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FINAL REPORT
ON THE
FIFTEENTH
IN-PLANT GROUP TRAINING
PROGRAMME ON MAN-MADE FIBRES
APPLICATION OF MAN-MADE FIBRES
IN TEXTILE PROCESSING
(BLENDING AND QUALITY CONTROL)
Project No. US/INT/88/130

15th In-Plant Group Training Programme

on Man-made Fibres

"Application Of Man-Made Fibres in Textile Processing"

(Blending and Quality Control)
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Höhere Bundes-Lehr- und Versuchsanstalt für Textilindustrie Wien V
Spengergasse 20, A-1050 Vienna, Austria

Österreichisches Chemiefaserinstitut
Plößlgasse 8, A-1040 Vienna, Austria

Director: OSTR Mag. A. Berger
Director of Austrian Man-Made Fibre Institut: Dr. Hans Keiper
Project Manager: Dr. Robert Katschinka

Fifteenth In-Plant Group Training Programme on Man-Made Fibres

Organized by the United Nations Industrial Development Organisation (UNIDO) in co-operation with

the Government of Austria
Austrian Federal Chamber of Commerce
Association of Austrian Industrialists
Höhere Bundes-Lehr- und Versuchsanstalt für Textilindustrie, Wien V, and
Österreichisches Chemiefaserinstitut Vienna;

Held in Vienna, Austria
from 26th September to 28th October 1988.

Final Report: by Prof. Dipl. Ing. Dr. L. Machherndl
Executive Manager
1. Acknowledgements

The Höhere Bundes-Lehr- und Versuchsanstalt für Textilindustrie Wien V, and the Österreichisches Chemiefaserinstitut wish to express their appreciation to the UNIDO for organizing this training programme and for the excellent and successful cooperation.

Our thanks are specially directed to

Mr. A. Vassiliev (Deputy Director General, Department of Industrial Operation, UNIDO)
Ms. A. Tcheknavorian-Asenbauer (Head, Chemical Industries Branch, Department of Industrial Operations, UNIDO)
Ms. I. Lorenzo (Head, Training Branch, Department of Industrial Operations, UNIDO)
Mr. V. Bysyuk (Chemical Industries Branch, UNIDO)
Mr. M. Youssef (Chemical Industries Branch, UNIDO)
Mr. D. Gardellin (Director, General Services Division, Department of Administration)
Mr. S. Morozov (Chief, Contracts Section)
Ms. U. Schandl (Project Assistant, Chemical Industries Branch, UNIDO)

At the same time we give our thanks to the Austrian authorities and corporations, whose aid, preparatory work, valuable aid and understanding enable us to achieve a remarkable effect of the training programme.

Austrian Federal Chancellery
Ms. B. Dekrout
Austrian Federal Ministry for Foreign Affairs
Mr. H. Miltner Mr. C. Krepela
Austrian Federal Ministry for Education and Art
Mr. W. John Mr. O. Tischler
Austrian Federal Chamber of Commerce
  Mr. H. R. Seidl
  Mr. K. Haas
  Mr. K. Laaber

Höhere Bundes-Lehr- und Versuchsanstalt für Textilindustrie (HBLVAT)
  Mr. A. Berger       Mr. L. Machherndl

We also are indebted to the Austrian Companies which we visited to complete our training programme.
2. Background and Objectives

1. The programme, organized by UNIDO in co-operation with the Government of Austria, is one of a series of UNIDO Training Programmes on specific sectors of industry for engineers from developing countries. The programme will be carried out by the Austrian Man-made Fibre Institute (Österreichisches Chemiefaser-Institut-OCI) and the Federal Institute for Higher Education and Research for Textile Industry (Höhere Bundes-Lehr- und Versuchsanstalt für Textilindustrie - HBLVAT), a leading technological institute in the field of textile technology. The programme is the fifteenth in a series of programmes implemented annually since 1974.

2. UNIDO implements technical assistance projects and holds meetings in the field of man-made fibres production and application. Therefore, the training programme is considered a logical and very important part of UNIDO activities aimed at further development and strengthening of these industries in the developing countries.

3. The trend of training activities in the field of production and application of man-made fibres is characterized by increasingly sophisticated nature of the training programme requiring high level experts, consultants and modern specialized equipment. Consultation meetings at plants and companies to deal with specific technological problems are also an important feature of current training activities.

4. Of the man-made fibres developed to date, four principal types, namely polyester, polyamide, polyacrylonitrile and cellulosic fibres, dominate the market at present. This situation will not change substantially in the near future, although olefin fibres have already become important in certain areas of application. Special fibres, including inorganic and carbon fibres, are still very expensive and will, for the present, continue to be produced only in small quantities.
5. On the whole, the trend is towards modified man-made fibres based on more basic polymer and extensive knowledge of production and conversion techniques. Chemical modification is affected essentially by: co-polymerization, introduction of additives, polymer combination, treatment by irradiation, introduction of reactive groups. Physical modification is possible by four principal methods: changing the fibre cross-sections or spinning hollow fibres, mixing elementary filaments of various types, texturing, increasing the number of elementary filaments while reducing the general titre.

6. Generally, the following trends are apparent in man-made fibres production:

- the reduction of process stages, e.g. for quasi-textiles by non-woven technology or by film production;
- the integration of textile treatment stages in the process of fibres, e.g. warping, stretch-texturizing, dyeing, converting;
- rapid spinning methods, combined shaping, stretching and winding or rapid shaping and winding for polyester and polyamide fibres;
- extrusion spinning;
- increasing the degree of automation in fully automatic production.

7. The developing countries, as a result of the increasing demand from the internal and external markets for man-made fibres products and the availability of comparatively cheap labour, have established man-made fibre industries which are rapidly expanding. A number of these countries lack the required raw materials, financial resources and know-how to start on man-made fibres production in order to meet the growing needs of the industry; but in general they have a relatively well developed industry for processing of man-made fibres for which the acquisition and introduction of new technical developments in this field are important.
8. The objective of the programme is to up-grade the knowledge and professional skills of the participants and to assist them in performing their duties more efficiently and solving the problems encountered in their daily work in the field of man-made fibre technology and application.

9. The programme has received the support of the Austrian Federal Economic Chamber and the Austrian Federal Ministry of Education and Fine Arts and the Association of Austrian Industrialists. HBLVAT will conduct the training on its premises utilizing its laboratories and equipment for this purpose. The institute has a staff of highly qualified specialists.

The Training Programme

10. Recently, the main emphasis of the textile industry was on technology to improve the quality of cotton yarns by blending with viscose, polyester, polyamide, acryl, polypropylene which required special finishing methods, machines and quality control methods which is very important for the industries in the developing countries. Therefore, in 1988 the training course will be concentrated on practical technology to improve the quality of cotton yarns by blending and on quality control of textile products, as well as on improvement of operational efficiency of existing plants. It will consist of theoretical training and professional discussions designed to update the participants' knowledge on man-made fibre technology, laboratory and in-plant visits to study the latest developments in production and processing equipment and techniques. (For tentative programme, please see Appendix I.)

11. In addition to the programme to be undertaken at the HBLVAT, study visits in Austria will be arranged to provide an opportunity for the participants to study new developments in materials, processes and
applications, to exchange technical information with experts as well as to study the possibility of obtaining licenses and know-how on processes and equipment.

12. During the theoretical training, individual appointments could be arranged for the participants to discuss with UNIDO staff members problems affecting the developments of the man-made fibre industry in the participant's home country and outline technical assistance projects for eventual implementation by UNIDO.
3. Description of the Training Programme

This Year's training was focused on "Textile Production - Blending and Quality Control". It consisted of a theoretical part designed to up-date the participants' knowledge on man-made fibre technology and laboratory and in-plant studies to familiarize them with the latest developments in production and processing equipment and techniques.

The programme took place in Vienna, Austria from 26th September to 28th October 1988. (See appendix I for the time table)

The programme covered the latest technological developments in the field of application man-made fibres in textile processing and consisted of a theoretical part designed to up-date the participants' knowledge on man-made fibre technology and laboratory and in-plant studies. The main emphasis of the processing technology including fibre engineering, testing and identification and on the application of man-made fibres for various purposes.

The Höhere Bundes-Lehr- und Versuchsanstalt gave full co-operation in running the theoretical and practical courses on its premises utilizing its laboratories and equipment for this purpose. (See appendix II for details of lectures and appendix III for equipment used in the practical classes.)

The institutes staff of highly qualified specialists took full charge of the lectures, demonstrations, laboratory work, discussions, in-plant training programme and plant visits. (See appendix IV for list of staff members who participated in the training programme).
In addition to the course conducted at the Institute, plant visits in Austria were arranged to provide an opportunity for the participants to see some new developments in materials, processes, and applications. To exchange technical information with experts as well as to study the possibilities of obtaining licenses and know-how on processes as well as equipment. (See appendix V for details of in-plant training and plant visits.)

The training programme was attended by participants each from the following countries: China, Cuba, Ethiopia, Ghana, Guinea, India, D.P.R. Korea, Nigeria, Sudan, Tanzania, Uganda, Yemen Arab Republic, Democratic Yemen.

During the course of the training programme, individual appointments were arranged for interested participants to discuss with UNIDO staff members problems affecting the development of man-made fibres and blending and quality control in the participants' home-countries.

A programme of social activities was organized by HBLVAT and other sponsors for the benefit of the participants. (See appendix VII for details of social activities.)

Appendix 1

Agenda and programme of work

Opening Ceremony: 26th September 1988, Conference Room III,"C"-Building at VIENNA INTERNATIONAL CENTRE

9:30 to 11:00 a.m. Chairman pro tem: Mr. M.A. Youssef
Officer-in-Charge
Chemical Industries Branch
Industrial Operations Technology Division, DIO

Opening Speech: Mr. M.H.A. Hamdy
Officer-in-Charge
Department of Industrial Operations

Speeches: Mr. M. Krapela
Austrian Federal Ministry for Foreign Affairs

Mr. H. Lederleitner
Austrian Federal Economic Chamber

Mr. H. Hubeny
Director
Laboratroy for Plastics Technology

Mr. L. Machherndl
Höhere Bundes-Lehr- und Versuchsanstalt für Textilindustrie, Spengergasse 20
A-1050 Vienna
Man-Made Fibres Institute (Österreichisches Chemiefaser-institut)

Mr. M. Wersonig
Austrian Plastics Processing Company SCHMIDBERGER
Monday, 26th September 1988

11:00 - 12:00  Opening Ceremony, HBLVAT Vienna V

14:00 - 17:00  Presentation of National Papers at Höhere Bundes-Lehr- und Versuchsanstalt für Textilindustrie

Tuesday 27th September - Friday 28th October 1988

Lectures, In-plant training and plant visits, laboratory work

Tuesday, 25th October 1988

19:00  Farewell Party at Ober St. Veit

Friday, 28th October 1988

08:30 - 12:00  Final session at HBLVAT, Vienna
Discussion about national problems
Appendix II

Details of Lectures

Subject

Man-made Fibre Trends. Raw Materials and the Environment
W. Albrecht, Prof. Dr., Head of Textile Technology Institute of Enka Glanzstoff AG,
Wuppertal, FRG

Selection of Fibres and Yarn Constructions for Textiles
W. Albrecht, Prof. Dr., Head of Textile Technology Institute of Enka Glanzstoff AG,
Wuppertal, FRG

Special Fabrics from Blends Cotton with Man-Made Fibres
Prof. Dipl.Ing. W. Herzog
Austrian Textile Research Institute
A-1050 Vienna

Knitted Fabrics from Blended Yarns
Prof. Dipl.Ing. W. Graninger
Member of the staff of the HBLVAT
A-1050 Vienna

Processing of Synthetic Fibres and Blends, Fibre-Blends and their Properties
Dipl.Ing. J. Hördler
Member of the staff of the HBLVAT
A-1050 Vienna

Cotton, one of the major agricultural Products of this world and some reflections on development and Industrialization
Ing. G. Grünwald
UNIDO Textile Expert

Yarn Making - Yesterday - Today - Tomorrow
Ing. K. Schnaubelt
Member of the staff of the HBLVAT
A-1050 Vienna

Spinning Quality from Pure cotton and Blends spun on conventional Systems
Ing. K. Schnaubelt
Member of the staff of the HBLVAT
A-1050 Vienna
Viscose - Filaments for modern Textiles
Dipl.Ing. Dr. L. Kloimstein
Enka Austria AG
St. Pölten, Austria

Fibre Fineness. Micronaire Reading of Cotton Fibres
Prof. Dipl.Ing. J. Hörder
Prof. Dipl.Ing. Dr. P. Schrefl
Members of the staff of the HBLVAT
A-1050 Vienna

The TREVIRA Sortiment - its Properties and Fields of Application
Dr. H. Zimmermann
Farbwerke Hoechst AG
Frankfurt, FRG

Physiological Aspects with Fabrics Made of Blends
Dr. techn. Dipl.Ing. P. Schrefl
Member of the staff of the HBLVAT
A-1050 Vienna

Dyeing of Synthetic Fibres and Blends
Prof. Dr. W. Lebensaft
Prof. Dr. L. Machherndl
Members of the staff of the HBLVAT
A-1050 Vienna

Dyeing of Polyester Fibre Blends
Prof. Dipl.Ing. Dr.techn. L. Machherndl
Member of the staff of the HBLVAT
A-1050 Vienna

The Burning Behaviour of Textiles - Textile Floor Covering
Ing.H.P. Bauer
Austrian Textile Research Institute
Vienna

Advanced Drycleaning Technology
Ing. H. Huff
Member of the staff of the HBLVAT
A-1050 Vienna

The Laundry in Theory and Practice
Ing. R. Hetzer
Member of the staff of the HBLVAT
A-1050 Vienna

Mercerisation and Aftertreatment
Prof. Dr. Dipl.Ing. H. Lass
Member of the staff of the HBLVAT
A-1050 Vienna
Transfer of Chemical Technology in Developing Countries
Dipl.lnq. K. Prah
Member of the staff of the HBLVAT
A-1050 Vienna

The Textile Industry from an International and National Point of view
Dr. H. Huber
Hauptgeschäftsführer des Fachverbandes der Textilindustrie
Vienna

Man-Made Fibres - Their Development and economic significance
Doz. A.O.Univ.Prof. Inq. DDr.habil H. Krässig
Formerly Director of the Research Department of Chemiefaser Lenzing AG.
Lenzing Austria

Quality Control
Modal-Fibres - an universal blending component
Ing. G. Neudorfer
Chemiefaser Lenzing AG
Lenzing Austria

Quality-Control of Man-Made Fibres, Filaments and Spinn Yarns. Principle and Methods
Dipl.Ing. F. Führinger
Dr. H. Schludermann
H. Schneider
Chemiefaser Lenzing AG
Lenzing Austria

Introduction to Polyester-Fibre Production and Equipment
Dr. Straberger
Austria Faserwerke
Lenzing Austria

The TREVIRA Sortiment - its Properties and Fields of Application
Dr. H. Zimmermann
Farbwerke Hoechst AG
Frankfurt, FRG

Process Planning and Practical Work
Dipl.Ing. Dr. Mach
Member of the staff of the Chemiefaser Lenzing AG
Lenzing Austria

Viscose - and Modal Fibres in Blended Fabrics
A.O.Univ.Prof.Doz.Dipl.Ing.Dr. H. Krässig
Director of the Research Department of Chemiefaser Lenzing AG
Lenzing Austria
Special Blends, i.e. Viscose, Polyester, Viscose/Cotton and Viscose/Acrylic Fibres
Dr. K. H. Wegleitner
Chemiefaser Lenzing AG
Lenzing Austria

Yarn Preparation for Weaving Machines
H. Mall
Sulzer Rüti Machinery Works Ltd.
Rüti, Switzerland

Organisation of a Modern Textile Plant, Part I and II
B. Streng
Sulzer Rüti Machinery Works Ltd.
Rüti, Switzerland

Latest Technology in Engineering and Optimizing Preparation machinery of Fibre Blending (Intimate Blend) applications: Open End Yarns - Ring Yarns
M. Schwartz, B.S.C. Engineer
Trützschler GmbH & CoKG
Mönchengladbach, FRG

Sulzer Bros. and the Textile Industry
W. Bingisser
Sulzer Rüti Machinery Works Ltd.
Rüti, Switzerland

Typical Fabrics
W. Bingisser
Sulzer Rüti Machinery Works Ltd.
Rüti, Switzerland

Yarn Preparation
H. Mall
Sulzer Rüti Machinery Works Ltd.
Rüti, Switzerland

Project Studies
B. Streng/H. Mall
Sulzer Rüti Machinery Works Ltd.
Rüti, Switzerland
Raw Material - related influences on Machine and Yarn
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Interference Factors and their Effect at the Spinning Process
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Technical Application Conditions
Cotton
Blends
Man-made Fibres
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

A new quality standard - the knot-free package
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

The Piecing Carriage
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

The principal of the automatic package doffer
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Waxing
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

The Relationship between density, volume and diameter of packages
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Installation Planing
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Warp and weft pars in woven fabrics
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Pars and uneven loop formation in knitted fabrics
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Effective doubling in Rota Spinning
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG
Spinning preparation and draw frames
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Technical application
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Manufacture of fine weaving yarns on AUTOCORO
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

New performance and quality standards in knitting, with fine-count AUTOCORO yarns
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Some thoughts on the role of cotton in new spinning technologies
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Theoretical and practical limits of rotor spinning in the production of fine yarns
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Foreign fibres - a problem in rotor spinning
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG

Why does the need for finer, stronger and cleaner cotton fibers require a change in the cotton grading and marketing system?
N.N., Schlafhorst & Co., Textile Machinery
Mönchengladbach, FRG
Appendix III

Equipment for Testing Fabrics and Man-made Fibres

Programme at HBLVAT Vienna

VIBROSKOP, linear density of fibres
MICRONAIRE, linear density of fibres
AIR-FLOW, linear density of fibres
JOHANNSEN-ZWEIGLE, fibres length distribution by array method
USTER, fibre length and length distribution automatically working
INSTRON, breaking-strength and elongations yarns, fabrics
USTER-DYNAMOMETER, breaking-strength and elongations yarns, automatically working
ZWICK-TESTIMAT, breaking-strength and elongations yarns, automatically working
ZWICK-Tearing-Tester
TWIST-Tester
PRESSLEY-Tester, strength of fibres, bundle method
BURSING-Tester, VEB Rauenstein
THICKNESS-Gage
USTER-Tester equipment (Uneveness of textile strands)
ABRASION-Tester
AIR-PERMEABILITY-Tester
RANDON tumble pilling Tester
ACCELERATOR
SCANNING ELECTRON MICROSKOP, PSEM 500, Philips
PRETEMA-Spectromat FS 3 A (Filterspectrophometer) Colour measurement, Pretema, Switzerland
FIXOTEST
XENOTEST, Original Hanau Quarzlampengesellschaft, BRD
PRAXITEST
LABOR-STENTER, LABOUR-PADDING Machine, K. BRNZ, Switzerland
EPPRECHT RHEOMAT 15 Contraves, Switzerland
FLAMETESTER, Ahiba, Basel Switzerland
INFRARED-SPECTROPHOTOMETER 197, Perkin Elmer
GASCHROMATOGRAPH SIGMA 3 Perkin Elmer
SPECTROPHOTOMETER PM Q II, C. Zeiss, BRD
ELREPHO, Zeiss, BRD
ELREPHO 2000, Zeiss, BRD
HT-Dyeing apparatures, Scholl, Switzerland
HT-Dyeing apparatures, Ochsner, Austria
HT-Yet Dyeing machine, Then, BRD
Appendix IV

Staff of the Training Programme

Director: Mr. OSTR Mag. A. Berger
Managing Director: Dr. R. Katschinka
Executive Manager: Prof. Dr. techn. Dipl. Ing. L. Machherndl
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                      Doz.A.O. Univ.Prof. Dipl. Ing. DDr.habil H. Krüssig

Public Relations and social Engagements: Ing. R. Hetzer
Plant Visits: Dr. R. Katschinka

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          Ing. W. Bingisser
          Ing. F. Führinger
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          Ing. G. Grünwald
          Dr. B. Fälder
          Prof. Dipl. Ing. W. Herzog
          Ing. R. Hetzer
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Dipl.Ing. Dr. J.M. Meißner
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G. Gschmeidler
B. Holzner
H. Neufingerl

R. Nothefler
J. Pichler
M. Schmid
Appendix V

In-Plant training and plant visits

To the special interest of the participants in-plant training at fibre producing companies and plant visits to fibres-using companies during the four week course were organized.

The selection of the companies gave a regional and technical survey on the Austrian man-made fibre-producing and using industry:

1) Chemiefaser Lenzing AG
   Pulp, Viscose Staple fibre, Acrylic staple fibres, Paper, Sodiumsulfate, Sulphuric acid, Synthetic sheets and foil strips, Machinery for processing Synthetic sheets, laboratories  
   A-4860 Lenzing

2) Austria Faserwerke GesmbH

3) Linz Textil AG
   Spinning and Weaving Mill  
   A-4020 Linz

4) Tumfart Comp., Weaving Mill  
   A-4183 Traberg

5) Baumann, Textile Printing Factory  
   A-3950 Gmünd

6) Schiel Seide AG, Weaving Mill  
   A-3813 Dietmanns

7) Triumph International AG  
   A-2700 Wr. Neustadt

8) Salesianer, Laundry - Drycleaning  
   A-2700 Wr. Neustadt

9) Asota Ges.m.b.H.
   Filaments, Spun Fibres, Sheets Non-woven, Fertilizers, Pharmaceuticals, Laboratories  
   A-4020 Linz

10) Becker & Söhne, Spinning Mill  
    A-4614 Marchtrenk

11) VOEST-Linz AG  
    A-4020 Linz
### LIST OF PARTICIPANTS

<table>
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<td>Mr. Shri Ranbir Kumar Vij</td>
<td>Bongaigaon Refinery and Petrochemicals Ltd. Surya Kiran Bldg 19, Kasturba Gandhi Marg, New Delhi 1, India</td>
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Appendix VII

Social Activities

1. Trip to the Wachau. Visit to the Monastery of Melk and Dürnstein
2. Visit to the Empiral Chapel (Hofburgkapelle)
3. Visit to the Spanish Horse Riding School
4. Visit to the Museum of Arms
5. Visit to the Museum of Arts
6. Visit to the Museum of Textiles
7. Visit to the "Schatzkammer"
8. Private Invitations
9. Visit to the Monastery of St. Florian
10. Sight-Seeing Tour in Vienna
11. Visit to the Opera
12. Visit to the Monastery of Klosterneuburg
13. Farewell Party at Ober St. Veit
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| Total            | 12   | 11   | 12   | 14   | 12   | 11   | 10   | 8    | 12   | 8    | 9    | 11   | 12   | 13   | 16   |

*Note: The table represents the number of participants from each country over the years.*
The UNIDO in Vienna has congratulated in bringing about this Training Programme and we want to express our appreciation to all UNIDO-members who have contributed to the realization of this project.

We hope that we could fulfill the intentions of UNIDO by giving the participants as much as possible of insight, knowledge and experience.

We also want to give our thanks to the participants for their co-operation and wish them an effective evaluation in their native countries.