International Wool Secretariat (IWS), which is really the expert on wool treatment, proposes an even higher temperature to get wool clean. 30°C is really a precaution. IWS proposes 40°C for wool.

Dr. Wentz said that research done some years ago demonstrated clearly that to get good cleaning, you need temperatures of 38-40°C.

Kaspar Hasenclever of Kreussler Chemical Manufacturing Company, added that shrinkage is not so strongly influenced with temperatures up to 40°C, but the bleeding of dye starts above 35°C.

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Summary of Discussion

Session II (Continued)

David Porter, President of Garment Care, Inc., wanted to thank Josef Kurz for the market data he provided. He remarked that he has not found comparable data for the United States. Mr. Porter asked if when Dr. Kurz said that he expected wet cleaning to increase by 90 percent is that because wet cleaning would allow them to do shirt laundering which is now done at home in Germany.

Dr. Wentz confirmed that shirt laundering in Germany is not done in dry cleaning plants at this time.

Mr. Seitz added that he thought Dr. Kurz, rather than talking about shirt laundering, was refering more to blankets, outerwear, and other articles currently done in the home that could be wet cleaned instead. He also noted that there is an old attitude in Germany about the importance of shirts being done at home. Many housewives are beginning to change that attitude, but it's a slow process.

Mr. Porter said that he was trying to point out that there is cultural difference between the potential U.S. market and the European market. He said his concern is there has been a decline in the market share of dry cleaning, which is very alarming.

Mr. Seitz noted that the dry cleaning share in the United States has been down the last 4 or 5 years and the reason has a lot to do with the economy. It's coincidental that the economy has been down for the last 4 or 5 years, both in the United States and in Germany.

Mr. Porter expressed concern about the cost of new equipment for dry cleaners. He asked what would prevent appliance manufacturers from making wet cleaning machines for the home? Mr. Porter said his goal is to increase business. In addition to having an environmentally acceptable process, we also make sure that we have an economically acceptable process which will not allow the continued decline of the professional garment care market.

Mr. Seitz responded that what we're attempting to do is point out that there are alternatives. Nothing prevents Whirlpool from making a home wet cleaning machine. It didn't prevent Whirlpool from making a coin dry cleaning machine 20 years ago. The question is, will it work in reality, and the dry cleaning machine didn't. A home wet cleaning machine may work, it may not. But nothing will stop Whirlpool from producing what they think is a marketable product.

Eric Frumin of Unite asked if, within the scheme of efforts that the European industries have underway, it is conceivable that an effort could be made to test the limits of machine wet cleaning or other wet cleaning methods beyond that which is being undertaken now. The Center for Neighborhood Technology (CNT) approach is to try to operate 100 percent wet cleaning, not to find a balance between wet cleaning and perc, or wet cleaning and non-aqueous solvents.

Mr. Hasenclever said that to ask that question is the wrong way of thinking because textile cleaning means serving customers. That has nothing to do

Summary of Discussion
Session II (Continued)

with processes. Of course, the better process from environmental, ecological, and economic aspects will also be the better process for consumers. Mr. Hasenclever pointed out that 90 percent of apparel is cleaned in the home and that home laundering processess are not friendly to the environment because they use too much water and chemicals. Wetcleaning these articles would be better for the environment than home laundry.

Mr. Frumin asked if what Mr. Hasenclever meant was that rather than focusing on the balance of wet cleaning versus non-aqueous cleaning within the percentage of articles already brought to industry to clean, what Mr. Hasenclever is doing is trying to develop a wet cleaning method which can address the environmental concerns of all the laundering that is being done, including the 90 percent done in the home.

Mr. Hasenclever replied that he was.

Peter Sinsheimer with the University of California-Los Angeles (UCLA) evaluation team said that at UCLA they are doing a comprehensive evaluation of 100 percent wet cleaning both in terms of the performance and the economic viability. They're looking at the question of transitions between dry cleaning and wet cleaning and the extent to which both could work simultaneously through a transition period. At the California Fiber Care Institute, there was a dry cleaner who was cleaning garments using dry cleaning, but certain garments had water-based stains that he couldn't get out with dry cleaning. The dry cleaner would then wash those garments in a domestic washer on site which would clean the water-based stains, but the consequence was that the perc on those garments would go down the drain. This was a real problem. They actually were in violation of waste water treatment standards in California. This is a real problem for care labeling as well if we change to having a care label listing both wet clean and dry clean. Mr. Sinsheimer said he wondered how to deal with this problem of residual perc on a garment that could be wetcleaned and the environmental consequences.

Mr. Seitz replied by citing a problem that existed in the dry cleaning industry and how it got solved. A number of years ago, there were chemical companies who made stain removers for laundries and made specific chemicals for the removal of oil and grease stains. Many of those chemicals were perc-based. The way they solved that problem is they stopped making chemicals with perc bases for laundry. The dry cleaner who is dry cleaning a garment and while it is still damp, putting it in the washing machine, is in violation and the way to stop it is to dry the garments properly.

Dr. Wentz added that in the 70's and early 80's, there was a dual cleaning process proposed where this problem of residual perc was even worse. Sterling Laundry had a big project going on there funded by the U.S. Army. They had a group of people monitoring the effluents coming from a laundry and dry cleaning combination. What Mr. Seitz said is true. If you dry the garment properly, you will have very little residue coming out in the water. The question is whether the dry cleaner does dry the garment properly.

Charles Riggs pointed out that if you do the wet cleaning part of the job first, dry the garment, and then clean it in a solvent, you eliminate that problem.

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He also wanted to respond to Mr. Porter's concerns about the cleaning industry and what they're seeing in terms of the declining business. Dr. Riggs said that another reason why consumers are cleaning more at home than they're sending out is that they're not satisfied with the job that they're getting at the cleaners. To increase the market share, three factors need to be taken into account: convenience, cost comparison, and quality. Dr. Riggs said that he hears over and over from consumers that they don't like to take things to be cleaned because they come back and they're not pressed properly, or they smell bad. Dr. Riggs said that when he addresses a cleaners group, he always gets the question, "what should I do now, because we're here in a state of limbo," and his response is "whatever you're doing now, do it better." It's important to get that customer as an ally who supports your business regardless of what technology you're using, rather than someone who is looking for another alternative to running into your shop.

Paula Smith of the Indiana Department of Environmental Management asked Jo Patton if, with the water issue, they had tested for bubbling at the Publicly Owned Treatment Works (POTW).

Ms. Patton of the Center for Neighborhood Technology, responded that they did the sampling right at the discharge and on the basis of the sample, they gave feedback.

Ms. Smith asked if they had any contact been made with the POTW.

Ms. Patton replied that that's who did the sampling. The Metropolitan Water Reclamation District is the sanitary district for Chicago. They were our research partners in this.

Ms. Smith asked if they noticed increased bubbling at the plant when it got down stream. They tested right at the site, but did they test when it got down to the treatment plant.

Jo Patton said that by the time it got down to any treatment plant in Chicago we're talking about very large quantities.

Ms. Smith pointed out that, in other cities, that might be a problem.

Ms. Patton said that the testers had considered bubbling and in their judgment, based on what they saw in the sample, it was not a problem.

Jessica Goodheart of the UCLA Wet Cleaning Demonstration Project, asked what the timetable is for developing a new care labeling system? She also asked what the relationship is between the European community's development of care labeling and what goes on in the United States.

Dr. Wentz responded to the second question about what the United States is doing with respect to developing test procedures for care labeling in this regard. AATCC has a committee, RA43, which had a meeting on May 7. A resolution was passed to participate in the European round robin trials. They have also recently attended a meeting of the European Wet Cleaning Committee working group. Our efforts are definitely coordinating and our

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goal coincides with the European Wet Cleaning Committee's goal, which is to have some information available and take some action, if possible, in 1998 at the International Organization for Standards (ISO) meeting.

Ms. Villa of the American Textile Manufacturers Institute (ATMI), pointed out that in the United States, more than 500 technical standards for textiles have been developed and that there are textile test methods to assess color fastness to ozone, color fastness to water. She also asked Ms. Goodheart if she was she talking about wet cleaning standards or care symbol standards?

Ms. Goodheart remarked that she understands that a testing protocol for professional wet cleaning must be developed prior to implementing care labeling policies, but her question was when will the whole process be complete.

Connie Vecellio from FTC pointed out that the FTC process for amending the Care Labeling Rule has already begun. FTC has asked for comment on two federal notices already, and they will issue another notice beginning a rule making hopefully this year. Ms. Vecellio added that FTC will be very interested in the development of the necessary test for the wet cleaning process, as FTC is dependent for testing on AATCC or ASTM or the European organizations.

Mr. Weinberg had a question for Josef Kurz. One of Mr. Kurz's slides showed *supercritical* CO_2, but one of the U.S. speakers had talked about *subcritical*. Mr. Weinberg asked if the German experiment is with supercritical CO_2. His question was does Germany use the same kind of CO_2.

Mr. Kurz replied that it's the same.

Mr. Weinberg had a question for Helmut Kruessman about the way wet cleaning was listed on the GINETEX proposed care labels. Mr. Weinberg's concern is that for an increasing number of garments, both methods will be technically possible and what is the best way to signal that a garment should be professionally cleaned without specifying wet or dry.

Mr. Kruessman responded that the problem is really a trademark problem of GINETEX. GINETEX currently has a combination of home laundering, chlorine bleach, and ironing symbols, with only one symbol for professional cleaning. For this reason, they needed to have some regulations if an article can be wetcleaned and drycleaned. The market will regulate and the consumers will regulate. GINETEX decided there are some possibilities. For example, if an article can only be wetcleaned, then the wet clean symbol can be included in this row of four or five symbols. If an article can only be drycleaned, then there is no problem. If the article can be wetcleaned or drycleaned, GINETEX decided that you cannot put both circles on the same row. It was decided then the wet clean symbol should be put under the symbol row. It's purely a question of trademarks. It's not permitted to put the dry cleaning and wet cleaning symbols in one row. That's just a decision for the moment.

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Mr. Weinberg asked if there would be a copyright problem if a third symbol were used that meant both wet cleaning and dry cleaning.

Mr. Kruessman responded that this issue was discussed, but the problem is some articles may be considered sensitive in wet cleaning which are not considered sensitive in dry cleaning. That would make it difficult to determine whether or not to put a bar [meaning sensitive] under the symbol. GINETEX decided two symbols was the easiest way to give the information to the dry cleaners.

Ms. Villa wanted to inform everyone about the U. S. position with regard to GINETEX. This method was promulgated in ISO in 1991 and it passed by a 75 percent majority, but there were five major western nations that voted against the standard including South Africa, Japan, Australia, Canada, and the United States. The United States has not accepted or recognized the GINETEX system, and one of the technical hang-ups with the particular standard itself was the instructions that were given to the consumer about the order. The United States also would not accept the standard because of the trademark issue.

Mr. Frumin noted the broad nature of the participation at the conference from many different sectors. He said he was curious to hear from the academics and industry participants which industry or industries, in the chain, from fiber to textile to apparel to retail, bear the greatest burden for the current changes.

Carl Priestland of American Apparel Manufacturers Association (AAMA) noted that the apparel industry in the United States produces something like $50 billion worth of apparel domestically and that means about 6.5 billion garments that have to have labels on them. So the biggest problem that the apparel industry faces is to make sure that what we put on those labels actually works. We have to get the information from the textile industry, and we have to give it to the consumer. The real problem is that apparel manufacturers are not the first ones to get this apparel back. It's the retailers and the dry cleaners. But the apparel manufacturers are the ones that have the biggest responsibility for care labeling changes.

Ms. Siegel asked Josef Kurz about his slides showing the rayon and wool swatches with different finishes on them. She asked if any research was being done about adding these protective finishes to the wet cleaning process such as in the detergent used.

Mr. Kurz replied that anti-felting finishes on wool and anti-shrinkage finishes on rayon are state of the art. But these finishes can't be added to the detergents.

Mr. Seitz commented that cleaners have a number of problems with the finishes that manufacturers currently use.

Mr. Wentz concluded the discussion by thanking all the speakers for excellent presentations. He said the message he would like to give all participants is: we are breaking the paradigm that dry cleaning means dry cleaning

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in perc. However, based on what we learned this afternoon, what we probably will also learn also tomorrow, and based on his own experience with AATCC and ASTM it's clear that it is a complex issue. There is no easy answer; however, if every one of us continues to participate in the process, we will hopefully reach our goals of environmentally responsible textile care and meeting the needs of the consumers. We are trying to influence them by giving them choices, but in the final analysis, the market place will make the final decision.