



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

FHBB

Fachhochschule beider Basel
Nordwestschweiz

Basel Institute of Technology
and Management



Institut für Umwelttechnik
Institute of Environmental
Technology

Final report

**FHBB Activities to
consult the Cleaner
Production Centre
Vietnam**

Incl. activities 10/2004-12/2004

University of
Applied Sciences
Basel

FHBB

Faculty

Industry

Institute of
Environmental Technology

Final report

FHBB Activities to consult the Cleaner Production Centre Vietnam

Incl. activities 10/2004-12/2004

Jürg Walder

Project manager, Institute of Environmental Technology FHBB

Muttenz, January 2005

© FHBB

University of Applied Sciences Basel
Institute of Environmental Technology
Fichtenhagstrasse 4
CH-4132 Muttenz
Switzerland

All rights reserved. No copyright without
the written permission of the publisher.

Phone +41 61 467 45 05

Fax +41 61 467 42 90

E-mail ifuinfo@fhbb.ch

Internet www.fhbb.ch/umwelt

Content

1	Summary	3
2	Student exchange program	5
3	Training	6
3.1	Industry specific CP training in Switzerland	6
3.2	Courses at VNCPC for industry and consultants	7
4	Technical support and information	7
5	EST transfer	8
6	Quality assurance at INEST and VNCPC	9
7	Overall lessons learnt	10
8	Enclosures	12
	Annex 1 Curriculum electroplating course at Hanoi University of Technology	13

1 Summary

According to the Terms of Reference and the contract No. 2002/039, US/VIE/96/063 the main activities of the support program for the VNCPC from 2002 through 2004 (33 months) were the following:

1. Development, organization and realization of tailor made and on the job training courses
2. Support of the VNCPC in building up his onsite measurement capacity
3. Support of the VNCPC in technical aspects on demand
4. Support of the VNCPC in information transfer with new CP publications, clean technology suppliers etc.
5. Organization and contracting of CP technology experts according the needs of VNCPC
6. Organization of training for students in Swiss academic institutions or government authorities

During the entire reporting period 2002-2004 (33 months) FHBB focussed on the following issues:

- Detailed curriculum descriptions of the Swiss trainings in the metalworking and metal surface treatment industry as well as in textile wet processing were elaborated in close co-operation with industrial partners and technology suppliers in Europe.
- Based on the curriculum CP-trainings in the metalworking and metal surface treatment industry and textile wet processing were realized in 2003 and 2004 at FHBB in Switzerland. These courses lasted for two and three weeks respectively. The training was also offered to staff from other NCPC. The overall feedback of the participants was very good. Important company connections could be developed.
- Together with the VNCPC FHBB developed a curriculum for a plating course to be offered by the VNCPC to company staff. In one mission to Vietnam University partners were interviewed and their contribution clarified. In order to also test the learning efficiency a CP test with exercises was elaborated on behalf of the VCPC.
- Regarding technical support of the VNCPC, especially on metal working, metal finishing and textile wet processing FHBB collected information about best practices, best available techniques (BAT) and supplier information and handed this over to the VNCPC.
- Especially for cleaner technology inquiries FHBB created together with EMPA an internet site with information about BAT and suppliers to enable the VNCPC to search for respective information on the web. Moreover an IT-specialist realized an electronic library with a vast amount of CP related documents on CD-ROM.

- Furthermore, a concept for technology transfer facilitation was elaborated. This concept covers a theoretical layout of technology transfer divided into principles and the transfer process and give an idea about other involved stakeholders and their claims. A further part contains connections to sources of information for NCPC, reference centres and technology suppliers in the form of links to internet web pages.
- Upon request of the VNCPC an expertise for a Vietnamese company was elaborated in the field of hot dip galvanizing in cooperation with a Swiss enterprise.
- Information on Swiss technology suppliers with representation in Vietnam was compiled and handed over to the VNCPC. Companies in Switzerland were visited together with VNCPC staff.
- During all three years of the contract FHBB organized training and coaching for six students from the Hanoi University of Technology at the Swiss academic Institution University of Applied Science Basel (FHBB). They all elaborated a Master of Science thesis as partial fulfillment of the requirements for the degree in Environmental Technology.
- In three missions to Vietnam the instrumental laboratory of the Hanoi University of Technology/VNCPC was inspected and a respective quality assurance system elaborated. The IT-network of the VNCPC was checked and possible improvements suggested. To improve the capacity of laboratory staff a course on lab basics was developed together with the VNCPC/INEST.
- In other two missions to Vietnam two trainings on metalworking and finishing processes were undertaken and company visits conducted in order to support the ongoing in-plant-assessments in the metal industry and to build capacity at the VNCPC. In one company a detailed technology gap assessment was performed in order to initialize a technology transfer project.

As agreed with UNIDO two positions of the terms of reference were cancelled in favor of the financial support of the two master students in 2003. These positions encompass following tasks:

- Help to up-date a CP master program at the Hanoi University of Technology
- Training course in chemical industry for VNCPC staff

The present report is considered as summary of the activities realized under the contract. For particulars on the subjects please refer to the respective activity and mission reports.

2 Student exchange program

FHBB invited every year two Vietnamese students who were nominated by the Hanoi University of Technology in Vietnam for conducting their Master theses in Switzerland. Altogether FHBB hosted six students in the contract period who elaborated their Master theses in environmental technology during six months each. The theses were practically oriented final modules of a Master study in environmental technology and were reviewed by the Vietnamese partner University.

All students have successfully finalized their studies and reached the expected targets within the time allocated. The students defined first the scope of the theses and elaborated an exact time schedule afterwards. During planning and execution of the works the students were closely supported by FHBB professors, research associates and external experts. Furthermore FHBB organised accommodation and provided all administrative services like visa, insurance, language courses etc.

A considerable amount of time was spent on scholarship search as the contract US/VIE/96/063 with UNIDO only covered FHBB's expenses and not the students' living costs. FHBB could get grants from the Swiss organization Swisscontact/SDC twice for the students' support. However, the application at and accounting for this organization were time-consuming activities.

The Master theses finalized are the following:

- Analysis and assessment of technologies for reduction and treatment of plating waste water in Vietnam (Mr. Do Khac Uan, Enclosure 1 of final report).
- Description of analytical methods for the determination of chemical substances in plating baths and waste water for environmental monitoring and quality assurance (Mrs. Nguyen Thi Thu Hien, Enclosure 2 of final report).
- Analytical methodology for PCBs (Poly chlorinated biphenyls) in soil, water and waste oil (Mr. Vu Duc Toan)
- Study on a suitable, environmentally sound dyeing technology for small-scale dyeing of silk (Mrs. Vo Thanh Le)
- Regression modelling of air pollution from highway vehicle (Mr. Bac La Tran)
- Implementation of Environmental Management System ISO 14001 in Vietnam: situation analysis, Swiss know-how transfer and recommendations (Mrs. Phuong Nguyen Thien)

All theses were rated by the Hanoi University of Technology between "good" and "excellent". Furthermore the students could transfer the knowledge to the VNCPC and the University where the establishment of a centre of excellence for electroplating is planned. Also the study done on PCB-analysis is regarded as foundation for the building of an instrumental analysis laboratory for the measurement of PCB at the University. If these services can be offered by the VNCPC to companies the all over attractiveness and credibility of the centre will be strengthened for longer periods. Therefore the student

exchange has not been proved as only a support activity for the students but also as an important means to promote the cleaner production centre.

After returning to Vietnam one student got a responsible job at the Ministry of Environment that can be lead back to the experience gained in Switzerland. For the VNCPC this kind of people-positioning also contributes to the networking in CP.

All other students were employed again by their Universities after their stay abroad and two of them are seeking for scholarships in order to continue their PhD-studies.

The cooperation with the Hanoi University of Technology and the direct support was a success story and should be extended to phase II of the support contract including also Laos and Cambodia.

3 Training

3.1 Industry specific CP training in Switzerland

Based on detailed curriculum description FHBB realized two different industry specific CP trainings in Switzerland with three and two weeks duration for technical NCPC staff. The subjects were selected by the VNCPC and the other participants invited from various different NCPC. Eventually metal processing and finishing as well as textile wet processing were chosen. FHBB intended to offer the services based on the real demand at the VNCPC and was in close contact with the responsible during curriculum elaboration. The overall feedback of the participants was very good.

Both trainings in 2003 and 2004 met most of the requirements. Such practically oriented courses seem to be a real need not only at the VNCPC but also at other cleaner production centres worldwide. At the beginning of the curriculum elaboration it was doubted that the practical training part would be appreciated by the participants. However, it was experienced that just this part with laboratory exercises and excursions consolidates the theoretical know-how. FHBB was informed that many courses offered on CP-methodology and CP-related topics are too academic or only informative and do not directly guide implementation. As the present training is partly carried out by sector expert and technology suppliers the participants may directly contact key players in the area. After the training FHBB realized that the NCPC independently fostered these contacts.

The trainings are rather expensive even though the number of participants was increased to 10 with the second training and some lecturers waived their fees. FHBB adjusted the length of the training (2 weeks instead of 3 weeks at the beginning) and accommodation (apartment instead of hotel) in order to lower the burden of cost for all participants and their NCPC. However, it was still not be possible to conduct the trainings without any financial support from existing support contracts and additional subsidies. This fact has to be taken into consideration for the organization of future trainings. For the year 2005 and phase II of the support activities for the VNCPC FHBB will define a new course

based on the requirements of the VNCPC and other CP-centres. First contacts have already been established.

3.2 Courses at VNCPC for industry and consultants

FHBB handed over all elaborated curricula of the Swiss trainings to the VNCPC as a model for national trainings in metal processing/finishing and textile wet processing. As a result one seminar in 2003 and another one in 2004 in electroplating were conducted in Vietnam based on this information and with the assistance of Swiss experts (program of last seminar in Enclosure 3). FHBB subcontracted and accompanied these experts. The target group, mainly company representatives and consultants, could profit from the know-how transfer. On the other hand on this occasion the VNCPC could acquire some companies that participated in the seminars.

During the last mission 11/2004 to Vietnam FHBB could also finalize the content of a training in electroplating that will be conducted by the VNCPC and the department of electrochemical technology and metal protection at the faculty of chemical technology (Annex 1). The target group of this training will be technical staff of Vietnamese companies as these people lack of basic technical know-how and are mainly responsible for the considerable environmental impact of the plating sector. Apprenticeships or advanced technical training do not exist in Vietnam. Therefore such courses have a real potential in industry and may be offered to companies in the future for full cost. FHBB interviewed all important lecturers and finalized the concept for the plating course together with the deputy of the VNCPC. It is planned to conduct the training in the year 2005 for the first time.

As it was noticed in the past that the learning success has not been checked properly FHBB elaborated a cleaner production test and respective solutions for the VNCPC. A set of questions is now available to evaluate the learning success of the students and course participants.

4 Technical support and information

With regard to the industry sectors selected by the VNCPC FHBB conducted a broad literature search. Hundreds of documents on best available techniques, practices, case studies, benchmarks and guides were collected in hardcopy and electronic format and handed over to the technical staff of the centre. This information was a supplementation for the VNCPC-library and an aid especially for new employees to learn more about a sector and to get familiar with CP. In addition specific manuals were elaborated by FHBB in order to document ongoing projects at the VNCPC (e.g. manual on energy efficiency for hotels).

In order to facilitate the information transfer on technology suppliers and consultants FHBB together with EMPA established an internet site. This platform acts as a turntable between the Cleaner Production Centre and their Swiss Reference Centre. This web page shows technical and financial information to optimise the transfer of Swiss

environmental technology. It presents a tool to include both the Swiss industries interests and their counterparts in developing countries. The platform grants the access to new technologies to promote the industrialisation according to international conventions.

All electronic documents available at FHBB regarding CP were compiled, characterized and saved on CD-ROM. More than 3'000 documents are now available on these CDs and enable the staff of the NCPC to specifically search for information. In order to create a user friendly tool the works were done by an IT-specialist at FHBB.

At FHBB also a CP library with hardcopy issues have been established and up-dated frequently. Every year a list of the newest documents available at FHBB was handed over to the VNCPC. At the end of 2004 more than 2'000 documents were ready for research. All specific information of this literature like title, author, issue etc. is saved on a database for easy search.

During their stay in Switzerland FHBB organized six company visits to metal and textile processing companies in Switzerland and Germany for the staff of the VNCPC in order to facilitate matchmaking and to show best available techniques and practices. The visits were appreciated by the Vietnamese staff. FHBB noticed during the last field mission in November 2004 that Vietnamese companies consulted by the VNCPC have already installed some technologies that were presented in Switzerland during these visits (e.g. counter-current rinse of plated work pieces).

Upon request FHBB helped the VNCPC and its client Danang steel structure manufacturer with an expertise. This company in Danang/Vietnam is a hot dip galvanizing factory and produces zinc dipped angular steel that showed insufficient quality. The VNCPC handed over a sample workpiece to FHBB and applied for technical expertise to overcome the problems. FHBB together with a proven expert from a hot dip galvanizing company in Switzerland investigated the sample and elaborated possible solutions.

5 EST transfer

In order to facilitate the transfer of environmental sound technology FHBB made a survey on companies that export to Vietnam. The selection was listed and handed over to the VNCPC. Another contribution to technology transfer was the guidelines FHBB elaborated on behalf of the centre. In this document the important working steps of the technology transfer process are listed and linked with practical information about banks, technology providers, facilitators like transport companies and governmental institutions (addresses, internet links). This information is vital for the execution of a practical technology transfer project in Vietnam.

During the industry specific CP courses in Switzerland FHBB invited more than 10 different experts each in the fields of metal working and textile processing for lecturing but also for the presentation of successful technology transfer projects.

In two missions to Vietnam metal plating companies were visited by FHBB and an expert in the surroundings of Hanoi in order to help the VNCPC with the ongoing in-plant-assessments and to select companies for a possible EST-transfer. During the last

7 Overall lessons learnt

During the last 33 months FHBB could support the Vietnamese Cleaner Production Centre in various different areas. The feedback received from our partners as well as from the chief technical advisor of the CP support program, Mr. Heinz Leuenberger was positive. Thanks to UNIDO's flexibility some activities planned and listed in FHBB's workplan could be cancelled in favour of other, more important tasks like the student exchange program and the laboratory assessment at INEST.

FHBB could learn how an organization like the VNCPC has grown and gained more credibility in public. This can also lead back to the number of well skilled people working at the centre. The present staff of the VNCPC is familiar with the overall cleaner production methodology and has proved its success by using it in various industries. FHBB will further contribute to these skills by offering tailor made CP trainings. However, in the future the centre will work more and more as facilitator instead of being exclusively technical service provider and will have to rely on a strong network. This is mainly for increasing the fraction of self financing. Industries are part of this network and help the VNCPC to extend its role as centre of excellence for environmental services. One limiting factor for the technical work of the centre is the lack of engineering know-how. For the promotion of EST-transfer technology gap-assessments will be a pre-condition and proper engineering support a real asset. However, it is very difficult for a cleaner production centre to cope with this situation as several different industry sectors have to be served. Therefore it is suggested to cooperate with professional engineering companies in Vietnam or abroad in order to provide the service that is needed within a realistic timeframe. FHBB would like to support the efforts of the VNCPC during phase II of the support program for the VNCPC.

The feasibility study for the plating technology transfer project showed that the Cleaner Production program does not provide sufficient financial support for the companies interested in technology implementation. Green credit lines are not available for Vietnamese projects at the moment therefore local banks or development banks have to be involved. FHBB focused on a strong, export oriented company (Xuan Hoa) in order to get the management's commitment for the investment. However, even for this company the proposed investment was too high. On the other hand for the VNCPC it is important to carry on the CP activities with an assessed firm in order to show improved i.e. implemented process technology as a demonstration project. FHBB will contribute to these activities in the future.

One main element of FHBB's support for the VNCPC was the student exchange program. Although the timeframe of six months is rather short the students could realize interesting and helpful studies on subjects that are of importance for the VNCPC and the University. It is convincing to see that the working outcome of the Master theses can be used in the daily support activities of the VNCPC. Therefore the student program contributes to the sustainability of the cleaner production centre and should possibly be continued in the future. Nevertheless, it was experienced in the past that the Vietnamese

students have great difficulties with the English language. FHBB financed language courses in Switzerland; however, English fluency has to be a pre-condition in the future as otherwise tutoring is very difficult. Furthermore the student program is currently not a real exchange program as only two students from Switzerland have carried out their theses in Vietnam. This has to be changed in the future. The funding of the students is still a problem as recurrent funds are not guaranteed at the moment. FHBB will have to look for other financial sources during phase II of the support program for the VNCPC.

FHBB experienced in the last years that communication with the VNCPC via email is rather limited without technical advisor located in Hanoi. For the important projects personal contacts are crucial to create confidence and to show possibilities concerning support but also limits. FHBB will try to improve the contacts with the help of the new staff at the VNCPC planned to be employed in phase II of the support program for the VNCPC. The assistance of local technical advisors is necessary and should be considered for the continuation of the activities in Vietnam, Laos and Cambodia.

FHBB could contribute to an important project in the framework of development cooperation and could also learn a lot from the Vietnamese partners. For this experience and UNIDO's support during the past months all involved staff of FHBB would like to express their gratitude. FHBB is looking forward to continuing the assistance to the VNCPC:

8 Enclosures

- **Enclosure 1:** Analysis and assessment of technologies for reduction and treatment of plating waste water in Vietnam (Mr. Do Khac Uan).
- **Enclosure 2:** Description of analytical methods for the determination of chemical substances in plating baths and waste water for environmental monitoring and quality assurance (Mrs. Nguyen Thi Thu Hien).
- **Enclosure 3:** Cleaner Production in Metal finishing, seminar with Swiss expert contribution (mission 11/2004 to VNCPC)
- **Enclosure 4:** Re-engineering project at Export mechanical tool stock company (mission 11/2004 to VNCPC)

Annex 1 Curriculum electroplating course at Hanoi University of Technology

UNIDO project No. US/VIE/96/063

Curriculum electroplating course at Hanoi University of Technology

**Further education for technical staff of Vietnamese plating
companies**

Jürg Walder

Project manager, Institute of Environmental Technology FHBB

Muttenz, November 2004

Introduction

The Vietnam Cleaner Production Centre (VNCPC) started its activities at the end of 1998 within the framework of the project signed by the Ministry of Education and Training and UNIDO. The VNCPC supports small and medium sized enterprises in the implementation of efficient industrial production techniques by the application of the Cleaner Production (CP) methodology and promotes the education of consultants and students. In Vietnam the project is hosted at the Institute for Environmental Science and Technology (INEST) at the Hanoi University of Technology. The CP-project has been financed through a contribution of the State Secretariat for Economic Affairs (seco) of Switzerland.

The University of Applied Sciences Basel (FHBB), Institute of Environmental Technology acts as a Swiss Reference Centre for the VNCPC for the international provision of training, technical information, management services and know-how on clean technologies.

During the last years the VNCPC has been very active in identifying potential for process optimisation in various industry sectors. Among others the consultants assessed several enterprises in the metal plating sector and could show versatile possibilities for process improvements. Furthermore FHBB supported the assessments with further expertise and also sent galvanic experts to Vietnam. It turned out that many companies are facing problems regarding inefficient manufacturing processes and resulting environmental impacts as well as high production cost.

In order to diminish these problems FHBB began to support the VNCPC with specific training missions for technical staff of plating companies. However, in order to sustain good quality further education and local excellence it is vital to establish a course at an educational institution in Vietnam, preferably at Hanoi University of Technology. The present paper outlines a possible curriculum for a plating course at HUT that is targeted on technical staff of plating companies. These people are daily involved in the practical work and mainly responsible for efficient and environmentally sound manufacture of plated goods as well as for the assurance of good product quality.

Environmental aspects of the plating industry

In industrialized countries, metal plating industry has developed rapidly and many technical innovations were introduced. In a country like Vietnam, metal plating industry has also been established in order to satisfy socio-economic needs. However, the common quality of plated metal can still be improved and therefore causes many problems to the end product as well as to the environment. Especially contaminated waste water that arises from the various plating and rinse operations is a current problem in this country containing acids, heavy metals and organic compounds. All of these substances easily cause a substantial environmental impact if not reduced and treated appropriately. In addition in certain cases also toxic air pollutants and hazardous waste are released that have to be treated correctly. Aspects of air emissions are related to VOC, CO₂ and odour. Occupational health and operational safety are therefore important issues to be considered. Amongst the contributions to waste, liquid waste tends to dominate over air emissions and solid wastes in terms of severity of environmental impact.

Although different ordinances and regulations regarding water discharge, waste and clean air exist in Vietnam the enforcement is still pending due to a lack of administrative personnel. In addition adequate sampling and measurement methods for chemical substances do not exist at the companies thus, appropriate determination of contaminants is not possible.

Vietnamese companies currently are facing difficulties to comply with international regulations and standards when they go competing globally thus bounding their entrance into world market. A substantial change in technology application and practices would sustain many jobs that may not be guaranteed in the future.

The training course – main goals

The main targets of the course are to provide specific technical support and information in the field of metal plating to the participants, namely

- Know-how transfer regarding best available techniques and practices and new CP methods based on the combination of theoretical training and practical exercises
- Technology Transfer: pre-condition of project, evaluation of technology and transaction
- Exchange of experience between participants and lecturers with CP-specific approach

Name of the course

The official designation of the training unit is as follows: "Electroplating course for technical staff of Vietnamese plating companies".

Duration of the course

It is intended to conduct the training course in one week comprising of theory and practical exercises preferably at a production site or laboratory. In total the course encompasses 42.5 hours or 5 days.

The course lasts from Monday through Friday from 8:30 a.m. to 5:30 p.m.

Target group

Among the target audience are the following people from Vietnamese plating companies (technical qualification required):

- Production managers
- Technical responsible
- Quality managers
- Foremen in electroplating departments

The number of participants should be appropriate to the venue and laboratory condition and is currently laid down at 15. The training course is aimed at participants with technical background and familiarity with electroplating principles. The participants should have authority in order to implement technical improvements at their companies.

Partners

The elaboration of the course and its execution will be done in cooperation with following institutions:

- Vietnamese Cleaner Production Centre (VNCPC), Head Mr. Tran Van Nhan
- Institute of Environmental Science and Technology HUT (INEST)
- Department of Electrochemical Technology and Metal Protection (HUT), Head Mr. Tran Trung
- Vietnamese authorities (Environmental / Industry ministry)
- Vietnamese plating companies
- Private consultants

Scope of the course

The course is focused on best available plating principles and techniques in plating industry and includes the Cleaner Production concept.

The course will provide information about the main production areas of plated products incl. pre-and after-treatment, important plating steps, rinsing, water treatment and occupational health and safety

Nickel-, Zinc- and Chromium-plating are selected as these are widely spread in Vietnamese plating industry and have the highest demand of the total plated products.

Plated products manufacture covers in general the following main steps:

1. Pre-treatment: Cleaning, Polishing, Degreasing and Pickling
2. Electroplating: e.g. Cu, Ni, Zn, Cr
3. Chemical finishes: Chromating, Phosphating, Metal coloring
4. Rinsing
5. Supporting processes: e.g. waste water treatment

Course structure and location

The course will be divided into theoretical lectures that are supplemented by practical exercises in the laboratory. To consolidate the know-how the participants are expected to prepare, summarize and present solutions to specific problems of electroplating in workshops/exercises. Moreover the participants need to write short reports or diaries about what they experienced during the training.

It is required that the participants bring along a case study they are familiar with from their companies in order to elaborate options for improvement during the course. The optimized case studies will be presented at the end of the course.

The course is carried out at the VNCPC hosted by the Hanoi University of Technology.

Teaching staff

The lecturers are experts in their field and practical oriented. They work either in the plating sector (University, plating companies, suppliers) or are experienced national or international consultants. An overview of the legislation and enforcement of relevant law may be given by Vietnamese authorities.

Responsibility

Vietnam Cleaner Production Centre, Mr. Tran Van Nhan

University of Applied Sciences Basel (FHBB), Institute of Environmental Technology,
Mr. Jürg Walder, Mr. Heinz Leuenberger

Program

No.	Subject	Content of the lesson	Form and duration of the lesson [h]	Responsible lecturer	Learning outcome
Day 1 Getting started					
1	Introduction	<ul style="list-style-type: none"> • Welcome address • Presentation of participants and teaching staff • Course procedure and organisation • Introduction of involved partners. Expectations. • Initial test 	Plenum 1	VNCPC (Mr. Nhan, Mrs. Nga)	<ul style="list-style-type: none"> • Participants know about the course targets, the content of the lectures and have expressed their expectations • Participants have exchanged experience from their working surroundings. • Review of participants' know-how in order to adjust course content and to allow training evaluation
Day 1 Theory I General plating techniques					
2	First steps	<ul style="list-style-type: none"> • Meaning of efficient plating • Basics of metal deposition • Work steps in plating 	Lecture 3	HUT, Dept. Electrochemical Technology and Metal Protection (Mr. Hoang) International expert	<ul style="list-style-type: none"> • Understand to define final product properties acc. to function and stress (e.g. corrosion effects on plated layers) • Understand adequate treatment processes according to raw material quality/surface contamination and required properties of final deposit: standard sequences in pre-treatment (degreasing, pickling etc.), plating and post-treatment (e.g. passivation) • Know difference between rack, barrel, strip, reel to reel plating • Know reasons for finishing processing cycles: degreasing, cleaning, pre-plating, plating • Understand electrochemical principles, quality influencing parameters: plating cell, Ohm's law, Faraday's law, electr. circuits

No.	Subject	Content of the lesson	Form and duration of the lesson (h)	Responsible lecturer	Learning outcome
Day 1 Theory II Pre-Treatment					
3	Grinding, Polishing and Buffing	<ul style="list-style-type: none"> • Principles of polishing • Mechanical and automatic polishing methods • Auxilliaries for polishing 	Lecture 1/2	HUT, Dept. Electrochemica l Technology and Metal Protection (Mr. Hoang)	<ul style="list-style-type: none"> • Understand critical points: influences of mechanical pre-treatment like effects of inappropriate grinding (correct sequences e.g. pre-degreasing before grinding), effects of polishing agent on lifetime and quality of degreasing process (demulsified/emulsified oils). Dust problem and its avoidance. Supplier information. • Know most appropriate grinding and polishing techniques and auxiliary chemicals
4	Degreasing / Cleaning	<ul style="list-style-type: none"> • Types of contaminants • Cleaning techniques: soak cleaning, ultrasonic cleaning • Cleaning agents • Extension of service life 	Lecture 1		<ul style="list-style-type: none"> • Know how to select appropriate cleaning baths and understand its properties • Know appropriate construction of degreasing tanks (overflow compartment, circulation part, oil/grease separator), belt/disk skimmers, explanation of microfiltration equipment for degreasing agent recovery.
5	Pickling	<ul style="list-style-type: none"> • Types of surface contaminants • Pickling agents, inhibitors • Extension of service life 	Lecture 1 1/2	International expert	<ul style="list-style-type: none"> • Understand chemical reactions of pickling process • Able to select adequate pickling agent for workpiece • Know how to remove metal contaminants from pickling baths: cristallisation, electrolysis, ion-exchange • Understand financial/technical comparison of different techniques for the bath lifetime extension

No.	Subject	Content of the lesson	Form and duration of the lesson [h]	Responsible lecturer	Learning outcome
Day 1 Theory III Plating processes					
6	Cu-plating	<ul style="list-style-type: none"> • Preparation and make-up of plating solutions • Operation of plating baths incl. proper arrangement of anodes/cathodes • Care and control of plating bath • Chemical and physical analysis of plating bath. 	Lecture / Exercise 1	International expert	<ul style="list-style-type: none"> • Know the various applications of copper layers and history of Cu-plating. • Know the application of appropriate equipment, conditions of deposition and part preparation techniques • Know the aspects of alkaline-cyanide free, sulfate, cyanide based Cu-plating. Correct use of brightener and leveling agent, • Able to calculate deposition thickness, current distribution, anodic/cathodic current efficiency • Be familiar with safety precautions, quality and performance analysis of copper plating (bath purification, thickness, brightness)
Day 2 Theory III Plating processes					
7	Ni-plating	<ul style="list-style-type: none"> • Preparation and make-up of plating solutions • Operation of plating baths incl. proper arrangement of anodes/cathodes • Care and control of plating bath • Chemical and physical analysis of plating bath 	Lecture 1 1/2	International expert	<ul style="list-style-type: none"> • Know history of Ni-plating and surface requirements of bright and dull deposits • Know appropriate chemicals and their concentration in Ni-solution: sulfates, chlorides, boric acid, brightener • Know how to operate Ni-baths under steady conditions • Able to use appropriate means to extend lifetime of Ni-baths • Able to calculate deposition thickness, current distribution, anodic/cathodic current efficiency • Ni-recycling: Ni-precipitation, electrolysis with membrane (chlorine gas avoidance)

No	Subject	Content of the lesson	Form and duration of the lesson [h]	Responsible lecturer	Learning outcome
8	Zn-plating	<ul style="list-style-type: none"> • Preparation and make-up of plating solutions • Operation of plating baths incl. proper arrangement of anodes/cathodes • Care and control of plating bath • Chemical and physical analysis of plating bath 	Lecture-/ Exercise 1 1/2	International expert	<ul style="list-style-type: none"> • Have an understanding of the development of zinc plating and the use/resources of zinc (reserves, recycling) • Know the important aspects of cyanide-based, non-cyanide-based and acid-based zinc plating: (components, make-up, conditions of deposition, physical properties, disposal) • Know possibilities of warm/uncooled acidic plating • Understand extension of lifetime (carbonate separation) • Able to calculate deposition thickness, current distribution, anodic/cathodic current efficiency • Be familiar with safety precautions, quality and performance analysis of zinc plating (corrosion resistance, adhesion, thickness, brightness, ductility)
9	Decorative / hard Cr-plating	<ul style="list-style-type: none"> • Preparation and mixing of plating solutions • Operation of plating baths incl. proper arrangement of electrodes • Care and control of plating bath • Chemical and physical analysis of plating bath 	Lecture / Exercise 2	International expert	<ul style="list-style-type: none"> • Have an understanding of chemistry and metallurgy in order to better understand the problems involved in plating chromium onto different substrates • Know the application of appropriate equipment, conditions of deposition and masking (current distribution), part preparation techniques (contacting) • Know the important aspects of conventional, mixed catalyst and mixed catalyst-non fluoride chromium plating incl. Cr^{+III} • Able to calculate deposition thickness, cathodic current efficiency

No	Subject	Content of the lesson	Form and duration of the lesson [h]	Responsible lecturer	Learning outcome
					<ul style="list-style-type: none"> • Be familiar with safety precautions, quality and performance analysis of chromium plating (bath purification, corrosion resistance, adhesion, thickness)
10	Passivation: phosphating, chromating	<ul style="list-style-type: none"> • Preparation and mixing of solutions • Operation of passivation baths • Care and control of passivation baths • Chemical and physical analysis of passivation bath 	Lecture 1	International expert	<ul style="list-style-type: none"> • Understand chemical basics of passivation, procedures and properties of deposits • Know the various applications of zinc chromate (incl. coloring), chromite (Cr^{III}) layers and history of passivation • Know common phosphate processes on iron • Be familiar with safety precautions, quality and performance analysis of passivation solution (corrosion resistance, adhesion)
Day 2 Theory IV Auxiliary processes					
11	Energy efficiency	<ul style="list-style-type: none"> • Reduction of energy usage 	Lecture + Exercise 2	VNCPC (Mr. Mui, Mr. Tang)	<ul style="list-style-type: none"> • Know how to reduce energy consumption in lighting, rectification and tank hardware. Energy management. • Understand different types of insulation material • Know to adopt energy efficient ventilation systems and process solutions
Day 3 Theory IV Auxiliary processes					
12	Rinse	<ul style="list-style-type: none"> • Techniques to reduce rinse water consumption • Technologies for rinse water preparation 	Lecture + Exercise 4	International expert	<ul style="list-style-type: none"> • Understand technologies like counter-current cascade or spray rinse for water saving and evaporation systems • Able to calculate rinse criterion acc. to required cleanliness • Understand lay outing of appropriate number of rinse cascades and investment/running

No.	Subject	Content of the lesson	Form and duration of the lesson [h]	Responsible lecturer	Learning outcome
					cost calculation • Understand mechanisms and use of ion-exchange for water preparation • Know how to reduce amount of contaminants in waste water: reduction of drag-out, recirculation, extension of service life, recycling.
13	Water treatment	<ul style="list-style-type: none"> • Raw water preparation • Waste water segregation • Water contaminants and their origin • Treatment of specific water contaminants • Waste water treatment technologies • Sludge and after-treatment 	Lecture + Exercise 4.	International expert	<ul style="list-style-type: none"> • Requirements on raw water quality, water preparation techniques • Understand basic chemistry of water contaminants • Know procedures and technologies to treat inevitable contaminants like: CN^-, Cr^{+VI}, acids/bases, other metals, complexing agents, fluorides, phosphate, sulfate, nitrite, ammonia, VOC, sulfide (e.g. solid-liquid separation, electrolytic and ion-exchange recovery) • Know how to dispose off sludge and solid waste
Day 4 Theory IV Auxiliary processes					
14	Removal of metal deposits (stripping)	<ul style="list-style-type: none"> • Chemical de-plating • Electrolytic de-plating • Construction of racks 	Lecture 1	International expert	<ul style="list-style-type: none"> • Able to chose appropriate selective de-plating means (agents and equipment) and processes • Able to construct and use appropriate plating racks • Know pre-treatment of de-plated surfaces before re-plating
Day 4 Theory V Measurement and quality assurance					
15	Analytical measurement (quality control)	<ul style="list-style-type: none"> • Analytical techniques and methods • Analytical control of electrolytes 	Theory and exercises in laboratory 8	VNCPC/INES T (Mrs. Hien)	<ul style="list-style-type: none"> • Understand different analytical measurement techniques for plating baths and waste water • Able to use different analytical methods to measure relevant chemical substances: rapid tests,

No	Subject	Content of the lesson	Form and duration of the lesson [h]	Responsible lecturer	Learning outcome
		<ul style="list-style-type: none"> • Estimation of efficiency • Measurement of deposit properties 			mobile analytics, laboratory (titrations, cell test) <ul style="list-style-type: none"> • Able to control and adjust relevant parameters of plating baths: hull cell test • Able to measure quality of plated products: thickness, hardness, corrosion, ductility
Day 5 Theory VI Measurement and quality assurance					
16	Occupational health and Operational safety	<ul style="list-style-type: none"> • Preventive personal and process safety measures • Safety management 	Lecture 2	VNCPC (Mrs. Anh)	<ul style="list-style-type: none"> • Know how to handle first aid, medical surveillance and devices (emergency showers, eye-rinse) • Know how to insure safety standards and to monitor injuries and illness • Know how to use protective personal equipment (goggles, gloves, apron, respiration mask etc.) • Understand handling of hazardous chemicals and energy incl. storage
17	Cleaner Production self-assessment	<ul style="list-style-type: none"> • Identification of CP.potential 	3	VNCPC (Mrs. Nga)	<ul style="list-style-type: none"> • Know how to carry out a short self-assessment in order to select areas for improvement
18	Evaluation	<ul style="list-style-type: none"> • Final participant test • Course evaluation, feedback 	Plenum 1 1/2	VNCPC (Mr. Nhan, Mrs. Nga)	<ul style="list-style-type: none"> • Participants get an idea of his/her performance and learning outcome

Total: 39.5 hours / 5 days (including breaks)

Financing (tentative as of 15/11/2004)

Personnel cost [USD]	Rate	Duration	Cost
Fees presentations (local, VNCPC)	100 USD/d	5d + 2d prep.	700
Fees presentations (local, ETMP)	105 USD/d	1d +1d prep.	210
Fees presentations (int. experts)	500 USD/d	5d + 2d prep.	3'500
Support, Organisation, Review	80 USD/d	1d	80
Administration	45 USD/d	3d	135
Travel			
Flights experts			1'400
Local travel	10 USD/d	5d	50
Expenses			
Daily allowance experts	100 USD/d	5d	500
Others			
Material			
Chemicals during laboratory use			200
Analytical equipment	100 USD/d	1d	100
External cost			
Insurance			---
Charge fees			---
Services on own account (HUT)			
Infrastructure	10 USD/participant		150
Translation English-Vietnamese	80 USD/d	3d	240
Internet, e-mail			---
Laboratory use			---
TOTAL cost USD			7'265
Income USD:			7'300
Participants contribution in 2005			no
Contribution FHBB			5'000
Contribution VNCP			300
Private donors			2'000