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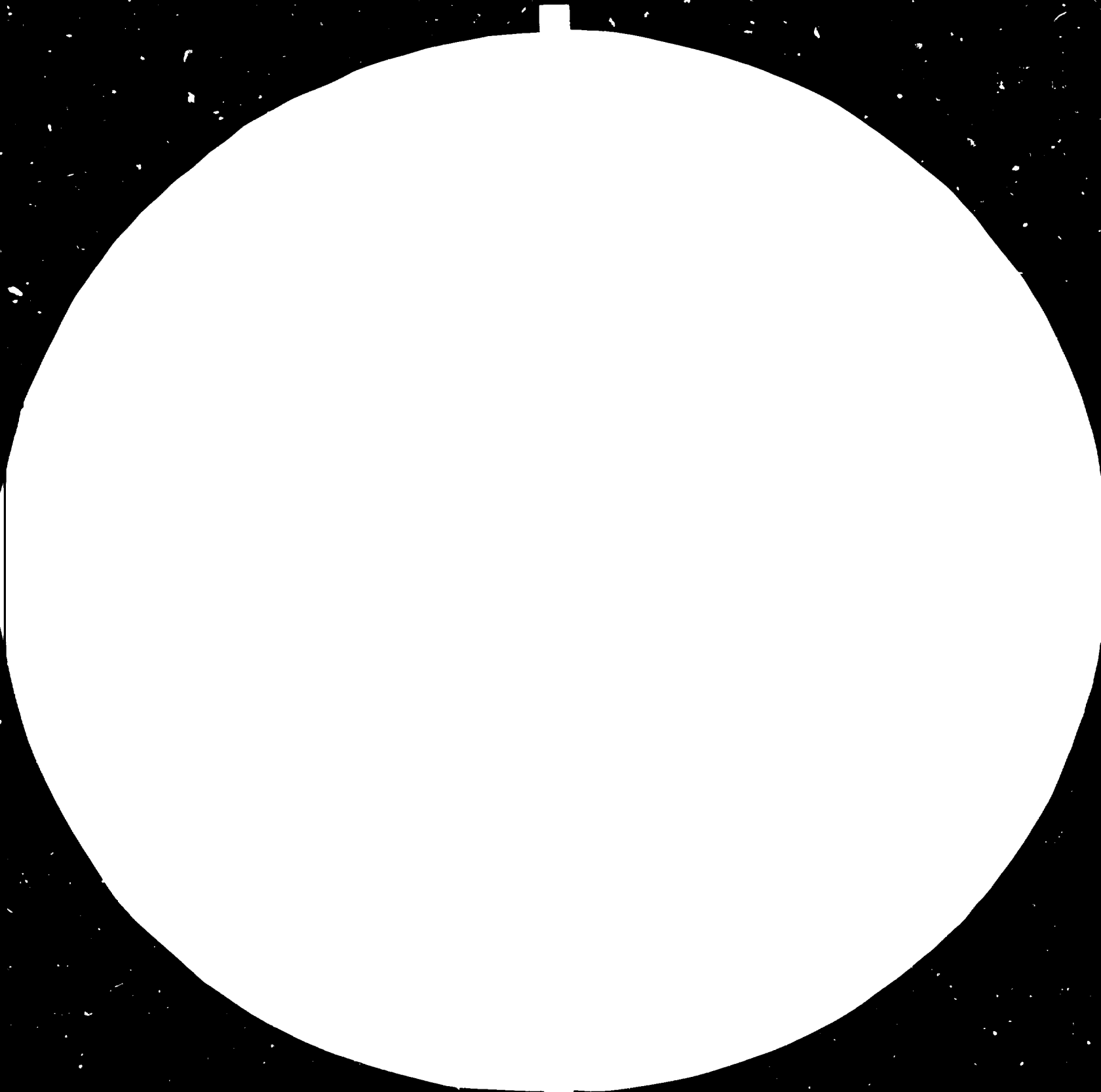
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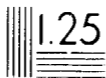
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DP/ID/SER.8/453  
9 November 1983  
English

ASSISTANCE TO THE INSTITUTE FOR TROPICAL TECHNOLOGY OF VIET NAM (ITT<sup>V</sup>)

DP/VIE/76/010

VIET NAM

Terminal report

Prepared for the Government of Viet Nam  
by the United Nations Industrial Development Organization,  
acting as executing agency for the United Nations Development Programme

Based on the work of B. Bartakova, chief technical adviser,  
and Vo Phien, national project director

United Nations Industrial Development Organization

Vienna

V.83-63768

cf. 12744

Explanatory notes

References to dollars (\$) are to United States dollars. The monetary unit in Viet Nam is the dong (D).

Besides the common abbreviations, symbols and terms, the following have been used in this report:

CTA	Chief technical adviser
DTA	Differential thermal analysis
ITTV	Institute for Tropical Technology of Viet Nam
NRCV	National Research Centre of Viet Nam

Mention of firm names and commercial products does not imply the endorsement of the United Nations Industrial Development Organization (UNIDO).

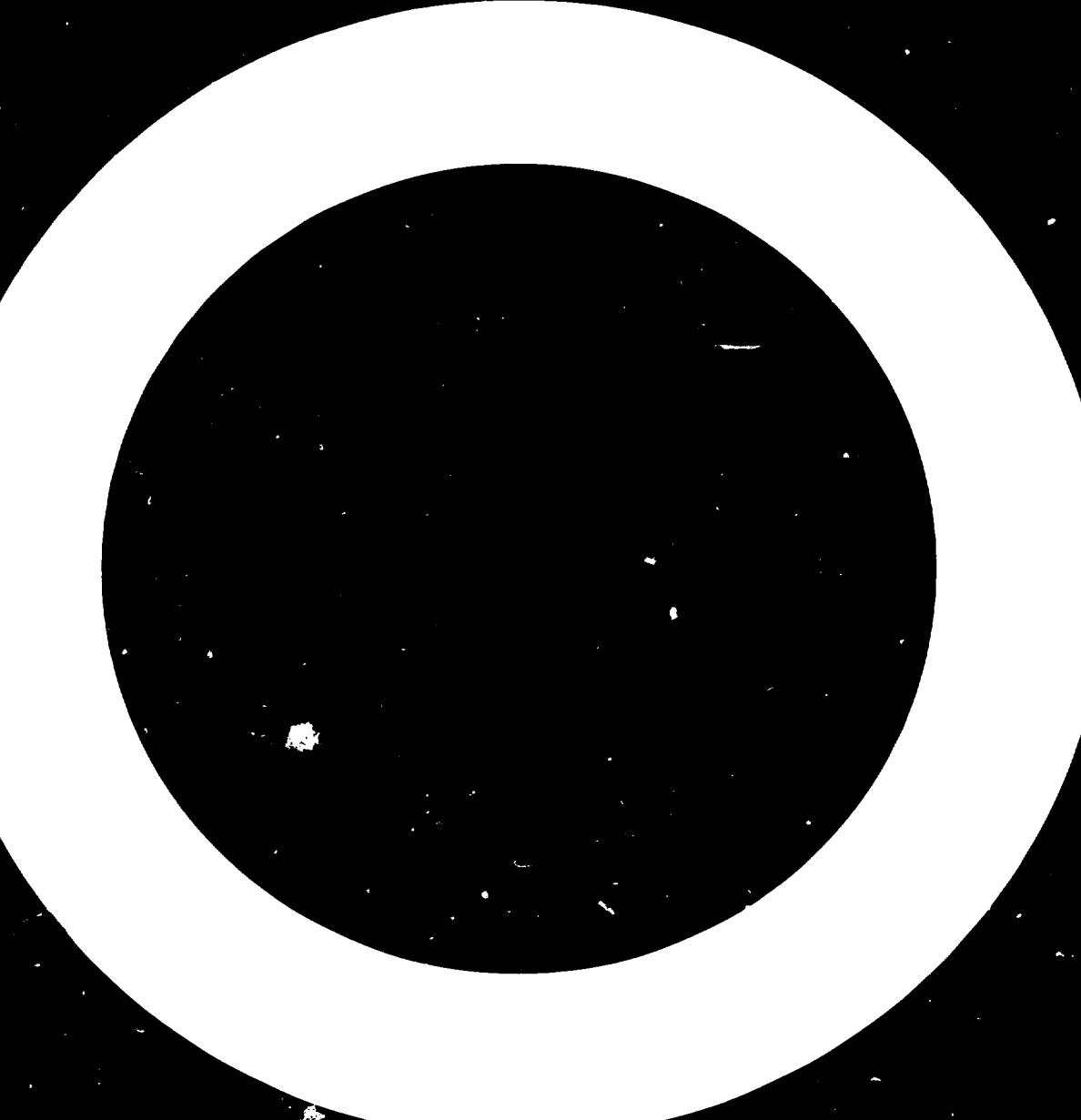
ABSTRACT

The Government of Viet Nam requested assistance from UNIDO to provide technical advice and equipment to the Institute for Tropical Technology of Viet Nam (ITTV) in order to strengthen its capacity for solving the growing problem of loss and waste of technical equipment caused by climatic conditions. Following a mission of United Nations experts in 1979, the project "Assistance to the Institute for Tropical Technology of Viet Nam" (DP/VIE/76/010) was approved, and actual field work, which began in December 1980, ended in late 1983.

The project funds were used mainly to purchase equipment for the Institute's ten laboratories, for fellowship training of ITTV's staff and for consultations. UNIDO provided the chief technical adviser (CTA) and four experts on metallic corrosion; organic material deterioration; utilization of local raw materials for developing new technical materials; and the preparation and publishing of a brochure on the work of ITTV.

During the assignment of the CTA to the project, the laboratories carried out a great number of research tasks and newly-developed materials that were developed were produced on a small scale in ITTV's own pilot production workshops. ITTV also advised industries and supplied them with know-how in the field of tropicalization.

The objectives of the project, e.g. to develop the Institute's capacity to evaluate new products technically and economically, to provide quality audits from the point of view of suitability to tropical conditions, and to serve as a clearing-house for information on tropical technology, have been met. ITTV is now an established institution that operates on a sound base of professional competence and expertise and plans to continue its research and development activities in accordance with the five-year plan. In this context the CTA recommends that future efforts be concentrated on the elaboration of specifications for the tropicalization of technical products and equipment, and the strengthening of the laboratory for the development of new tropic-proof materials as well as an expansion of that activity.



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## INTRODUCTION

Technical equipment was and still is designed and developed mainly in countries having a mild climate and is therefore technically and economically optimized for these climatic conditions. If such equipment is operated in tropical or arctic climates, it has a higher failure rate and a shorter service life. There are two ways to avoid its untimely deterioration: either the immediate environment is changed (for instance by air-conditioning), or the equipment or products are adapted to local climatic conditions. Air-conditioning is very expensive and can be considered only in exceptional cases (for laboratories, offices, living rooms, some special workshops etc.), while most equipment and products are exposed to environmental attack and should therefore be designed or modified accordingly. In Viet Nam where humid tropical conditions are predominant the deterioration of technical equipment is caused by the concurrence of the following main climatic factors:

- (a) High air temperature;
- (b) High humidity;
- (c) Microbial infection (mould and bacteria during the humid season);
- (d) Dust (in the dry season);
- (e) Salt mist in coastal regions;
- (f) Atmospheric pollution (for example by SO<sub>2</sub> and other emissions which are especially dangerous in combination with high humidity).

A further cause of a high failure rate lies in the fact that countries in the tropical region which are in the process of industrialization do not have enough skilled manpower for maintenance, attendance and repair.

There are also significant difficulties in the provision of materials and spare parts resistant to tropical atmosphere, a problem which exists to a greater or smaller extent in every country located in the tropical zone. They are multiplied by the fact that, due to the lack of relevant information the technical staff is supposed to be provided with, no proper technical specifications are imposed on the design of equipment and parts ordered or produced. Neither are the conditions which the products are to endure precisely indicated; nor is the quality of workmanship systematically tested with regard to climatic resistance. Similarly the procurement staff, due to insufficient information, often order items without indicating the tropical and other specific conditions of the country. It also seems that both, procurement and technical staff give preference to easily available and cheaper products and equipment, without guarantees for reliable operation under tropical conditions.

Tropical technology, or tropicalization, includes all measures to increase and secure the reliability of locally-produced or imported technical equipment (electric, power-generating and electronic) in tropical zones. Considering the envisaged intensive development of its industry, Viet Nam has to tackle this problem without delay, especially since it urgently needs to increase its exports. To achieve this objective the Vietnamese industry must be able to produce goods and equipment that meet the quality standards not only of the local, but also of the export market.

### A. Project background

Vietnamese leaders of research and industry were well aware that the tropicalization of technical equipment and products and the development of their own tropic-proof materials and means of protection were the key and principal precondition for the successful development of national industry and foreign trade.

An atmospherical station for testing the suitability of materials and technical products for tropical climates was established 20 years ago and equipped according to the limited resources of the Polytechnical University of Hanoi.

After the war the station was administered by the National Research Centre of Viet Nam (NRCV) and became one of its departments. For lack of equipment, apparatuses and experience the department could not fully meet the industry's demands. In 1976 the Government requested UNDP assistance to strengthen the department of tropicalization research by providing modern equipment, experts and training for the national staff.

As the extension of the department in question, as proposed by the Vietnamese side, was not considered the only way of solving the tropicalization problem in Viet Nam, a mission consisting of two experts and a UNIDO representative visited the country and investigated, together with Vietnamese experts, the local conditions in order to make an optimal decision.

They proposed the establishment of an institution now known as Institute for Tropical Technology of Viet Nam (ITTV) comprising well-equipped laboratories, and which, as its primary function, would carry out basic and immediately applicable research and assume a leading role in tropicalization for the local industry. A draft project document, including a list of equipment required for each laboratory, was elaborated accordingly. For the structure of the Institute see annex I.

During the debriefing of the mission in Vienna the draft project document was refined and its final version signed by the Government of Viet Nam, UNDP and UNIDO on 24 February 1982.

### B. Objectives

#### Development objectives

The project was to contribute to the following development objectives:

- (a) To increase the resistance of locally-manufactured technical products and equipment to the effects of tropical environments and thereby increase their reliability;
- (b) To increase the acceptability of Vietnamese products on foreign markets;
- (c) To reduce the dependance of Viet Nam on imported technical materials suitable for tropical climate;
- (d) To ensure the suitability of imported products and equipment by providing supplies with detailed specifications;

(e) To eliminate losses caused by unfavourable climatic conditions during production, transportation and operation of manufacturing facilities;

(f) To improve industrial production qualitatively and quantitatively.

Immediate objectives

The immediate objectives of the project were:

(a) To extend the existing Tropicalization Department under the National Research Centre of Viet Nam and to grant it the status of an institute with an adequate research and development capacity in tropicalization and the capability of co-ordinating all problem-solving efforts in that field;

(b) To expand the premises and complete the equipment of the Institute's headquarters at Hanoi;

(c) To equip the laboratories of the Institute's branch at Ho Chi Minh City;

d) To train abroad the Institute's technical personnel in the following areas;

(i) Corrosion of metals and their protection;

(ii) Applicability and protection of non-metallic materials and their degradation in tropical climates;

(iii) Tropicalization of electronic devices and components;

(iv) Environmental testing and technical climatology;

(v) Development of new materials from local raw materials;

(e) To ensure that the knowledge and experience gained from foreign experts is applied to combat the effects of tropical climates on materials and products;

(f) To establish standards and regulations for the improvement of the quality of materials and products and for their protection against adverse environmental influence;

(g) To increase the Institute's responsiveness to all kinds of tropicalization problems;

(h) To increase the Institute's staff from the present level of 67 to 136.

C. Inputs

UNDP provided a financial input of \$US 1,150,000 and the Government of Viet Nam provided D16,535,000 as financial input.

The UNDP input was subsequently increased to \$US 1,191,000 to reflect the expenditures connected with the extension of the chief technical adviser's (CTA) contract and the visit of a short-term expert who assisted in the preparatory work connected with the publication of two pamphlets dealing with

general tropicalization problems and which should serve as basic information for other experts and industrial workers in tropical countries encountering similar difficulties. The brochures were also meant to further the co-operation and exchange of information in this field among tropical countries.

UNDP funds were used to provide the services of the CTA and international experts in various fields of specialization. These specialists visited the Centre, gave lectures, provided training, put the instruments and equipment into operation and trained local staff in operating the equipment.

UNDP inputs were also used for training abroad of ITTV national staff in various fields of research and technology. Research workers of ITTV visited many organizations concerned with material protection, materials and equipment manufacturing and testing with regard to operation in tropical countries. They visited not only developed countries in the mild climatic zone but also tropical countries which have to cope with problems of a similar nature to Viet Nam, had an opportunity to meet specialists dealing with some of the issues in the wide spectrum of tropicalization, and were able to compare the different methods by which research and industry try to solve these problems.

The laboratories of ITTV at Hanoi were completed with additional modern apparatuses while those at Ho Chi Minh City were almost completely newly equipped.

The Government funds were used for the construction of a new building at Hanoi, the repair of a building at Ho Chi Minh City, the construction of a building for pilot production at Ho Chi Minh City and for repairs or new installations of the electricity and water supply systems. Government funds were further employed for the purchase of some equipment available in Viet Nam, for providing furniture, technical literature and periodicals and all services connected with the stay of foreign experts (transportation, office facilities, CTA's assistants etc.), as well as for organizing national conferences and colloquia.

## RECOMMENDATIONS

1. Research and development work should be continued in accordance with the five-year plan, in co-operation with industry and other organizations.
2. In co-operation with industry and in the course of time, instructions for the tropicalization of all kinds of technical products and equipment manufactured in Viet Nam should be elaborated. They should include all or some of the following aspects, depending on the kind of product:
  - (a) Basic principles of design and construction;
  - (b) Basic principles of protection from unfavourable climatic influences;
  - (c) Thermal analysis;
  - (d) Ventilation, cooling and eventual heating;
  - (e) Hermetic sealing;
  - (f) Selection of suitable tropic-proof materials;
  - (g) Joining and joints;
  - (h) Cementing;
  - (i) Impregnation;
  - (j) Application of fungicides;
  - (k) Surface treatment and protection of metals;
  - (l) Protection by paints;
  - (m) Other kinds of protection against climatic effects;
  - (n) Climatic testing of products;
    - (i) Sequence of various climatic tests;
    - (ii) Evaluation of results;
    - (iii) Criteria of "tropic-proofness" (requirements which the products must meet);
  - (o) Preservation (temporary protection during transportation and storage);
  - (p) Packaging;
  - (q) Aeration;
  - (r) Maintenance;
  - (s) Repair.
3. The laboratory for development of new tropic-proof materials should be strengthened and, in the course of time, further laboratories established within ITTV or a new institute concentrating on the development of new materials based on glass and glass fibres, mica, ceramics, insulating materials for electrical parts etc.

## I. ACTIVITIES CARRIED OUT AND OUTPUTS PRODUCED

### A. Work-plan

The project activities laid down in the work-plan have been developed on the basis of those defined in the project document. Necessary changes in scope and time were made in accordance with actual conditions and the requirements of the industry. The work-plan includes the following activities:

- (a) Carry out research and development tasks in accordance with the long-term work-plan and application of results unpracticed;
- (b) Establish a permanent liaison with industry and other institutions with a view to co-operate effectively in solving tropicalization problems in important industrial branches, and train managers and technical personnel in tropical technology;
- (c) Assist the industry by executing short-term tasks according to the actual needs of factories (consultation, testing etc.);
- (d) Provide assistance in the compilation, translation and dissemination of information on testing and standards in a format that is helpful to and easily understood by the user;
- (e) Assist ITTV in establishing specifications for the testing and inspection of equipment, its installation, procurement and maintenance, as well as for its protection in transit;
- (f) Provide experts in various fields of activities;
- (g) Make provisions and prepare schedules for fellowship training of the local technical staff;
- (h) Prepare detailed specifications for the procurement and installation of equipment;
  - (i) Develop new tropic-proof products in co-operation with industry and audit quality control procedures and practices in industrial plants;
- (j) Investigate the possibility of using indigenous materials for tropicalization of products;
- (k) Initiate the regular collection of data concerning the impact of the Vietnamese environment and other tropicalization issues and factors.

### B. Activities carried out with UNDP/UNIDO assistance

#### Equipment

The equipment purchased in support of this project is shown in annex II. As the cost for most equipment and apparatuses had been underestimated, their number had to be radically reduced. Furthermore, the variation in planned and actual terms for delivery resulted in extra costs due to inflation so that

only about 50 % of the equipment foreseen in the original proposal could be ordered. Although the laboratories have been modestly equipped as compared with those in highly-developed countries, their capability has been considerably improved. Almost all equipment has been put into operation, except that for pilot production in Ho Chi Minh City which could not be installed on time due to late delivery.

A final consignment of accessories and spare parts is still outstanding due to the late placement of the purchase order by UNIDO. An unsolved problem is the supply of spare parts after the completion of the project. There are no funds available for that purpose in the country, and it is likely that many new, modern pieces of equipment will become unusable because of minor defects.

#### Training of project personnel abroad

The training programme for project personnel, as proposed in the project document, had to be amended in the course of project implementation due to difficulties in finding host countries. The dates and travel costs had to be adjusted accordingly. Ten foreign countries were visited by Vietnamese research workers and leaders of ITTV laboratories. Details of the fellowship training programme are contained in annex III.

#### Assignment of international staff

In addition to the CTA's assignment of 18 months, six experts assisted ITTV. Their field of activity and the duration of their assignment, planned and actual, are shown in annex IV.

### C. Activities carried out by the Government

The activities described below, which were carried out by the Government, included preparatory work and activities during project realization.

#### Assignment of national staff

ITTV is located at the premises of NRCV at Hanoi with a branch at Ho Chi Minh City. NRCV is an independent organization having the status of a ministry. The research tasks are financed partly by the Government and partly by industry. ITTV is the first institute among nine others which deals predominantly with industry-related tasks and aims to apply actual results to meet the direct needs of industry. The number of the national staff is 156, and the leading personnel is listed in annex V.

ITTV has a council of technical advisers which is composed of members from industry, Government, universities and other organizations which co-operate with it. They are listed in annex VI.

#### Experts

Besides the experts financed by UNDP, four experts came under bilateral arrangements. They gave lectures in some special fields concerning the activities of ITTV. For details see annex VII.

#### Training of personnel abroad

The Government of Viet Nam financed the long-term training (12 to 36 months) of five fellows in the subjects of material deterioration, material protection and environmental testing. Details are given in annex VIII.

### Building, equipment and supplies

The department for tropicalization is located in the buildings of NCRV at Hanoi. The existing laboratories in Hanoi had to be extended by the construction of a new building which, however, is not yet finished due to the shortage of building materials such as bricks and cement. The extra space has been provided for ITTV by NRCV. Although the working areas are small and overcrowded, all equipment has been put into operation. The Government of Viet Nam provided equipment and materials available in the country (laboratory glasses, chemicals etc.).

The new building will be finished within about one year and the same equipment will be installed therein.

In Ho Chi Minh City an old building has been repaired and adapted for the use by ITTV with provision of electric power, water conduits, laboratory and office furniture and some equipment and materials available in Viet Nam.

### Transportation and other facilities

The Government has taken care of the transportation of all equipment from the port of arrival to the place of destination and arranged also for the transportation of the experts and the CTA.

The CTA and the experts were ensured suitable working conditions, provided with accommodation and could contact and co-operate with national staff, industry and other organizations as required for their activities.

## D. Outputs produced

### Research and development work

Research undertaken in the laboratories at Hanoi and Ho Chi Minh City is financed jointly by industry and the Government. The research and development work and related activities (training of industrial workers, consultations, lectures etc.) carried out by ITTV in the course of project implementation were based on the five-year state programme no. 04808, which is given in annex IX.

Seventy two tasks have been completed and the results implemented in industrial plants. For the research work the Government and the industry have paid the sum of D26,140,000 to ITTV. At this stage it is impossible to estimate accurately the amount of direct as well as indirect contributions to the national economy, because in most plants the coefficients of efficiency have not yet been determined. Further 29 research activities will be completed in accordance with a detailed plan elaborated during the project implementation (see annex X).

### Standards and instructions for tropic-proofing of technical equipment

Sixty five standards for environmental and other testing of materials and equipment have been compiled or translated, and instructions elaborated for the introduction of tropic-proof technologies and the protection of materials and technical equipment against tropical effects. A contract with the Institute for Standardization has been signed and a five-year plan established for the publication of the standards.



Substitution of imported tropic-proof materials by local products

The possibility of using and developing indigenous materials to cover a larger part of imported tropic-proof materials has been explored. The capacity of the laboratories involved, however, does not fully meet the demands of Vietnamese industry.

## II. ACHIEVEMENT OF IMMEDIATE OBJECTIVES AND UTILIZATION OF PROJECT RESULTS

### A. Achievement of immediate objectives

The existing laboratories for tropical research have been extended and provided with new facilities and equipment which have all been put into operation, but the working areas are overcrowded because the new building has not yet been finished.

The ITTV branch in Ho Chi Minh City is now housed in a partly reconstructed and repaired building, suitably equipped for its work in accordance with a limited budget.

The number of national staff has been increased as planned. The abroad training programme will have been fulfilled with regard to the research field specified in the project document although the last fellows had not started their training when the project was concluded. The originally planned 100 man-months were reduced to about 70 man-months due to increased travel costs and high tuition fees requested by some countries.

The five experts passed on their knowledge by giving lectures, training the technical personnel and putting equipment into operation.

The dissemination of the 65 standards, as described under outputs, will contribute to improving the quality and reliability of products under tropical conditions.

A great quantity of information such as books, standards, articles and summaries has been collected. Lectures, discussions, training of fellows and new international contacts will provide further information on tropicalization after the completion of the project.

Contacts have been established with industrial plants and their co-operation is ensured by a common five-year plan. The relationship with industry and other organizations has been strengthened by lectures, training of industry workers and by publishing the results of ITTV in technical newsletters and magazines. The steady dissemination of technical information has increased the responsiveness of industrial enterprises towards environmental protection. The ongoing task of environmental testing of products will induce manufacturers to co-operate closely with ITTV in developing suitable technologies for their products.

In spite of some shortcomings the immediate objectives have thus been achieved.

### B. Utilization of the project results

The results of the project have already been utilized in:

- (a) Long-term research financed by the Government and industry and aimed at improving the resistance of technical products against tropical effects;
- (b) Assistance to industries in accordance with their actual needs;

- (c) Production of sample batches of tropic-proof materials and protection means;
- (d) Training courses for industrial technical workers and students;
- (e) Dissemination of results in technical publications, seminars and consultations to industry and other organizations;
- (f) Assistance to specific industrial plants during the introduction of new materials or technological processes.

### III. FINDINGS

ITTV, with its centre in Hanoi and the branch in Ho Chi Minh City, is in a position to assume a leading role in the development of the Vietnamese industry. The capability and competence of the Institute should be further enhanced by the Vietnamese Government so as to enable it to meet also future demands of the industry. This concerns especially laboratories at Ho Chi Minh City which are modestly equipped, while the centre at Hanoi is temporarily suffering a shortage of laboratory rooms.

The personnel of ITTV is very enthusiastic, and makes every effort to further the development of the Vietnamese industry.

The close links which have been established with industry are managed by the heads of laboratories in a very flexible manner, and with responsiveness to the industries' demands and actual needs.

The assistance of UNIDO permitted the execution of research and development tasks which are very important to the industry. Many of them have been completed either in a shorter time or at a higher level of quality thanks to this assistance.

The fact that ITTV comes under NRCV constitutes a guarantee that the former will continue its activities after the completion of the project.

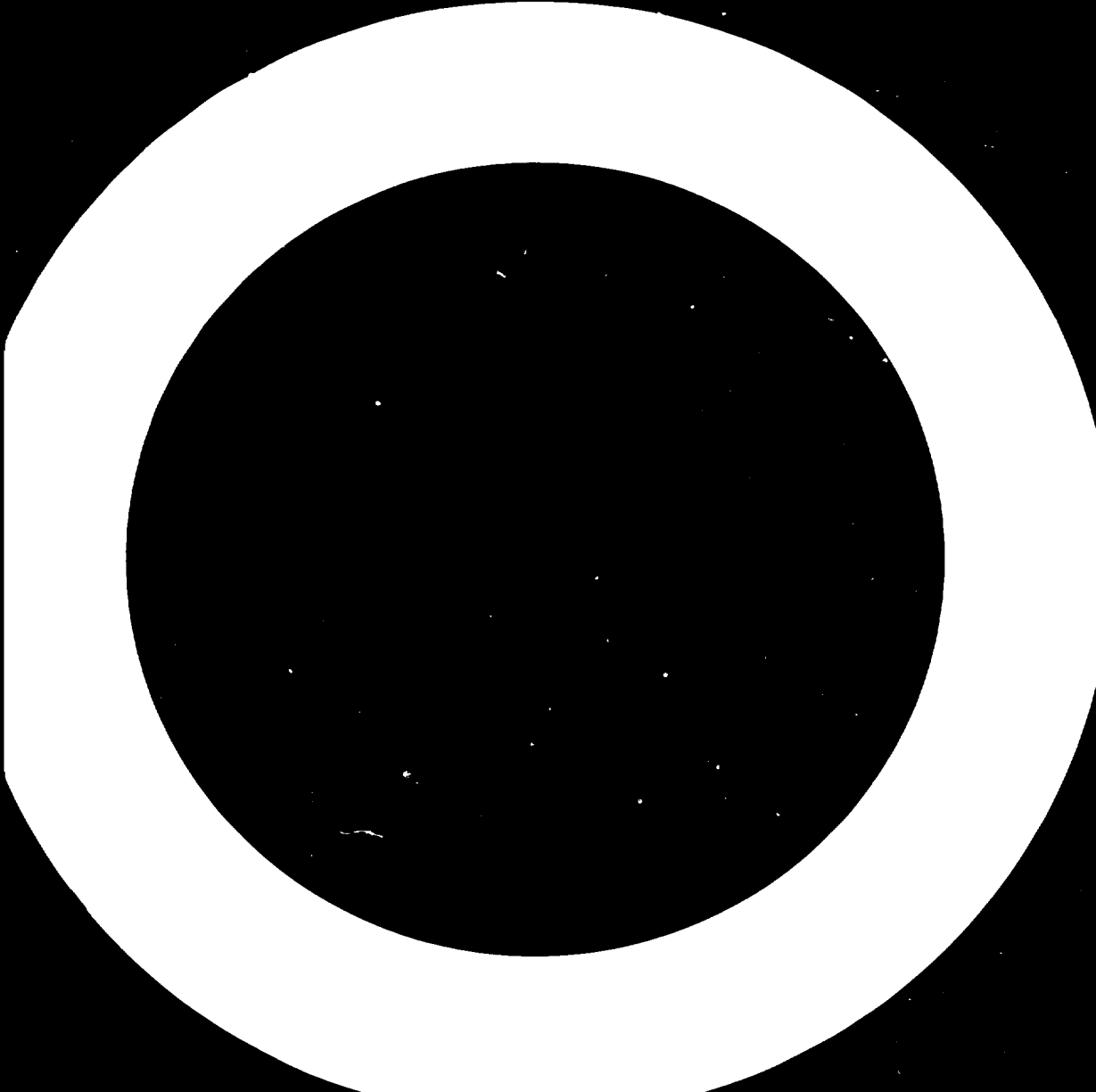
The presence of foreign experts and the training abroad of Vietnamese personnel have helped to increase the staff's knowledge considerably and reduced existing gaps in practical experience.

The equipment for ITTV has been selected and ordered from suppliers offering the most advanced technologies, and its continued operation is ensured by a relatively great number of spare-parts. The only anticipated problem is in fact a shortage of spares after the completion of the project.

The publication of the elaborated or translated standards and instructions for the testing of materials and products by the Institute for Standardization will ensure an increased awareness of testing results in Viet Nam, and contribute to a standardization of laboratory testing routines. The membership of Viet Nam in the Council for Mutual Economic Assistance (CMEA) opens a possibility for ITTV to participate in international standardization activities of the Institute for International Standardization at Moscow (within the framework of the Technical Committee for Environmental and Corrosion Testing) and makes all international standards in this field accessible.

Two national conferences were held on the topic of tropical technology to acquaint the public with research and development results. The reports were supplemented with an exhibition in which models and specimens of products were displayed and which met with a great interest and acceptance on the part of the industry. Several colloquia on some topics concerning tropical technology were organized as well.

The personnel of ITTV and the international staff have lectured in technical universities, conferences, colloquia and industrial plants. This way over 700 research and development workers, technicians and students have been trained in various fields of tropical technology. Twenty nine articles have been published in technical magazines in Viet Nam and abroad and one patent has been granted for a new kind of tropic-proof lacquer made on the basis of cashew seed oil.



Annex I

ORGANIZATIONAL STRUCTURE OF ITTV

NRCV

Scientific Council  
of Advisers

ITTV

		<u>Laboratories at Hanoi</u>	<u>Laboratories at Ho Chi Minh City</u>
Scientific research	Administration	Lab. 1	Lab. 1
Planning	Finance	Lab. 2	Lab. 2
Co-ordination	Purchase	Lab. 3	Lab. 3
Personnel	Transport	Lab. 4 + 6	Group 1
Training	Security	Lab. 5	Lab. 5
Information and library	Clerical	Pilot plant	Pilot plant
		Workshop	Workshop

Note: Lab. 1: Corrosion of metals and alloys, protection of metallic materials  
Lab. 2: Physical and physico-chemical testing of non-metallic materials, deterioration of organic materials  
Lab. 3: Development of new technical materials  
Lab. 4: Tropicalization of electrical equipment  
Lab. 5: Tropicalization of electronic equipment and components  
Lab. 6: Environmental testing and technico-climatology (group 1 at Ho Chio Minh City).

Annex II  
EQUIPMENT SUPPLIED B

NO (Inst. No.)	Item No.	Qty.	Unit	Description
(1)	(2)	(3)	(4)	(5)
80/5.	6.13-18, 32+34			<b>ELECTRONIC EQUIPMENT:</b>
		1	EA	100MHZ OSCILLOSCOPE DQ/07-3681
		1	EA	A.C. CURRENT PROBE DQ/00-1891
		1	EA	15MHZ DUAL TR SCOPE DQ/03-4790
		1	EA	PH METER
		3	EA	R.C. BRIDGE
		1	EA	COUNTER/TIMER
		1	EA	PULSE GENERATOR
		1	EA	AUTOMATIC DIGITAL MULTIMETER 21944
		1	EA	AC MILLIVOLTMETER 2661
		1	EA	DIGITAL MULTIMETER 2996
		1	EA	DC POWER SUPPLY WB 624
80/6.	11, 15, 18, 32+34	5.1-15.4, 17.		
		1	EA	COUNTER TIMER
		1	EA	RCL BRIDGE
		1	EA	PULSE GENERATOR
		1	EA	DIGITAL MULTIMETER 2997
		1	EA	AUT. DIGITAL MULTIMETER NO. 18984
		3	EA	DC POWER SUPPLY WB770-757-759
		1	EA	15MHZ DUAL TRACE OSCILLOSCOPE
		3	EA	PH METER.
80/16	1	1	EA	LONG-TERM-VOLTAGE-INTEGRATOR EVI 80
80/19	1	1	EA	LONG-TERM VOLTAGE INTEGRATOR EVI 80
80/42	1	2	EA	REGAVOLT VARIABLE TRANSFORMER TYPE 404E
80/46	1	1	EA	CENTRIFUGE "ROTOFIX II" WITH SWING HEAD

Y UNIDO

US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condi- tion	Qty. on hand	Remarks
		Qty.	M	V			
(8)	(7)	(9)	(10)	(11)	(12)	(13)	
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816.-	- " -	1	5	81			
653.-	- " -	1	5	81			
653.-	- " -	1	5	81			
2,865.-	- " -	1	5	81			
1,429.-	- " -	1	5	81			
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1,940.-	- " -	1	5	81			
301.-	- " -	1	5	81			
7,241.-	- " -	3	5	81			
690.-	- " -	1	5	81			
2,068.-	- " -	3	5	81			
1,152.-	15-0-00830	1	5	81			
1,152.-	15-0-00831	1	5	81			
164.-	15-0-00863	2	1	81			
176.-	15-0-00864	1	6	81		1 tube broken	



HO Req. Ref.	Item No.	Qty.	Unit	Description
(1)	(2)	(3)	(4)	(5)
80/24	1	4	EA	PROGRAMMABLE CALCULATOR TI-59
	2	2	EA	PRINTER FOR CALCULATOR PC-1000C
80/24	1	4	EA	PROGRAMMABLE CALCULATOR TI-59
	2	2	EA	PRINTER FOR CALCULATOR PC-1000C
80/10	1	1	EA	VIBRATING REC ELECTROMETER
	1.1	1	EA	HIGH VOLTAGE POWER SUPPLY
	1.2	1	EA	HIGH RESISTANCE MEASURING CHAMBER
	1.3	1	EA	1 X 10 <sup>8</sup> OHM STANDARD RESISTANCE CHAMBER
	1.4	1	EA	1 X 10 <sup>10</sup> OHM " " "
	1.5	1	EA	1 X 12 <sup>10</sup> OHM " " "
	1.6	1	EA	HIGH RESISTANCE MEASURING CHAMBER
80/66	1	1	EA	UNIVERSAL OVEN MODEL UL.50, 240 LITER
	1.1	1	EA	UNIVERSAL OVEN MODEL UL.50, WITH ACCESS.
80/67		1	EA	UNIVERSAL OVEN UL.60, 400 LITER
80/41	1	4	EA	KIPP GAS GENERATOR, CAPACITY 2,000ML
80/43	1	2	EA	ROTARY EVAPOURATOR UNDER VACUUM
	1.1	2	EA	ROTARY EVAPOURATOR WITH QUICK JACK AND WATER BATH
80/49	1	1	EA	MELTING POINT DET APP. MODEL:BUCHI 510
80/60	1	4	EA	RÜHRMAG-MAGNETIC STIRRER MODEL RH22
80/61	1	1	EA	CENTRIFUGAL-BALL MILL MODEL S1
80/62	1	1	EA	ULTRA-TURRAX DRIVE T45
	1.2	1	EA	GENERATOR TP 45/20
80/63	1	1	EA	IKA BIRAX VXR 8 (UNIVERSAL SHAKER)
80/60	1	1	EA	UNIVERSAL OVEN MODEL UL 50, 240 LITER
	1.1	1	EA	UNIVERSAL OVEN MODEL UL 50 WITH ACCESS.
8 67	1	1	EA	UNIVERSAL OVEN UL 60, 400 LITER

US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condi- tion	Qty. on hand	Remarks
		Qty.	M	Y			
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1,093.-	15-0-00871						
572.-	- " -						
1,093.-	15-0-00872						
572.-	- " -						
2,739.-	15-0-00883						
783.-	- " -						
261.-	- " -						
196.-	- " -						
209.-	- " -						
261.-	- " -						
1,957.-	- " -						
830.-	15-0-00884						
1,020.-	- " -						
1,455.-	- " -						
419.-	15-0-00885						
943.-	- " -						
1,371.-	- " -						
757.-	- " -						
819.-	- " -						
957.-	- " -						
262.-	- " -						
158.-	- " -						
257.-	- " -						
830.-	- " -						
1,020.-	- " -						
1,457.-	- " -						

NO Req. No.	Item No.	Qty.	Unit	Description
(1)	(2)	(3)	(4)	(5)
80/11	1	2	EA	AC VOLTAGE STABILIZER MODEL E
80/22	1-4	2	EA	D3232 MULTIMETER COMPLETE
80/11	1	2	EA	AC VOLTAGE STABILIZER MOD. E
80/22	1-4	2	EA	D 3232 MULTIMETER COMPLETE
80/13	1	4	EA	A4 X-Y RECORDER TYPE 3022-11
80/11	1	1	EA	VAPOUR PRESSURE OSMOMETER COMPLETE
	12	1	EA	MEMBRANE OSMOMETER COMPLETE
	22	1	EA	DIGITAL METER (DIGITAL INDICATOR)
	23	1	EA	ANALOGOUS INDICATOR
	24	1	EA	CRYSCOPIC UNIT
	31	1	EA	SINGLE CHANNEL RECORDER TY COMPLETE
	35	1	EA	UNIVERSAL TEMPERATURE MEASURING INSTRUMENT
80/38	1	1	EA	INVERTED METALURGICAL MICROSCOPE NEOPHOT 21 300046
80/56	1	1	EA	LABOVAL 2 NO. 300045:050.20
80/56	1	1	EA	MICROSCOPE LABOVAL 30004506020/3
80/44		1	EA	VACUUM OVEN 200C 31L
80/135	1	1	EA	BALANCE DE MOIR PROLABO
80/13	1	1	EA	LABORATORY SIEVING MACHINE MODEL VIBRO COMPL
80/128	1	1	EA	ULTRA-THERMOSTAT TYPE WB 20-S15/12 WITH TEST TUBE RACK RS 18/2
80/120	1	1	EA	SHIMADZU MICRO HARDNESS TESTER TYPE M WITH ACCESSORIES
80/33	1	1	EA	SARTORIUS-ANALYTICAL BALANCE TYPE 2842
80/33	1	2	EA	ANALYTICAL BALANCE TYPE 2842
80/126	1	1	EA	HEATING AND DRYING OVEN WU 340

US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condi- tion	Qty. on hand	Remarks
		Qty.	M	Y			
(8)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
868.-	15-0-00886						
1,347.-	- " -						
868.-	15-0-00887						
1,347.-	- " -						
6,848.-	15-0-00891						
3,719.-	15-0-00892						
3,845.-	- " -						
405.-	- " -						
270.-	- " -						
1,442.-	- " -						
631.-	- " -						
1,533.-	- " -						
13,720.-	15-0-00893						
943.-	- " -						
944.-	15-0-00894						
1,253.-	15-0-00895						
653.-	15-0-00896						
769.-	15-0-00897						
933.-	15-0-00898						
7,073.-	15-0-00899						
816.-	15-0-00902						
1,658.-	15-0-00903						
2,236.-	15-0-00905						

NO Req. Ref.	Item No.	Qty.	Unit	Description
(1)	(2)	(3)	(4)	(5)
80/50	1	1	EA	UNIVERSAL TESTING INSTRUMENT ZWICK 1445 SERIAL NO. 81220
80/68	1	1	EA	BALANCE OHAUS DIAL-O-GRAM 1650, 1600g
	2	1	EA	BALANCE OHAUS TRIM 750S, 610g
80/68	1	1	EA	BALANCE OHAUS DIAB-O-GRAM 1600g
	2	1	EA	BALANCE OHAUS TRIP BEAM 750S 2610g
80/20	1	1	EA	COMMUTABLE UNIVERSAL SCHERING BRIDGE TYPE 2801
	1.1	1	EA	ELECTRONIC ZERO INDICATOR TYPE 5511
	1.2	1	EA	CABLE UNIPOLAR, DOUBLE SHIELDED NO. 111WA/10
	1.3	1	EA	CABLE UNIPOLAR, DOUBLE SHIELDED NO.111W/10
	1.5	1	EA	COMPRESSED GAS CAPACITOR TYPE 3380/100/70
80/21	1	1	EA	KILOVOLTMETER TYPE 5621
80/105	1	1	EA	HM 14A HUMIDITY AND TEMPERATURE METER COMPL
80/110	1	1	EA	HIGH-QUALITY THREE-ROLLER MILL TITAN MODEL DR 250 K COMPLETE
80/100	2	1	EA	TEMPERATURE SHOCK-TEST-CABINET, SYSTEM WEISS TYPE 2X64/80-200 DU-ST S/N 6571 COMPLETE WITH ACCESSORIES
	4	1	EA	COLD-HEAT CLIMATE TESTING CABINET SYSTEM WEISS, TYPE: 1000 RB/40 DU, S/N 6582 COMPLETE WITH ACCESSORIES
	1	1	EA	SALT SPRAY TEST CHAMBER, SYSTEM WEISS, TYPE: S 1000, S/N 6198 COMPL. WITH ACCESS.
	3	1	EA	OZONE-CLIMATE TESTING CABINET, SYSTEM WEISS, TYPE 100 AB/+5 JU-OZ-S, S/N 6462 COMPLETE WITH ACCESSORIES

US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condi- tion	Qty. on hand	Remarks
		Qty.	M	Y			
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
29,837.-	15-0-00907						
254.-	15-0-00918						
130.-	- " -						
254.-	15-0-00919						
130.-	- " -						
10,114.-	15-0-00925						
2,739.-	- " -						
671.-	- " -						
410.-	- " -						
5,222.-	- " -						
2,142.-	- " -						
1,872.-	15-0-00961						
9,071.-	15-0-00982						
31,182.-	15-0-01002						
28,889.-	- " -						
8,668.-	- " -						
25,007.-	- " -						

HQ Req. Ref.	Item No.	Qty.	Unit	Description
(1)	(2)	(3)	(4)	(5)
80/100	5	1	EA	SPLASH WATER TEST UNIT, SYSTEM WEISS, BASIC MODEL, TYPE: SWT 600/800 S/N 6580 COMPLETE WITH ACCESSORIES
	6	1	EA	DUST TEST UNIT, SYSTEM WEISS, TYPE: ST 750, S/N 6584 COMPLETE WITH ACCESSORIES
80/125	1	1	EA	TSS NO. 560 SMALL MIXING TEST ROLL COMPL.
80/170	1	1	EA	HIGH-VACUUM APPARATUS PUMP SYSTEM PD 170
80/133	1	1	EA	THERMOBALANCE METTLER TA-HE20 COMPLETE WITH ACCESSORIES
80/117	1	10	EA	WINDOW AIR-CONDITIONERS TYPE ALASKA 220V. MONO 50 P
80/84	1	1	EA	TSS NO. 515 CLASH-BERG TYPE TORSION FLEXIBILI TY TESTER COMPLETE
80/98	1	2	EA	"SHINKO SEIKI" BRAND VACUUM PUMPS MODEL NO. SVC-300
80/86	1	1	EA	AUTOCLAVE WITH MAGNETIC STIRRING
80/83	1-5	1	EA	CONDUCTIVITY METER TYPE PW9505/20 WITH ACCESS
80/73	1	1	EA	VAPOUR PRESSURE OSMOMETER COMPLETE WITH ACCESSORIES
80/89	1	1	EA	DISTILLING APPARATUS
	1	1	EA	DUROMETER
	1	1	EA	MELTING POINT APPARATUS
	1	1	EA	VISCOMETER
	1	1	EA	REFRACTOMETER
	2	1	EA	HUMIDITY METERS
	1	1	EA	DISTILLING APPARATUS

US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condi- tion	Qty. on hand	Remarks
		Qty.	M	Y			
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
21,421.-	15-0-01002						
11,700.-	- " -						
7,229.-	15-0-01003						
4,800.-	15-0-01004						
22,461.-	15-0-01020						
5,734.-	15-0-01029						
3,243.-	15-0-01091						
2,217.-	15-0-01092						
5,891.-	15-0-01093						
1,230.-	15-0-01094						
5,252.-	15-0-01095						
550.-	- " -						
1,586.-	- " -						
453.-	- " -						
1,521.-	- " -						
2,783.-	- " -						
345.-	- " -						
522.-	- " -						



HO Req. Ref.	Item No.	Qty.	Unit	Description
(1)	(2)	(3)	(4)	(5)
80/15	1	4	EA	01-10 LOWEL OMNI-LIGHT, 650W/220V + ONE DICHROIC FILTER AND FRAME
	2	4	EA	FLASH GUN WITH VARIABLE ANGLE OF EXPOSURE AUTOMATIC CONTROL OF LIGHTING OUTPUT EVA BLITZ ELECTRONIC FLASH MODEL 34S
	3	2	EA	LUCKY 3-DIAL ENLARGING TIMER
80/116	1	1	EA	LUCKY MODEL 90MC ENLARGER COMPLETE
80/116	1	1	EA	LUCKY MODEL 90MC ENLARGER COMPLETE
80/107	1	1	EA	MINIATURE SO2 SAMPLER
		1	EA	RECORDER/PROGRAMMER SO2
80/8	1	1	EA	TF2015 AM/FM SIGNAL GENERATOR CODE 52015- 015F WITH ACCESSORIES
80/138	1	1	EA	TYPE AG-4301 LCR METER
80/140	1	1	EA	TYPE NM-36 PSOPHOMETER
80/14	1	1	EA	TYPE GRN-3B WHITE NOISE GENERATOR
80/27	1	1	EA	BREAK-DOWN VOLTAGE TESTER, TYPE PGK COMPL.
80/54	1	1	EA	WENKING POTENTIOSTAT LT 78
	1.1	1	EA	SCANNING POTENTIOMETER SMP 72
	1.2	1	EA	VOLTAGE SCAN GENERATOR VSG 72
	1.3	1	EA	DOUBLE PULSE CONTROL GENERATOR DPC 72
80/54	1	1	EA	WENKING POTENTIOSTAT LT 78
	1.1	1	EA	SCANNING POTENTIOMETER SMP 72
	1.2	1	EA	VOLTAGE SCAN GENERATOR VSG 72
	1.3	1	EA	DOUBLE PULSE GENERATOR DPC 72
80/55	1	1	EA	CORROVIT UNIT FOR MEASURING CORROSION RATE
	1.1	1	EA	CORROSION STUDY CELL FOR ABOVE

US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condi- tion	Qty. on hand	Remarks
		Qty.	M	Y			
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
833.-	15-0-01124						
246.-	- " -						
120.-	- " -						
797.-	- " -						
797.-	15-0-01125						
1,442.-	15-0-01126						
1,502.-	- " -						
4,668.-	15-0-01130						
2,000.-	15-0-01134						
1,500.-	- " -						
1,720.-	- " -						
9,600.-	15-0-01135						
933.-	15-0-01137						
1,248.-	- " -						
1,210.-	- " -						
1,300.-	- " -						
933.-	15-0-01138						
1,248.-	- " -						
1,210.-	- " -						
1,300.-	- " -						
3,388.-	15-0-01157						
326.-	- " -						

NO Item Ref.	Item No.	Qty.	Unit	Description
(1)	(2)	(3)	(4)	(5)
80/57	1	1	EA	LABORATORY MIXER FOR FLUIDS 2 L. CAP. WITH ACCESSORIES
80/200	1	4	EA	REACTION APPARATUS DURAN 0972-060
80/57	1	2	EA	LABORATORY MIXER FOR FLUIDS 2 L, CAP. WITH ACCESSORIES
80/200	1	4	EA	REACTION APPARATUS DURAN 0972-060
80/77	1	1	SET	TR-10C DIELECTRIC MEASURING SET
		1	SET	TO-9 TYPE ENVIRONMENTAL CHAMBER
		1	SET	WBG-9 TYPE OSCILLATOR
		1	SET	BDA-9 TYPE BALANCE DETECTOR
		1	SET	SE-70 TYPE ELECTRODE
80/95	1	1	EA	TSS NO.519 SMALL HYDRAULIC TEST PRESS WITH COOLING DEVICE
80/53	1	1	EA	ERA DISCHARGE DETECTOR, MODEL 3, TYPE 562/
	1.1	1	EA	STEP WAVE GENERATOR AND ATTENUATOR
80/14P	1	1	EA	VEHICLE: TOYOTA LANDCRUISER STATION WAGON CHASSIS NO. <del>5K1-690001</del> FJ60-012774 ENGINE NO.: 2F-0535050 REG.NO.:
80/120	1	1	EA	MODEL TSS NO.291 SPECIMENT PUNCHING MACHINE
80/58	1	1	EA	DIPOLMETER DM 01
	1.1	1	EA	SPECIAL MEASURING CELL DFL 1
	1.2	1	EA	SPECIAL MEASURING CELL DFL 2
	1.3	1	EA	LIQUID MEASURING CELL MFL 1
	1.4	1	EA	DITTO MFL 2
	1.5	1	EA	DITTO MFL 3

US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condi- tion	Qty. on hand	Remarks
		Qty.	M	Y			
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
214.-	15-1-00264						
232.-	- " -						
429.-	15-1-00265						
232.-	- " -						
6,100.-	15-1-00352						
6,100.-	- " -						
1,697.-	- " -						
1,591.-	- " -						
1,007.-	- " -						
3,864.-	15-1-00355						
4,550.-	15-1-00361						
3,680.-	- " -						
7,575.-	15-1-00381						
1,477.-	15-1-00384						
6,250.-	15-1-00397						
677.-	- " -						
664.-	- " -						
310.-	- " -						
310.-	- " -						
310.-	- " -						

HQ Req. Ref.	Item No.	Qty.	Unit	Description	US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condi- tion	Qty. on hand	Remarks
							Qty.	M	Y			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
80/0	1	1	EA	SP2000 INFRARED SPECTOPHOTOMETER COMPLETE WITH ACCESSORIES	31,479.-	15-1-00406						
80/01	1-7			L/BORATORY CENTRIFUGE O317-100 STANDARD MODEL LE. COMPL. WITH STANDARD EQUIPMENT, TOOLS AND SPARE PARTS	6,407.-	15-1-00431						
80/40	50			APPARATUS FOR RAPID DETERMINATION OF THE POLY-DISPERSION OF POLYMER MIXTURES	24,230.-	15-1-00583						
81/1	1	2	EA	AIR COMPRESSORS : (TEST CHAMBER+TEST UNIT water)	1,757.-	15-1-00630						
80/121	1	1	EA	CENTRIFUGE MSE MINORS WITHOUT ROTOR	849.-	15-0-00910						
80/114	1	2	EA	PHOTOGRAPHIC CAMERA R4 FOR CINE FILM COMPL.	1,358.-	15-0-00911						
		1	EA	SUMMILUX-R 1:1.4/50MM LENS	515.-	- " -						
80/75	1	1	EA	25 L ALKYD RESIN PLANT, INDUCTION HEATER SYSTEM AND SPARE PARTS	53,119.-	15-1-00389						
81/1		2	EA	AIR COMPRESSORS	1,836.-	15-1-00630						
80/132	1	1	EA	UNIVERSAL PILOT PLANT TYPE UE 0.3 COMPLETE WITH PIPINGS AND SWITCH CABINET ASSEMBLED REACTOR WORKING CAPACITY 30 LITRES INFINITELY VARIABLE GEAR MULTICOLOUR POINT RECORDER EXPLOSION PROTECTION	57,924.-	15-1-00883						
82/2	1	8	EA	AIRCONDITIONER FOR WINDOW OR WALL MOUNTING TYPE O85C, 220V, 50 CYCLES	6,208.-	15-2-00431						
83/4	1	2	EA	PYE UNICAM 11010 HYDROGENERATOR	8,419.-	15-3-0667						
82/17	1	1	EA	VEHICLE: TOYOTA CROWN DELUXE SEDAN CHASSIS NO.: ED-244140 ENGINE NO.: 5M 3392052 REG.NO.:	5,902.-	15-3-00239						

HO Req. Ref.	Item No.	Qty.	Unit	Description
(1)	(2)	(3)	(4)	(5)
82/1		1	EA	PNEUMATIC PUMP
82/2		2	EA	THERMOSTATED CELL FOR CORROSION STUDIES
		1	EA	CYLINDRICAL SAMPLE CELL WITHOUT REF. ELEC TR.
		1	EA	GROUND JOINT 50x20 PLATINUM PLATE
82/3		8	EA	WINDOW AIR CONDITIONERS MODEL ALASKA 44220 - 2 CV 220 V. 50P
82/32	1	2	EA	MILLIVOLTMETER MV 60
	2	1	EA	DIGITAL MULTIMETER MCD. 3020
	3	1	EA	DIGITAL MULTIMETER MOD. 3030
	4	1	EA	1452-100 Large TOOL CABINET
	5	1	EA	1454-100 MICRO DRILL MOD. 20
	6	1	EA	1454-120 DRILL STAND
	7	1	EA	0418-005 OSCILLOSCOPE MOD. HM 103
	8	2	EA	MULTIMETER
	9	1	EA	INSULATION TESTER
	10	1	EA	MULTI RANGE WATTMETER
82/35	1	1	EA	0193-010 ANALYTICAL CUTTER MILL A10
82/11	1	1	EA	0463-015 SEMICONDUCTOR TESTER MODEL SEMITEST V-TGP WITH ACC
	2	1	EA	0461-005 HIGH-VOLTAGE TESTER MODEL UHP
82/15	6	2	EA	0068-320 Surface EVAPORATOR OF TRANSLUCENT SILICA ROTSIL
82/16	2	1	EA	0171-010 TEST SCREENING MACHINE JEL 200/80 WITH ACC.

US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condition	Qty. on hand	Remarks
		Qty.	M	Y			
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
2,269.-	15-2-00445						
834.-	15-2-01139						
807.-	- " -						
290.-	- " -						
4,099.-	15-2-01291						
735.-	15-2-01141						
235.-	- " -						
294.-	- " -						
1,248.-	- " -						
152.-	- " -						
83.-	- " -						
260.-	- " -						
521.-	- " -						
569.-	- " -						
467.-	- " -						
240.-	- " -						
972.-	15-2-01390						
1,349.-	- " -						
482.-	- " -						
708.-	- " -						

HQ Req. Ref.	Item No.	Qty.	Unit	Description	US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condi- tion	Qty. on hand	Remarks
							Qty.	M	Y			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
82/38	1	2	EA	"KONDO SCIENTIFIC MUFFLE FURNACE" MODEL 1002-2M	800.-	15-2-01323						
82/20	1	1	EA	"ANDO" ELECTRODE MODEL: SE-43 FOR TYPE TO-9	1,838.-	15-2-01138						
	2	1	EA	"ANDO" ELECTRODE MODEL: LE-21 FOR TYPE TO-9	409.-	- " -						
		2	EA	"ANDO" ADAPTOR MODEL; ADP-203	899.-	- " -						
	2.1	1	EA	"ANDO" ELECTRODE MODEL LE-22 FOR TYPE TO-9	409.-	- " -						
	3	1	EA	"ANDO" GC BOX MODEL YS-1	970.-	- " -						
82/5	3	2	EA	L-TYPE THERMOMETER RANGE -70 to +20 degr.c	60.-	15-3-00302						
		2	EA	- DITTO - RANGE +10 to +100degr.c	60.-	- " -						
82/40	1	1	EA	NO. 560 SMALL MIXING TEST ROLL	5,762.-	15-3-00204						
82/26	1	1	EA	GUARD POT. REGULATOR TYPE 2901	1,024.-	15-3-00269						
	3	1	EA	SHUNT TYPE 2902	1,918.-	- " -						
	4	1	EA	SHIELDED TRANSFORMER TYPE 7651	2,240.-	- " -						
	6	1	EA	PRECISION CURRENT INSTRUMENT TRANSFORMER Type 4732	3,524.-	- " -						
	9	1	EA	IONISATION FILTER TYPE 7345	1,111.-	- " -						
82/19	1	1	EA	XENON LAMP 150/1	345.-	15-3-00267						
82/37				COMPLETE SET OF THERMOMETERS NO. 00401	180.-	15-3-00259						
				COMPLETE SET OF THERMOMETERS No. 01799	490.-	- " -						
		1	EA	COOLING FAN NO. 11064	37.-	- " -						
		1	EA	ELECTRONIC UNIT COMPLETE NO. 01667	183.-	- " -						



HQ Req. Ref.	Item No.	Qty.	Unit	Description	US Dollar Equivalent	P.O./Shipping Advice Ref.	Received			Condi- tion	Qty. on hand	Remarks
							Qty.	M	Y			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
82/5	1	1	EA	EVENT MARKER	659.-	15-3-00303						
		1	EA	SENSOR SELECTOR	686.-	- " -						
		1	EA	IMPULSE MONITOR	659.-	- " -						
		1	EA	IMPULSE RATION SELECTOR	940.-	- " -						
82/13	14	1	EA	BAROMETRE TYPE FORTIN	571.-	15-3-00281						
		1	EA	MICROSCOPE LECTURE XZ PTI 2158	651.-	- " -						
82/8	2	1	EA	THERMOCONTROL BATH 55 P2 PRECISION 1/10 DEGR. C	590.-	15-3-00547						
82/34	1	2	EA	RECORDER A4-X-Y MODEL: 3022-11	3,800.-	- " -						
82/30	1	1	EA	GENERATOR MOD. TP 30/2G FOR IKA ULTRA- TURRAX T 45	123.-	15-3-00514						
		1	EA	GENERATOR MOD. T 30/3G	161.-	- " -						
		1	EA	THYRISTOR SPEED CONTROLLER TR 50	48.-	- " -						
83/5	1	1	EA	ERMA CONTACT ANGLE METER MODEL G-1 WITH STANDARD ACCESSORIES	2,286.-	15-3-00668						

Annex III  
FELLOWSHIP TRAINING PROGRAMME

<u>Name of fellow</u>	<u>Field of training</u>	<u>Host country</u>	<u>Date</u>	<u>Status of training</u>
Bui dac Sang Dao van Pho	Environmental testing	FRG CSSR	24 May-5 June 1981 6 June-8 August 1981	Completed
Vo Phien Le dang Anh	Protective materials	France GDR FRG GDR	25 oct.-5 Nov. 1981 6 Nov.-28 Nov. 1981 29 Nov.-12 Dec. 1981 13 Dec.-18 Dec. 1981	Completed
Vu dinh Cu Pham quang Du	Corrosion of metals	CSSR Sweden India	20 April-21 May 1982 22 May-1 June 1982 2 June-17 July 1982	Completed; new request made to UK
Nguyen viet Hue Bui trong Tai	Corrosion protection	Sweden	14 Nov. 1982-15 Jan. 1983	Completed
Le viet Hung	Physics of failure of electronic elements	CSSR	24 Dec. 1982-25 Feb. 1983	Completed
Huynh bach Rang	Development testing of plastics	FRG	24 Oct.-2 Dec. 1983	Confirmed
Le thi Luc	Development of new technical materials	FRG	8 April-24 May 1983	Confirmed
Nguyen nhi Tru Nguyen phung Vo	Corrosion of metals	GDR	Confirmed	
Dang duc Luong Pham ngog Linh	Development of glue materials	France	2 Nov.-24 Dec. 1982	Completed
Nguyen cao Thinh Hoang duc Quang	High voltage techniques High-voltage, heavy current testing of equipment	France	24 March-23 May 1982	Abroad

<u>Name of fellow</u>	<u>Field of training</u>	<u>Host country</u>
Nguyen khoa dieu Oanh	Reliability of electric elements	Bulgaria
Nguyen quang Tri	Corrosion testing methods	CSSR
Nguyen Quang	Development of new technical polymer materials	FRG
Vu thi Thanh	Thermal deterioration and stability of polymers	GDR
Dinh duc Nhuan	Technical climatology	CSSR
Vu dinh Cu Phan quang Du		UK
Nguyen Binh	Physio-chemical properties	GDR
Dao cong Minh	Paints and film-forming polymers	
Nguyen thanh Nhan	Development and testing of plastics	CSSR
Dang van Tho	Corrosion testing methods	
Dao thi Phu	Reliability of electronic elements	Hungary
Nguyen van Doi	Environmental testing and reliability	CSSR
Van ba Nam	Reliability of semi-conductors and integrated circuits under tropical climatic conditions	CSSR

DateStatus of training

25 Oct.-24 Dec. 1982

Completed

9 Jan.-13 March 1983

Completed

8 April-24 May 1983

FRG accepted 6 weeks  
training instead of  
two months

12 Feb.-11 April 1983

Abroad

9 Jan.-13 March 1983

Completed

30 Sept.-30 Oct. 1982

Completed

6 April-7 June 1983

Confirmed

Placement in USSR under  
consideration - pending

2 May-1 July 1983

Confirmed

Placement in USSR under  
consideration - pending

Confirmed

24 Dec. 1982-25 Feb. 1983

Completed

Confirmed

Annex IV

UNIDO EXPERTS

Chief technical adviser

B. Bartáková, Czechoslovakia

First mission: December 1980-June 1981

Establishment of secretariat, ordering of equipment, initiating contacts with industries, elaboration of plan of activities, lectures and consultancies, preparation of fellowships abroad (first part).

Second mission: January-July 1982

Ordering of last part of accessories and spare parts, establishing contacts with further industrial works in the south and with the Institute for Standardization, preparation of fellowships (second and third part).

Third mission: December 1982-May 1983

Co-operation with laboratory, four lectures for staff of the laboratory on tropic-proofing of electrical equipment, preparation of the final project report, lectures and consultations.

Expert in metallic material protection and corrosion testing

M. Prazak, Czechoslovakia

Duration of mission: 2 months (March-May 1981)

Training in the field of corrosion testing, protection of metals, assembly of equipment, mounting and putting into operation; consulting activities in factories and other organizations.

Expert in organic material deterioration

Z. Kubista, Czechoslovakia

Duration of mission: 2 months (March-May 1981)

Training in the field of organic protective coating, methods for determination of material ageing, consulting activities in factories and other institutions.

Expert in the utilization of indigenous materials for the production of tropic-proof materials

M. Ratzsch, German Democratic Republic

Duration of mission: 1 month (October-November 1981)

Training in exploitation of raw materials sources and utilization of by-products and agricultural and industrial wastes for the manufacture of different kinds of plastic materials; application of research results in pilot and full-scale production; research into problems of resistance of polymers to temperature, moisture, solar radiation etc., polymers as electrical insulating materials in tropical climates.

Expert in gel-liquid chromatography  
(I. Molnar, Federal Republic of Germany)

Duration of mission: 10 days (August 1982)

Installation of gel-liquid chromatograph for rapid analysis of high-molecular compounds, training in utilization of this equipment for determination of material properties.

Expert in and differential thermal analysis (DTA) equipment  
H. Lorenz, Switzerland

Duration of mission: 5 days (August 1982)

Installation and adjustment of thermobalance for DTA, training in utilization of this instrument.

Annex V

NATIONAL STAFF

<u>Post Title</u>	<u>Name</u>
A. <u>At Hanoi</u>	
Director of Institute for Tropical Technology, Hanoi (physicist)	Prof. Vu dinh Cu
National Director, co-ordinator and head of laboratory 3 (chemist)	Dr. Vo Phien
Leader of project, member of laboratory 2	Ing. Tran bich Thu
Head of laboratory 1 - corrosion of metals (chemist)	Dr. Nguyen viet Hue
Group leader - Corrosion of metals (chemist)	Ing. Don van Thu
Group leader - Corrosion of metals (chemist)	Ing. Nguyen phung Vo
Head of laboratory 2 - organic materials (physical chemist)	Dr. Tran thanh Son
Group leader, laboratory 2 (electr.)	Dr. Dang duc Luong
Group leader, laboratory 2 (physical chemist)	Ing. Nguyen thac Kim
Head of laboratory 3 - development of new technical materials	Dr. Vo Phien
Group leader, laboratory 3	Ing. Mai van Thanh
Group leader, laboratory 3	Ing. Ngo ke The
Head of laboratories 4 and 6, heavy-current electric environmental testing	Dr. Nguyen cao Thinh
Group leader - electrical testing	Ing. Nguyen thi Kim
Group leader - environmental testing	Ing. Nguyen duc Bao
Group leader - environmental testing device treatment	Ing. Bui duc Sang
Head of laboratory 5 - electronic	Ing. Nguyen duc Cuong
Group leader, laboratory 5	Ing. Nguyen dieu Oanh
Group leader, laboratory 5	Ing. Nguyen van Con

<u>Post Title</u>	<u>Name</u>
B. <u>At Ho Chi Minh City</u>	
Director of Institute for Tropical Technology (physical chemist)	Dr. Huynh bach Rang
Leader of project, member of laboratory 3	Ing. Ninh thanh Lich
Head of laboratory 1 - corrosion of metals (chemist)	Dr. Le dang Anh
Group leader, laboratory 1	Ing. Phan van Ba
Group leader, laboratory 1	Ing. Nguyen nhi Tru
Head of laboratory 2 - organic materials (electr.)	Dr. Mai xuan Quang
Group leader, laboratory 2	Ing. Dang van Tho
Head of laboratory 3 - development of new technical materials	Dr. Huynh bach Rang
Group leader, laboratory 3	Ing. Pham ngoc Linh
Group leader, laboratory 3	Ing. Ninh thanh Lich
Head of laboratory 5 - electronic	Dr. Nguyen van Doi
Group leader, laboratory 5	Ing. Le viet Hung
Head of environmental testing laboratory	Ing. Dao van Pho



Number and distribution of staff of ITTV

A. At Hanoi

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Laboratory	Research workers	Technicians and support staff	Total
1	18	4	22
2	22	11	33
3	21	11	32
4	9	7	16
5	13	5	18
Workshop	-	5	5
Pilot plant	4	2	6
	—	—	—
Total	88	45	122

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B. At Ho Chi Minh City

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Laboratory	Research workers	Technicians and support staff	Total
1	8	4	12
2	5	2	7
3	10	5	15
5	5	2	7
Group 1	2	1	3
Workshop	-	2	2
Pilot plant	6	4	10
	—	—	—
Total	36	20	56

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Annex VI

BODIES REPRESENTED ON THE COUNCIL OF TECHNICAL ADVISERS OF ITTV

Central Administration of Oil and Gas  
Corporation for non-ferrous metals and alloys  
Electric machine repair factory  
Factories of electric motors  
Factories of electronic components and devices  
Factory of cables and insulated wires  
Factory of lacquers and paint  
Factory of transformers  
General administration of Meteorology and Hydrology  
General Department for Standardization and Metrology  
General Department of the Telecommunication and Post Offices  
Hydro-meteorological station  
Institute of Chemical Industry  
Institute of Electrical Equipment Design and Construction  
Institute of Industrial Machinery Design and Construction  
Institute for Standardization at Hanoi and Ho Chi Minh City  
Institute of Transport Technology  
Ministry of Electrical Power and Coal  
Ministry of Foreign Trade  
Ministry of Health  
Ministry of Mechanical Engineering and Metallurgy  
Ministry of Transport  
Polytechnical Institute of Hanoi  
Research Institute of Telecommunication  
Service of electric power distribution of Hanoi  
State Committee for Science and Technology  
University of Hanoi

Annex VII

BILATERAL ASSISTANCE EXPERTS

Expert in atmospherical corrosion

F. Schultze, Netherlands

Duration of mission: 1 month (January 1981)

Training in theory of atmospherical corrosion and methods of metal protection.

Expert in atmospherical corrosion

N.U. Michajlovski, Union of Soviet Socialist Republics

Duration of mission: 1 month (October 1982)

Training in corrosion protection with specific reference to humid tropical climates. Presentation of results of research in USSR. Mechanism of corrosion inhibition in different environments.

Expert in surface finishing

J. Ráfl, Czechoslovakia

Duration of mission: 3 weeks (April 1981)

Training in surface finishing of metals. Solutions for pickling before metal-coating of steel and new ways of metal coating.

Expert in surface protection by organic material

J. Vrnata, Czechoslovakia

Duration of mission: 3 weeks (April 1981)

Training in surface protection of metals by organic coating. The properties of new types of laquers for outdoor application.

Annex VIII

TRAINING ABROAD - GOVERNMENT ACTION

Tran thanh Son	Deterioration of macro-molecular plastic materials. Methods for determination of material ageing. Testing of material properties (electrical, mechanical etc.) Composition of new plastic materials (polyamides). Czechoslovak Academy of Sciences, Institute for Macro-molecular Chemistry, Prague. 14 months, 1981-1982 (Czechoslovakia).
Dong van Thu	Corrosion of ferrous and non-ferrous metals; methods of corrosion rate determination; metallic and non-metallic protection of iron. 12 months, France.
Ngo ke The	Determination of properties of plastic-materials. Utilization of anti-oxydants and anti-ozodants for improving resistance of plastic materials against atmospherical ageing. 12 months, France.
Nguyen duc Bao	High-voltage testing of dielectrics. Environmental testing of material and electrical equipment under artificial and real conditions. Study of tropicalization measures in use. Visits to Skoda electro-technical factory (high-voltage generators, motors and transformers) and CKD Paha (electrical locomotives and trams). 6 months, Czechoslovakia.
Vu dinh Huy	Atmospherical corrosion of metals and alloys. Study of corrosion processes and mathematical analysis of them; relationship between corrosion mecharisms and atmospherical effects (humidity, temperature, pollution). Academy of Sciences, Moscow. 36 months, Union of Soviet Socialist Republics.
Nguven thac Kim	Determination of material deterioration by atmospherical effects. Utilization of DTA and other analytical methods. Academy of Sciences, Berlin. 12 months, German Democratic Republic.

Annex IX

RESEARCH AND DEVELOPMENT ACTIVITIES OF ITTV SCHEDULED  
FOR THE PERIOD 1981-1985 WITHIN THE FRAMEWORK OF STATE PROGRAMME NO. 4808

The list on the following pages contains the research activities to be supported financially by the Government with the participation of industry.

Besides these long-term activities, ITTV will also handle tasks of a shorter duration. Part of its capacity has been reserved for the actual cases of assistance to the industry such as consultations in the factories or in the laboratories of ITTV, the testing of samples, minor laboratory works etc.

The State plan of the research and development activities comprises general tasks as approved by the authorities. The plan is subject to precisioning and adjusting according to the capacities of the organizations to which the tasks have been delegated.

Based on results achieved so far, it may be anticipated that the five-year plan will be fulfilled by ITTV. However, it cannot be guaranteed that the results will be fully utilized as in a number of cases, the factories are not prepared for implementation from the technical point of view due to deficiencies of equipment and shortage of raw materials. These factors are not within the control and responsibility of the project and ITTV.

Description of activity	Aim of activity	Executing laboratory
Determination of the rate of corrosion of structural steel and of means for surface protection of such steel in the humid, tropical climate of Viet Nam	<p>Set up regulations and recommendations for:</p> <ul style="list-style-type: none"> <li>(a) The selection of appropriate means for steel surface protection;</li> <li>(b) Their optimal thickness and methods of application;</li> <li>(c) The choice of temporary protections during storage and transportation;</li> <li>(d) The selection of suitable grades of steel;</li> <li>(e) The importation of alloy steels.</li> </ul>	Laboratory 1 Hanoi
Compilation of an atlas (set of maps) of Viet Nam from the viewpoint of effects of tropical environment on technical equipment	<p>Provide information about the corrosion mechanism in various climatic zones of Viet Nam. The atlas will permit to:</p> <ul style="list-style-type: none"> <li>(a) Anticipate the degree of aggressiveness of conditions and the economical selection of appropriate means of protection;</li> <li>(b) Develop a policy for the construction of new factories with due regard to the character of the envisaged production.</li> </ul>	Laboratory 4 Hanoi
Research in the process and mechanism of deterioration of plastics and rubber materials in tropical climates. Finding ways of slowing down or eliminating the degradation of plastics and rubber materials	<p>Elaborate methods to increase the resistance of plastic and rubber materials to the effects of the tropical environment by:</p> <ul style="list-style-type: none"> <li>(a) Selecting suitable materials;</li> <li>(b) Developing of anti-oxidants and anti-corrosives from local sources;</li> <li>(c) Identifying of suitable fillers;</li> <li>(d) Elaborating of instructions for surface protection of organic materials;</li> <li>(e) Establishing regulations for the import of plastics;</li> <li>(f) Elaborating regulations for the development of plastic materials from local raw materials.</li> </ul>	Laboratory 2 Hanoi  Laboratory 2 Ho Chi Minh City

Description of activity	Aim of activity	Executing laboratory
<p>Research in thermal ageing (thermo-destruction and accelerated oxidation) of high-molecular materials by heat and light radiation. Selection of suitable thermal and light stabilizers (thermo-photo-stabilizers)</p>	<p>Find methods for the accelerated testing of efficiency of thermo- and photo-stabilizers in plastics.</p>	<p>Laboratory 2 Hanoi</p>
<p>Study the effects of solar radiation on the mechanical and other physical properties of polymers</p>	<p>Increase the resistance of electric cable sheathes to deterioration.</p>	<p>Laboratory 2 Hanoi</p>
<p>Develop varnishes, cements and compression moulding materials from local raw material sources (colophene, shellac, wood oils, rubber etc.) and the combination of local and imported raw materials</p>	<p>Develop the technology in a pilot plant, determine the suitability of new materials and investigate the possibility of substituting them for imported materials, especially phenol.</p>	<p>Laboratory 3 Hanoi  Laboratory 3 Ho Chi Minh City</p>
<p>Development of materials for the protection of the ship hulls against overgrowth with plankton and small animals, based on local natural resins and organic compounds of heavy metals</p>	<p>Elaborate the technological processes for (a) The production of organic compounds of heavy metals; (b) The modification of oil-alkyd- and other varnishes by means of organic compounds of heavy metals.</p>	<p>Laboratory 1 Ho Chi Minh City</p>
<p>Development of coating materials against corrosion, based on natural rubber (especially for highly corrosive environments in industrial, chemically-polluted areas)</p>	<p>Elaborate a production technology for varnishes and coating materials as corrosion protections on the basis of natural rubber.  Establish their pilot-plant production.</p>	<p>Laboratory 3 Hanoi</p>

Description of activity	Aim of activity	Executing laboratory
<p>Research in the effects of tropical conditions on electrical equipment and in ways of treating and protecting it.</p>	<p>Find causes for faultiness of electrical equipment.  Determine causes for reduced service life of electrical equipment by statistical analysis.  Elaboration of regulations for:  (a) The storage, operation, maintenance and repair of electrical equipment in tropical conditions;  (b) The production of electrical equipment in tropics, including material selection and technology.</p>	<p>Laboratory 4  Hanoi</p>
<p>Research in the reliability of electronic equipment and elements working under tropical conditions.</p>	<p>Determination of service lives of electronic elements under tropical conditions.  Elaborate methods for the protection of electronic equipment and elements in tropical climates.  Establish regulations for the selection of electronic equipment and elements intended for use in tropical zones.</p>	<p>Laboratory 5  Hanoi   Laboratory 5  Ho Chi Minh City</p>



Annex X

COMPLETED, CONTINUING AND PLANNED ACTIVITIES OF ITTV's LABORATORIES

A. Laboratory 1, Hanoi

1. Activities completed and applied in industry in the course of project realization

	Cost (million dong) borne by		
	Govern-	Industry	
		long-term	Immediate
Determination of corrosion rate of low-carbon steel and protective coating of this steel in eight atmospheric stations in order to find out optimal protection.	1.00		
Determination of the amount of salinity in various areas of Viet Nam and study of the effect of salinity on the corrosion process of different metals in order to transfer the basic information to industry.	0.50		
Determination of structure of the corrosion products on metals and alloys used in industry in order to find out the behaviour of these metals in a humid atmosphere. This research enables to determine the durability of mechanical parts made of these materials and the properties of corrosion layers.	0.10		
Temporary protection of low-carbon structural steel for Thang-long bridge. The protection is based on inhibitors.			0.10
In co-operation with bicycle factory at Hanoi protection of about 1,000 kg of different parts of steel by a coating combining Cu, Ni and Cr and of another 500 kg of steel parts was by Zn coating. The aim of this activity was to train technicians in industry in the use of improved technology of metal surface finishing.		0.20	
Application of the casein-cement coating developed in laboratory 1 for the protection of large structures, e.g. vessel's against corrosion. This coating is suitable for the marine atmosphere and sea water and is low in price as is made of local raw materials.	0.10	0.20	

Elaboration of optimal nitration procedure for oil and grease and its application in industry for temporary protection purpose. By this method the protective properties of oil and grease are considerably improved. 0.20 0.20

Introduction of a new method for temporary protection in highly-aggressive atmosphere by using nitrated oil in addition to different inhibitors available in Viet Nam. These oils are already made in pilot production.

Testing of rust stabilizers based on phosphoric acid, which were found to be unsuitable for highly humid atmosphere. 0.05

Establishment of laboratory regime and procedures for studying of electro-chemical properties of metals by using the new equipment delivered by UNIDO. 0.05

Elaboration of a steel-pickling procedure for surface preparation of metals and its introduction in two industrial plants. 0.05

Development of an efficient method for blackening of carbon steel surface as a cheap protection of mechanical parts and its introduction in industry. 0.50 0.01

Elaboration of phosphating procedures and their introduction in a motor-factory for the protection of rotor and stator sheets. 0.05 0.01

2. Continuing or new activities

Determination of the corrosion rates of different kinds of metal alloys and coats in various areas of Viet Nam in order to determine optimal protective abilities (kind of materials, thickness etc.). 1.00

Determination of distribution of chlorides content in marine atmosphere. 0.50

Measuring of SO<sub>2</sub> content in atmosphere, particularly in industrial areas.

Determination of corrosion causes of transistors produced in Viet Nam by imported technology and materials. 0.20

Development of protective oils extracted from local natural organic materials. 0.10 0.20

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B. Laboratory 2, Hanoi

1. Activities completed and applied in industry in the course of project realization

Research in degrading mechanisms and methods for the stabilization of PVC: 1.00

(a) Natural (atmospheric) test of PVC specimens;

(b) Accelerated degradation under thermal, humid and irradiated conditions.

All tests were carried out at the same time at Hanoi, Da nang and Ho Chi Minh City on 2,108 samples in order to determine the durability of material and the effect of stabilizers.

The following six methods were elaborated:

1. Method for the determination of HCl content and induction period.
2. Method for the determination of unsaturated and carbonyl groups.
3. Method for the determination of plasticizer content in industrial PVC specimens.
4. Method for atmospheric and accelerated tests and evaluation of degradation degree of PVC.
5. Method for the determination of the life time of some PVC products under thermal and photodegradations.
6. Method for structural determination of PVC specimens by X-rays and electronic reflex.

The following stabilizers for plastic materials were developed and experimentally produced (synthesized) in order to improved their durability in outdoor tropical conditions:

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(a) Stabilizers based on isocyanates (about 30 kg);

(b) Stabilizers based on all kinds of natural and hindered (substituted) phenols (about 30 kg);

(c) Stabilizers based on tin-organic materials (about 10 kg).

Those stabilizers were used in PVC compounds and tested under natural and accelerated conditions. The results of the tests showed that they are suitable and can substitute the imported materials.

All developed stabilizers will be produced in two plastic factories (the Hanoi Plastics Factory and the Hung Plastics Works), about 500 kg/year.

For the Post and Telecommunication Institute, insulating material based on PVC and PE (300 kg) for electrical wires and cables were tested in order to determine its properties and to forecast its durability in tropical conditions. 0.30

In co-operation with Hai Hung Plastics works the following problems were solved:

(a) Application of three kinds of stabilizers and antioxidants (about 30 kg) for PVC-films; 0.20

(b) Determination of stability of mechanical, thermal, electrical and photo properties of the factory's products; 0.20

(c) Application of 50 kg of high-quality glue for metal-rubber glueing. 0.30

The following problems were solved for the Institute for Scientific Information:

(a) Protection and storage of microfilms and microfiches; 0.20

(b) Measurement of D-parameter (photo-density) of microfilms and microfiches. 0.20

The following problems were solved in co-operation with the Centre for Development of leather manufacturing Development of suitable glue materials for humid climates 0.50

for joining leather to leather, rubber to rubber, plastic to plastic, leather to rubber, leather to plastic and rubber to plastic. Protection of leather against mold using evaporating fungicides.

For the film factory were developed: 0.20

(a) Method for protection of films against biological factors;

(b) Method for measurement of D-parameter.

For the Tho-Xuan district telecommunication system a method for improving the resistance of electrical insulators against high humidity was developed. 0.30

2. Continuing or new activities

Solving of the following problems in co-operation with CONTAP and other foreign trade companies:

(a) Testing and selecting of suitable plastic materials imported into Viet Nam for different industrial branches; 0.20

(b) Determination of the quality of PVC products concerning their durability under tropical conditions (local and imported products); 0.10

(c) Improving of the reliability of galvanization control system by better electrical insulation.

Execute the following tasks in co-operation with Hanoi Plastics Factory: 0,50

(a) Elaboration of methods for polyure-tan mass production;

(b) Synthesis of two catalysts to substitute the catalysts T-9 and A-1 from Japan; 2.00

(c) Synthesis of thermal stabilizers, photostabilizers and antioxydants for PVC films. 0.20

Treatment and regeneration of some products of the plastics factory.

0.20

Determination of the energy portion in important parts of the solar spectrum in Hanoi and Ho Chi Minh City in the course of several years in order to refine the method for testing plastics.

C. Laboratory 3, Hanoi

1. Activities completed and applied in industry in the course of project realization

|                                                                                                                                                                                                                                                                                                                                                                                 |      |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|
| <p>Insulating varnish for the impregnation of electric windings for insulation class B as the replacement of varnish RL-480 from GDR. The new Vietnamese varnish with trade mark APC-76, based on the alkyd-phenol resin, has been produced since 1981 on an industrial scale. The main results can be found in <u>Journal of Vietnamese Chemistry</u>, Nos. 1 and 4, 1978.</p> | 0.20 | 0.30 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|

|                                                                                                                                                                                                                                                                       |      |      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|
| <p>Varnish on the basis of ester-epoxy to protect printed circuit of electronic equipment. This varnish was produced at the lacquer factory Son Ton Hop at Hanoi. Some results have been described in <u>Journal of Vietnamese Chemistry</u>, Nos. 1 and 2, 1979.</p> | 0.30 | 0.20 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|

Varnish on the basis of Tung oil (wood oil), rubber-seed oil and colophene as insulating material for electrical steel. This varnish has been used as substitute of imported varnish No. 202 and is being produced by the Son Tong Hop lacquer factory. The results were published in Vietnamese Journal of Science and Technology, No. 9, 1978.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <p>Sealing compound on epoxide basis with SiO<sub>2</sub> addition to replace the bitumen compound of small transformers. It has proved to be the best sealing compound against high humidity, and has been produced since 1980 in the Bach Tuyet lacquer factory at Ho Chi Minh City and the So Dien factory of electrical supplies at Hanoi. The result can be found in <u>Vietnamese Journal of Science and Technology</u>, No. 10, 1978.</p> | 0.20 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|

|                                                                                                                                                                                                                                                                                                                                                                        |      |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|
| Humidity-resistant enamel for wires for electrical machines and transformer windings on an alkyd-epoxy-amine basis. The enamel is already applied in industry and the result was confirmed by the State Scientific Committee of Viet Nam. It was given Vietnamese patent No. 82-48-001, dated 31 December 1982.                                                        |      | 1.20 |
| Varnish for use in canning industry on the base of alkyd-epoxy and phenol-epoxy compo-site resins. The Bach Tuyet factory at Ho Chi Minh City produces now that varnish. The result has been published in <u>Vietnamese Journal of Science and Technology</u> , Nos. 3 and 4, 1981.                                                                                    | 0,40 | 0.50 |
| Lacquer for enamel on the basis of poly-vinylformaldehyde modified by cashew nut shell liquid (Cardanol). 200 kg of that lacquer were produced in the pilot plant.                                                                                                                                                                                                     | 0.50 |      |
| Varnish on the basis of cashew nut shell liquid and epoxide resin for use in chemical industry. It was produced in the pilot plant and is tested in a chemical factory. The varnish was described in <u>Journal of Vietnamese Chemistry</u> , Nos. 2 and 4, 1981.                                                                                                      | 0.60 | 0.20 |
| Coating for electronic components on the basis of cashew nut shell liquid, tung oil and dammar resin. This new coating was tested in many works for repair of electronic equipment. Since its properties are suitable for the Vietnamese climate, it was produced on a pilot scale. The results are published in <u>Journal of Vietnamese Chemistry</u> , No. 2, 1982. | 0.30 | 0.20 |
| Research in cyclicizing of natural rubber under various conditions as basic product for photoresistance and varnish, to resistant to glue and chemical effects. First results were published in <u>Journal of Vietnamese Chemistry</u> , No. 4, 1982 and No. 1, 1983.                                                                                                  | 0.20 |      |
| Research in coating materials for ships on the basis of an organo-tin compound and natural resins. Partial results were described in <u>Journal of Vietnamese Chemistry</u> , No. 2, 1980.                                                                                                                                                                             | 0.30 | 0.30 |

|                                                                                                                               |      |      |
|-------------------------------------------------------------------------------------------------------------------------------|------|------|
| Research in fillers for rubber factories on the basis of rice husk. The product is tested in the Xay Yen My factory at Hanoi. | 0.10 | 0.30 |
| Waterproof adhesive for wood-working industry on the basis of carbamide resins. 150 tons per year are produced.               |      | 0.50 |
| Improvement of imported varnishes for bicycle factory and wire factory.                                                       |      | 0.05 |
| Varnishes for toys for the export market.                                                                                     |      | 0.12 |
| Glue for application in the production of hats.                                                                               |      | 0.20 |
| Glue and varnish for use in the production of rackets and similar items for export.                                           |      | 0.30 |
| Production of epoxid-resin in small scale for mechanical and electrical industries.                                           |      | 0.50 |

D. Laboratory 4, Hanoi

1. Activities completed and applied in industry in the course of project realization

|                                                                                                                                                                                                                                                         |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Completion of 17 climato-technical maps of Viet Nam which enable uses to estimate the degree of aggressiveness of climatic conditions prevailing in various parts of Viet Nam and to choose the optimal measures for protection of technical equipment. | 1.00 |
| Elaboration of instructions for the production of tropic-proof motors and transformers. The new technology will be applied in the production of 150 000 motors per year with an output of up to 10 kW.                                                  | 0.30 |
| Elaboration of a method for the protection of high-voltage transformers against humidity. The transformer oil is covered by nitrogen and thus insulated against atmospheric humidity.                                                                   | 0.50 |
| Determination of the causes of failure of electrical equipment in 12 industrial plants. The elaborated instructions and measures for avoiding such failures were handed over to the industries concerned.                                               | 0.30 |



Elaboration of a new method for repair and drying of electrical motors in order to avoid the failures caused by humidity and to extend their life. 0.30

Elaboration of a method for testing the insulation of motor coils based on motor-tests with different models of stators. This method will be introduced in the Vietnamese system of standards.

Determination of humidity resistance of lacquers for the impregnation of electrical equipment imported from the German Democratic Republic. Their properties in humid tropical conditions were not known. The results were passed on to the electrical industry.

Investigation into microclimatic conditions in textil stores. Instructions for optimal air-conditioning were elaborated to avoid mold-grow on stored textiles. 0.3

Investigations into the climatic conditions (outdoors and in different spaces and rooms) in order to determine the degrees of aggressiveness. The conditions were divided into four groups according to their level of aggressiveness and instructions concerning maintenance and protection of technical equipment as well as recommendations for technology processes were elaborated for each of them. This basic information was handed over to the industry.

## 2. Continuing or new activities

Research in the resistance and atmospheric ageing of high-voltage insulators (glass and cement).

Development of a new insulating system based on local insulating materials for electrical motors and other electrical equipment in order to substitute part of the imported materials.

Elaboration of a procedure for determining and controlling the reliability and service life of electrical equipment. This includes the physical investigation

in industrial plants, collection of data, their classification and mathematical analysis. The aim of this systematic approach is to determine the actual service life of electrical equipment, its reliability and the causes of failure.

Accelerated atmospheric testing carried out for industry and other laboratories of ITTV (testing in high humidity, at high temperatures, salt spray tests, dust test, sunshine test, rain test and various combined tests).

Long-range investigations of outdoor atmosphere to determine the changes in atmospherical conditions in the surroundings of Hanoi (pollution etc.)

Completion and publishing of a set of technoclimatical maps of Viet Nam. The complete set will contain about 24 maps with classified atmospherical effects which affect the choice of technical equipment for laboratories.

Establishing and equipping the high-voltage laboratory and the laboratory for accelerated environmental testing mostly with equipment made available by UNIDO.

Erection of 15 atmospherical stations and their equipment with instruments for following up of atmospherical effects; stands and bases for tested samples.

E. Laboratory 5, Hanoi

1. Activities completed and applied in industry during project realization

Complex climatic tests of semi-conductor components. Two kinds of diods (made in Viet Nam and USSR) were tested for climatic resistance and reliability for  $9.76 \times 10^6$  hours. Results proved that both components are suitable for local conditions. The distribution function of failures follows the Weibull law. 0.40

Complex climatic tests of paper and polyester capacitors for  $6.38 \times 10^6$  hours (environmental and reliability tests). Test results showed that only capacitors with metallic enclosure are suitable in 0.40

humid conditions. The distribution function of failures follows the Weibull and exponential laws.

Both tests were carried out in natural as well as in artificial atmospheres which accelerated the effects of degradation.

Elaboration of a new technology for the production of transformers for electronic devices in order to increase their resistance and reliability in humid tropical conditions. 0.20

Elaboration of instructions for the protection of electronic devices against tropical effects, for imported as well as locally produced equipment. 0.50

2. Continuing or new activities

Testing of further locally-produced and imported electronic components in order to prove their properties and reliability in tropical conditions. The tests are carried out in natural as well as in artificial atmospheres. 0.50

Research in the reliability of integral circuits. Elaboration of testing methods and evaluation of results. 0.40

Elaboration of a draft national standard concerning the testing of electronic components and devices. 0.40

F. Laboratory 1, Ho Chi Minh City

1. Activities completed and applied in industry in the course of project realization

Formulation of a varnish with  $Cu_2O$  content for the protection of ship-hulls under the waterline and its pilot production (300 kg) by ITTV. A new electrochemical method was developed for the preparation of this  $Cu_2O$  pigment which constitutes an effective addition against depositing of small animals (shells etc.) and plankton. This task was requested by the Hau Giang Ship Repair Works. 0.10 0.05

The technology for galvanic protection of steel coated by Cu-Ni-Cr was improved. With the new technology better protective 0.10

properties for tropical conditions were obtained and it is also more economical concerning consumption of protective materials and electrochemical bath. Solution of this problem was requested by the Cuulong Bicycle Works.

Difficulties encountered by the Cuulong Bicycle Works in protective blackening of mechanical parts were studied and solutions found. 0.05

Improvement of the technology of phosphating of steel parts in repair shops for bicycles, motorcycles and cars at Ho Chi Minh City. 0.01

Improvement of the method of anodic oxydation of aluminium surface to increase the resistance in tropical conditions. The coloring "Alizarin" is used for this purpose and the requestor was the Automobile Repair Workshop, Ho Chi Minh City. 0.01

2. Continuing or new activities

Development of surface protection for steel by bright chromate zinc. This research was requested by the gas and petrol industry, Ho Chi Minh City, and the protection is designed for oil-boring equipment. 0.50

Determination of causes for corrosion of parts made of aluminium alloy which are affected by brake fluid in the automobile's brake system. 0.07

Investigation of deterioration and durability of different combined paints in sea water in the Vung-Tau area. 1.00

Investigation of optimal corrosion protection for oil-boring equipment 1.00

G. Laboratory 2, Ho Chi Minh City

1. Activities completed and applied in industry in the course of project implementation

Measurement of the following properties of polymers and rubbers in the course of ageing in order to determine

their resistance to tropical environments: viscosity, hardness, molecular weight, density, dielectric properties, elongation, compressibility, torsion and thermic properties.

Determination of the properties of ethylene-vinyl-acetate (EVA) polymers for medical instruments and other purposes in co-operation with the Factory for Medical Instruments. 0.10

All above-mentioned measurements were carried out under standardized conditions according to ISO.

Determination of mechanical and physical-chemical properties of materials, produced in Viet Nam or imported, exposed to atmospheric ageing (varnishes, impregnating agents, PVC and other macromolecular substances), for Cong ty Son Va chat cable manufacturing factory and for other factories at Ho Chi Minh City. 0.20

Investigation into the utilization of rubber waste for the production of material for pneumatic tires, in co-operation with a company for pneumatic tires' production at Ho Chi Minh City. 0.20 1.00

Testing of polyvinyl butyral (glue) membranes in order to compare the quality of imported and locally-produced materials. This glue material is used in the manufacture of car windows, and the task was solved in co-operation with a company producing glass for car windows. 0.01 2.00

2. Continuing or new activities

Testing and evaluation of rate and degree of deterioration of PVC tubes under accelerated atmospherical conditions. The tubes are designed for water conducts for fields, and the Binh Minh Polymer Company is co-operating. 0.10

H. Laboratory 3, Ho Chi Minh City

1. Activities completed and applied in industry in the course of project implementation

This laboratory developed the following materials and production methods:

|                                                                                                                                                                                                                                                                     |       |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|
| (a) A varnish on the basis of nitro-cellulose resisting to humidity;                                                                                                                                                                                                | 0.025 | 1.00 |
| (b) A varnish for the impregnation of electric materials based on ester-epoxy-styrene;                                                                                                                                                                              | 0.02  |      |
| (c) An epoxy varnish to protect electronic parts such as diodes, transistors etc. and shows excellent resistance against aggressive atmospheres. This material with suitable electrical properties was developed for Xi nghiep Lien hiep dien tu, Ho Chi Minh City; | 0.50  |      |
| (d) A method for hydrophilizing of polyamide for filters used for medical purposes, requested by a factory for medical instruments;                                                                                                                                 | 0.01  |      |
| (e) An adhesive for glass which is already used in the manufacture of car windows. It was requested by the company producing glass for car windows.                                                                                                                 | 0.20  | 0.5  |
| Recuperation of carbon black from rubber waste to produce a filler for rubber materials.                                                                                                                                                                            | 0.025 | 0.6  |
| Introduction of dimethyldichlorovinyl-phosphate (DDVP) insecticides into porous polymers. This product is designed to kill insects in rooms, and its effective durability is two months. It was developed for a medical station at Ho Chi Minh City.                | 0.50  |      |

2. New or continuing activities

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|------------------------------------------------------------------------------------------------------------------------------------------------|------|------|
| Development of fungicides for glasses, especially for optical glass suffering of mold attacks. Requested by a company for optical instruments. | 0.20 | 1.00 |
|------------------------------------------------------------------------------------------------------------------------------------------------|------|------|

I. Laboratory 5, Ho Chi Minh City

1. Activities and applied in industry during the project realization

|                                                                                                                                                                                      |      |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--|
| Testing and evaluation of reliability and tropic-proofness of two kinds of transistors (ST 301/303 and ST 601/603/605) produced in Viet Nam. The results showed that the transistors | 0.10 |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--|

which are produced in accordance to TCVN standards 3292-80 and 3293-80 and CCMEA standard CT-CEV 300-76, are suitable for tropical conditions. The tests were carried out for the Ban dan factory of semi-conductor devices, Hanoi.

Testing and evaluation of tropic-proofness and reliability of passive electronic components, resistors and ceramic capacitors produced in Viet Nam. This complex testing showed that these elements meet the demands of international standards IEC 62 and are suitable for tropical conditions. The tests were made for Binh Hoa electronic passive components plant. Both of the above-mentioned tests were carried out by accelerated testing methods according to IEC TC 50. 0.05

2. Continuing or new activities

Establishment of complex testing procedure to determine the operational life of transistors, diods, resistors and capacitors and testing of electrical elements produced in Viet Nam. 0.40

Elaboration of instructions and recommendations for accelerated reliability and environmental testing methods for electronic components with respect to international standards and local conditions in Viet Nam. 0.01

Elaboration of general instructions for the utilization and maintenance of electronic devices in tropical climates in order to maintain their reliability operation and increase their operational life. 0.01

Translation of international standards concerning electronic elements and equipment and adaptation of these standards to local conditions for the electronic industry. These standards will include testing of semi-conductors, transistors, micro-electronic elements and electronic devices. 0.01

Further building up of the electronics laboratory and completion of testing equipment for the above-mentioned purposes. The standard conditions of the room will permit parametric measurements. 0.20

