EPA 744-R-97-004b
May 1997

Training Curriculum for Alternative Clothes Cleaning:

INSTRUCTOR'S MANUAL

prepared by

The Massachusetts Toxics Use Reduction Institute
under EPA Grant #X823854

for

Economics, Exposure and Technology Division
Office of Pollution Prevention and Toxics
US Environmental Protection Agency
401 M Street SW
Washington, DC 20460

GARMENT WET CLEANING WORKSHOP

Instructor's Guide

Table of Contents

SECTION I

Methodology I-1

Logistics I-8

Workshop Overview I-10

Garment Wet Cleaning Workshop Agenda I-11

Evaluation/feedback I-13

SECTION II

Information and overheads for modules I-XI

This material is based upon work supported by the United States Environmental Protection Agency under Grant # X823854. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the United States Environmental Protection Agency.

The Instructor's Guide: This guide has been developed to assist Instructors who will be delivering the Garment Wet Cleaning Workshop.

INTRODUCTION

This workshop is designed to introduce the concepts, skills, and benefits of garment wet cleaning. A portion of the workshop is conducted in the classroom, and a portion is conducted at an operating garment wet cleaning facility. The purpose of the classroom component, which has a mixture of participatory lecture and small group activities, is to provide participants with the basic concepts of garment wet cleaning. The purpose of the portion that is conducted on-site at an operating facility is to provide participants the opportunity to wet clean garments that have traditionally been "dry clean only."

The intended audiences for this workshop are operators of dry-cleaning establishments and those with some garment industry experience interested in opening a garment wet cleaning facility. Because of this, the workshop does not spend much time on basics of garment care, although a review of issues relevant to garment care professionals does get considerable attention.

This workshop was designed to be participatory and learner centered. In the next section there is a discussion of learner centered methodology and some helpful hints for instructors/facilitators. This instructor's guide is meant to accompany the participant manual. All module objectives and text will be found in the participant manual.

This Instructor Guide is divided into two sections. Section I provides methodological and logistical information that should prove useful to instructors. For example, this section describes how to facilitate the small group activities that are found throughout the workshop. It also has agendas for two day and three day workshops, giving the instructor some flexibility in scheduling.

Section II contains module specific information for instructors, such as overviews, hints for instructor preparation, and module highlights. This section also gives information on how to conduct specific activities. Finally, this section contains overheads that the instuctor might want to use in delivering the lecture portion of the workshop. These are only suggested overheads. Instructors should feel free to eliminate, modify or replace these overheads which are thought to be more appropriate.

METHODOLOGY

The Alternative Garment Cleaning workshop was designed to be learner-centered and participatory. This approach encourages and depends on participant participation. The format of the sessions generally includes participant discussions of case studies and small group exercises, rather than following a traditional classroom lecture model. This interactive method is based on the understanding that people, adults in particular, learn more fully by doing than by listening passively.

The following several pages lay out general guidelines for presenting this type of workshop. These guidelines were used in the development of the workshop.

A supportive learning environment which puts participants at ease is critical and should be established at the beginning of the workshop. Participants know more about their own workplaces and businesses than the instructors; the methodology builds on the knowledge and experience of participants and lets participants learn from each other as well as from the instructor.

As instructors, we need to avoid the temptation of relying too much on the lecture format -- either because there is so much information to cover in a short time or because of unfamiliarity or discomfort with participatory group activities. It is essential to this workshop that participants bring their ideas and workplace experience into the classroom.

In keeping with the goals of this workshop, each session allows:

- time for learning new information,
- time for applying new skills, and
- time for discussing causes of problems and barriers to solving them.

Types of learning activities will include:

- lectures,
- small group exercises,
- report-back sessions,
- large group discussions,
- hands-on exercises,
- audio-visual presentations, and
- evaluation sessions.

LECTURES

The purpose of a lecture is to convey a basic body of information. It should:

- be brief, and
- be combined with participatory exercises that allow participants to work with and apply information provided in the presentation.

Guidelines for lecturing:

- keep presentations short (people can only sit and listen attentively for limited periods of time),
- begin with an overview of what the lecture will cover and its practical application; end with a similar summary,
- be explicit on why this information is useful or important,
- make lectures relevant by drawing on examples from participants' workplaces,
- make lectures interesting by using good visual aids and never reading your notes, and
- encourage active participation by inviting questions from the group and by posing questions which require participants to apply the information being presented to their own situations.

SMALL GROUP EXERCISES

The purpose of getting people to work together in small groups to solve problems is:

- to increase participation,
- to allow people to use their own experience and new information presented in the workshop to answer questions or address complex issues,
- to establish trust between and enhance the confidence of workshop participants.

Small group exercises can take different forms, including:

- filling out worksheets as a group,
- brainstorming a list of ideas on a given topic, or
- analyzing situations presented.

These activities can be adapted for relevance to a particular group. Some guidelines for designing case studies and role plays:

- The situation presented should be familiar and evoke strong feelings among the participants so they will want to act on it.
- The situation should lend itself to in-depth analysis that requires participants to explore underlying causes of a problem and a wide range of possible strategies for solving it. Don't try to limit or direct participants' efforts too much; let them explore how to proceed on the matter for themselves.

- Enough information should be provided to outline the basic problems and issues to be dealt with, but it is not necessary to include every detail about a situation. (Participants can improve on the scenarios, calling on their own experience to make them realistic.)
- Make it clear what you want participants to do with the role-play or case study by posing questions to be addressed or tasks to be achieved by the group. A good basic series of questions for most case studies include:
  - what are the problems in the situation?
  - how do these problems compare with ones in your own workplace?
  - what are the root causes of the problems?
  - what can be done about them (what strategies are called for, what obstacles will be faced)?

It is important for the instructor to facilitate small group activities well. Some guidelines for administering small group activities:

Group size and selection

- Each group should contain 4-6 people.
- Each instructor can supervise up to 5 groups.
- Each group should work in a separate area.
- Group composition can be varied during the workshop for the widest sharing of experience (this also prevents dominant people from establishing control over any one group). One way to break up groups and allow people to mix is to vary the size: for example, start with 5 groups of 3 each and change to 3 groups of 5.

Recording

Tell participants to select a recorder/discussion leader each time they break into a group. This helps organize the group to work efficiently and enables people to learn important communication and leadership skills. Some helpful techniques to review with participants include:

- Keep time. Try to prevent the group from running out of time before completing the exercise.
- Keep the group focused on one question at a time. Make sure all sides are heard before moving on to the next question.
- Encourage participation from everyone. If one person dominates, you can say, "thanks for your information, maybe someone else would like to add something?" Or ask someone who has been quiet if they have a different perspective or experience to relate.
- Be responsible for summing up the discussion (either the consensus reached or

the many sides presented). This requires you to be neutral. Even though you have your own personal opinion, your role now is to facilitate group discussion.
- Listen for key words and basic ideas.
- Check things out: "Is this what you meant?"

Supervising

The role of the instructor during small group activities is to ensure that the groups are operating smoothly. At the start of a workshop, it is especially important to get people talking instead of working quietly as individuals. Circulate among the groups and listen in to assess their progress. Make sure a recorder is selected and is fulfilling his/her roles; ask questions that will help them proceed if they get stuck and suggest resources they may have overlooked.

It is important that the instructor NOT provide all the answers for the groups or distract them from working things out for themselves. It is too easy for a small group to disintegrate into a question and answer period between the instructor and the participants if the instructor hovers. There is a fine line between ignoring and intervening too much. Therefore, make your observations: intervene only when necessary; move on to the next group. If the groups are talking among themselves and making progress, leave them alone.

REPORT-BACK SESSIONS

Report-back sessions which follow small group activities are more than time for summarizing and rehashing; they are separate and important activities. The effectiveness of small-group work is drastically reduced if not followed by adequate report-back.

Report-back sessions:
- are not optional; always end the small groups in time to allow for ample discussion and analysis in the report-back sessions.
- require as much preparation as other learning activities and need discussion questions to be planned ahead of time.
- may begin with each group giving a summary of findings but the bulk of time should be devoted to discussing questions that bring more depth to the issue.

In a report-back session there is time:
- to explore what participants learned during the small group exercises,
- to correct answers that are factually wrong,
- to pursue a deeper analysis,

- to challenge the participants to defend their analyses and conclusions,
- to allow groups that reached different conclusions for different reasons to learn from each other,
- to have the instructor summarize and raise any important points that did not come up in small group discussions.

Sample questions for instructors to pose:

- How did you come up with your conclusions?
- Why did the groups come up with different conclusions?
- Who benefits from the analysis you come up with?
- What are some of the underlying reasons for the problems you have identified?
- What further information would you need in order to come up with a more thorough answer to the question(s) your group addressed?

Do not be afraid to leave some questions unresolved (for example, if different participants express views at odds with each other or are unconvinced by the group discussion). Some activities do not have correct answers and sometimes participants will push to have the teacher tell what the right answer is. However, don't be afraid to take a stand on factual issues.

LARGE GROUP DISCUSSIONS

It takes preparation to lead an effective discussion with a large group of people. Two points to consider:

- How will you initiate the discussion?
- How will you ask questions and elicit participation to maintain the discussion?

To initiate discussion, you can:

- Use a small group exercise or other activity (film, mini-lecture) to provide a common experience that participants can talk about. Plan a few specific questions which ask for opinions of the common experience. After a small group activity, people already will have expressed their opinions and should have less difficulty talking in a large group.
- Use "brainstorming," a listening exercise, where the group is asked to generate as many ideas on a given topic as possible. After a list is compiled, it is easier to go back and get a discussion going on some of the points already raised.
- Use "buzz groups": briefly break into pairs or small groups to come up with ideas on an issue.
- Ask an open-ended question of the group, or pose a controversial position to evoke a response. This technique doesn't work so well early on in the workshop when people are not yet used to talking together.

Once a discussion is off the ground, think about keeping it lively and on track. Pointers for maintaining discussions:

- Be prepared to keep asking questions of the group which require them to come up with ideas themselves (rather than just responding to instructor's ideas). Questions should encourage participants to draw on their own experience to make or illustrate points. Calling on people to answer may be necessary to keep things moving.
- If participants direct questions to you, you can redirect them to the group. Ask if others have ideas that could address the situation.
- Try to keep everyone involved in the discussion. Don't allow one or two people to dominate. If necessary, stop the discussion and tell the group you will call on only those who have not yet spoken. Set a good example yourself by keeping your own comments brief.
- Sometimes you will have to direct the discussion, with a class that likes to talk a lot, to make sure the section you are doing is covered thoroughly and does not expand to take time from later sections. If the discussion loses its focus, try a couple of things to regain it; for instance, summarize points that have been made on the blackboard or break into small groups to summarize where discussion stands.

HANDS-ON EXERCISES

The purpose of hands-on exercises is to:

- break up the day so participants are not all sitting at tables doing book work; people can get up and move around, and
- allow people to learn by doing.

Some pointers on running hands-on exercises:

- As a rule, more instructors are needed to run hands-on exercises than other activities.
- Often classes will have participants with a range of prior experience. Instructors should try to plan for this by pairing buddies, splitting groups, or having additional instructors available to help some people.

AUDIO-VISUAL PRESENTATIONS

A variety of audio-visual materials can be used in the workshop to supplement other teaching methods. The more different ways that information is provided (graphics, audio, print) the more likely people are to retain it.

- **Chalkboards** or **flip charts** can be used for recording ideas generated by the group. Having one participant record main points while you lead a discussion makes it easier for people to remember what was last said, introduces participants to a "teaching role," and reinforces the belief that solutions have to start with them.
  Flipcharts can be prepared ahead of time to accompany a presentation; the visual outline helps participants listen effectively.
- **Overhead transparencies** can be prepared to accompany a lecture. Using overhead transparencies generally means dimming the lights, so some instructors prefer to use pictures drawn on flipcharts.
- **Slides and videos** can present information in an entertaining way. Used sparingly, they can stimulate large group discussions.
  - Videos should always be short (less than 30 minutes).
  - Make sure you pre-screen the video to check that its point of view ties in with what you are teaching.
  - Avoid showing videos right after lunch!
  - Using videos and slides usually means darkening the room and therefore reducing discussion.

EVALUATION

The final learner-centered teaching technique is the evaluation session. Evaluation is important for:

- ensuring that participants' needs are being met by the training; it allows the instructor to make appropriate adjustments of workshop content to respond to unmet needs.
- helping participants to become more effective instructors by having them think about what they would do the same or do differently in teaching the workshop.
- helping instructors to become more effective; although it can be difficult to hear criticisms or suggestions, instructors can always improve their ability to provide future training by getting feedback from the group.

LOGISTICS

Registration: Mailing registration forms should take place three to five weeks before the first session. This will give participants enough time to plan for the workshop, but not enough that they put any notice or announcement aside and forget about it. **Be sure to include a closing date for registrations in any announcement for the workshop.**

Participant Pre-work: Each participant should receive a **confirmation of attendance, a workshop Agenda** (see later in this section), and a copy of the **Garment Wet Cleaning Manual** prior to the beginning of the workshop. Participants should be asked to review the **Garment Wet Cleaning Manual and agenda,** and **to prepare a list of questions** that they might like to have addressed during the workshop.

Instructor Pre-workshop tasks: Several tasks should be completed before the first session.

✔ **Reserve space** and break-out areas for the workshop. The room should be set up classroom style with round tables.

✔ **Select a site for the hands-on training.** The site should have enough open area for participants to gather for discussion and the facility owner should be agreeable to workshop participants using equipment in the facility. A few chairs should be available for participants to use if necessary.

✔ **Prepare signs** to hang at each station in the plant. The signs should include; Stain Removal, Sorting, Wet Clean Machine, Dryer and Finishing.

✔ **Review registrant names.** Knowing the background of participants may be useful in discussion groups. Individuals can be called upon to share unique experiences thereby adding to the depth of discussion.

✔ **Review the Instructor Guide and your own notes.** While it is true that instructors use different styles, the content of the presentation should remain the same.

✔ **Prepare workshop materials.** Be sure that there are enough hand-outs, exercises, manuals and evaluation forms for all participants. Check handout material for copy quality.

✔ **Review prepared overheads.** Overheads have been prepared for the workshop and are referred to in the instructor notes by title.

✔ **Gather sufficient materials for Activities:** Many of the Activities require demonstration materials such as fabric, fibers, MSDS's, etc. Also, it is helpful to bring a box supplied with masking tape, overhead markers, pens, flip chart markers, scissors, paper clips, stapler, ruler etc.

Garment Wet Cleaning Workshop
Workshop Overview

Workshop Overview: This **16 hour** workshop provides practical information and experiences which participants can immediately apply in their own facilities. The workshop includes pre-work and in class exercises.

After attending the workshop participants will be more informed to answer the following questions:

- **What is garment wet cleaning?**
- **Can I increase the percentage of wet cleaning I currently perform in my facility?**
- **Is it economically feasible to justify the purchase of a wet cleaning system?**

Audience: An excellent workshop for facility managers or owners to evaluate the garment wet cleaning.

Class Size: Maximum *15*

Workshop Benefit: Participants will gain experience and insight into the practical application of wet cleaning

Objective of the Workshop:

To provide participants a **learning environment** in which to:

- Better understand the mechanics and logistics of garment wet cleaning.
- Better understand the positive environmental and public health impact of wet cleaning.
- Experience performing garment wet cleaning procedures.

Participant Pre-workshop Work:

1. To review the Garment Wet Cleaning Manual.
2. To review agenda and prepare a list of questions you would like addressed during the workshop.

Suggested Workshop Agendas: The next two pages contain sample agendas for the workshop. Option 1 agenda is for two day long sessions. Option 2 might be for an evening, a full day, and a morning. For example, Option 2 might be used for Friday night, Saturday all day, and Sunday morning. **These are only sample agendas.** Each instructor will need to modify the agenda to fit the instructor's style.

Option 1
Garment Wet Cleaning Workshop Agenda

Day One

1 hour	Introductions
1 hour	Health, Safety, and Environmental Regulations
20 min	Break
2 hours	Fiber, Fabric and Soil
1 hour	Lunch
½ hour	Garment Cleaning Methods
1 hour	Overview of Wet Cleaning
20 min	Break
1 hour	Economics of Wet Cleaning
½ hour	Available Wet Cleaning Equipment

Day Two

2½ hours	Hands-On Wet Cleaning
20 min	Break
2 hours	Hands-On Wet Cleaning (cont.)
1 hour	Lunch
1 hour	Hands-On Wet Cleaning (cont.)
½ hour	Facility Design
20 min	Break
½ hour	Labeling Liability
1 hour	Wrap-up and Discussion

Option 2
Garment Wet Cleaning Workshop Agenda

Day One

1 hour	Introductions
1 hour	Health, Safety, and Environmental Regulations
20 min	Break
2 hours	Fiber, Fabric and Soil

Day Two

½ hour	Garment Cleaning Methods
1 hour	Overview of Wet Cleaning
20 min	Break
2½ hours	Hands-On Wet Cleaning
1 hour	Lunch
3½ hours	Hands-On Wet Cleaning (cont)

Day Three

1 hour	Economics of Wet Cleaning
½ hour	Available Wet Cleaning Equipment
½ hour	Facility Design
20 min	Break
½ hour	Labeling Liability
1 ½ hour	Wrap-up and Discussion

Evaluation Form

GARMENT WET CLEANING WORKSHOP FEEDBACK

As professionals, we are interested in continuously improving our services and products. We would appreciate your comments to help us achieve this goal.

1A. What were your expectations of this workshop?

1B. Were your expectations met? Yes_____ Partially_____ No_____

Please tell us whether the following were:	Highly effective				Not effective
2. Developing an understanding of garment wet cleaning	1	2	3	4	5
3. Workshop materials	1	2	3	4	5
4. Workshop instructors/facilitators	1	2	3	4	5
5. All day hands-on session at the wet cleaning facility	1	2	3	4	5
In regards to Friday and Sunday session, did the following help you better understand garment wet cleaning.					
6. Fibers, Fabric, and Soil Comments:	1	2	3	4	5
7. Garment Cleaning Methods Comments	1	2	3	4	5
8. Overview of wet cleaning Comments:	1	2	3	4	5
9. Health, Safety, and Regulations Comments:	1	2	3	4	5
10. Economics of Wet Cleaning Comments:	1	2	3	4	5
11. Available Wet Cleaning Equipment Comments:	1	2	3	4	5
12. Facility Function and Design	1	2	3	4	5

Please answer the following questions. Feel free to use additional paper if needed.

1. What concepts presented were most valuable?

2. What concepts presented were least valuable?

3. What suggestions do you have for improvement?

4. How will you use the ideas or information you learned at this workshop?

5. What barriers might you encounter in implementing garment wet cleaning?

6. Check the appropriate response	Strongly Agree	Agree	Don't Know/ Unsure	Disagree	Strongly Disagree
The training provided new insights into garment cleaning	1	2	3	4	5
The training provided new insights on the potential benefits of garment wet cleaning	1	2	3	4	5
I would recommend this training to other cleaners	1	2	3	4	5

TRAINING INTERESTS for ADDITIONAL COURSES

List personal interest for additional training related to garment wet cleaning.

DIVIDER PAGE

Garment Wet Cleaning Workshop

Module I: Introduction

Note: For all modules, all time allocations that involve group work assume a group of *15 people.*

Module Overview:

This module gives the instructor an opportunity to welcome participants, and to set the "tone" for the remainder of the workshop. It is important that the participants feel comfortable asking questions during the sessions. The instructor should encourage questions, and make participants feel involved in the workshop. There is an "icebreaker" activity in this module.

Instructor Preparation:

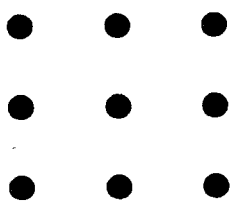
Review overheads and Student Manual.

Prepare flipcharts with the following, each on a separate sheet;

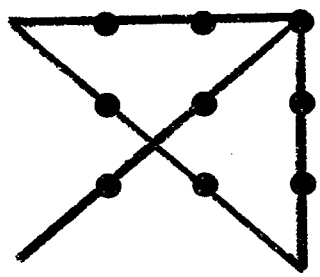
1. Your name / Organization (to be used when you introduce yourself)

2. Nine Dots Activity (The problem and solution should each be drawn on a separate flipchart sheet, see participant manual)

Problem



Solution



3. To be used when partipants introduce themselves:
   Name
   Organization
   Reason for attending this workshop

Module Highlights:

Opening:

Have the ***"Welcome to the Garment Wet Cleaning Workshop"*** on the projector as participants arrive. Introduce yourself and the organization which you represent. Discuss

the evolution of the government's involvement in wet cleaning using the following overheads:

1. Government Involvement
2. Cleaner Technology Substitution Assessment
3. Multiprocess Wet Cleaning
4. Times are Changing
5. Warning

Video: Video clips which spotlight issues surrounding perchloroethylene usage are available. This would be a good time in the course to show a short video.

Activity: See Activity on page 8 in student manual.

Ask the participants to connect all nine dots with four straight lines, without lifting their pen from the paper. After a short period ask if any of the participants have figured out how to connect the dots. The solution (shown above) can be demonstrated by the instructor on a flip chart (prepared previously).

Ask the participants why they were not able to solve the problem. The solution is that one has to go outside the "box" formed by the nine dots. Then ask the participants "who restricted you to drawing inside the box." The answer is no-one, therefore, the limitations were self imposed. This is true of many problems that people face. They create the limits. The purpose of this workshop is to help participants think "outside the box," to think creatively.

Introductions:

Using the prepared overhead (Name, Organization, Objectives), introduce yourself stating your name and organization.

Participants should then introduce themselves by stating their name, organization, and their expectations for the workshop.

Agenda and handout material review:

Review the following handout material:

1. Garment Wet Cleaning Workshop Agenda
2. Garment Wet Cleaning Workshop" Manual

Objectives: Review the module and course objectives (found in the participant manual).

Topics:

What is wet cleaning?
Who should take this course?
Why do we need a new way to clean?
A brief history of wet cleaning

Course Objectives

To give participants the information and experience they need to:

- Understand how wet cleaning works
- Understand how to set up and run a wet cleaning facility
- Understand how wet cleaning and dry cleaning affect the environment, the health of workers, and public health in general
- Gain first-hand experience by actually cleaning garments using the wet cleaning method

WELCOME TO THE GARMENT WET CLEANING WORKSHOP

Government Involvement

- International Roundtable on Pollution Prevention and Control in the Dry Cleaning Industry - May, 1992
  - Convened by U.S. EPA and DfE
    - consider health and environmental concerns
    - participants included dry cleaning industry, allied trades, researchers, environmentalists and government officials
  - Goal was to reduce risks associated with perc

Cleaner Technology Substitutes Assessment

- DfE developing pollution prevention awareness and practices
- CTSA is a strategy for communicating methods fro reducing risks
- Evaluate potential substitutes for dry cleaning considering
  - environmental,
  - health and
  - economic perspectives
- Manual has been produced for the CTSA

Multiprocess Wet Cleaning

- Study showed it is technically feasible and economically competitive
- Obstacles include increased labor and labeling requirements
  - machine wet cleaning reduces labor
  - proposed FTC labeling change

"Times are Changing"

- 1930's and 1940's were profitable
- 1950's home laundry was introduced
- 1960's wash and wear clothing
- 1970's Polyester
- 1980's discount dry cleaner
- 1990's casual office wear has opened a new market

WARNING

- PROPOSITION 65 COMPLIANCE STATEMENT

IT IS THE RESPONSIBILITY OF THIS BUSINESS TO WARN ITS CUSTOMERS AND EMPLOYEES THAT PRODUCTS SOLD OR USED ON THESE PREMISES MAY CONTAIN CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER OR BIRTH DEFECTS.

CALIFORNIA HEALTH & SAFETY COD SEC. 25249.5 ET SEQ.

Connect the nine dots

Course Objectives

- Better understand the mechanics and logistics of garment wet cleaning
- Better understand the positive environmental and public health impact of wet cleaning
- Experience performing garment wet cleaning procedures

Better understand the mechanics and logistics of garment wet cleaning

- Started with a high volume, short term "multiprocess wet cleaning demonstration in Nov. and Dec. of 1992
  - multiprocess wet cleaning is a process where garments are spot cleaned and tumbled dried
- Currently two full scale government funded studies are on-going
  - Environment Canada
  - Center for Neighborhood Technology

Introduction

- Curriculum and course have been developed to train fabricare specialists and staff the techniques of wet cleaning and how to operate a wet cleaning facility

It is hoped that after participating in this course you will increase your percentage of wet cleaning and/or water based cleaning

DIVIDER PAGE

Module II: Health, Safety, and Environmental Regulations

Module Overview:

This module gives participants basic information that they need in order to understand the regulatory framework in which they operate, and the occupational and environmental risks associated with dry and wet cleaning.

Instructor Preparation:

Review overheads and student manual.
Review Activity and following MSDS

Module Highlights:

Activity:
This activity introduces participants to Material Data Safety Sheets (MSDS). There is no standard format for an MSDS, although they are required to have certain information. MSDSs should have the following information:

- ingredients,
- physical data,
- fire and explosion hazard data,
- reactivity data,
- environmental and disposal information,
- health hazard data,
- first aid,
- handling precautions, and
- additional information.

Have participants review the four following MSDSs. For a small class (about 10 participants) assign each individual all four. Review the sections of an MSDS pointing out the relevance of each section. For a larger class break into groups of four or five participants, and give each group all four MSDSs. Then ask the participants to try to identify the product (by type, eg. Detergent) for each of the MSDS. The answer key is below. Point out that even chemicals that we normally think of as "harmless" have some associated health issues.

MSDS # 1 - Perchloroethylene
MSDS # 2 - Wet Clean Detergent
MSDS # 3 - Dry Side Stain Removal Agent
MSDS # 4 - Toothpaste

Topics:
What are the hazards?
Who makes the rules?
What rules are currently in effect?
What are the potential liabilities?

1. INGREDIENTS: (% w/w, unless otherwise noted)

CAS# 000127-18-4 99.9%

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

2. PHYSICAL DATA:

BOILING POINT: 250F (121.1C)
VAP PRESS: 13 mmHg @ 20C
VAP DENSITY: 5.76
SOL. IN WATER: 0.015 g/100g 25C
SP. GRAVITY: 1.619 @ 25/25C
APPEARANCE: Colorless liquid.
ODOR: Ether-like

3. FIRE AND EXPLOSION HAZARD DATA:

FLASH POINT: None
METHOD USED: TCC, TOC, COC

FLAMMABLE LIMITS
LFL: None
UFL: None

EXTINGUISHING MEDIA: Non-flammable material.

FIRE & EXPLOSION HAZARDS: No autoignition temperature.

FIRE-FIGHTING EQUIPMENT: Wear positive pressure self-contained respiratory equipment.

MATERIAL SAFETY DATA SHEET

4. REACTIVITY DATA:

STABILITY: (CONDITIONS TO AVOID) Avoid open flames, welding arcs, or other high temperature sources which induce thermal decomposition.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Strong acids and oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Involvement in fire forms hydrogen chloride and small amounts of phosgene and chlorine.

HAZARDOUS POLYMERIZATION: Will not occur.

5. ENVIRONMENTAL AND DISPOSAL INFORMATION:

ACTION TO TAKE FOR SPILLS/LEAKS: Small leaks - mop up, wipe up, or soak up immediately. Remove to out of doors.
Large spills - evacuate area. Contain liquid; transfer to closed metal containers. Keep out of water supply.

DISPOSAL METHOD: When disposing of unused contents, the preferred options are to send to licensed reclaimers or to permitted incinerators. Any disposal practice must be in compliance with federal, state, and local laws and regulations. Do not dump into sewers, on the ground, or into any body of water.

6. HEALTH HAZARD DATA:

EYE: May cause pain, and slight transient (temporary) irritation. Vapors may irritate the eyes at about 100 ppm.

SKIN CONTACT: Short single exposure not likely to cause significant skin irritation. Prolonged or repeated exposure

6. HEALTH HAZARD DATA: (CONTINUED)

may cause skin irritation, even a burn. Repeated contact may cause drying or flaking of skin.

SKIN ABSORPTION: A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. The LD50 for skin absorption in rabbits is >10,000 mg/kg.

INGESTION: Single dose oral toxicity is low. The LD50 for rats is >5000 mg/kg. If aspirated (liquid enters the lung), may be rapidly absorbed through the lungs and result in injury to other body systems.

INHALATION: In confined or poorly ventilated areas vapors can readily accumulate and can cause unconsciousness and death. Dizziness may occur at 200 ppm; progressively higher levels may also cause nasal irritation, nausea, incoordination, drunkeness; and over 1000 ppm, unconsciousness and death. A single brief (minutes) inhalation exposure to levels above 6000 ppm may be immediately dangerous to life. Based on structural analogy and/or equivocal data in animals, excessive exposure may potentially increase sensitivity to epinephrine and increase myocardial irritability (irregular heartbeats). Alcohol consumed before or after exposure may increase adverse effects.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Signs and symptoms of excessive exposure may be central nervous system effects and anesthetic or narcotic effects. Observations in animals include liver and kidney effects.

CANCER INFORMATION: For hazard communication purposes under OSHA Standard 29 CFR Part 1910.1200, this chemical is listed as a potential carcinogen by IARC and NTP. Perchloroethylene has been shown to increase the rate of spontaneously occurring malignant tumors in certain laboratory rats and mice. Other

6. HEALTH HAZARD DATA: (CONTINUED)

long-term inhalation studies in rats failed to show tumorigenic response. Epidemiology studies are limited and have not established an association between perchloroethylene exposure and cancer. Perchloroethylene is not believed to pose a measureable carcinogenic risk to man when handled as recommended.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Exposures having no effect on the mother should have no effect on the fetus. Did not cause birth defects in animals; other effects were seen in the fetus only at doses which caused toxic effects to the mother.

MUTAGENICITY (EFFECTS ON GENETIC MATERIAL): Results of in vitro (test tube) mutagenicity tests have been negative.

7. FIRST AID:

EYES: Irrigate immediately with water for at least 5 minutes.

SKIN: Wash off in flowing water or shower.

INGESTION: Do not induce vomiting. Call a physician and/or transport to emergency facility immediately.

INHALATION: Remove to fresh air. If not breathing, give mouth-to-mouth resuscitation. If breathing is difficult, give oxygen. Call a physician.

NOTE TO PHYSICIAN: Because rapid absorption may occur through lungs if aspirated and cause systemic effects, the decision of whether to induce vomiting or not should be made by a physician. If lavage is performed, suggest endotracheal and/or esophageal control. Danger from lung aspiration must be

7. FIRST AID: (CONTINUED)

weighed against toxicity when considering emptying the stomach. If burn is present, treat as any thermal burn, after decontamination. Exposure may increase "myocardial irritability". Do not administer sympathomimetic drugs unless absolutely necessary. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

8. HANDLING PRECAUTIONS:

EXPOSURE GUIDELINE(S): Perchloroethylene: OSHA PEL is 25 ppm TWA. ACGIH TLV is 50 ppm TWA; STEL is 200 ppm.

VENTILATION: Control airborne concentrations below the exposure guideline. Use only with adequate ventilation. Local exhaust ventilation may be necessary for some operations. Lethal concentrations may exist in areas with poor ventilation.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required for certain operations, use an approved air-purifying respirator. For emergency and other conditions where the exposure guideline may be greatly exceeded, use an approved positive-pressure self-contained breathing apparatus or positive pressure airline with auxilliary self-contained air supply. In confined or poorly ventilated areas, use an approved positive pressure self-contained air breathing apparatus.

SKIN PROTECTION: For brief contact, no precautions other than clean body-covering clothing should be needed. When prolonged or frequently repeated contact could occur, use protective clothing impervious to this material. Selection of specific items such as gloves, boots, apron, or full body suit will depend on operation.

8. HANDLING PRECAUTIONS: (CONTINUED)

EYE PROTECTION: Use safety glasses. Where contact with liquid is likely, chemical goggles are recommended because eye contact with this material may cause discomfort, even though it is unlikely to cause injury.

9. ADDITIONAL INFORMATION:

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Handle with reasonable care and caution. Avoid breathing vapors. Vapors of this product are heavier than air and will collect in low areas such as pits, degreasers, storage tanks, and other confined areas. Do not enter these areas where vapors of this product are suspected unless special breathing apparatus is used and an observer is present for assistance.

MSDS STATUS: Revised section 9 and regsheet.

1.1 CHEMICAL CHARACTERIZATION: Combination of surface active agent, proprietary anti shrinkage, anti felting and protecting agents dissolved in water.

1.2 FORM: Liquid 1.3 COLOR Amber 1.4 ODOR Perfumed

2. PHYSICAL DATA AND SAFETY DATA

2.1 Change in Physical State	
2.2 Density at 20	1.04 g/ccm
2.3 Vapor Pressure at 20	Approx. 18 m bar
2.4 Viscosity at 20	30-50 cps
2.5 Solubility in Water	Miscible
2.6 ph Value (1%) at 20	5 - 5.5
2.7 Flash Point	> 100 degrees C
2.8 Ignition Temperature	Not tested
2.9 Explosion Limits	Not tested
2.10 Thermal Decomposition	-
2.11 Hazardous Decomposition Products	None
2.12 Hazardous Reactions	None
2.13 Further Information	

3. TRANSPORT Not Regulated

GGVS/GGVF/ADR/RID: Class: N/A Number: N/A
Technical Name: N/A
Packing Group: N/A
GGVSee/IMDG Code: Class: N/A UN No: N/A
Technical Name: N/A
Packing Group: N/A EmS No: N/A MFAG No: N/A
IATA: Class: N/A UN No: N/A
Technical Name: N/A

4. REGULATIONS

Not regulated by the Environmental Protection Agency.
Not classified under CHIP regulations (Hazardous Substance Regulations) 1995

MATERIAL SAFETY DATA SHEET

5. PROTECTIVE MEASURES, STORAGE & HANDLING

5.1 Technical Protective Measures: Not Necessary
5.2 Personal Protective Equipment
-Respiratory Protection:
-Eye Protection: Not necessary unless significant risk of splashing during handling.
-Hand Protection: Not necessary unless repeated or continuous contact.
-Other:
5.3 Industrial Hygiene: Standard hygiene practice to be observed
5.4 Protection Against Fire and Explosion: Not Necessary.
5.5 Disposal: After dilution, may be passed to a biological waste water purification plant through the sanitary sewer.

6. MEASURE IN CASE OF ACCIDENTS & FIRE

6.1 Spillage/Leakage: Flush away with water.
6.2 Extinguishing Media: Suitable foam powder water CO_2
Not Suitable:
6.3 First Aid
-Skin contact: Wash with soap and water
-Eye contact: Rinse immediately with plenty of water, seek medical advice if irritation persists.
-Ingestion: Seek medical attention.
-Inhalation: N/A
6.4 Further information:

7. INFORMATION ON TOXICITY: Not tested. No harmful effects to health are known to date.

8. INFORMATION ON ECOLOGICAL EFFECTS: No adverse effects upon waste water treatment plants have been found.

9. FURTHER INFORMATION: Water Hazard Class 2 (self classification)

This information is based upon present information and knowledge. This MSDS describes products with relation to safety requirements. The information does not assure absolute properties.

MATERIAL SAFETY DATA SHEET

I. IDENTIFICATION

Product Name:
Chemical Name:
CAS Number: Mixture:
Emergency Telephone Number:

II. COMPONENTS AND HAZARD INFORMATION

Component	CAS No. Of Component	TLV of Component	OSHA PEL	Approximate: Concentration

None under 29 CI.R 1910.1200 N.T.P. ACGIH, NEPA, JARC

D.O.T. Hazard Classification: Not applicable,
Hazardous Materials Identification System (HMIS)

Health	Flammability	Reactivity	BASIS
1	0	0	Recommended by company BASIS Calculated TLV Ref ACGIH

III. PHYSICAL DATA

Boiling Point: 215oF
Vapor Pressure: Not determined
Specific Gravity: 1,0100

Vapor Density: Not determined
Percent ???
Evaporation Rate: Not determined

IV. FIRE AND EXPLOSION DATA

Flash Point (oF TCC): Not applicable
Extinguishing Media: Not applicable
Special Firefighting Procedure: None
Unusual Fire & Explosion Hazards: None
National Fire Protection Association: (NFPA) - Hazard Identification

Health	Flammability	Reactivity	Basis
1	0	0	

V. HEALTH HAZARD DATA

Effects of Overexposure:

Eyes: Mild transient irritant
Skin: Mild irritant skin with prolonged contact
Breathing: None known
Swallowing: Can contribute to gastrointestinal irritant

First Aid Procedures:

Swallowing:	Obtain medical attention
Skin:	Wash with soap and water
Inhalation:	If affected remove individual to fresh air
Eyes:	Flush with water for at least 15 minutes

Health studies have shown that health risks vary from person to person. As a precaution exposure to hazards, vapors, misty fumes or dust should be minimized.

VI. REACTIVITY DATA

Hazardous Polymerization: Will not occur
Stability: Stable
Incompatibility: Not applicable
Hazardous Decomposition Products: None known

VII. SPILL OR LEAK PROCEDURES

Steps to be taken in case material is released or spilled
Check local, state and federal regulations. May be flushed into sewage system

VIII. PROTECTION AND PRECAUTIONS

Respiratory Protection: None required
Ventilation: local exhaust ventilation recommended
Protective gloves: Not necessary
Eye Protection: Chemical splash goggles if eye contact is likely
Other Protective Equipment: Not necessary

IX. PRECAUTIONS OR OTHER COMMENTS

Precautions to be taken in handling and storing: Maintain good housekeeping. Avoid contact with eye. Wash thoroughly after handling. Use with adequate ventilation.
The information and recommendations accumulated herein are to the best of knowledge and belief, accurate and reliable as of the date issued. The company does not warrant or guarantee their accuracy or reliability, and shall not be liable for any loss or damage arising out of the use thereof.
HMIS ans NFPA recommended ratings are based upon the criteria supplied by the developers of these rating systems together with interpretation of the available data.

MATERIAL SAFETY DATA SHEET

- **Hazard Rating:**

Health: 0	**4=EXTREME**
Flammability: 0	**3=HIGH**
Reactivity: 0	**2=MODERATE**
	1=SLIGHT

- **Date:** 3/1/95

2. COMPOSITION & INGREDIENTS

Components
Water
Sodium fluoride
Hydrated silica
Sorbitol
Trisodium phosphate
Sodium lauryl sulfate
Sodium phosphate
Xanthan gum (not in Icy Clean paste)
Flavor
Titanium dioxide
Carbomer 956
Sodium saccharin
FD&C Blue No. 1
Mica
Cellulose gum

3. HAZARDS IDENTIFICATION

- **Emergency Overview:** This may produce transient eye irritation. Ingestion of small amounts may cause nausea, vomiting, and mild GI irritation; ingestion of larger amounts may cause symptoms of fluoride toxicity which should be evaluated by medical professional.

- **Potential Health Effects:**

  Eye - May produce transient superficial eye irritation.
  Skin - Prolonged exposure may produce transient irritation.
  Inhalation - NA
  Ingestion - Nausea and vomiting may occur within minutes, and diarrhea and mild GI irritation may occur up to 24 hours after ingestion of small amounts (1 oz or more). Ingestion of larger amounts ($\geq$ 3oz in children; $\geq$ 8 oz in adults) may cause symptoms of fluoride toxicity.

4. FIRST AID MEASURES

- **Eye** - Rinse thoroughly with water.
  Oral irritation - Discominue use. See MD if symptoms persist
- **Skin** - Rinse with water.
- **Ingestion** - If a small amount (1 oz or more) has been ingested, administer milk (water or other liquid if milk is not available) to dilute stomach contents. If a large amount ($\geq$ 3 oz in children; $\geq$ 8 oz in adults) has been ingested, administer milk (water or other liquid if milk is not available) to dilute stomach contents and contact a medical professional for further advice.
- **Inhalation** - NA

5. FIRE FIGHTING MEASURES

- **Flash Point & Method:** >200°F (closed cup)
- **Explosive Limits:** NA
- **Autoignition Temperature:** NK
- **Flammability Classification:** Non-flammable
- **Hazardous Products of Combustion:** None known
- **Extinguishing Media:** Use water spray, dry chemical, alcohol foam or CO_2
- **Fire Fighting Instructions:** No special instructions
- **Other Fire Fighting Considerations:** None Known

6. ACCIDENTAL RELEASE MEASURES

- **Personal Precautions:** None known
- **Environmental Precautions:** None known
- **Procedures for Spill/Leak Clean-up:** Wipe up with sorbent material. Collect and place in a suitable disposal container. Prevent from reaching waterways. Landfill for small quantities.

7. HANDLING AND STORAGE

- **Precautions for Safe Handling:** None
- **Conditions for Safe Storage:** None
- **Other Recommendations:** None

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

- **Engineering Controls:** None required
- **Personal Protective Equipment**
  - **Eye:** None required
  - **Skin:** None required
  - **Inhalation:** None required
- **Other Controls:** None

9. PHYSICAL AND CHEMICAL PROPERTIES

Melting Point: NA

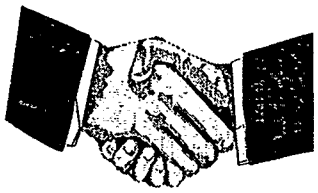
Boiling Point: NA
Solubility in Water: Moderately soluble

- **Odor Threshold:** NK
- **Physical State:** Paste
- **Vapor Density:** NK

Other Data: None
Vapor Pressure: NA

Alternative Garment Cleaning

HEALTH AND SAFETY



Health and Safety

- Health and Safety covers a range of topics:
  - **Safe working procedures**
    - Engineering Controls
    - Ergonomics
    - Personal protective equipment
    - Procedures for chemical handling, disposal, etc.
  - **Structural Guidelines**
    - Placement of ventilation systems and process machinery
    - Placement and availability of safety equipment
  - **Training**
    - Management/employee safety
    - Hazard Communication Standard
    - Fire prevention and response

Health and Safety

- Occupational Safety and Health Administration
  - Created by the Occupational Safety and Health Act to enforce the law by:
    - Setting legally enforceable standards and regulations
    - Inspecting workplaces and issuing citations and fines for violations
    - Conducting and supporting safety and health training for managers, employees, and health professionals

Health and Safety

- Exposure to chemicals can occur through four routes into the body:
  - Ingestion
  - Inhalation
  - Skin Absorbtion
  - Injection

- Exposure can also be classifyed by type:
  - **Chronic**- An exposure to low levels of a chemical over a prolonged amount of time
  - **Acute** - An exposure to high levels of a chemical over a short span of time

Health and Safety

Effects of Exposure

- Effects of chronic exposure can include:
  - Liver, kidney, and lung damage
  - Cancer
  - Reproductive disorders

- Effects of acute exposure can include:
  - Irritation to skin, eyes, nose, and throat
  - Burns
  - Loss of consciousness

Health and Safety

- To determine the risk of exposures in a particular workplace, perform a walk-through and ask yourself:
  - **Are there signifigant exposure sources?**
    - *What types and amounts of chemicals are used?*
    - *Are there visible leaks, spills, or emissions from equipment, vents, or containers?*
    - *Does heat effect the volitility of the chemicals in use?*
  - **How much potential for exposure accompanies each job duty?**
    - *How much time is spent handling chemicals or chemical containing materials (clothes)?*

Health and Safety

Dry Cleaning

The chemical posing the most risk to workers in the dry cleaning industry is perchloroethylene.

The following slides are based on data that has been gathered from previously published works from industry trade groups, State and Federal agencies.

Health and Safety

Dry Cleaning

- The risks associated with perchloroethylene are compounded by its widespread use
  - In 1994, an estimated 11 million gallons were used
  - "Perc" is one of the top ten groundwater contaminants, and is found in 26% of groundwater supplies
  - The legally enforced "permissible exposure limit" for perc is set at 100 parts per million, but many state agencies, scientific groups, and manufacturers recommend a 25 ppm level

Health and Safety

Dry Cleaning

- Perchloroethylene poses specific risks, such as:
  - In the shops containing "transfer machines" employees must manually transfer perc saturated clothing from machine to machine, exposure takes place both through the skin and through inhalation
    (there are about 10,000 of these machines in use today)
  - Exposure to the general public
  - Perc is classified as a possible carcinogen
  - Chronic exposure, (minimized by safety features in most equipment), can include damage to the central nervous system, lungs, kidneys, and the liver
  - Acute exposure can include irritation to the eyes, skin, and respiratory system

Health and Safety

Wet Cleaning

- Does not produce hazardous waste
- Does not use volatile chemicals, therefore;
  - **Poses no risks to workers**
  - **Does not generate emissions**
  - **Does not contaminate groundwater**
  - **Poses no risk to customers or the general public**
  - **Not a source of liability**

Health and Safety

Wet Cleaning

- Companies that produce detergents, finishing agents and conditioners for wet cleaning are producing non-toxic alternatives

- Most "wet cleaning" shops will continue to dry clean a percentage of garments, resulting in a decrease of perchloroethylene usage, and the assiociated risks.

Alternative Garment Cleaning

Regulations

Regulations

- Comprehensive regulatory efforts began in 1970
- The regulations in this presentation largely effect dry cleaners through profit loss from:
  - Liability and insurance
  - Permitting
  - Disposal
  - Equipment upgrades
  - Site clean up
  - Training time

Regulations

- Resource Conservation and Recovery Act
  - Enacted in 1976
  - Applies to management of
    - Solid Waste
    - Hazardous Waste
  - This can apply to facilities generating 220 lbs./month of hazardous waste in the form of
    - Still bottoms, cartridge filters, filter muck
    - Contaminated water from use and maintenance of emission control devices, perc filtrators, and separator water if the water contains over 150ppm of perc

Regulations

- Clean Air Act
  - Amended in 1990
  - Enacted NESHAPS
    - National Emissions of Hazardous Air Pollutants
  - Regulates tracking of use and disposal of perc

Regulations

- Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA)
  - Commonly known as Superfund
  - Enables EPA to respond to potential or actual releases
  - Requires responsible parties to clean up or reimburse the EPA if contamination occurs

Regulations

- Sewer or Septic Discharge
  - For average facilities, discharge permits, pretreatment systems, or discharge monitoring systems are not needed
  - Septic discharge is regulated by either
    - Publically Owned Treatment Works (POTW's)
    - The state
    - Or local municipalities
  - All applicable agencies should be notified during the planning stages of a wet cleaning facility to determine possible requirements

DIVIDER PAGE

Module III: From Fiber to Garment

Module Overview:

This module is a review of basic textile science. It will help ensure that all participants have at least a common vocabulary during the workshop.

Instructor Preparation:

Review overheads and student manual.

This module has two activities. In order to prepare for these activities, the instructor should carefully read about the activities in the participant manual (pages 43 and 44.) Materials needed for these activities include:

Burn test

Be sure that the facility knows that you will be preforming this test. Make sure that participants are careful with matches and that all work is done over the aluminum foil.

- aluminum foil (approximately one square foot/participant)
- swatches of a variety of fabric, eg. rayon, cotton, silk, wool, acrlyic, polyester, nylon (enough for several swatches / participant)
- matches
- tweezers (one for each two participants)

Tensile test

- strands of fibers (two strands per participant)
- paper cup with eyedropper (one set for each two participants)
- water

Module Highlights:

<u>Activities:</u>
Fiber and fabric burn test
Fiber identification by tensile strength

<u>Topics:</u>
Fibers, yarns, and fabrics
The effect of cleaning on fibers
The effect of cleaning on fabrics
Garment construction
How to identify fibers

FIBER, FABRIC AND SOIL

Learning Objective

To provide a basic understanding of fiber properties, yarn structure and fabric structure, and their impact on the process of cleaning clothes.

OUTLINE

I. Fibers

A. Definitions

B. Types of fibers

C. Properties
   1. Mechanical
   2. Chemical

D. Identification

II. Yarns

III. Fabric Types

A. Woven fabrics

B. Knitted fabrics

C. Nonwoven fabrics

IV. Coloring Textiles

A. Dyeing

B. Printing

V. Finishing Textiles

VI. Garment Construction

DEFINITIONS

fiber

a formation with a length at least one hundred times greater than the width; with hairlike dimensions

staple fiber

fiber of relatively short length, measured in inches or centimeters

filament fiber

indefinitely long fibers, measured in yards or meters

natural fiber

fiber that *exists as a fiber* in the natural state - animal, plant, or mineral

manufactured fiber

fiber produced commercially through regeneration of natural materials or synthesis from chemicals

DEFINITIONS

abrasion
the wearing away of material through rubbing against another surface

crocking
transfer of color from the surface of a colored fabric to another surface

bleaching
the procedure of improving the whiteness of a textile by oxidation or reduction of the coloring matter

hydrophilic
having an affinity for water; "water-loving"

hydrophobic
having no affinity for water; "water-hating"

oleophilic
having an affinity for oil; "oil-loving"

DEFINITIONS

tenacity
the strength of a fiber when expressed as force per unit linear density

unit linear density
the weight of a specified length of fiber

elasticity
the immediate recovery of size and shape after deformation

dimensional stability
the ability of a fiber or yarn to withstand shrinking or stretching

Major Classifications of Textile Fibers (Chart in Excel)

FIBER PROPERTIES

Tenacity (Strength)

	Dry (grams/denier)	Wet (grams/denier)
Acetate	1.2 - 1.5	0.8 - 1.2
Acrylic	2.0 - 3.5	1.8 - 3.3
Cotton	3.0 - 5.0	3.3 - 6.4
Linen	stronger than cotton	
Modacrylic	2.0 - 3.5	2.0 - 3.5
Nylon	3.0 - 6.0*	2.6 - 5.4
Olefin	4.8 - 7.0	4.8 - 7.0
Polyester	4.0 - 5.0*	4.0 - 5.0
Rayon	0.73 - 2.6*	0.70 - 1.8
Silk	2.4 - 5.1	1.8 - 4.2
Wool	1.0 - 1.7	0.8 - 1.6

* high tenacity nylon as high as 9.5 g/den
high tenacity polyester as high as 8.0 g/den
high wet modulus rayon - 4.5 g/den

FIBER PROPERTIES

Elasticity & Dimensional Stability

	Elasticity	Dimensional Stability
Acetate	poor	fair
Acrylic	good	poor
Cotton	poor	good
Linen	poor	good
Modacrylic	fair	good if not exposed to high temperatures
Nylon	excellent	good if not exposed to high temperatures
Olefin	excellent	good if not exposed to high temperatures
Polyester	excellent	good if not exposed to high temperatures
Rayon	poor	poor
Silk	good	good
Wool	excellent	poor

FIBER PROPERTIES

Absorbency

	Moisture Regain (%)*
Acetate	6.0 - 6.5
Acrylic	1.0 - 2.5
Cotton	7.0 - 11.0
Linen	8.0 - 12.0
Modacrylic	0.4 - 4.0
Nylon	4.0 - 4.5
Olefin	0.01 - 0.1
Polyester	0.2 - 0.8
Rayon	11.0 - 15.0
Silk	11.0
Wool	13.0 - 18.0

* as a percentage of the dry weight at 70°F and 65% relative humidity

FIBER PROPERTIES

Effect of Bleaches

Acetate	resistant to peroxygen bleaches* under 90°F
Acrylic	highly resistant
Cotton	resistant, but chlorine bleaches will destroy if uncontrolled
Linen	similar to cotton
Modacrylic	some fibers may be harmed by chlorine bleach
Nylon	resistant to reducing bleaches; may be harmed by chlorine and strong oxidizers
Polyester	highly resistant
Rayon	can withstand reducing and oxidizing bleaches; attacked by strong oxidizing bleaches
Silk	deteriorates in chlorine bleach; resistant to peroxygen bleaches
Wool	will yellow and dissolve in sodium hypochlorite; damaged by most oxidizing bleaches; less damage by reducing bleaches

* e.g.; hydrogen peroxide and sodium perborate

FIBER PROPERTIES

Effects of Alkalies

Acetate	little effect from cold, weak alkalies
Acrylic	destroyed by strong alkalies at a boil; resists weak alkalies
Cotton	swells when treated with caustic soda, but is not damaged
Linen	very resistant
Modacrylic	resistant to alkalies
Nylon 66	little or no effect
Olefin	very resistant
Polyester	resistant to cold alkalies; slowly decomposed at a boil by strong alkalies
Rayon	no effect by cold, weak alkalies; swells and loses strength in concentrated alkalies
Silk	similar to wool, but damage is slower
Wool	attacked by weak alkalies; destroyed by strong alkalies

FIBER PROPERTIES

Effects of Acids

Acetate	soluble in acetic acid; decomposed by strong acids
Acrylic	resistant to most acids
Cotton	similar to rayon
Linen	similar to rayon
Modacrylic	resistant to most acids
Nylon 66	decomposed by strong mineral acids, resistant to weak acids
Olefin	very resistant
Polyester	resistant to most mineral acids; disintegrated by 96% sulfuric
Rayon	disintegrates in hot dilute and cold concentrated acids
Silk	similar to wool, but more sensitive
Wool	destroyed by hot sulfuric, otherwise unaffected by acids

FIBER PROPERTIES

Effects of Organic Solvents

Acetate	soluble in acetone; dissolved or swollen by many others
Acrylic	unaffected
Cotton	resistant
Linen	unaffected
Modacrylic	soluble in warm acetone, otherwise unaffected
Nylon 66	generally unaffected; soluble in some phenolic compounds
Olefin	soluble in chlorinated hydrocarbons above 160°F
Polyester	soluble in some phenolic compounds, otherwise unaffected
Rayon	unaffected
Silk	unaffected
Wool	generally resistant

FIBER PROPERTIES

Effect Of Heat

Things to consider:

- Softening, melting, or decomposition temperatures
- Tendency of a fiber or fabric to shrink when heat-relaxed, or to stretch when heated and tensioned
- Ability of a fabric to be heat set
- Ability of a fabric to function properly after exposure at high temperature for a given period of time
- Ability of a fabric to function properly at elevated temperatures in single or repeated use

FIBER PROPERTIES

Thermal Properties[1]

Fiber Type	Melting Point		Softening or Sticking Point		Safe Ironing Temperature	
	F°	C°	F°	C°	F°	C°
NATURAL						
Cotton	Nonmelting				425	218
Flax	Nonmelting				450	232
Silk	Nonmelting				300	149
Wool	Nonmelting				300	149
MANUFACTURED						
Acetate	446	230	364	184	350	177
Triacetate	575	302	482	250	464	240
Acrylic	Does not melt		400-490	204-254	300-350	149-176
Modacrylic	410	210	300	149	200-250	93-121
Nylon 6	414	212	340	171	300	149
Nylon 66	482	250	445	229	350	177
Olefin*	275	135	260	127	150	66
Polyester	480	249	460	238	325	163
Rayon	Nonmelting				375	191
Saran	350	177	300	149	Do not iron	
Spandex	446	230	347	175	300	149
Vinyon	285	140	200	93	Do not iron	

* Iron at lowest possible setting

---

[1] Adapted from Moser, 1994

BURN TEST[2]

1. Clip a small sample from an unexposed area of the garment.

2. Unravel to a single yarn. If the fabric has several different yarns, it is imporatant to test all.

3. Hold yarn with tweezers.

4. Bring a flame to the edge of the yarn and observe reaction.

5. Bring the flame to the yarn until it burns.

6. Observe the result in three ways:
   - **smell and look at** the smoke
   - **look** at the appearance of the burnt residue
   - once it has cooled, **feel** the residue

   Compare observed results with *Fiber Identification by Burning* table.

---

[2] adapted from SEFA's Wet Cleaning Clinic, C.J.Schwass.

FIBER IDENTIFICATION BY BURNING[3]

FIBER	BURNING CHARACTERISTICS	ODOR OF RESIDUE	APPEARANCE
CELLULOSE FIBERS			
acetate	yellow flame, melts	acetic acid or vinegar	hard bead - cannot crush
cotton	yellow flame, continues to burn when flame removed	burning wood or paper	grey fluffy ash
linen	yellow flame, continues to burn when flame removed	burning wood or paper	grey fluffy ash
rayon	yellow flame, continues to burn when flame removed	burning wood or paper	grey fluffy ash
PROTEIN FIBERS			
silk	burns in short jumps, does not burn when flame removed	burning hair	crushable black bead
wool	burns in short jumps, does not burn when flame removed	burning hair	crushable black bead
SYNTHETIC FIBERS			
acrylic	ignites and burns	acrid	hard black bead - cannot crush
modacrylic	melts, does not burn when flame is removed	acrid	hard bead - cannot crush
nylon	melts, does not burn when flame is removed	burning wax	amber bead - cannot crush
olefin	melts, burns with sooty smoke, continues to burn when flame removed	chemical odor	hard bead - cannot crush
polyester	shrinks from flame and melts; may self-extinguish	strong pungent or sweet odor	hard bead - cannot crush
spandex	melts	musty	soft, sticky, gummy

[3] Adapted from table by Jane Rising, IFI, and Tortora, Phyllis, Understanding Textiles, Fourth Edition, MacMillan, NY, 1992.

DEFINITIONS

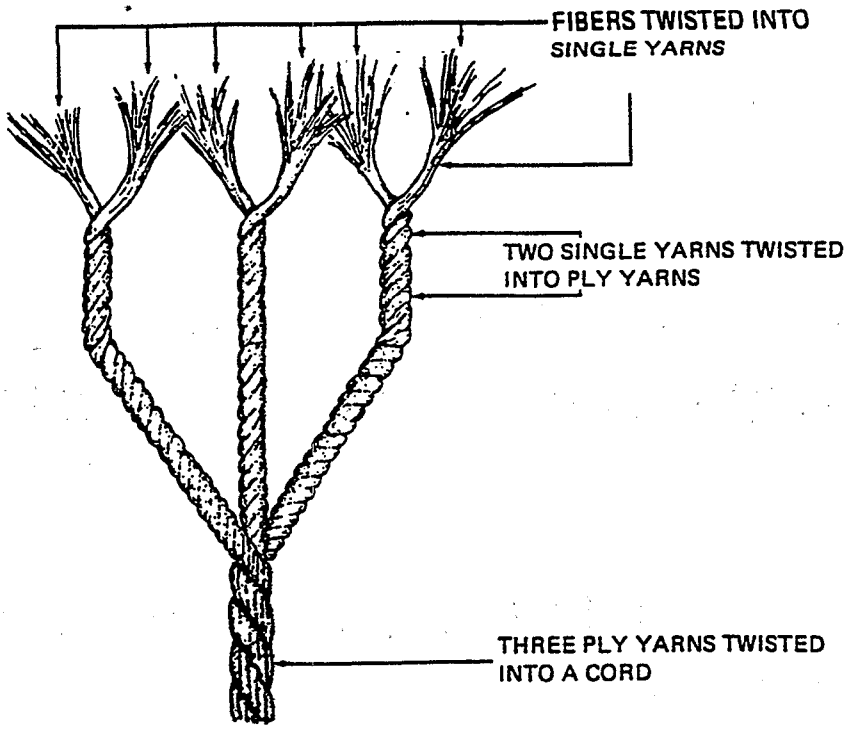
yarn
an assembly of fibers twisted or otherwise held together in a continuous strand

twist
"turns" given to fibers in a yarn to help them stay together

ply
a single yarn twisted into a consolidated "ply yarn"

simple yarns
yarns with uniform size and regular surface

fancy yarns (a.k.a. complex or novelty yarns)
yarns made to create interesting or decorative effects



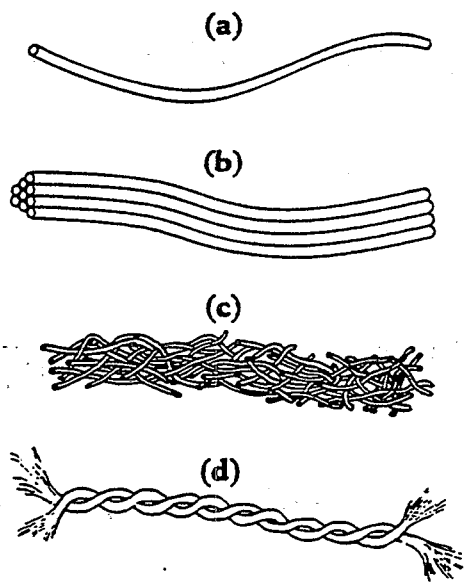


Figure 14.2. Yarns depicted are: (a) monofilament—solid single strand of unlimited length; (b) multifilament—many continuous filaments; (c) staple—many short fibers twisted together; (d) two-ply—two single yarns twisted together. Drawings reproduced courtesy of John Wiley & Sons, Inc., from *Textile Yarns: Technology, Structure, and Applications*, by B. C. Goswami, J. G. Martindale, and F. L. Scardino, p. 2.

DEFINITIONS

woven fabric

two sets of parallel yarns - one horizontal set and one vertical set - that are interlaced to form a fabric

warp

yarn running lengthwise in a woven fabric

filling or weft

yarn running crosswise in a woven fabric

knitted fabric

one or more continuous yarns that are looped through themselves to form interconnected chains

courses

lines of stitches that run in *rows* along the *crosswise* direction of the knitted fabric

wales

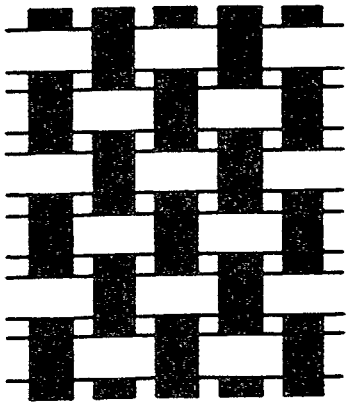
lines of stitches that run in *columns* along the *lengthwise* direction of the knitted fabric

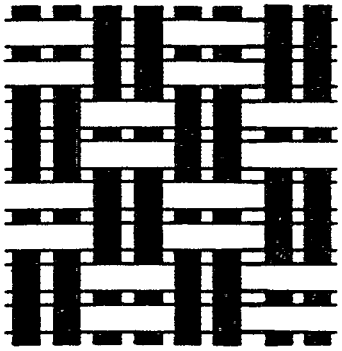
lace

made of yarns that are knotted, twisted or looped to provide a fragile, sheer pattern, often with intricate designs

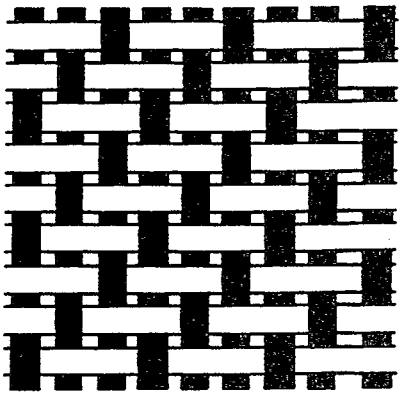
TYPES OF WOVEN FABRICS

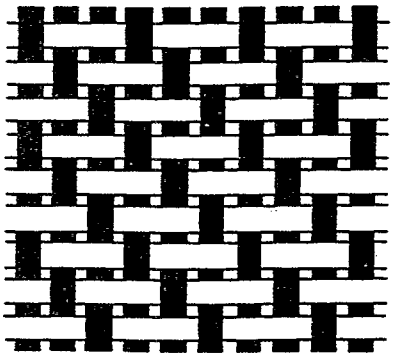
PLAIN

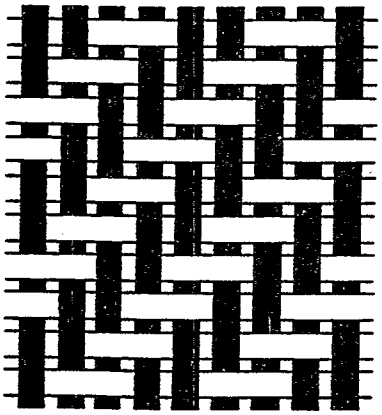




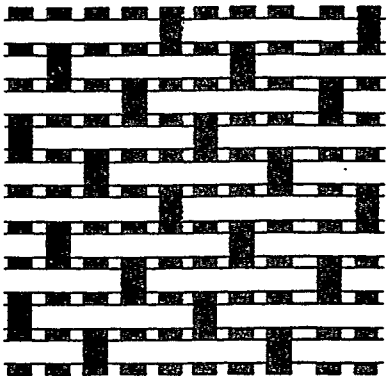
TWILL

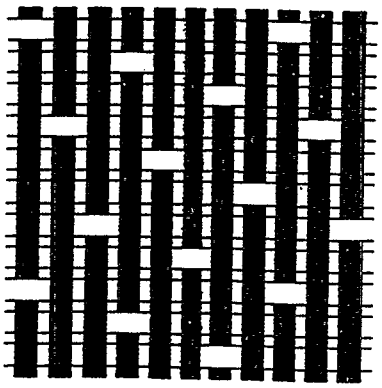






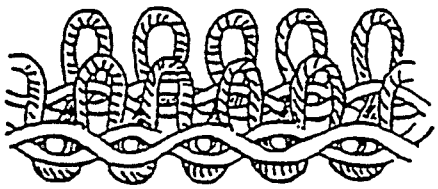
SATIN



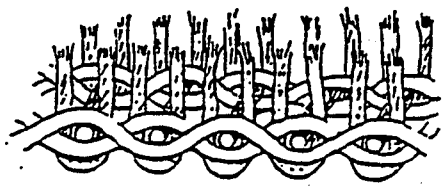


TYPES OF WOVEN FABRICS

PILE

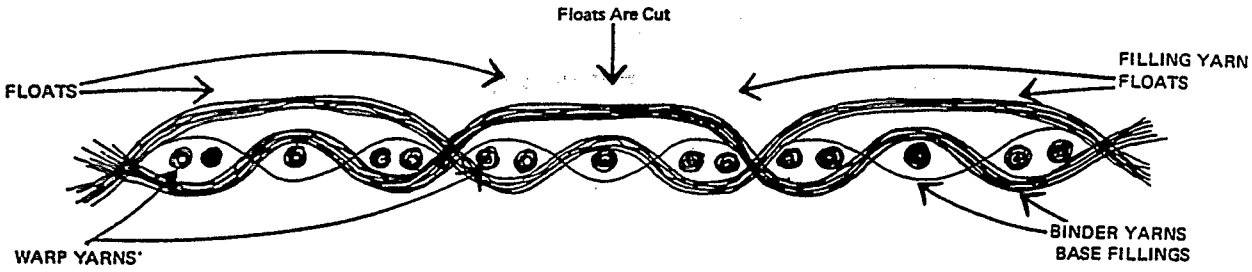


UNCUT LOOP

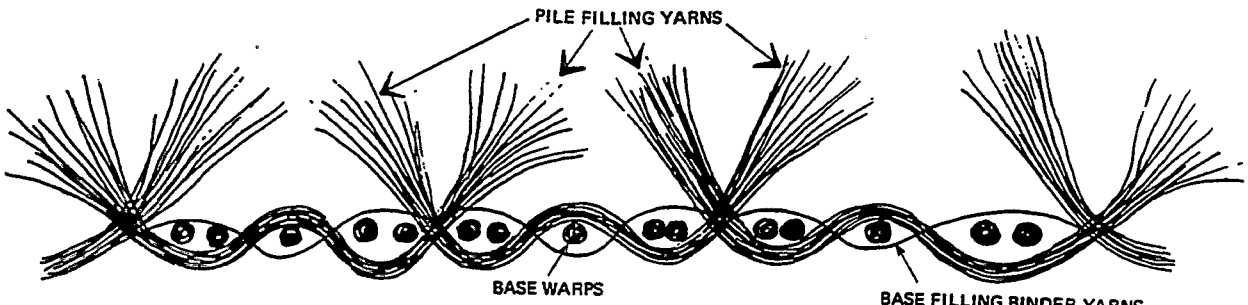


CUT LOOP

CORDUROY



Cut Floats Form Pile



Cross-section of Pile Fabric (Corduroy)

DEFINITIONS

fabric count

the "closeness" of the weave, or
the number of yarns in one square inch of fabric

examples:

a) 80 x 64
80 warp yarns (length)
64 fill yarns (width)

b) 80 x 80 = 80 square = 160 count
80 warp yarns (length)
80 fill yarns (width)

DEFINITIONS

fabric weight

weight of a specified area of fabric

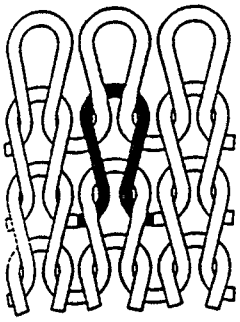
ounces/yard (grams/meter)
high number → heavy fabric

yards/pound (meters/kilogram)
high number → light fabric

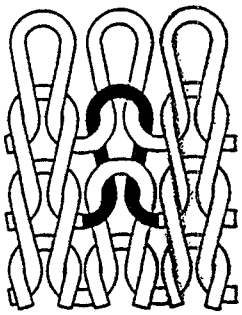
WEIGHT	OZ / SQ.YD.	EXAMPLES
light	1 - 4	sheers, gauze, blouses
medium	5 - 7	shirts, slacks
heavy	9 - 11	jeans
very heavy	over 14	upholstery

TYPES OF KNITTED FABRICS

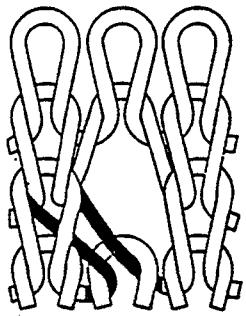
WEFT KNITS



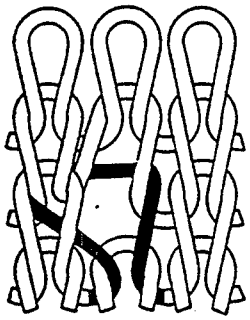
PLAIN



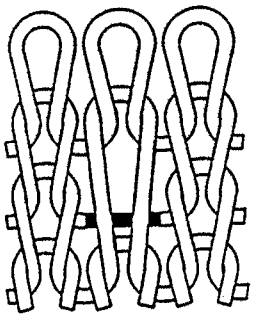
PURL



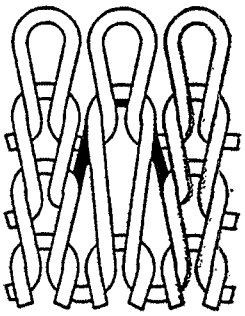
TRANSFER



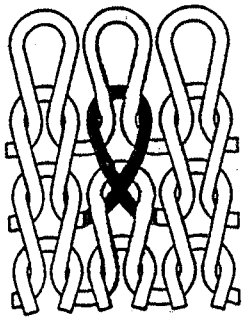
SPREAD



MISS OR FLOAT

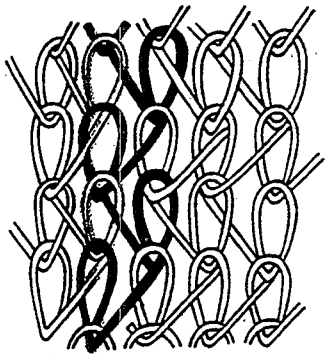


TUCK



CROSS

WARP KNITS



FABRIC CHARACTERISTICS

WOVEN FABRICS

- stability
- high lengthwise shrinkage
- strength

KNITTED FABRICS

- Comfortable
- Tend to stretch/distort
- High shrinkage
- Can be "blocked"
- Snagging ⇨ single yarn
- Pilling
  - especially synthetics & loose twist yarns
  - abrasion ⇨ tiny balls
  - weak fibers break
  - stronger fibers hold on

NONWOVEN FABRICS

Fabrics made by bonding together a web of fibers through physical or chemical adhesion, knotting, stitching, or other means.

Examples

- interfacings
- insulation materials
- shoulder pads
- upholstery & drapes

Characteristics

- low strength
- poor abrasion resistance
- delamination
- differential shrinkage

felt

made primarily of wool fibers, activating the natural "felting" properties of wool through mechanical and chemical action, moisture and heat

SHRINKAGE

Natural Shrinkage

- depends on fiber properties
- wool & rayon

Progressive Shrinkage

- continues through successive cleanings

Residual Shrinkage

- shrinkage remaining in a fabric even after preshrinking

Relaxation Shrinkage

- takes place during initial cleaning
- fibers, yarns, fabric have "memory"
- fabric is stretched in processing
- tension is removed
- water helps relaxation of tension
- woven fabrics
  - warp yarns under greater pressure, so tend to shrink more
- knitted fabrics
  - stretch a lot in process, so shrink and distort in wash

DYEING & COLORFASTNESS

A textile can get its color as a:

- polymer
- fiber
- yarn
- fabric
- garment

Better dye penetration = Better colorfastness

Different dyes used for different fibers ⇨ varying levels of colorfastness

Possible Causes of Color Loss

- water
- chemicals (perchloroethylene, chlorine)
- (sun)light
- perspiration
- heat
- abrasion (crocking)
- poor dyeing process

TEXTILE FINISHES

Why use finishes?

- modify appearance
- modify behavior
- both

How are they applied to fabrics?

- mechanical means
- chemical means
- both

How long do they last?

- permanent
- durable
- temporary

TYPES OF FINISHES

Sizing

- forms a film around yarns and individual fibers
- adds body
- starch & gelatins ⇨ temporary
  used on cottons & rayon for hand & luster - lost in laundering
- resins ⇨ durable

Glazing

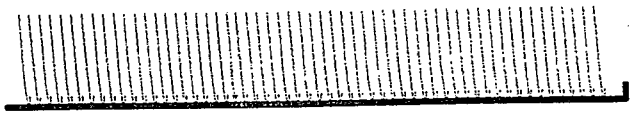
- polished surface finish
  temporary (starch) or durable (resin)

Embossing

- durable if done on thermoplastic fibers or with resins

Flocking

- short fibers glued to surface



FINISHES / TREATMENTS

Permanent / Durable Press

- resin treatment
- special care in laundering

Stain Repellency

- diminishes with laundering
- can be reapplied

Soil Release

- diminishes with laundering
- difficult to reapply

Water Repellency

- renewable finish
  - inexpensive & easy to reapply
- durable finish
  - wash according to care label only

GARMENT CONSTRUCTION

Seam puckering

Seam ravelling

Edge fray

Buttons & trim

Multiple fabrics
- differential shrinkage
- color bleed

DIVIDER PAGE

Module IV: Soils, Odors, Stains

Module Overview:

This module provides a basic review of exactly what are soils, odors, and stains. It helps ensure that participants have a common understanding of issues relating to removal of soils, odors, and stains from garments.

Instructor Preparation:

Review overheads and student manual.

Module Highlights:

Topics:
Soils, odors and stains
Separating soils, odors and stains from fabrics

Reasons for Cleaning

- Garment is soiled with dirt
- Garment has a stain
- Garment has objectionable odor
- Garment is wrinkled or creased
- Garment has lost its color or brightness
- Garment has lost its desired shape or finish
- Garment has been worn and customer wants it cleaned before wearing again

Soil Origins

- Inorganic dust, dirt and particulates
- Inorganic dirt
- Organic oils
- Perspiration stains
- Food and drink stains
- Blood and urine
- Grease, tar or adhesive
- Skin cells

Soil Removal

- Dry mechanical action
- Dry mechanical spinning
- Flushing with water, surfactant or solvent solution, or
- A combination of the above

Odor Origins

- Perspiration and body oil
- Organic contaminants
- Bacteria or mites
- Smoke or soot particulates
- Synthetic volatile organic compounds

Odor Removal

- Agitation, steaming or washing with water, surfactant or solvent
- "Airing out"
- Disinfecting with bleach, peroxide or ozone
- Masking the odor with another
- Heating to promote oxidation or
- A combination of the above

Stains

- There are several different kinds of stains
  - some adhere to the surface of the fiber
  - some soak into the fibers
    - may "set" over time
- Color a fiber like a dye
- Stains can be removed by
  - flushing with water, surfactant or solvent
  - bleaching or dyeing
  - a combination of the above

Separation Technologies

- Mechanical agitation
- Water
- Chemical additives
- Steaming
- Heating
- Drying

Chemical Agents

- Detergents
  - Surfactant
    - surround or emulsify
    - both surfactants and fabrics have negative charges preventing dirt from being redeposited onto fabric
  - Made up of hydrophilic and hydrophobic segments
    - surfactants have affinity for both segments, orient at interface and reduce interfacial tension, resulting in removal of dirt

Chemical Agents continued

- Soaps
  - made when fatty acids are reacted with alkali
  - soil = slightly acidic soap = alkaline
  - results in breaking of bonds and removing soil
- Synthetic solvents
  - many are petroleum based
- Bleaches and oxidizers
  - whitening, odor removal and organic stain removal
  - bleaching only disinfects
  - disinfection kills bacterial and mites

Chemical Agents continued

- Digestors
  - biologically removing organic material
  - enzymes consume and digest organic soil

- Finishing agents
  - designed to restore body and handle
  - forms a film around surface of fiber
    - dissipates the build up of static
    - protects the fiber
    - gives body back to the fiber
    - decreases wrinkling

DIVIDER PAGE

Module V: Garment Cleaning Methods

Module Overview:

This module addresses current methods in garment cleaning. It provides participants with an overview of a variety of approaches to clean garments. This module also compares the two most available methods, wet and dry cleaning.

Instructor Preparation:

Review overheads and student manual.
Review activity in student manual.

Module Highlights:

Activity:

This activity should take place at the end of the module and will lead directly into the next module.

The answers to the question are:

- time
- moisture
- temperature
- agitiation
- chemicals (ie. detergents, etc.)

Topics:
Current and alternative garment cleaning methods
A comparison of dry cleaning and wet cleaning

GARMENT CLEANING METHODS

Garment Cleaning Methods

- Conventional dry cleaning
- Carbon dioxide
- Ozone
- Ultrasonics
- Rynex
- Wet cleaning

Conventional Dry Cleaning

- 4 generations of machines
  - transfer
  - dry to dry
  - control technology
  - control technology with air recycling
- Improvements in technology resulted in
  - increased solvent mileage
  - decrease in the amount of human exposure

Cleaning With Carbon Dioxide

- Low human toxicity
- Ease of recyclability
- Low cost
- No ozone depletion
- Non-corrosive
- Non-flammable
- Non-polluting to ground water or soil
- Availability

Carbon Dioxide

- Supercritical
  - Artificially increase temp. and pressure
  - Temperature = 88 °F Pressure = 1071 psi
  - Grease and oils are solubilized
  - Separate dissolved materials by reducing pressure
  - Commonly used for metal parts cleaning
  - More research need for garment cleaning
- Liquid
  - No surface tension and surfactants enhance cleaning abilities
  - Early research done by aerospace industry
  - Lower temperature and pressure than supercritical
  - Research is on-going

Ozone Cleaning System

- Ozone acts a oxidizing agent
  - disinfects
  - deodorizes
  - bleaches
- Ozone combined with detergents
  - cleans
  - disinfects
  - deodorizes

Ozone Cleaning Process

- Garment remains on hanger
- Results in reduced labor (cleaning and finishing)
- Researchers report
  - no shrinkage
  - deformation
  - wrinkling
  - no removing ornamental buttons

Ultrasonic Cleaning

- Cooperatively funded by U.S. DOE and Garment Care

- Mechanics of process
  - ultrasonic waves directed at fabric through soap/water
  - denser contamination particles are excited and dislodged
  - needs careful monitoring
  - research is ongoing

Rynex

- Made from plant material - waste is non-hazardous
- Can be used in perc machines with minor modifications
- 127 modifications
- Testing done on Grace and Multimatic machines for compatibility
- Does not corrupt seals and gaskets
- In a five minute wash cycle with 20 water and solvent soluble stains
  - perc removed 5
  - Rynex removed 20

DIVIDER PAGE

Module VI: Overview of Wet Cleaning

Module Overview:

This module provides participants with a "walk through" of a wet cleaning facility. The module also discusses a wet cleaning perspective on common cleaning practices such as stain removal.

Instructor Preparation:

This module will prepare participants for the hands-on (on-site) portion of the workshop. Discuss each of the five stations (stain removal, sorting, wet clean machine, drying and finishing) ***making notations*** on flip chart paper of participant questions that will be answered during the hands-on session. This is a technique that is often used in training workshops and is called the "parking lot" or "bicycle rack". The purposes for listing the participant questions are: 1. participants get to see their questions written before the entire class thus validating the questions, 2. the list serves as a reminder for the instructor that there is a question or are questions that need to be answered, 3. reviewing and answering the questions (and checking them off as they are addressed) brings closure to the class, ensuring that all students' questions are answered (their needs are met.)

Review overheads and student manual.

Module Highlights:

<u>Topics:</u>
Front counter
Garment measuring
Sorting
Testing for colorfastness
Stain removal
Cleaning with water
Drying
Finishing

OVERVIEW OF WET CLEANING

OVERVIEW OF WET CLEANING

- Many skills are transferrable
- Key factors
  - well trained and skilled personnel
  - following manufacturers directions
  - quality detergents
  - appropriate finishing techniques

Wet Cleaning Process

- The wet cleaning process utilizes
  - wet cleaning machine
  - detergents
  - finishers
  - stain removal agents
  - specialized dryer
  - process enhanced with quality finishing equipment

Wet Cleaning Technology

- Environmentally friendly method
- Gentle mechanical action of hand washing with convenience of laundry
- Dependent upon knowledge of fiber science
- Requires a larger amount of observation and skill
- Success is dependent upon
  - quality detergents
  - proper training
  - commitment to process

FRONT COUNTER

- The forgotten station
  - only person in shop to interact with customers
  - turnover rate may decrease if well trained and challenged
- Need to examine garments for...
  - sun damage
  - tears
  - missing adornments
  - stains
  - seams and hems in need of repair

GARMENT MEASURING

- Use inside seams on legs and sleeves
- Measure wearer's right side
- Close the waist and double measurement
- Don't include waistbands on pants or cuffs of shirts in measurements
- Note any additional measurements taken

TESTING FOR COLORFASTNESS

- Most wet cleaning detergents are slightly acidic
- Testing done with 1:4 detergent/water mixture
  - white cloth moistened w/solution, gently rub garment

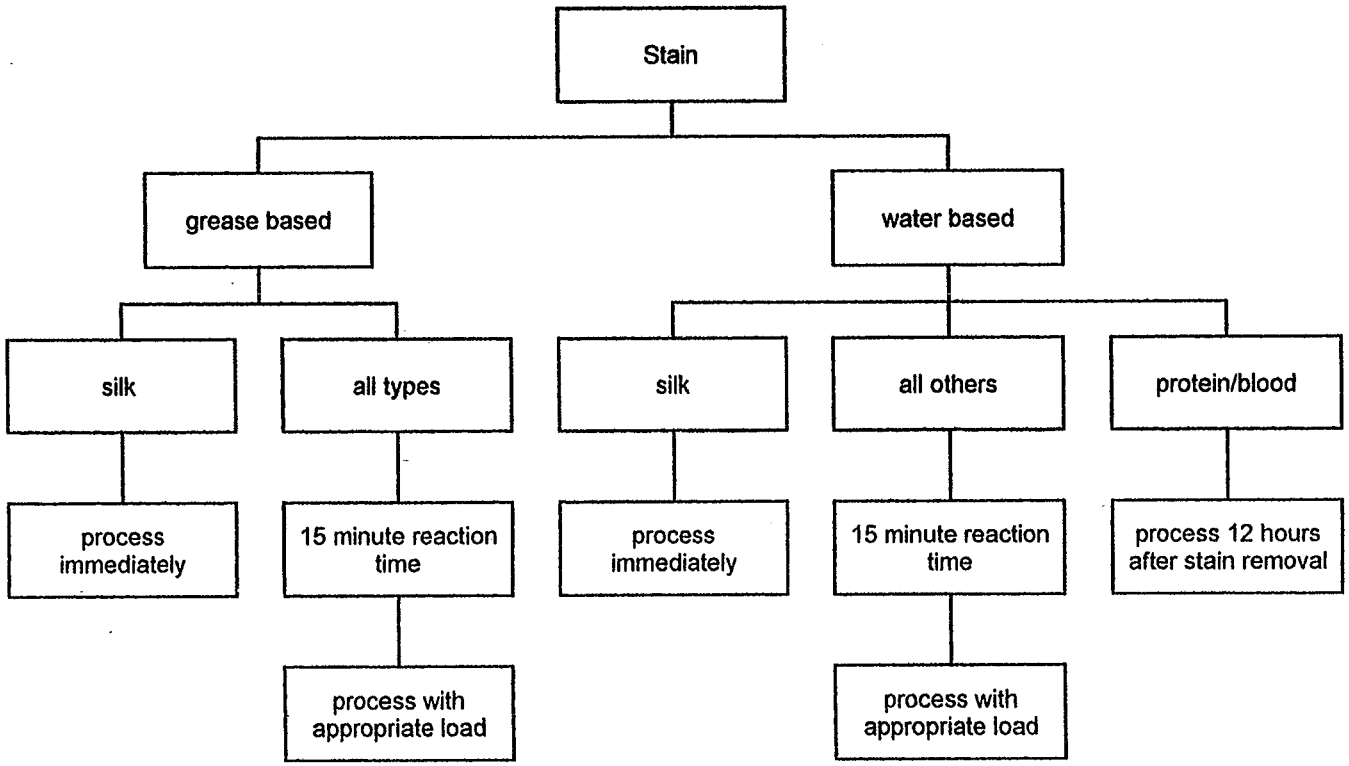
STAIN REMOVAL PROCESS

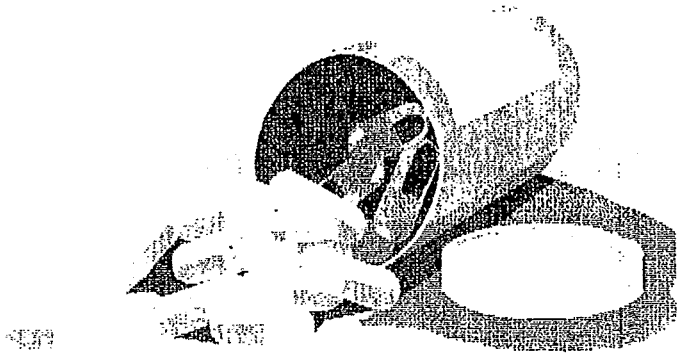
- Proper combination of
  - agitation
  - stain removal agents
  - time
- 70% water based - 30% grease based
  - water based may go directly into machine
  - grease based must be dealt with at the stain removal board

FACTORS CRITICAL FOR STAIN REMOVAL

- Thorough inspection
- Full spectrum fluorescent lighting
- 1:4 detergent/water mixture for ground in dirt
- Perform stain removal before sorting
- Process silks immediately after stain removal

Stain Removal





SORTING

- Sorting procedures are defined by soap/machine manufacturers. Programs may include
  - Outergarments
  - Delicates
  - Wools
- Cycles may be further split into lights and darks
- When mixing loads default to gentler cycle

Sorting

- Sort loads according to machine/detergent manufacturers directions
- Sort complete full loads and half loads
- Ties should be pinned inside pant leg
- Put fine knit sweaters in knit bag
- Suit pieces should be sorted into same load

WET CLEAN MACHINE

- Microprocessor controlled drum
  - precise control which mimmics hand washing
- Cycles control
  - drum rotation as low as 5 RPM's
  - timing
  - temperature
  - addition of chemicals
  - water level
  - extraction
- Water temperature critical
  - too warm may cause dimensional change
  - too cold may not clean properly

Wet Clean Machine

- Match machine program to load size and type
- Take clothes out upon completion of cycle
- Switch machine to wet clean cycle
- Clean drum after waterproofing/fire retard cycle
- Cycle downs in a quick fill/extract cycle to completely wet down
- Use only EPA approved soaps and detergents
- Wet clean suit pieces in same load
- If very soft water is encountered: decrease detergent and increase sizing to protect fabric
- Watch for cracks in through the door tubing - may cause problems
- Process jackets in p.m. so you have room to hang overnight
- If using machine for both laundry & wet cleaning rinse well between cycles

FACTORS CRITICAL FOR WET CLEANING

- Water temperature critical
  - too warm may cause dimensional change
  - too cold may not clean properly
  - 80 degrees F is commonly recommended
- Water hardness/softness
  - extremely soft water may warrant decreasing additive amounts
  - most detergents will function in hard water

DETERGENTS

- Three major functions
  - protect the fiber against damage
  - remove the dirt
  - prevent redeposition of suspended dirt
- Work best in about 80 degree F water
  - warm water increases surface activity of chemicals
  - surface activity enables detergents to decrease interfacial tensions between fabric, soil and solvent
  - decreased interfacial tensions results in soil removal
- Strong anti-deposition properties
- Slightly acid pH decreased color loss

Dryer

- Use large enough dryer for adequate tumbling
- Utilize shortest cycle possible to prevent relaxation damage
- Take clothes out immediately after processing
- Do not dry clothes to <10% humidity
- Air dry garments when necessary
- Very fine and loose weave sweaters should be dried flat
- Molded black plastic form hangers work best

Three types of dryers available

- Home dryers
  - time and temperature controlled
- Wet cleaning dryers
  - two types
    - compares humidity of exhaust air with ambient air
    - humidity sensors in drum measure humidity 400 times/second

DRYING

- Dryer should be twice the wet cleaning capacity of wet clean machine
  - allows for even circulation of heated air
- Using an undersized dryer may result in
  - shrinkage (most occurs at humidity <10%)
  - deformation
  - excess wrinkling
- Drying should be done at high temp. for brief periods of time
- Monitor temperature and humidity

Finishing

- Finish garments only when moisture content has reached equilibrium with ambient air
- Finishing time will be decreased if stretching equipment utilized
- Conditioners (starches) will reduce finishing time on some garments
- Brush suedes with copper wire brush toward nap to bring back nap
- Heavy wool coat should be brushed w/dog brush to pick up pile
- Wipe velvet with your hand to get pile going in same direction

DIVIDER PAGE

Module VII: Hands-on Wet Cleaning

Module Overview:

This module is the heart and soul of the workshop. It give participants the opportunity to do hands on wet cleaning, and to see the results of wet cleaning garments that have been traditionally "dry clean only."

Instructor Preparation:

Review overheads and student manual.

Gather approximately 250 pounds of garments to be processed in the wet clean machine, include mostly "Dry Clean Only", delicates and garments with bead work or trim for demonstration. Participants will be most interested in seeing rayons, silks, and wools processed.

Hang signs at each station in the facility where the hands-on training will take place. The signs should include: Stain Removal, Sorting, Wet Clean Machine, Dryer and Finishing. **See "Logistics" for site selection and preparation.** ***Breaks and lunch*** should be taken at appropriate times.

Module Highlights:

<u>Topics:</u>
Sorting
Stain removal
Wet cleaning
Drying
Finishing

Participants should be instructed how to ***sort*** garments for the machine they will be using. The group should then be allowed to sort all of the garments to be processed. The instructor will inspect the sorted piles for garments that don't belong. The instructor should then explain why he/she might sort the particular garment differently, if appropriate.

Participants will then be split up into three groups of five persons. The groups will be assigned to ***three areas*** for ***2 hours each***; stain removal, wet clean machine/dryer and finishing. This will allow participants adequate time at each station to participate *and* ask questions.

The remaining time will be spent answering further questions and discussing what was learned.

DIVIDER PAGE

Module VIII: Economics of Wet Cleaning

Module Overview:

This module discusses the economic "bottom line" of wet cleaning. Included in this module are tools for dry cleaners to use in analyzing costs of converting to a partial or complete wet cleaning operation.

Instructor Preparation:

Review overheads and student manual.

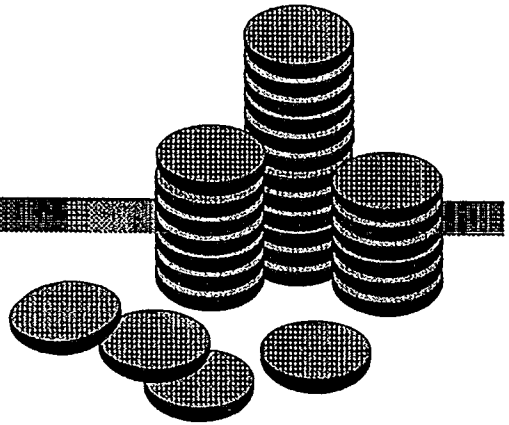
Module Highlights:

Activity:
The instructor should review the cost sheets with the participants. This is a good opportunity to review, line by line, what each entry means. Participants should be encouraged to offer estimates of their costs so some actual comparisons can be made.

Topics:
Understanding and finding costs
Converting from dry to wet
Identifying and comparing costs of dry vs. wet cleaning
Cost comparison worksheets

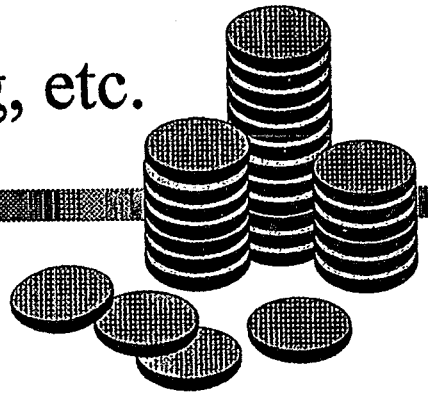
ECONOMICS

DRY CLEANING
AND
WET CLEANING



Cost of Toxics - True Costs

- Purchase Cost is just the beginning, include all related activities:
  - **Waste Management**
    - Pre-treatment, storage, hauling, insurance, disposal
  - **Utilities**
  - **Indirect Labor**
    - Maintenance (materials & labor), housekeeping, calibration
  - **Regulatory Compliance**
    - Monitoring, Manifesting, Recordkeeping, etc.

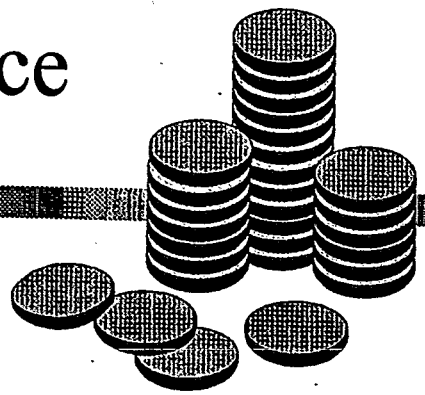


COST OF TOXICS
"Hidden Costs"

- Often costs are incorrectly combined as "Overhead"

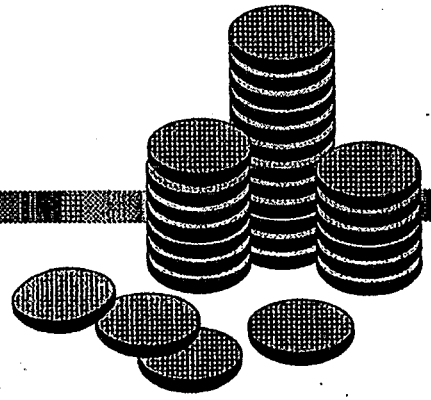
- If a cost is paid for the sole purpose of the toxic....
  - Ventilation, construction, training time, etc.

- "Overhead" typically understates total expenses, and doesn't assign a source



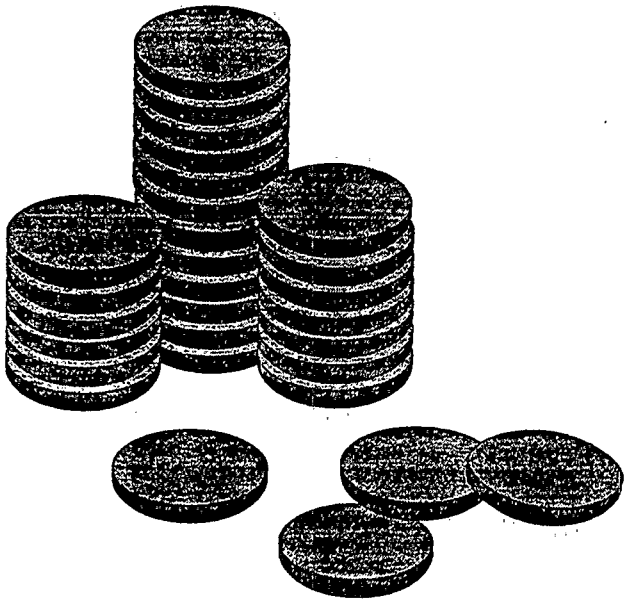
COST OF TOXICS

- Used to identify the true costs of a chemical
- Proven business tool
- Uncovers "hidden" costs
- Used to replace conventional cost accounting



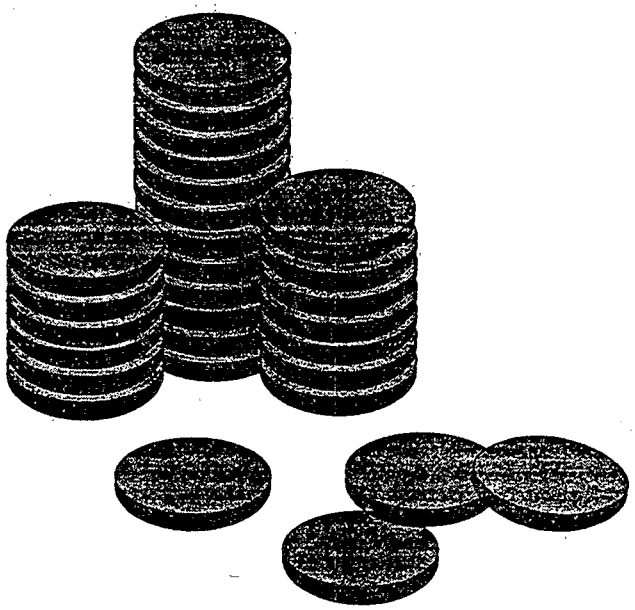
UNDERSTANDING AND FINDING COSTS

- Capital Costs
- Operating Costs
- Intangible Costs



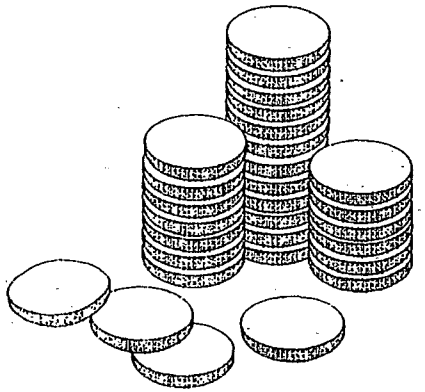
CAPITAL COSTS

- New Equipment
- New Buildings



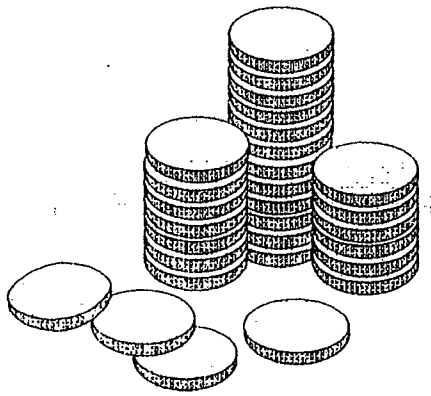
OPERATING COSTS

- Consumable materials
- Utilities
- Waste disposal
- regulatory compliance



INTANGIBLE COSTS

- Public image
- Community goodwill



Why Are Costs Neglected?

Perception that

...some costs are not relevant
...some costs are not significant enough to quantify
...some costs are too difficult to quantify

Environmental costs are often

...hidden
...assigned to overhead accounts

Which Costs Are Typically Neglected?

- Less Likely To Be Neglected
  - One-Time Investment Costs
  - Direct Costs
  - Certain Costs
  - Short-Term Costs
  - Easily Quantifiable Costs
- More Likely To Be Neglected
  - Annual, Recurring Costs
  - Indirect, Hidden Costs
  - Uncertain, Probabilistic Costs
  - Long-Term Costs
  - Difficult-To-Quantify Costs

Examples of Costs/Savings Typically Neglected

- Indirect Hidden
  - One-Time Investment Costs
    - Start-up/training
    - Permitting
  - Annual, Recurring Costs
    - Regulatory Compliance
    - Green Market Revenues
    - Liability

Difficult-To-Quantify
Long Term

Examples of Costs/Savings Typically Included

- Direct, Certain Easily Quantifiable
  - One-Time Investment Costs
    - Purchased Equipment
    - Construction/Installation
  - Annual, Recurring Costs
    - Raw Materials
    - Operating Labor
    - Waste Hauling and Disposal

Comprehensive Cost/Savings Inventory

One valuable tool for ensuring inclusion of all relevant and significant costs and savings is to start project analysis with a comprehensive cost/savings list, or inventory.

Activity V

- Tasks
  - Identify components of the operation
  - List possible costs foreach component
    - use handout

DIVIDER PAGE

Module IX: Available Wet Cleaning Equipment

Module Overview:

This module discusses the types of equipment available for wet cleaning. Charts are included that compare different types of wet clean and drying equipment.

Instructor Preparation:

Review overheads and student manual.

Module Highlights:

Topics:
Wet cleaning machines
Dryers
Wet cleaning equipment features and specifications

Discuss each of the entries on the tables on pages 98-100 of the *Garment Wet Cleaning Manual*. Be sure to remain generic in your description of standard and optional features. Using the equipment at the hands-on site in the facility, demonstrate the features which make that brand unique.

EQUIPMENT OPTIONS

- Max. load capacity
- Extract G force
- Drum RPMs
- Frequency controlled motor
- Programmable microprocessor
- Number of programs

EQUIPMENT OPTIONS cont.

- Average wash cycle
- Steam heat (direct or indirect)
- Electric heat
- No. of detergent/chemical dispensers
- Auto spray thru door (waterproofing and flame retardant)
- Low level/empty tank alarm
- automatic shut-off

EQUIPMENT OPTIONS cont.

- No. of recycling tanks for water/chemicals
- Pump/filter recirculation system
- Wet cleaning detergents/chemicals recommended

DIVIDER PAGE

Module X: Facility Function and Design

Module Overview:

This module provides basic information on the design of a wet cleaning facility, especially as it relates to the functions of a wet cleaning operation.

Instructor Preparation:

Review overheads and student manual.

Module Highlights:

Topics:
Adapting the staff to wet cleaning procedures
Designing a functional floor plan

FACILITY FUNCTION AND DESIGN

Facility Function

- When converting or retraining you need staff with an open mind
- Commitment to process is crucial
- Counter personnel
  - the "forgotten station"
  - critical to success of business
  - need to be well trained, motivated and pleasant
- Many skills are transferable with minor modifications

Floor Plan Design

- Efficient design is critical
  - labor costs affected
- Streamline the flow of garments
- Think about efficiency when replacing equipment
- Work flow should be "U" or "O" shaped
- Additional hanging space required
  - ?drying cabinet?

DIVIDER PAGE

Module XI: Labeling Liability/Wrap-up

Module Overview:

This module discusses the issue of labeling liability as it pertains to garment wet cleaning.

Instructor Preparation:

Review overheads and student manual.

Module Highlights:

Topics:
Proposed changes in care labeling
The current situation
Wrap-up

The wrap-up component of this module should focus on some of the organizations (see overheads) that participants should consider valuable resources.

Evaluations (see I-13) should be handed out for participants to complete, and collected before participants leave.

Certificates, if available should be distributed.

What's Next for Wet Cleaning?

- Center for Neighborhood Technology
  - results from The Greener Cleaner study
  - contact CNT at
    - wet cleaning hotline (312)278-4800, ext. 299
    - fax (312)278-3840
    - download a copy
      http://www.pond.com/~hhorning/wetclean/gcrep/gcrep0.html
    - e-mail sylvia@cnt.org

What's Next? cont.

- Environment Canada
  - Green Clean Trial
    - six month study to research and evaluate customer acceptance
    - two cleaners funded to wet clean only
  - Green Clean Extension
    - Depot taken over by private operator
    - 3 more cleaners funded & giver option to dry clean
  - Green Clean Facility
    - 100% wet clean conversion
    - any dry cleaning sent off-site

What's Next? cont.

- University of California at Los Angeles
  - Cleaner By Nature
    - plant in LA
    - drop shop in Santa Monica
- Project parallels the demonstration at The Greener Cleaner

THE FABRICARE LIST

- e-mail list service
- send e-mail to Dave Spensley at cleanlist@uncled.com
- include in your message
  - your name
  - company name
  - industry affiliation
  - street address
  - city
  - e-mail address where you want messages sent
- interesting Web addresses
  - http://www.cnt.org/sus_man/wet_cln.html
  - http://members.aol.com/nadagroup
  - http://www/pond.com/~hhorning
  - http://www.epa.gov/docs/enviro/html/ef_home.html/