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STRENGTHENING OF THE CHINA DYEING AND FINISHING DEVELOPMENT CENTRE

DP/CPR/85/056

CHINA

Technical Report: Preparatory Assistance Mission\*

Prepared for the Government of the People's Republic of China  
by the United Nations Industrial Development Organization  
acting as executing agency for the United Nations Development Programme

Based on the work of Robert Hirschler  
Consultant in the dyeing and finishing of textile fabrics

United Nations Industrial Development Organization  
Vienna

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**ABSTRACT**

The purpose of the mission (5 January 1986 to 12 February 1986) was to give preparatory assistance to the Government of the CPR in preparing the project document [PD] for the establishment of the China Dyeing and Finishing Development Centre [CDFDC] (DP/CPR/85/056).

A draft PD has been prepared in close cooperation with the national counterparts in Shanghai, and discussed with the SIDFA and the SPO at the UNDP office as well as the representatives of the Government in Beijing, and submitted to the Substantive Officer at UNIDO HQ.

It is recommended, that

- the PD be submitted for approval, the project be approved and launched as soon as possible;
- some activities (organization of general identification study tour, selection of site and planning of construction for Pilot Plant building, nomination of fellows) be started immediately, not waiting till the approval of the project, if need be on Advance Authorization or other suitable form of financing;
- the posts for CTA and Expert in Bleaching (missions due in September/October this year) be advertized as soon as the project is approved.

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I PURPOSE OF MISSION

The purpose of the mission was to give preparatory assistance for the establishment of the China Dyeing and Finishing Development Centre [CDFDC]. In particular the consultant - in close cooperation with the designated counterpart - had to

- survey a representative sample of the dyeing/finishing industry;
- review the project proposal prepared by the Counterpart Agency;
- prepare the ingredients for a project document, with the objective of establishing a China Dyeing and Finishing Development Centre;
- formulating the outputs: preparing a list of activities, including a timetable, a draft work-plan and a final list of Government and UNDP/UNIDO inputs.

## II ACTIVITIES AND OUTPUT

In addition to briefing/debriefing in Vienna and Beijing the consultant had discussions with officers of the Ministry of Textile Industry, the project counterpart staff, and visited a number of factories and institutions primarily in Shanghai. The output of the mission is the Project Document [PD], prepared in close cooperation with the project counterpart staff, and in constant consultation with the Ministry of Textile Industry.

### A. Discussions with the Ministry of Textile Industry and project counterparts

The CDFDC has been put under the authority of the Ministry of Textile Industry [MTI], and the purpose of discussions in Beijing and in Shanghai (ANNEX 1.) was to clarify the background and justification of the project, with particular emphasis on the rather high equipment component.

The MTI provided data on the number, size and production of the most important dyeing, printing and finishing factories within the direct sphere of influence of the CDFDC, and made it quite obvious, that such a Development Centre is necessary and fully justified when the magnitude of the industry it serves is taken into consideration. This is fully explained in the PD.

It should be mentioned here, that one of the main arguments for the CDFDC to operate independently of (albeit in close cooperation with) the Shanghai Textile Research Institute [STRI] is the need for an institution of applied research and development specializing in the field of textile wet processing and operating under the authority of the MTI (and not, like the STRI under one of the regional Textile Industry Bureaus).

Dr. Zhu Xing of the MFI participated in the preparation of the PD, has been in agreement with the technical contents of the PD and accepted it as the basis for the project.

The method of the preparation of the PD was that of continuous discussion with the project counterpart staff in Shanghai (ANNEX 1.). They supplied all the background information, and every chapter had been thoroughly discussed prior to its inclusion in the PD. The PD submitted for approval is thus - with minor modifications, mainly extensions - that agreed on in Shanghai.

#### B. Factory and institution visits

Prior to the preparation of the PD a number of visits to dyeing, printing and finishing factories had been organized for the consultant (ANNEX 2.) to survey a representative sample of the industry in accordance with the purpose of the mission.

The factories visited reflected the wide range of size and technical level of the would be clientele of the CDFDC, but the general picture was that of an industry where vast potential for improvement is present. The expertise is there (with obvious place for a great number more of highly qualified experts), and judged by the quality produced on not-so-modern machinery these factories can utilize the latest in technology and equipment with high efficiency.

These visits have been convincing of the need for CDFDC, and the brief discussions with the directors, technical directors resp. chief engineers have clearly shown that the industry is fully aware of this need. It also became evident that the senior staff of CDFDC has been well known and well respected throughout the dyeing and finishing industry, which is important - and very reassuring - in respect of the future acceptance of CDFDC as a focal point of professional activity.

### C. Remarks on the Project Document

The background information, statements and proposals of the PD will not be repeated here, but some remarks concerning the first few activities - which might precede the acceptance of the PD and thus the actual commencement of the project itself - may not be amiss.

#### Preparation of detailed workplan

A detailed workplan draft should be prepared as soon as possible by the National Project Director, which can be finalized and incorporated into the PD during the first visit of the CTA, and which should be the basis of activities until then.

#### Selection and language school of fellows

In order to start fellowship programmes this year, Fellows 1. and 2. have to be selected immediately (the MTI indicated during debriefing in Beijing that steps have already been taken), and Fellows 3. to 13. have to be selected by June this year, and start their language courses in September in order to get the 1 or 2 years training necessary prior to the longer-term (10 months) fellowships.

#### Planning of Pilot Plant building

A new, 3,000 m<sup>2</sup> building has been envisaged for the Pilot Plant, housing most of the equipment listed in the PD under Government and UNDP Inputs. The site of this building has to be selected by the MTI and the project staff, and construction planning work started in March in order to get the building ready by the end of 1987 according to schedule. This is essential, because the installation of the pilot machinery cannot be started before the very final stages of the construction work, leaving only about 2 years of the project's time for the utilization of this machinery.

### General identification Study Tour

The aim of this study tour is to gather information on up-to-date techniques and machinery in textile wet processing in general, and to facilitate the selection of imported machinery for the Pilot Plant. It is essential that this study tour be organized in May/June this year so that bids for the equipment can be invited and orders placed by the end of this year. Should the project not be approved by the time necessary, it is recommended that the study tour be organized using Advance Authorization or other means of financing.

Names and addresses of some companies recommended to be visited are listed in ANNEX 3. Manufacturers of machinery or dyestuffs and chemicals should be asked to arrange - where possible - visits not only to their own plant, but also to dyehouses, printing and finishing factories (which is not easily achieved). There are some factories in Hungary worth visiting - also listed in ANNEX 3. - where the consultant <sup>can</sup> arrange it, and for some companies in Western Europe the possibility of such a visit has in principle been agreed to, in those cases the name of the "contact person" is given.

### Posts for CTA and Expert in Bleaching

The first visit of the CTA is envisaged for September this year, and the visit of the Expert in Bleaching for October this year. In order to keep this schedule both posts are recommended to be advertised in the usual manner as soon as possible, so that the visits can take place as scheduled even if the project is authorized as late as May/June 1986.



### RECOMMENDATIONS

In order to start project activities as scheduled, it is recommended, that

1. The project document be submitted for approval and the project be approved and launched as soon as possible.
2. Study Tour 1. (general identification) be organized for May/June this year, on Advance Authorization if needed.
3. Post for CTA (first visit September 1986) and Expert in Bleaching (mission in October 1986) be advertised as soon as the project is approved.
4. The Ministry of Textile Industry of the PRC select the site for the Pilot Plant and have the planning work started in March 1986.
5. The Ministry of Textile Industry of the PRC accept the nomination of 2 fellows for Fellowships 1. and 2., and they start language school immediately so that these Fellowships can take place this year.

Senior counterpart staff

A. MINISTRY OF TEXTILE INDUSTRY

Department of science and technology

Mr. Li Bai-Chang, Deputy Director

Mr. Chen Shu-jie, Senior Engineer

Mr. Huang Zhao Pei, Engineer

Department of Foreign Affairs

Dr. Zhu Xing, Senior Engineer

B. CHINA DYEING AND FINISHING DEVELOPMENT CENTRE

Mr. Ding Li, Director, Deputy Director of Shanghai  
Textile Industry Bureau, President of  
STRI

Mr. Zhou Wei-Tao, Vice-Director, Vice-Director of STRI

Mr. Cheng Cheng-Kang, Vice-Secretary General,  
Director of Project Planning Department

Mr. Gao Han-Yu, Administration Director

Mr. Pan Zheng-Zhong, Director of Information and  
Advisory Dept.

Mr. Cai Pei-Wei, Engineer (acting as interpreter)

C. SHANGHAI TEXTILE RESEARCH INSTITUTE

Mr. Hu Jiafu, Deputy President

Mr. Xu Zhensheng, Deputy Chief Engineer

Mr. Shao Xinzhou, Vice-Director of D/F Department

Mr. Chen Shouzhi, Consultant

Details of factory and institution visits

A. BEIJING TEXTILE ACADEMY (10 and 13 January 1986)

Ms. Wu Hui Li, Assistant Director

Mr. Ji Gui-Sheng, Chief of Dyeing and Printing Department

The Textile Academy of the MTI is one of the leading institutions in the textile industry of the PRC. It comprises four Institutes: Textile Technology, Synthetic Fibre, Textile Standardization and Textile Automation; and two Offices: Electrical and Mechanical Engineering and Technical Economics. The Academy has a staff of nearly 1600, including 450 engineers and technicians.

The Fibre Processing and the Dyeing and Printing Departments have a staff of around 100, with 30-40 engineers. They conduct R and D work in a variety of topics in textile wet processing.

The laboratories are equipped with highly sophisticated instruments, in addition to the usual equipment for materials testing and analysis they include a DSCE/DTA/DTG (Perkin Elmer), scanning electronmicroscope, IR spectrophotometer (Perkin Elmer), thin layer chromatograph (Shimadzu), UV/VIS spectrophotometer (Pye-Unicam 8800), tristimulus colorimeter (SUGA AUD CH-Z) etc.

The pilot scale dyeing and finishing laboratories are equipped with:

- winch (Werner Mathis)
- thermosol (Uenoyama)
- jet dyeing machine (Werner Mathis)
- roller printing machine (Mitsubishi)
- Pad Roll (Artos)
- finishing range (Benz)
- coating machine (Werner Mathis)
- Multicolor dyer (Pretema)

The Dyeing and Printing Department has a full size pilot plant, with jets, package dyeing machines and stenters.

The central database for the whole textile industry of the PRC is being organized at the Textile Academy: a number of mini- and micro computers (PDP 11/24, IBM PC, ALTOS PC, Great Wall PC) are used already for training and data processing.

The expert gave a technical lecture at the Textile Academy on dyehouse automation for an audience of about 20, with some discussion on the topic afterwards.

#### B. BEIJING PRINTING AND DYEING FACTORY (10 January 1986)

Mr. Bao Suichu, Deputy Director

This is a fairly big dyeing and printing factory, typical in size, technical level and in product mix of the would be clientele of the CDFDC. The 3100 employees of the factory produce around 100 million m/year of apparel and decoration fabrics (including textile based wall papers) of cotton, synthetics and blends, at an average width of 45 inches.

The technical level of the factory is being improved quite dramatically, around USD 2 M is invested annually on new equipment.

C. THE SHANGHAI TEXTILE RESEARCH INSTITUTE (14 January 1986)

(List of senior counterpart staff see ANNEX 1.)

The STRI was established in 1956, and has 11 departments, covering the whole field of textile processing: spinning, weaving, knitting, nonwovens, technical/industrial fabrics, dyeing/finishing, automation, testing and measurements, information, product development and environmental protection.

The STRI operates under the authority of the Shanghai Textile Industry Bureau, and most of its departments serve the Shanghai area, except for the Information Station, which operates on a nationwide basis, and will become the Information and Training Department of the CDFDC. The institutional linkages of STRI and CDFDC as well as the list of equipment of direct interest to the project are described in detail in the project document, and will not be repeated here.

D. SHANGHAI XINGUANG DYEING WEAVING AND  
SHIRT MANUFACTURING MILL (15 January 1986)

Mr. Wu Zhongshi, Manager

A large, and technically very advanced factory producing annually around 70 Mm shirting material mainly of PES/CO blends (70/30, 60/40, 50/50 and 80/20) at an average width of 40 inches (36 to 44), and 2.4 M pieces of made up shirts. 80% of the production goes for export, including such well known brands as Van Heusen, Shanghai Smart etc. Around 30% of the production is resin finished for easy care, some fabrics are hydrophob finished with organic silicones, fluorochemical finishes or soil release finished. For some fabrics the polyester component is treated with alkali weight reduction.

The factory has the usual range of machinery for such a product mix: continuous bleaching range, chain mercerizer, Pad Roll, thermosol (self built), etc. and an unusual machine for heat setting with vertical IR gas heater. The laboratory is fairly well equipped, an ACS colour matching/match prediction system has recently been installed.

E. SHANGHAI # 7 SILK PRINTING MILL (15 January 1986)

Mr. Chen Ze Zing, Manager

The small (600 employees) factory specializes in printing natural silk, about 3 Mm annually of 50 different qualities (drill, georgette, crêpe etc.) in 2000 designs and 5000 patterns. Most of the production is exported to 90 countries.

The buildings and machinery is rather outdated, there are printing tables for hand printing and flat screen machines with a maximum of 15 colours. A new 6 floor building is under construction.

F. SHANGHAI # 2 DYEING AND PRINTING MILL (16 January 1986)

Mr. Yue Jia Dong, Director

The factory has been established in 1947 with Japanese machinery and 200 employees. Today there are 2400 employees, and the technical level of the machinery is above average, it includes:

- 3 open width bleaching ranges
- 1 rope form desizing/bleaching range
- 1 Japanese and some self built thermosols
- 5 self built roller printing machines
- 1 Chinese made rotary screen printing machine
- 1 Artos and several self built stenters
- 1 Morrison liquid ammonia treatment machine

etc.

ANNEX 2. (contd.)

The laboratories are fairly well equipped: in addition to the pilot scale Werner Mathis horizontal/vertical pad mangle and combi stenter and a roller printing machine there is an ACS 3100 colour measurement and match prediction system with a DEC PDP 11/73 computer.

The factory produces high quality apparel and decoration fabrics of pure cotton (30%) and polyester/cotton blends (70%), 40% of which is bleached, 20% dyed and 40% printed. The total production is 400,000 m/day (about 120 Mm/year), 80% of which goes for export.

The Director of the factory finds the establishment of the CDFDC important, in his view the CDFDC should have special equipment (pilot scale and full size) for development, market research, pre-investment studies for factories etc. He also expressed his willingness to consider the factory as the possible site for the Pilot Plant of CDFDC.

G. SHANGHAI # 3 PRINTING AND DYEING WORKS (16 January 1986)

Mr. Jin Renzhong, Chief Engineer

This is another factory producing outstanding quality cotton fabrics, 80 Mm annually, for apparel and decoration. 20-25% of the production is bleached only, 25-30% dyed and 50% printed. All of the production is exported: to New Zealand, Australia, USA, and recently to the USSR and Eastern Europe.

Before the war this used to be a factory of Calico Printers, since 1954 it has produced only for export. The factory was reorganized in 1979, when the machinery has been modernized.

Today the machinery is still in very good condition, though most of the machines are not new any more. There are continuous rope bleaching, kier bleaching and open width bleaching machines (Küsters), high speed mercerizing machines (120 m/min), 8 fourcolour roller printing machines, 3 rotary screen printing machine (Stork), an Arioli steamer, a Küsters washing machine, 16 jiggers, 2 overflow machines (Thies), a number of calanders (chintz, Schreiner, embossing), and among the stenter frames the Brückner stenter with a Stork foam generator and special coating applicator is noticeable.

The laboratories are also very well equipped: the pilot scale equipment include a Pad Steam (W. Mathis), steamer (Arioli), rotary and flat screen printing table (J. Zimmer), and two colour measurement/match prediction systems: the original MS 2000 of Kollmorgen, and a Color Eye IV. from Kollmorgen, with ICS software.

The factory has 2000 employees, among them a number of young graduates, many of whom are in leading positions. The Chief Engineer supports the idea of the CDFDC, particularly in the field of product development: in his views the Pilot Plant of the CDFDC could save precious capacity of production machinery by undertaking test runs of new qualities, and - although the factory does have highly qualified experts - the professional help from the staff of the CDFDC, who can devote their full time to development work, can also be significant.

#### H. CHINA TEXTILE UNIVERSITY (17 January 1986)

Professor Wan Ju Xian, ExDirector of the Department of  
the Department of Textile Chemistry

The University is one of the nine institutions of higher learning in the PRC in the field of textile processing (two



of which - the ones in Souzhou resp. in Hangzhou - specialize in natural silk).

The CTU has the following departments: Synthetic Fibres, Spinning, Weaving, Knitting, Textile Chemistry, Garment Making, Textile Mechanical Engineering, Automation, Environmental Protection/Ecology, Administration and the Research Institute for Fibre Science.

The education follows the American system: 4 years of undergraduate studies are followed by 2½ years Masters courses, and 2 to 3 years for the PhD work. There are 60 undergrads and 6 to 8 graduates annually, which is low in respect of the actual demand of the industry.

The curriculum is similar to that of other similar institutions, the specialized textbooks are those published in the UK and USA (Vickerstaff, Rattee, Bird, Peters etc.) For the BSc the thesis work takes 15 weeks (1 term), some of the thesis topics include: foam finishing, properties of rami during finishing, flame retardant finishes on cellulose and synthetics, behaviour of dyestuffs etc. For the MSc courses include those in advanced maths, organic analysis, reaction mechanism, flame retardancy etc.

The research facilities at the CTU have some of the most sophisticated instrumentation: scanning electron microscope (CamScan), X-ray diffraction and small angle scatter instruments (Rigaku), DSC/DTA (Du Pont) with self designed thermal dynamic analyser (measurement at constant tension/length), dynamic viscoelastometer, IR spectrophotometer (Perkin Elmer), DIANO MatchScan II recording spectrophotometer with DEC Professional 350 computer, and the usual range of laboratory and pilot scale dyeing and finishing equipment, including a flock printing machine (Maag & Schenk).

I. SHANGHAI # 2 BLEACHING AND DYEING FACTORY FOR  
KNITTING YARNS (17 January 1986)

Mr. Nu Zai Chon, Director

Mrs. Chen Qin Feng, Technical Director

This is a small dyehouse with 200 employees, with an annual production of 2000 tons of synthetic yarns, 2/3 of the production is polyester, 1/3 polyamide.

The dyehouse has worked in close cooperation with the STRI in the past 12 years on dyehouse automation. In 1983 process controllers have been installed for the dyeing machines, the IC boards have been developed by the Shanghai Computer Factory, the software by STRI. The development costs were around RMB 70,000 (approx. USD 23,300), and the calculations show a Return on Investment figure of 7 months, the main advantages being the higher productivity and improved quality.

J. SHANGHAI # 2 DYEHOUSE FOR WEAVING YARNS (17 January 1986)

Mrs. Zhou, Director of the Technical Department

This is another dyehouse where the STRI has developed process controllers for the dyeing machines. The dyehouse produces 20 tons/day of polyacrylic, polyester, polyvinylalcohol and cotton resp. cotton/synthetic yarn on 4 machines of 100 kgs and 2 of 200 kgs each.

The PS 962 and PC 821 programmer/controller units can be operated centrally and take care of the temperature control (i.e. the heating/cooling cycle) of the machines.

K. SHANGHAI # 17 DYEING AND BLEACHING FACTORY (18 January)

Mr. Liu Tian Fu, Director

Ms. Chuang Xi Hua, Chief Engineer

A medium size factory with 850 employees and a production of 40 to 45 Mm/year. The technical level of the machinery is not very high, the factory is planning an investment of RMB 3 million (approx. USD 1 million) for the coming 5 year plan period (1986 to 1990).

The machinery consists of continuous ranges for preparation (singeing, desizing, bleaching), mercerizing (1 double layer and 1 high speed chain mercerizer), dyeing (1 naphtol line, 2 vat dyeing lines, Küsters Pad Steam, 10 jiggers) and finishing (drying, chemical finishing, sanforizing).

The quality produced surpasses by far that expected of the machinery at its present level: a rich assortment of fabrics is produced in fairly short yardages (min. 1800 to 3000 yards) in 300 colours at a very high quality level. 90% of the production goes for export.

The Director and Chief Engineer were of the opinion that the CDFDC would be of prime importance for small to medium size factories, like theirs. One particular problem to be solved is the economic production of small yardages, there is at present no easy solution, although the market requires ever smaller lots at acceptable prices. (The problem of dyeing 500 to 1000 yards of cotton is not easily solved, and this question has been raised at several other factories, so it will be one of the first research topics for CDFDC.) The services of CDFDC would also be required in colour matching and technology development.

L. SHANGHAI DYESTUFFS RESEARCH INSTITUTE (21 January 1986)

Mr. Pan Junliang, Vice Director

The SDRI is one unit - among 14 others - of the Shanghai Dyestuff Industries Corporation, the others being factories manufacturing organic pigments (1 and 12), naphthols and direct dyes (2 and 9), cationic dyes (3), acid dyes and organic pigments (4), disperse dyes (5), intermediates (7 and 14), reactive dyes (8), vat dyes (10 and 11), auxiliaries for dyeing (15). Unit 13 does the finishing of products for the other factories, and unit 6 is SDRI.

The Corporation has 20,000 employees, and produces mainly for the domestic market, at present only 500 tons of (reactive) dyestuff are exported annually.

The SDRI has nearly 600 staff and workers, including approx. 80 engineers and 60 assistant engineers. The UNIDO/UNDP project "Research and Development in Dyestuffs" has been going on for 6 years now, Phase I between 1980 and 1983, Phase II from 1984. UNDP input in Phase I included 6 fellowships, the visits of 5 experts and USD 120,000 worth of equipment. UNDP input for Phase II includes visits of 4 experts, 6 fellowships of 3 to 12 months, 2 study tours and USD 175,000 worth of equipment (CPR/84/004).

The pilot plant of the SDRI consists of laboratory, pilot scale and some full scale dyeing and finishing machines, and some very sophisticated instruments. Some pieces worth mentioning include an Xray diffraction instrument (Rigaku), light fastness measurement (Xenotest), IR spectrophotometer (Perkin Elmer), DMC 26 top of the range research spectrophotometer (Opton) with Hewlett Packard MX 21 computer,

MatchScan II colour matching system (DIANO) with Professional 350 computer (DEC). The pilot scale machinery in the laboratories includes a rotary screen/flat screen printing table (J. Zimmer), Multidye dyeing machine (Pretema), W. Mathis jet dyeing machines JF (5 to 10 gs) and JFO (50 to 100 gs), vertical/horizontal pad mangle (Benz), continuous dyeing range: pad-IR-thermosol/steamer-washing (Benz), coating machine LTF/LTSV (W. Mathis) with Minimix foam generator.

There are some full scale dyeing machines, viz. 2 jet dyeing machines (10 kgs from Roaches already installed, the other one still in crates) and a jigger (Mezzera).

The Vice Director of the institute explained that the SDRI and the CDFDC could very well complement each other's work, the Institute from the dyestuff manufacturer's side, the Center from that of the user. The slight overlapping of the machinery is a necessity, there is no duplication of research activity between the two institutions.

Some companies recommended to be visited during the  
general identification study tour

A. FEDERAL REPUBLIC OF GERMANY

Bayer AG, Abt. AV-WE-FB,  
D-5090 Leverkusen-Bayerwerk  
(Dyestuff and synthetic fibres manufacturer)

Babcock Textilmaschinen GmbH,  
D-2105 Seevetal 3 - Maschen

(Stenter, with coating applicator)

Brückner-Trocknertechnik GmbH + Co. KG  
Pf 1154, D-7250 Leonberg b. Stuttgart  
(Stenter, with coating applicator)

Hoechst AG, Marketing-Textilfarbstoffe  
ATA-Färberei,  
D-6230 Frankfurt am Main 80  
(Dyestuffs and synthetic fibres)

Eduard Küsters Maschinenfabrik GmbH & Co. KG  
(jigger)

and

Scholl AG (Switzerland)  
(jets, overflow and dyehouse automation)

Contact person: Mr. Stefan Falk

Omnitech GmbH,

Pf 123, D-7441 Neckartenzlingen

Monforts GmbH & Co.,  
Pf 386, D-4050 Mönchengladbach 1  
(Stenter with computer control)

Schermuly-Elektronik GmbH  
Hauptstraße 25, D6296 Mengeskirchen  
(dyehouse automation)

Contact person: Mr. Klaus Schermuly

THEN Maschinen- und Apparatebau GmbH  
Pf 40 10 20, D-7170 Schwäbisch Hall 4  
(jets, overflow, dyehouse automation)

B. SWITZERLAND

Ernst Benz AG,  
CH-8153 Rümlang-Zürich  
(pilot scale dyeing and finishing machinery)

Werner Mathis AG,  
CH-8155 Niederhasli ZH  
(pilot scale dyeing and finishing machinery)

Scholl AG  
c/o Omnitech GmbH, see PRG

Hepatex AG, Heberlein Textile Consulting  
CH-9630 Wattwill  
(possibility of arranging factory visits)

Contact person: to be arranged

C. UNITED KINGDOM

Roaches Engineering Ltd.  
Upperhulme, Leek, Staffordshire ST 13 8TY  
(pilot scale dyeing and finishing machinery)

Instrumental Colour Systems Ltd.  
Kennetside Park Industrial Estate,  
Newbury, Berkshire RG14 5TE  
(colour matching, dyehouse automation)  
Contact person: Mr. Martyn White

ICI Organics Division  
POB 42, Blackley, Manchester M9 3DA  
(dyestuffs and synthetic fibres)

D. JAPAN

Hisaka Works Ltd.  
4-4 Hirano-Machi, Higashi-Ku, Osaka 541  
(dyeing machinery)

The Ichikin Ltd.  
673-1 Nomuracho, Kusatsu City Shiga  
(stenter, with coating applicator)

Wakayama Iron Works Ltd.  
Minami Kat 'hara Wakayama  
(jet, overflow, stenter with coating applicator)

E. HUNGARY

Visits to dyeing and finishing factories, where  
dyehouse automation, colour matching, computerized stenter,  
coating/foam finishing can be seen in practice

Contact person: dr. Robert Hirschler

DUNASILK Finishing Factory  
H1037 Budapest, Bécsi ut 267.