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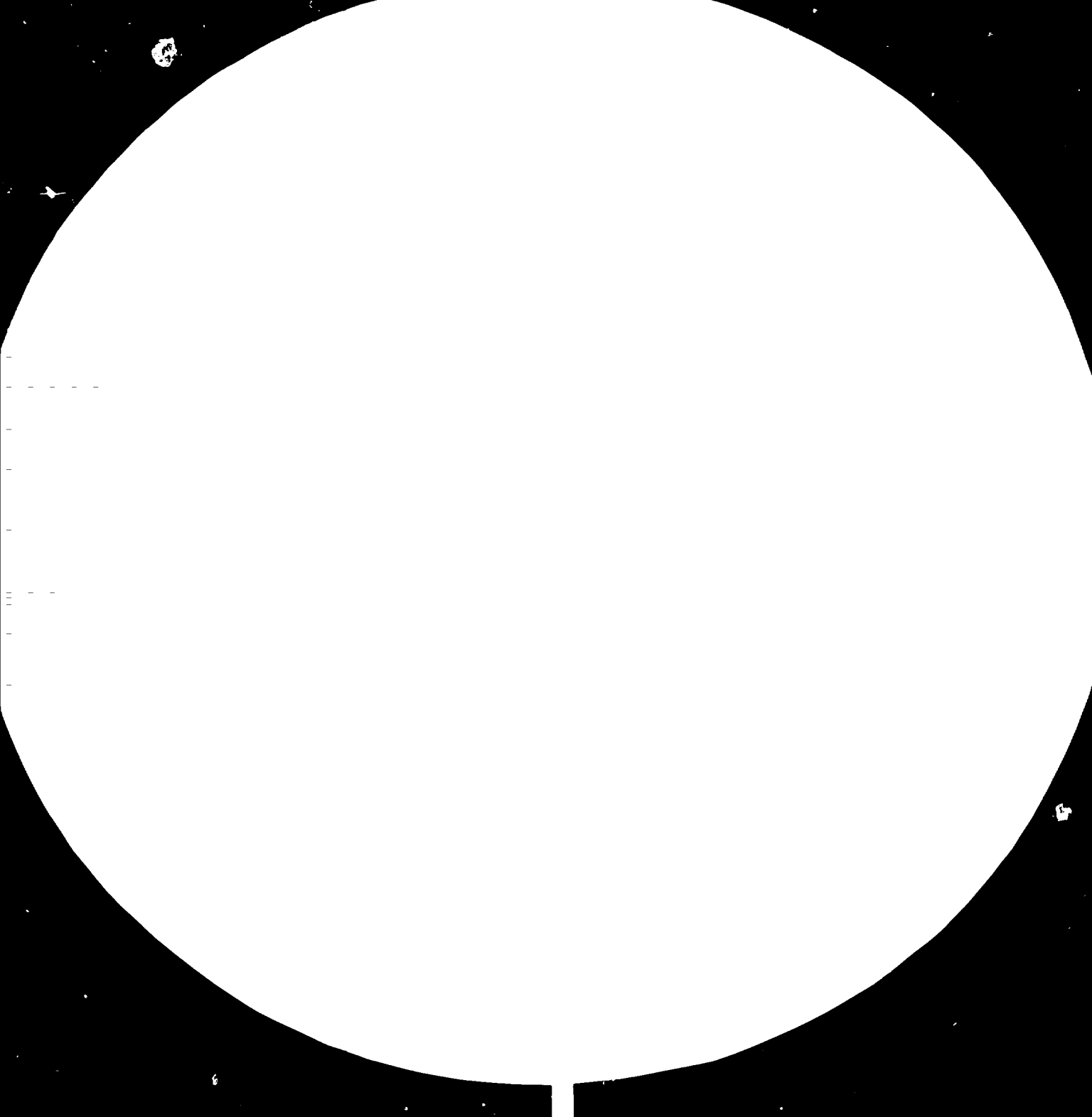
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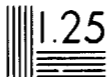
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AND QUALITY CONTROL

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VIETNAM

Terminal Report.

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

Based on the work of and prepared by
J. J. Cekiera
Chief Technical Adviser for the project

United Nations Industrial Development Organization

Vienna

This report has not been cleared with the United Nations Industrial Development Organization, which does not, therefore, necessarily share the views presented.

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1. INTRODUCTION AND BACKGROUND

1.1 Project Background

For the reconstruction and development of a national economy, the Socialist Republic of Viet Nam urgently needs to increase its export revenues to cover a larger part of the imported goods and services. It also has the strong parallel objective of improving consumer protection, by producing goods of higher quality for its people. To achieve those objectives, industrial production must be both efficient and able to meet quality demands for export markets, that impose increasingly stringent standards of acceptance.

The Government is well aware that the introduction of an accurate and correlated system of measurements, references and national standards is the principal precondition for the development and progress in industrial efficiency, national and international trade and commerce. Through the State Committee of Science and Technology and its agency General Department for Standardization, Metrology and Quality Control (GDSMQ), the Government is making efforts to improve the situation in this sphere in the country, by promulgation and enforcing the relevant legal statutes, by introduction of a unified organizational structure of the state agencies, institutions and departments responsible, and by co-ordination of their activities in standardization, metrology, quality inspection and quality testing.

Development of the GDSMQ's services to industry has been hampered by a lack of reference standards, high-precision measuring instruments, and properly equipped testing facilities for quality control and certification. These deficiencies are sharply evident in the southern provinces, where a high proportion of the country's light and consumer industry is concentrated, particularly in the Ho Chi Minh City area, where a large variety of machinery and equipment produced to different standards from different countries exist. The result was a technical chaos, poor manufacturing process control, ineffective use of equipment and materials and poor quality of products.

The Government therefore asked for UNDP assistance in the 1977-1981 Country Programme, to strengthen the former Institute for Standardization in Ho Chi Minh City, with its laboratories located in a modern building complex at Bien Hoa. The laboratory centre at Bien Hoa has been in existence since 1968 and, during the previous IPF period, received a modest amount of UNDP/UNIDO assistance, specifically for the laboratories for textile, chemistry and rubber. In 1976 a metrology laboratory was added to deal with length, mass, pressure and electricity. Equipment was needed to complete the various existing laboratories for standard measurements, calibration and testing, and to set up the new laboratories for construction materials, mechanical/metallurgical and cereals seeds.

A project formulation mission, Mr Hopper and Mr Talashov from UNIDO, had visited the country, foremost to ascertain the prerequisites, to make a feasibility assessment and to prepare a draft project document.

The project expectations were identified in correlation to the country's development objectives. The function, immediate objectives and the expected results, inputs and work programme have been outlined in a final version of the Project Document, signed by the three parties involved, i.e. Government, UNDP and the Executing Agency, on 21 November 1979.

Institution building was found to be a primary function of the project located in the Government sector of Science and Technology and sub-sector Industry. The State Committee of Science and Technology was selected as the Government Implementing Agency. The starting date of the project operations was indicated as September 1979 with a duration of two years, the Government input equal to 5.000.000 dong VN (in kind) and the UNDP input US\$1,115.00.

2. CONTRIBUTIONS

2.1 Subcontracting

In order to identify the needs of the various laboratories, to make recommendations for changes where necessary and to supervise the compilation of all equipment, the subcontract for a Consultancy on the Strengthening of the Metrology and Testing Centre has been awarded to the Cranfield Institute of Technology (CIT).

A.J. Scarr, the assignee, had paid two visits to Viet Nam. During the first visit from 7 -20 November 1979, general and detailed discussions were held, laboratory and industrial visits were arranged and the agreement on the equipment required for the laboratories had been reached.

To meet the UNIDO project budget limits, it was necessary to discuss the problem again and to establish priority lists for the equipment needed in each laboratory. These tasks were performed during the second visit to Viet Nam from 31 January - 7 February 1980.

The training programme for national staff was worked out and a detailed recommendation for modifying the laboratory was made by the subcontractor, and presented in his Final Report. Purchasing recommendations and requisition forms were supplemented afterwards.

The total value of the subcontractor's service amounted to US\$29,819.

3. EXPERTS

3.1 Agency personnel of the project consisted of the Chief Technical Adviser - Expert in Quality Control and Testing of Construction Materials, and five short-term consults/experts in the following areas:

- | | |
|-----------------------------|--|
| 1. POOS, L.E., Hungary | - Chemical and Food Testing Expert |
| 2. OHLON, R.R., Sweden | - Electrical Testing and Metrology Expert |
| 3. GOSH, A., India | - Mechanical Testing and Metrology Expert |
| 4. BANERJEE, S.K. India | - Textile and Paper Testing Expert |
| 5. WROBLEWSKI, K.E., Poland | - Consultant on Establishment of Testing Laboratories. |

3.1.2 Each short-term assignment is of a principal duration of two months focused on the installation of equipment, teaching in its use, and a general sharing of experience with the counterpart staff, mainly as specified in the respective job descriptions.

The scheduled and effective timing of the assignments is shown in the enclosed bar chart - Annex 4. The CTA arrived in Viet Nam on 24 April 1981, and after extensive briefings, introductions and meetings in Hanoi, arrived at the duty station in Ho Chi Minh City on 2 May 1981.

3.1.3 The Project Document considered as the basis for undertaking of activities in the field, and for the whole implementation process had been found out-of-date in scheduled timing and starting dates of various tasks. Field work was projected to start in September 1979, while veritabily started at the beginning of 1980. Ongoing overseas training programme, as well as the delivery of equipment and laboratory construction work were found to be delayed. The originally planned duration of the project that was intended to expire by August 1981, had to be extended, in primary assumption up to the end of 1981, and then by tripartite agreement recommended to be continued until the new phase would start, that actually meant the end of July 1982.

A generous and frield atmosphere accompanied by keen and sincere co-operation was offered to the CTA by the national personnel since the first days of his stay in Viet Name and is continued up to the present time.

National Personnel

| | |
|-----------------------|---|
| Mr. VAN TINH, | Director of Project, Deputy Director General of General Department for Standardization, Metrology and Quality Control. |
| Dr. NGUYEN HUU THIEN, | Director of the Centre III of General Department for Standardization, Metrology and Quality Control (Formerly called the Institute for Standardization) |
| Mr. NGUYEN VAN CHIEN, | Secretary of the Project |

Senior counterpart technical personnel represented by managing staff of the Centre III and the head of laboratory divisions, specialized in particular fields:

| | |
|----------------------|---|
| Dr. HUYNH VAN QUANG | Mechanical Metrology and Testing |
| Dr. NGUYEN NGOC THO | Electrical Testing, Air Conditioning Equipment Installation and Maintenance |
| Dr. DIEP NGOC SUONG | Chemical and Physio-Chemical Analyses |
| Mr. TRAN VAN DUNG BS | Construction Materials Testing |

| | | |
|----------------------|----|-------------------------------|
| Mr. MAI XUAN CANH | BS | Chemical Analyses and Testing |
| Mr. DUONG HIEN HE | BS | Textile and Paper Testing |
| Mr. NGUYEN XUAN HIEN | BS | Rubber Testing |
| Mrs. DO THI MAI | BS | Electrical Metrology |
| Mrs. LE CAM NHUNG | BS | Food Testing |

Financial Contributions

The UNDP input originally stated in Project Document, was subsequently corrected in the ensuing budget revisions to reflect actual yearly expenditures and adjustments in individual budget lines, and to cover the emerging necessities within the scope of a project programme, as follows:

| | | US\$ |
|-------|---|---------------------|
| (i) | Project budget code 'D' = Revised UNDP input | 1,119,565 |
| (ii) | Project budget code 'E' = Revised UNDP input approved on 24.11.1980 increase | 1,146,965 27,400 |
| | Revision reflected actual expenditures for the year 1979 | |
| (iii) | Project Budget code 'E' = Revised UNDP input drafted on 30.6.1981 increase/decrease | 1,146,965 nil |
| | Amended to: (a) extend post 11.06, Consultant on Establishment of Laboratories by 0.5 m/m | |
| | (b) decrease the equipment component by \$2900 to cover the cost of extending post 11.06 | |
| (iv) | Project Budget Code 'F' = Revised UNDP input advance authorization increase effective 21.8.1981 | 1,173,594 26,629 |
| | Amended to: (a) reflect actual 1980 expenditures as reported by UNIDO | |
| | (b) extend post 11.06, Consultant on Establishment of Laboratories by 0.5 m/m | |
| | (c) extend post 11.04 Mechanical Test- ing and Metrology Consultant by 0.5 m/m | |
| | (d) increase the training component by \$ 20,829 to complete courses accord- ing to plans | |
| (v) | Project Budget Code 'G' = Revised UNDP input signed on 21.12.1981 increase \$ | 1,175,394 1,800 |

US\$

Amended to: (a) reflect actual expenditure for
1980
(b) extend the services of the
Consultant post 11.02

| | | | | |
|------|--------------------------------------|---|--------------------|-----------|
| (vi) | Project Budget code 'H' | = | Revised UNDP input | 1,165,205 |
| | Mandatory Project Revision | | decrease | 10,189 |
| | 1982 approved 16.5.1982 | | | |
| | Rephase of the project to reflect | | | |
| | actual expenditure for the year 1981 | | | |

The Government in kind contribution was provided for the project in various forms of financial allocations, purchases, investments, supplies and services, that according to available financial records of the Centre III for the period of implementation up to 31 July 1982 amounted to:

| | |
|--|------------------------------------|
| - in equipment purchase and supply | 1,815,828 dong (518.808 US\$) |
| - in building construction, renovation, repairs, services | 1,100,606 dong (314,459 US\$) |
| - other: transportation, sundries | 715,326 dong (204.379 US\$) |
| | <hr/> |
| TOTAL: equipment buildings and others | 3,631,760 dong (1,037,646 US\$) |

Note: US dollars equivalent was counted in 1981
(first half of the year) exchange rate

II. PROJECT OBJECTIVES AND LOGICAL FRAMEWORK

A. Programme Objective

The logical framework of the project and the relationship among its design elements have been delineated in the Project Document. By provision of resources from both UNDP and the Government for the purpose of undertaking the specific activities determined in the Work Plan, the expected outputs were to be produced, and these were needed to achieve the immediate objectives. Project results were to be competently utilized to contribute effectively, towards the fulfilment of the higher-level development objectives to which the project is related.

The reason and justification for undertaking of the project, has already been outlined in the Introduction to this report. Long range sectorial objectives have been defined in the Project Document as follows:

"The country's development objectives, which are served by this project are:

- a) Increasing export potential through quality which matches the requirements of world markets.
- b) Providing greater consumer protection for the Vietnamese people through better quality and greater durability of indigenous products. (These two primary objectives are considered by the Government to hold parallel priority).
- c) Increase industrial rationalization and economy through the inherent virtues of applied standardization.
- d) Improve applied technology and research in Vietnam."

The above assertions denote that the programme goals toward which the efforts of the project had to be directed were the industrial associations, production outfits, and technology and research institutions. These organizations ought to be considered as expected indirect beneficiaries on which the changes, improvements and the project impact is being sought. The ultimate direct beneficiary is to be the population, the Vietnamese domestic consumers, for whom the greater protection and improvements in the economy are being pursued.

B. Project Objectives and Function

As it has already been mentioned, the primary function of the project is an institution building one. In conformity with this function, the Project Document stipulates the following immediate objectives:

- a) "To supplement and improve the capability of existing laboratories for food technology, light industrial products and electrical and electronics and for metrology at Bien Hoa to enable them to offer the widest assistance to a broad range of industries in 15 southern provinces in establishing efficient quality control. A service for standards, metrology and quality control was established in Hanoi from 1963 and the institute has published over 2600 standards since that date. The laboratories are reasonably well equipped and certain reference measurement standards are held. It is clear, however, that those laboratories cannot contribute much to the development of the 15 southern provinces by virtue of the distances involved and the immediacy of factory/laboratory integration.
- b) To establish newly equipped laboratories for the purpose outlined above and in particular for those industries which are of central importance in achieving the country's economic objectives, namely construction materials, mechanical/metallurgical and cereal seeds.
- c) To train qualified staff in contemporary product testing procedures.
- d) To afford management officials the opportunity of studying successful certification and quality control procedures in other developing countries and in the sophisticated laboratories of highly industrialized nations.
- e) To improve the integration of effort between the Institute, industry, the universities and associated and participating external Government bodies.
- f) To establish the Bien Hoa laboratories of the Institute of Standardization in Ho Chi Minh City as an important reference centre and control organization in the export and consumer protection drive of southern industry."

The statement of immediate objectives above, reflects the functional emphasis of the project, that is to strengthen the capacity of the institution, formerly called the Institute for Standardization in Ho Chi Minh City, and at present General Department for Standardization, Metrology and Quality Control - Centre III, in the following key aspects:

- extend the programme of activities to produce the outputs in development and application of standards, in quality testing, inspection and standard measurement services provided to a range of industries in the south of the country;

- increase the physical resources of the Centre III by extension of its laboratory complex at Bien Hoa through the procurement of equipment to the existing laboratories, and setting up the new laboratory sections as stated above;
- ameliorate and upgrade the human resources by provision of different kinds of training opportunities, including overseas fellowships and study tours;
- improve the organizational structure and management of the Centre III by greater involvement in the integration with industry, educational and research institutions, state administration departments, and provincial committees for science and technology.

III PROJECT ACTIVITIES AND OUTPUTS PRODUCED

A. Work Programme Outline

Project activities determined in the Work Plan have been developed on the base of those defined in the Project Document. The necessary alterations and corrections in scope and time were introduced, and a final version set out in an abbreviated form as a schedule and bar-chart diagram annexed to the Preliminary Report by the CTA of 22 May 1981. Activities identified and enumerated in the Work Plan encompass the following groups of problems:

- a) Establishment of metrology and testing facilities of the Centre III in Ho Chi Minh City, with a complex of laboratories called Metrology and Testing Centre (MTC) at Bien Hoa, by supply and installation of laboratory equipment and initial training in operation.
- b) Compilation, review and study of the standard specifications for testing, measurements and calibration; selection and adaptation of methods; introduction and development of new procedures.
- c) Training conducted by international experts on-the-job, on work study sessions, short-term courses, lectures and seminars, in standard and new advanced testing and measurement techniques.
- d) Development of industrial services, dissemination of knowledge and experiences, diffusion of standards and technical information.
- e) Extension of quality supervision and national quality certification system.

Originally, the project activities were scheduled optimistically in time and were intended to be completed by the end of 1981. The second phase of the project was forecasted to be initiated at the beginning of 1982. However, in view of a more prolonged process than previously foreseen for equipment delivery and for fielding the experts, and more time needed for training and development of industrial services, it was recommended and agreed by the Tripartite Monitoring

Review held in November 1981, that the project activities would continue throughout the next few months of 1982 until the new phase of the project planned for May would start.

B. Analytical Account of Activities

1. Establishment of metrology and testing facilities

1.1 Planning, construction and arrangement

Before the CTA's arrival in the field at the beginning of May 1981, some activities defined in the Project Document had already been started and two of them were nearly completed, i.e.:

- the drawing up of detailed requirements and ordering of equipment needed for each laboratory;
- the determination of particular requirements in terms of environmental control for new laboratories.

The following two were continued:

- construction of new laboratory building for the civil engineering materials testing;
- staff training on overseas fellowships.

Project implementation was found to be delayed generally of about six months in relation to the amended programme outlined by the subcontractor's Final Report (Cranfield Institute of Technology).

Activities carried on under CTA co-ordination and in joint CTA/NPD close co-operation commenced with a review of existing plans and proposals. The preparation of thorough functional planning for each laboratory was then carried out. This job was followed by the reconstruction and rearrangements, by inspection and installation of new laboratory equipment, and by initial training in operation. A considerable extent of planning and construction work was executed to convert the existing rooms into a complex of metrology laboratories. The tasks performed included: design, fabrication and installation of air ducts, erection of foundations and external sheds for cooling units, installation of suspended ceilings, electric power supply mains, wiring distributions, water supply and discharge, partitions with joinery, thermal insulation of walls and

ceilings. Air conditioning units were then installed and put into operation.

New metrology instruments have been placed and arranged in each of the following laboratory sub-divisions:

- Geometric dimensions: length, angle, surface finish, straightness and flatness;
- Mechanical and Physical parameters: mass, force, hardness
- Physio-chemical and Thermodynamic parameters: specific gravity and density, viscosity, pH, pressure volume and flow;
- Electrical and Temperature parameters: AC and DC current, potential, power, impedance, transformers, voltage, attenuation, distortion, noise.

Training programmes for metrology were prepared and subsequently implemented by mechanical metrology expert, and by the electrical and temperature metrology expert afterwards.

Construction and finishing works were next completed for the civil engineering materials testing laboratory. A detailed plan of the laboratory arrangement was prepared by the CTA, and the installation of equipment was carried out. This was followed by the engagement of new personnel and the initiation of training and trial testing programmes.

For chemical and food testing laboratories, considerable rearrangements and extensions were made according to the plans prepared on-the-spot. New benches and partitions were erected, fume hoods, air coolers and ventilators installed and chemical stores were arranged in a separate building.

In the mechanical laboratory, a new adaptation plan had been prepared at first and then existing room-space subdivided by partitions, and furnished with electrical and water lines, air conditioning, benches and ancillaries. The laboratory was arranged in three separate functional sections: for destructive testing, non-destructive testing and samples preparation room.

The chemical testing expert and mechanical metrology and testing expert had subsequently arrived in the field, to participate and advise on the further installation of equipment and to conduct their specific training programmes for the staff, according to the earlier prepared curriculums.

A similar type of work comprising the restoration of existing rooms, enlargement in furniture, building services and improvement of the functional layout was executed for the light industry (textile, paper, paint and rubber) testing laboratory, before the new equipment was set up and put into operation.

The electrical and electronic testing laboratory was arranged in a new building constructed for the project (see enclosed plan - Annex 8), accommodating also the civil engineering testing laboratory, maintenance and service rooms and space for future extension. A special chamber was erected in one of the electrical laboratory rooms for the standard output and performance testing of the ceiling fans.

The electrical metrology and testing expert arrived in the field for his short-term mission in October 1981 and the textile and paper testing expert in January 1982. The terms of references for these experts was prepared by the CTA in advance and detailed work plans were formulated at the outset of their missions. These aids were agreed and adjusted in the discussion which took place, in which the national Project Director and counterparts participated.

A new laboratory for electrical metrology has been located in the main office building in Ho Chi Minh City. The main reasons for this localization were: organizational and functional convenience for the staff involved and for management, proximity to the objects of the service rendered, and suitable spacious rooms being available. The construction work was executed for the conversion of the existing rooms into a laboratory before the precision electrical/electronic metrology instruments were set up, it included: erection of new thermally insulated partitions, suspended ceilings, installation of locally made air conditioning, insulated air ducts, electrical power supply lines, lighting system, finishing works and furniture.

1.2 Installation of equipment

The following main items of the new equipment delivered to the project were installed in the laboratories:

- i) About 20 different types of electrical/electronic precision metrology instruments from Sullivan have been added to existing stocks, to increase the range and accuracy of the electrical measurements and calibration. Two separate sets of instruments for temperature metrology from Land Pyrometer: (1) for calibration of thermocouples and (2) for calibration of visual pyrometers, have been received and installed, enabling the commencement of verifications of high temperature range instruments used in industry.
- ii) In the light industries materials testing laboratory, the new advanced instruments like Weatherometer, Hunterlab Colorimeter, Wash-weel, Light Fastness Tester, Comb Sorter, Presley Index Tester, Yarn Friction Tester, Crimp Rigidity Tester were set up and engaged in testing operations, remarkably extending the range of tests performed for fibres, yarns, textiles, paints and coloured materials. In the rubber testing section, the Relaxed Modulus Tester, Abrasion Tester, Buffing Machine, Double Rolls Mill were added to the existing apparatus, resulting in an amelioration of working capabilities of the section.
- iii) The newly established civil engineering laboratory has been equipped with a large variety of machines and instruments for cement testing, physical and mechanical testing of aggregates, ceramics and concretes, and abesto-cement products, for compressive, tensile and flexural strength tests of the above materials and for samples preparation: cutting, crushing, mixing, storing, curing and vibrating.

Some of the attachments and bearers lacking certain flexural and compressive tests were designed by the CTA and fabricated on the spot in the project workshop.
- iv) A series of instruments were added to in the mechanical and metallurgical laboratory, the most important being: (1) set of instruments for ultrasonic and magnetic non-destructive tests like Thickness Gauge Tester, Ultrasonic Flaw Detector, Eddy Current Instrument, Magnetic Particles Tester, (2) Salt Spray Cabinet for metallic coating tests (3) instruments for the preparation of specimens like Metallurgical Mounting Press, Abrasive Wheel Cutter and Bolt Surfacer.
- v) In physio-chemical laboratory, two of the most advanced and sophisticated analytical instruments from Pye Unica have been installed, i.e. Atomic Absorption Spectrophotometer and Gas Chromatograph. After a training period the AAS was applied in the first instance to the determination of heavy metals contamination in foodstuffs and canned fruit products, and then to the analysis of metal alloys. The Gas Chromatograph has been applied to the analysis of alcohols. In the next phase of the project, after supplying more hollow cathode lamps for the AAS, more columns for the GLC and more standard chemicals and other accessories for both, the application of the instruments will be extended, and in particular the GLC on analysis of fatty acid composition of vegetable oils.

A Flame photometer has also been installed in this section and applied in analytical methods of the determination of sodium, potassium, barium and lithium in testing of chemical composition of mineral silicates.

- vi) The testing capability of the chemical laboratory has been extended by the procurement and setting up of a number of instruments, most of them presenting the latest technical advances and performance.

A Sulphur Analyser System consisting of a high temperature tube furnace, analyser module, reagent rack assembly and inlet manifold assembly offers a level of performance that employs unique titration technique combined with an integral pre-programmed microprocessor, permitting for the fast, simple and accurate measurement of sulphur content in fossil fuels. It is foreseen that it will be applied to a greater extent in fuel oil tests for the developing national oil company.

A Calorimeter from Gallenkamp, Pensky-Martons Flashpoint Apparatus for determination of flashing points of petroleum products, Freezing point apparatus for liquid solutions, Melting Point Apparatus, Universal Torsion Viscometer, Orsat Gas Analyser, Bi-Distillation Water Still, Flow Meter Kit and Mufflo Furnaco are among the instruments disposed to this section.

However, certain of these valuable instruments so far have not been utilized, because the supply was incomplete and some accessories are still missing.

- vii) In the food testing section a series of new apparatuses have been added and brought into function to increase the efficiency of the work and the variety of tests performed. These are: Turbidimeter, Speedy Moisture Tester for the determination of moisture content in ground products, Moisture Meter Grainmaster, Steam Generator, Moisture Determination Balance, Levibond Tintometer for the examination and measurement of coloured materials, either liquid or solid by transmitted or reflected light. Combined digestion and distillation Kjeldahl System with blower fan, ejector and trunking, was assembled in the laboratory room to facilitate and speed up the test operations. A Colony Counter from Gallenkamp with digital reagent fluorescent illumination and provision for light and dark viewing enables accurate and easy direct contact and in closed dishes counting of bacterial and mould colonies in microbiological analyses.

More glassware, utensils and accessories like burners, crucibles, spatulas, stirring bars, funnels, inoculating needles etc., have been added to the chemical, microbiology and food testing sections to cover the currently extended working capacities and to provide the necessary minimum reserve for the immediate future work.

- viii) Four sections of the metrology laboratories have been equipped with a series of sets or individual measuring standard tools and instruments some of them of highest level of performance and accuracy. The main items are:

- In the length metrology section: Universal Measuring Machine, Talysurf, Autocollimator, length bars, block levels, straight edges and angle gauges, surface roughness standard blocks, micrometers, gauges, calipers, indicators.

- In the mechanical and physical parameters section: two sets of standard weights class E₂ and F₁, precision balances hardness blocks, impact test gauges, set of proving rings, set of load measuring rings, load column.
- In the physio-chemical and thermodynamic parameters section: viscosity bath, Canon-Fonsko and U-tube viscometers, standard viscosity fluids, pH meters, set of standard volume burettes, set of dead weight pressure gauge testers, set of pressure gauges.
- In the electrical parameters section: AC standard resistors, Standard cell bank, AC oscillator, DC potentiometer, AC detector, DC null detector Megohmmeter, Precision decade bridge, Precision inductive voltage divider, Ration transformer, Ammeter, Voltmeter, AC Test set, Kelvin/Wheatstone bridge, DC voltage calibrator.

The actual list of the equipment received for the whole project is attached to this report as Annex 6.

2. Compilation, review and study of standard specifications

In order to the engage the various types of instruments and machines delivered to the project, in testing and measurements operations, and to increase and upgrade the working capabilities of the extended and re-equipped laboratories, the proper testing methods had to be searched for and selected at first, on the basis of review and thorough study of recommended and currently available standard specifications. The work performed in this scope involved:

- Compilation of relevant technical literature, different kinds of standards documents, instructions and recommendations;
- comparison and verification of methods, preparation and adaptation of new prodecures;
- introduction and development of new testing and measurement techniques.

These tasks were carried out in all laboratories in largely diversified forms, focusing on various specific problems, the main ones of which are outlined below.

- i) A list of principal publications and standard specifications of the International Electrotechnical Commission (IEC), International Organization for Standardization (ISO) and Organization Internationale de Metrologie Légale (OIML), recommended for adaptation and use in electrical measurements and calibration work was prepared by the expert. The accumulation of these standards was undertaken by the library of the Centre III from different available sources, by the international experts and by professional contacts abroad.

Most of the principal specifications for metrological work, namely the set of OIML Recommendations were also acquired, subsequently reviewed and acceded to practical applications in calibration work, primarily for length and mass metrology.

- ii) In force measurements, two standard methods for the load verification of testing machines have been trained and practised on the calibration of 2000 KN Compression, Flexural and Transverse Testing Machine in the civil engineering laboratory, namely: BS1610 method, with (1) Constant true load procedure, (2) Constant indicated load procedure, and ASTM E4-64 method.

For physio-chemical parameters and in particular for the determination of the viscosity of liquids, BS188 : 1957 methods with glass capillary Canon-Fonsko and U-tube viscometers were adapted in laboratory work and verified with Deutche Normen designations DIN 51550 and 51562.

- iii) In the civil engineering materials testing laboratory extensive study of disparate standard specifications in the field of asbestos and asbestocement products had to be performed before the introduction of a proper method into laboratory practice. In the absence of Vietnamese standards, the others, national and international, like ISO, BS, ASTM, AFNOR, GOST, ISI, DIN and Korean were thoroughly examined in order to select and adapt the most suitable methods of testing.

For cement testing, AFNOR, BS, GOST and ASTM methods were reviewed and ASTM mainly being parallel to the national Vietnamese standards were accepted into practice for a reason of equipment being at disposal. In ceramic testing, national domestic specifications were adapted easily, except for new products, where alternative procedures had to be searched for. A study of the problem of the introduction of uniform standards and material for cement and mortar testing was undertaken in order to obtain more comparable and reproducible results in different laboratories throughout the country.

- iv) Several new standard specifications and testing procedures have been developed in the mechanical laboratory and these are the following: (1) for saltspray testing, national standard method was combined with ASTM B117, (2) for magnetic and ultrasonic flaw detections foreign standard methods were adapted, principally the recommendations of JIS (Japanese Industrial Standards) and ASTM E109 for dry method and E138 for wet method of magnetic detection, and E114 for reflection method of ultrasonic detection, (3) for fatigue test DIN and ASTM standards as the most suitable to the apparatus possessed had been studied and then a simplified method adapted into practice.
- v) In the rubber section of the light industries testing laboratory a selection of ISO standards and recommendations were prepared and studied. However, many of these documents were not available at the time and the laboratory suffers a shortage of equipment, so it has been rather difficult to implement any outstanding progress in this field.

In textile testing, colorimetric methods were particularly emphasized and applied with wash and light colour fastness instruments and Hunterlab Colormeter. Colour measurements in different scales: (1) CIE X.Y.Z.; (2) Hunter L, a,b; (3) CIE 1976; (4) Y, x, y; (5) Grey scale BS2662, were practised and few kinds of optical determinations like colour differences the blue reflectance, the whiteness index and yellowness index of white materials, the opacity tests, initiated. For the determination of resistance

to weathering and multiple aging deterioration by accelerated method with Weatherometer, federal standards and JIS L 1073 - 1965 were found to be applicable and most suitable.

- vi) In the food testing laboratory new methods were examined for the determination of toxic contamination of foodstuffs, vitamins by thin layer chromatograph and other alternative procedures. Laboratory standards methods for milk and butter tests were actually worked out and adapted.
- vii) As a general approach in any new application, Vietnamese national standard specifications were usually studied and adopted at first where available. Then ISO standards and recommendations were referred to if local ones did not cover the subject entirely or satisfactorily. When both kinds of standards were not available or unsuitable to the equipment possessed, certain other international recommendations like IEC, OIML, or foreign national but internationally recognized standard specifications have been followed.

3. Training

The training component was implemented in the project in two general forms: (1) by overseas fellowships and study tours, and (2) as a local in-service training, conducted by international experts and their national counterparts.

3.1 According to the Project Document the overall overseas training programme consisted of:

- senior management level study tour
- training programme on metrology
- training programme in laboratory testing, and
- training in maintenance of laboratory equipment and repair.

The total originally specified training, included international seminars and workshops and amounted to 60 man-months. A detailed disposition of the subjects set out in the Project Document had not quite been adequately planned to the needs of the project. It was subsequently corrected in duration to 50 man-months, and accomplished as follows:

- i) Study tours: duration 1.5 months, 4 participants, total 6 man-months, France - one week; Sweden - three weeks; India - two weeks; completed on 24 November 1980.
- ii) Training on metrology: duration 4 months for 5 persons, total 20 man-months, Czechoslovakia - three months; GDR - one month; ended on 6 February 1981.
- iii) Training in laboratory testing: planned duration 4 months for 4 persons, total 16 man-months, but implemented 4 months for 3 persons

and 3 months for 1 person, total 15 man-months. Czechoslovakia - nineman-months; GDR - six man-months. Training period started in May 1981 and ended in February 1982.

- iv) Training in maintenance of laboratory equipment and repair: planned duration 3 months for 2 persons and 2 months for 1 person, total duration 8 man-months, but implemented 2.5 months for 2 persons and 2 months for 1 person, total 7 man-months in the U.K., started in May 1981 and ended in July 1981.

The results of the study tour and participants' observations have been presented in a joint report. The fellowship trainees have elaborated their own individual reports, certain of them in consultation with the CTA, that were transmitted successively to UNIDO, Vienna.

Four fellowships for testing training were retarded in time, because of the transitional shortage of funds in the project budget line 30. The total training component has been shortened by two man-months in comparison to the planned 50 months. As a whole, twelve persons from the project national staff have passed their 2 - 4 months training abroad and four other persons participated in overseas study tours. A list of participants and details are given in the enclosed form "Fellowships" as Annex 1.

3.2 Local in-service training activities were conducted on the project by UNIDO experts and their national counterparts, consisting of training courses, on-the-job training sessions, lessons, lectures and seminars.

During project operations, the training was concentrated on various testing and metrology problems in different times, respectively to the presence of the branch expert involved. In the remaining periods training and practice was continued, guided by counterparts and laboratory personnel in charge, advised and periodically instructed by the CTA.

- i) Training in diverser aspects of the installation problems, of the operation and maintenance of the air conditioning system was carried out following the circumstantial plan - "Counterpart Personnel Training Programme" - elaborated by the Consultant. A technical instruction manual designated "Installation, operation and maintenance instruction for air conditioning equipment in Metrology Laboratories" was prepared by the Consultant to help to explain the sophistication of the system. It served as a working aid for training and operation.

The following specific points were covered in the programme:

- description and technical data of the air conditioning system and its components: cooling units, steam humidifiers, electric control panel, duct-mounted electric heaters, perforated suspended ceiling, room humidistats, room temperature detectors, and air re-circulation ducts.
- installation requirements, succession and procedures.
- operation principles and instructions: setting up the system, starting and stopping the system, procedure for setting the new system going, working recommendations.
- maintenance requirements and instructions.

ii) Training in the field of chemical and food testing conducted by the Expert was based on previously discussed and formulated programmes, worked out in detail at the outset of the mission. Except for general on-the-job training in classical laboratory practices, the programme assumed the concentration of the activity on the following subjects:

- atomic absorption spectrophotometry, in application to the analysis of aluminium alloys and the determination of heavy metal contamination in tinned foodstuffs.
- gas chromatography and its application to the analysis of alcohols and fatty acid composition of vegetable oils.
- thin layer chromatography applied to testing of food stuffs.
- calorimetry, for the determination of the calorific value of the substances and nutritive products.

Training was planned to be combined with the installation of the respective instruments delivered to the field. However, because of some obstacles caused by shortages of supplies, fittings, fuels and accessories, and unavoidable involvement of the expert in the laboratory rearrangement problems, the substantive aspects of the programme could not be covered entirely during a shortened schedule time. Two first topics were highlighted in on-the-job activities and on training sessions for laboratory staff, as well as in a seminar attended by guests invited from scientific centres, industrial and public institutions. The application and testing programmes for the two remaining instruments have had to be delayed and are still being studied. The required chemicals and components are to be procured in the next phase of the project and will be followed by the necessary theoretical training and practice.

ii) In mechanical metrology and testing, some general problems and concepts of measurements, metrological instrumentation, destructive and non-destructive mechanical testing were reviewed at first in lectures delivered by the expert. Practical training was then carried out in the metrology section and in the mechanical testing section on the operation and applications of the new sophisticated measuring and testing instruments.

The following instruments were focused upon in the training programme for metrology:

- Universal Measuring Machine, for the measurement of angle, length, width, thickness, external and internal thread profile;
- Talysurf, for measurement of surface texture of various machine items and mechanical work pieces having different geometric shapes;
- Autocolimator, dealing with the measurement of angle, angular displacement, flatness, straightness and contours of mechanical surfaces.

In mechanical testing, modern non-destructive ultrasonic and magnetic methods were emphasized, with the application of the following instruments:

- Ultrasonic Thickness Gauge Tester, for the measurement of thickness of any shape of material by means of transducer utilizing the piezoelectric principle to convert the electrical energy into mechanical vibrations that penetrate the material.
- Ultrasonic Flaw Detector, for the detection of flaws, seams, cracks, slag inclusions etc., in any rolled, cast or forged products and for measuring the thickness.
- Eddy Current Tester, for the detection of surface and sub-surface cracks corrosion detection, conductivity measurements, metallic and non-metallic coating thickness.
- Magnafluc Particle Tester, for the detection of flaws and cracks in any ferrous materials.

To facilitate the training, and to make clear and easy to remember the functional adjustments, controls and operating procedures of the instruments, several guide charts have been prepared and developed by the expert, and used as convenient working aids.

Due attention has been paid in the training activities to initiate and develop precise and systematic working approaches, to get familiarity with the phenomena affecting the measuring techniques involved in the functioning of the most modern instruments, and to observe the safe operating conditions, proper maintenance and service.

iv) In electrical metrology, training conducted by the expert covered the following specific fields:

- measurements of resistances by means of Wheatstone and Kelvin bridges.
- method for determination of voltage differences of standard cells.
- use of potentiometer for DC voltage measurements and for DC calibrations of amperometers, voltmeters and wattmeters.
- use of standard instruments for AC calibrations of amperometers, voltmeters and wattmeters.

v) In temperature metrology the following subjects were included:

- measurements of standard thermocouple voltages with either digital or analogue voltmeters;
- temperature determination by means of the output voltage from standard thermocouple by DVM or potentiometer.
- calibration of thermocouples by means of a standard thermocouple.

vi) In the textile testing laboratory, theoretical and practical training was concentrated on two principal subjects: optical test methods and weathering testing. Two seminars were held and attended by representatives from industries, university, science and technology committees, on the following subjects: (1) the role of textile testing laboratories in the evaluation of materials and assessment of qualities as part of the quality control process; (2) principle and applications of optical testing methods.

Practical training, instructions and correct test procedures were examined during the operation of several new instruments like Pressley Index Tester, Array Tester, Yarn Friction Tester, Washwool etc., with particular attention paid to:

- effect of standard conditions on the results of tests
- importance of correct preparation of test specimens
- precision in testing operations, processing and reproduction of the results
- importance of proper maintenance and periodic verification of equipment.

vii) In the civil engineering materials testing laboratory, the following series of training courses were conducted:

- physical properties of cement
- mineral aggregates and sands specifications sampling and testing
- building bricks and ceramics specifications and testing
- hardened concrete testing methods: preparation of the samples, cement content Method A BS 1881 and ASTM Designation C 85 method.

Two special programmes were initiated and extensive study developed:

(1) asbestos and asbestos-cement products sampling specifications, standards, standardization and testing, and (2) standardization of sand for cement and mortar testing. Programme (1) is aimed at elaboration and introduction of the uniform methods of properties determination of raw materials, components and final products, and at preparation of the standard specifications and testing methods for the above. In programme (2) the review of different technical requirements and existing standards and practices were studied and then investigation of a favourable source of the material is to be followed by examination of the provisions for control and supply.

A review of the testing methods and equipment requirements for wood and wood-base materials was also carried out as a part of the training programme, in view of a prospective development of the laboratory in future phases.

The above-mentioned short-term training courses are summarized in the attached Annex 2, and the list of personnel trained in each laboratory branch is attached as Annex 3.

3.3. A series of seminars conducted on the project covered the following topics:

- Principles of application of Atomic Absorption Spectrophotometer to the determination of heavy metal contaminations in foodstuffs.
- General concept of measurements and metrology instrumentation.
- Mechanical destructive and non-destructive testing methods.
- The role of textile testing laboratories in evaluation of materials and assessment of qualities as part of quality control processes.
- Principle and application of optical testing methods with: (a) Hunterlab Colorimeter, (b) Loribond Tintometer, (c) Carbon Arc Lamp Weatherometer, (d) Light Fastness Tester, and (e) Launderometer, for evaluation of various properties of coloured materials.

The seminars had been prepared by the respective experts in relations to their specific subjects, shared and contributed to a different extent in each case by their counterparts, and always combined with practical tests or instruments demonstrations. They were attended by project staff and invited guests, representatives from industrial companies, universities, research centres, science and technology committees and the administration, usually by about 30 persons from outside each time. These meetings merged with the lectures and lively discussions were always found to be very interesting and appreciated by the participants. They contributed to a great extent in the exchange of actual technical information and in establishing the close links between the Standardization, Metrology and Quality Control - Centre III from one side, and industrial, scientific and research centres from the other.

Except for the above, internal seminars were prepared by the project national staff on the following subjects:

- Procedures and results of work on determination of heavy metals contamination in foodstuffs by AAS.
- Installation and operating problems of the Sulphur Analyser and its application for sulphur contents determination of fossil fuels.
- Gas chromatographic analysis of alcohols.
- Application of non-destructive methods and instruments for thickness gauging, flaw detection and sub-surface coating measurements.

These seminars were attended by project personnel and some persons invited from external enterprises concerned. They were aimed to provide information and make a review of the work progress and the results obtained. The seminars were conceived also as a training opportunity for local staff in lecturing, professional discussion, exchange of views, opinion and experience.

3.4 Beside of the above reported training activities, directly participated by project staff, the training section of the Quality Control Division organized frequently different specialized training courses and lectures on quality inspection problems, products evaluation, metrology, testing problems, new standard specifications, calibration work and maintenance, for the external personnel from industries, administration and from 18 provincial committees for science and technology. About 850 persons organized in different groups attended these courses and lectures lasting totally for more than about 900 hours during the period of project implementation.

4. Development of industrial services

Development of industrial services and dissemination of knowledge and experiences was one of the most principal, continuous activities carried out on the project and implemented through the following sub-activities: (1) testing,

metrology and calibration services provided for clients, (2) contracts and agreements concluded with industrial plants, companies and production units for permanent testing services, preparation of standard specifications and quality supervision programmes, (3) verification and approval of new designs of metrology instruments, (4) production and supply of some metrology simple tools and standards ,(5) repair and maintenance services of testing equipment belonging to certain industrial laboratories (6) establishment of the regional Association of Testing Laboratories "Vinatest", (7) industrial visits, meetings. seminars and personal contacts, (8) distribution and diffusion of standard documents, library and technical information activities, film shows.

i) During the period of project implementation from January 1981 to 20 July 1982 the following number of tests were performed and documented in Centre III's laboratories:

| | |
|--|-----------|
| in mechanical laboratory | 488 tests |
| in electrical laboratory | 140 tests |
| in textile testing laboratory | 766 tests |
| in rubber testing laboratory | 791 tests |
| in chemical and physio-chemical laboratory | 439 tests |
| in food testing laboratory | 474 tests |

Metrology verification and calibration services:

| | |
|--|-------------------|
| mass metrology | 1105 pcs of soale |
| pressure gauges | 2462 pcs |
| electrical instruments | 338 pcs |
| temperature thermocouples and pyrometers | 16 pcs |
| force machines and gauges | 26 pcs |
| length metrology standards | 54 pcs |
| surface finish measurements | 6 tests |
| volume standards | 24 pcs |

- ii) The contracts and agreements for long-term co-operation in quality testing and metrology services have been prepared, negotiated and concluded or acceded with the companies and branches as beneath:
- asbesto cement factory, for works and services described before in Chapter III, B, item 3.2 (vii)
 - diesel engine factory, for mechanical testing of metal parts, work pieces and for metrological measurements and verficiations
 - rubber manufacturing company: contract for testing of rubber and rubber products, preparation of a programme to promulgate a national standard and set forth a draft of international standard on natural rubber in co-operation with General Department for Rubber
 - chemical industrial company, for testing and setting up the standard specifications for detergents and cosmetics
 - canned food production company, for testing the heavy metal contamination in canned food by AA Spectrophotometer, and materials used for cans
 - beer production and alcohol export company, for testing alcohols by Gas Chromatograph
 - fuel oil company: preparation for testing the oil by Sulphur Analyser
 - electro-mechanical associated enterprises, for testing of electrical fans for export and testing of plating and galvanization
 - electro-mechanical factory at Dong Nai for testing of electrical fans for export
 - city committee of science and technology, for testing of construction materials and commodities of general use.
- iii) Design documentation, technical requirements and data have been verified and officially approved for manufacturing the following measuring devices:
- thin strip standard meter slide-ruler - for one factory
 - scale of max. load 500 kg - for two factories and one co-operative

- scale of max. load 1000kg - for one co-operative
- scale of 10-500kg - preparation made for ten factories

Sets of weights, accuracy class M_2 and standard volume flasks 5 and 10 litres have been manufactured by the subcontractor, calibrated and distributed by Centre III to provincial science committees and metrology units.

Repair and maintenance services of testing machines, drying ovens, refrigerators and other measuring and electrical instruments were rendered for a mechanical factory, canned food manufacturing company, geology and building construction laboratory units.

- iv) The Regional Association of Testing Laboratories "Vinatest" was created with the initiative and guiding role of Centre III, the administration office also being located there. Few meetings and discussions concerning the status, organization and programme of activities were held and the publication of a monthly bulletin and directory was undertaken. A general conference of the Association's members is scheduled in August 1982. The aim of the Association is to improve co-ordination of work, exchange of technical information and experience, mutual assistance in problems of equipment, standard materials, personnel, repair, service and maintenance of laboratory instruments.
- v) Many visits have been arranged to industrial plants of various industrial branches and provincial committees and many visits from factories, industrial departments, committees and scientific centres were being received frequently in the laboratories at Bien Hoa. Five seminars were organized on the project dealing with problems of metrology, quality control instrumentation and testing (refer chapter III B item 3). Three films were borrowed from the Audio-visual Information Service, UNIDO, Vienna, two of them on rubber testing, production process, standard qualities and applications, and one film

on stainless steel production technology. About 12 shows were arranged at different occasions, on meetings and conferences, participated by managing and technical personnel, laboratory staff and administration from rubber industry and mechanical plants. Both seminars and the film shows were found to be very interesting and appreciated by the guests.

- vi) Co-operation, supervision and support were being continuously provided for 18 provincial committees of science and technology in the south of Vietnam, by means of administrative and technical guidance, supply of standard documents, assistance in arrangement of metrology and testing services, supply of metrology mass, volume and length simple tools, and standards, training sessions and courses provided by Centre III for provincial staff. Several persons from the provinces Dong Thap, Dalak and An Giang were given long-term training in the chemical and food testing laboratories at Bien Hoa. Methods of preparation of standard specifications for 20 agricultural and food products are being adapted and developed in the provinces. Especially active co-operation is maintained with the local committee and quality control department of the City of Ho Chi Minh.
- v) Agreements have been concluded for a provision by Centre III of a practical laboratory training for the students preparing the final thesis or passing probationary period, with the University of Ho Chi Minh City, Polytechnical University and Agricultural University. Several small groups as well as individual students have already passed this kind of training in chemical, physio-chemical, micro-biology, food testing and electrical laboratories at Bien Hoa, and others in the mechanical section, metrology and workshop are practising their courses at present.

5. Extension of quality supervision

Quality control services were mainly concentrated on surveillance rendered by the quality control division of the Centre III for 54 selected products, (22 among them for export) in 37 production plants. Activities included inspection of the production process and final products at the factories and on the market, guidance for quality control personnel at the factories, periodical reports and evaluations of the quality level of products. Two especial intensive quality control and testing programmes were developed: (1) quality control of bicycles manufactured for export, and (2) quality control of mechanical parts of locally manufactured diesel engines.

Supervision, technical guidance and advisory services were provided by the Centre III quality control personnel to the leaders of quality control sections in about 300 factories belonging to various industrial sectors and in about 100 provincial production units.

For 1982-1983 the new plan of activities for export goods quality inspection has been adopted. The most important products of this plan are: natural and synthetic rubber, consumable alcohols and sea food frozen products. The first phase of the implementation comprises the preparation of industrial plants and branches by upgrading and modernizing the manufacturing processes, where feasible and necessary. Then the specific working programmes will be developed, quality inspection and testing actions intensified and some additional statutory incentives introduced.

In the domain of planning a national system of product quality certification, two substantial regulations have been promulgated and enforced in recent years:

- Dept. Regulation No. 93/TCD/QD of 15 June 1981, "Certification of Industrial Products". (Frame method)
- Dept. Regulation No. 92/TCD/QD of 6 June 1981, "Type testing of Measuring Equipment".

Long-term engagement of this scope consist in determination of standardized requirements for certification of being successively selected kinds of products. Activity is planned to be prolonged for the next years to cover possibly greater numbers of products.

C. Estimation of Outputs Produced

The assessment of the final results set out beneath is based on a comparison of the planned outputs as they appeared in the Project Document and the description of the results actually produced through project activities;

Output No. 1

"The provision of testing, measurement and calibration services to industry by establishing, where they do not exist, and reinforcing, where they do exist, the following laboratories:

Civil Engineering Laboratory for analysis, research and tests related to construction materials and equipment.

Food Technology Laboratory for the analysis and quality control of products such as meat, fish, poultry, rice, flour, noodles, animal and vegetable oils, milk products, tea, coffee, tobacco, cocoa products, alcoholic products, fish and other popular sauces, and canned food stuffs of many types.

General Light Industrial Products Laboratory dealing, inter alia with textiles and garments: cotton, wool and silk yarns; leather and imitation leather products; paper and pulp; board and foamed materials.

Electrical and Electronic Laboratory for the analysis and testing of low-voltage conductive and non-conductive materials: insulating ceramics, boards and plastics; electric wire and cable; low-voltage electrical products such as incandescent and fluorescent lamps, switches, starters, etc; small electrical machinery; domestic electronic instruments - radio, television, amplifiers, tape recorders, etc; electrical meters with moderate accuracy requirements.

Chemical Products Laboratory for the analysis and quality control of in-organic and organic fertilizers: inorganic metal; basic chemical products; silicate products; rubber and plastic products covering both synthetic and natural rubber.

Special Laboratory Branch for the testing and control of rice and cereal seeds.

Metallurgical and Mechanical Laboratory for analysing and testing mechanical components and ferrous and non-ferrous materials.

Metrology Laboratories for calibration and measurement reference materials covering:

- geometric dimensions; mechanical and physical parameters; thermodynamic parameters; physio-chemical parameters; electrical parameters; frequency;

Workshop for the provision of special rigs, etc."

As a result of the complex task performed in the course of the project implementation, all of the above-mentioned laboratories, including the Workshop but with the exception of the Special Laboratory Branch, have been established or strengthened by reconstruction, re-equipping, reorganization and staff training, and are now providing the extensive range of services to industry, in testing, measurements and calibration. The scope of services covers in general the planned areas, with some differences that are as follows:

- establishment of the Special Laboratory Branch has been transferred to the next phase of the project, because of the budget limit imposing a cut in the equipment supply for this section. Only the laboratory room could be prepared at the present phase.
- Light Industrial Products Laboratory covers additionally natural and synthetic rubber products and plastics testing, that were attributed in planned outputs to the chemical section.
- The testing capability of the Electrical/Electronic Laboratory does not conform entirely to the description in the Project Document. The limitation in the testing programme still eliminates the tests of lamps, electrical machinery and domestic electronic instruments, caused again by shortage of expected equipment, postponed to the next phase for a budget restriction.
- The testing programme of the Chemical Laboratory is extended on the determination of sulphur content in fossil fuels by the Sulphur Analyzer System.
- Physio-chemical Laboratory was established as an additional branch, equipped with advanced analytical instruments: Atomic Absorption Spectrophotometer, Gas Chromatograph and Flame photometer, and provides the service in determination of heavy metal contaminations in foodstuffs, analysis of some metal alloys, analysis of organic mixtures and components actually alcohols, and flame photometric analyses.

Output No. 2

"Liaison with industry in order to cover self-monitoring quality control".

The linkage with the industry is realized by permanent statutory activities of the Quality Control Division of the Centre III, by testing laboratories at Bien Hoa, and by metrology and calibrations services provided for many industrial

companies and production units in the south of the country, and in Ho Chi Minh City area in particular. The extension of those tasks, and the diversity of the quality testing services have been significantly increased by augmented capability of the instrumentation installed in the laboratories, by upgraded qualifications of the staff and their number, and by the introduction of some new planning, organizational and legal stimulators (refer to chapter III B item 5).

The Quantitative estimation of the above services is given in Chapter III B, item 4 of this report.

The quality control supervision and inspection activities are largely assisted and reflected by the contracts or agreements concluded with factories industrial companies or associations, for permanent quality testing services (refer to chapter III B item 4 (ii)). In some branches the demand for these services exceeds the existing laboratory physical and personnel potential, and the efforts must be directed to advice and co-ordination rather than performing the services.

Output No. 3

"The education of industry in the necessity for quality control and standardization."

This is in fact a long-term and veritably infinite process. In order to ascertain some practical results, certain definite indicators ought to have been adopted and baseline data determined more precisely. Nonetheless, in the intention of the Project Document's description, although expressed in rather a general term, certain explicit effects have been produced in this scope. Various activities carried out on the project were aimed to contribute to progress in that wide and complex problem. Many events and conditions, especially economical and social conditions, influencing the progress in the field of education of industry, are outside the control of project management. Some of them, as for example volume of products supplied on the market, promotion policy and pricing systems are of critical importance. Nevertheless, as a result

of activities described in chapter III B item 4 and in particular sub-activities (6), (7) and (8), the significant change in attitudes, and positive impact are being observed, and manifest in augmented demands for quality testing services, as already mentioned above in outp No. 2, for consultancy, advice and information on standardization problems, for repair and maintenance of industrial laboratories' equipment. The signs of competition between companies, to obtain quality certification licences has also been noticed.

Output No. 4

"Liaison with universities, technical colleges and associated Government bodies on analysis and testing."

The visit to the Polytechnical University of Ho Chi Minh City has been arranged, combined with visits to the laboratories and discussion of the research, educational and experimental programmes of the institution. Individual visits of the Professor of chemistry and his assistants from the university have been received at Bien Hoa in addition to several other scientific visits and many contacts on the occasion of seminars arranged on project and special ceremonies (e.g. opening ceremony of the Metrology and Testing Centre at Bien Hoa, attended by about 60 high ranking persons, many of them scientists).

Close liaison has been established with the Academy of Science, Ho Chi Minh City Branch, and co-operation is carried on in the field of physio-chemical analytical problems. One of the project seminars on gas chromatography was contributed to by a lecture delivered by the specialist from this Academy.

Extensive regular contacts in the domain of analytical work and various aspects of testing problems have been initiated by the foundation of the Regional Association of Testing Laboratories "Vinatest". These contacts are rapidly expanding, and the Association was joined by as many as 58 institutions in only four months time. New membership declarations are still being received.

Liaison with the universities and high schools is also realized quite effectively through the agreements concluded for provision by Centre III of a practical laboratory training for small groups or individually selected students, as described in chapter III B item 4 (vII).

Output No. 5

"Liaison with universities, associated bodies and industry in order to arrive at technical standards recommendations."

In addition to the aforementioned different forms of co-operation and relationships, the expanded physical and human resources of the Centre III, as well as organizational and managerial improvements brought about by project implementation, stimulated the activities aiming at revision and preparation of the standard recommendations and requirements, standard specifications, test methods and codes of practice at different levels: factory, provincial and branch, and also indirectly on the national level. In the field of standardization, the role of the Centre III as a regional institution consists mainly in co-ordinating the problems and control, in the southern area of the country.

National standards are, as a rule, dealt with by the technical sections of GDSMQC in Hanoi, which are the following:

- Mechanical and metallurgical section
- Electrical and electronic section
- Chemical and civil engineering materials section
- Agricultural and foodstuff section
- Basic problem section.

These sections are in their specific fields responsible to a national standardization council for the whole process of preparation, revisions, approval and introduction of the standard documents.

Centre III is largely involved in supply, distribution and circulation of all kinds of standards, consultation, advice and training in standardization, provided for by industrial and provincial personnel, and in verification,

approval and control of regional and provincial standards. An important output has lately been achieved in these activities by approval on 23 July 1982 of a list containing 72 provincial standards recommended for application in different domains: civil engineering materials, bicycle spare parts, garments and textiles, agricultural products, sea products, etc.

Co-operation links have been established with the Institute of Tropical Technology, Ho chi Minh City (UNIDO Project DP/VIE/76010), for the preparation of a series of standard specifications and methods for reliability and environmental testing of materials and different electrical/electronic components.

Output No. 6

"The dissemination of technical information and conclusions as increased skills and aptitudes are acquired following the installation of new equipment."

Various sub-activities mentioned before in chapter III, B item 4 contributed to aim at this goal. The most definite results have yet been produced and reflected in three forms of project exercises:

- establishment of the regional Association of Testing Laboratories "Vinatest"
- industrial visits, meetings, seminars and personal contacts
- press publications, film shows and radio broadcasts.

The rapid and spontaneous developing activities of "Vinatest" Association, guided and co-ordinated in all its sections by Centre III managing personnel, constitutes the most convenient form for dissemination of technical information and expertise. A few articles prepared by project personnel have already been published in the "Vinatest" Bulletin; one of them dealing with food testing problems by the AA Spectrophotometer, the others concerning technical information, instrumentation and organizational issues.

A series of press articles have also been prepared on quality problems, metrology and testing by project national personnel. The articles were published in a daily regional newspaper "Saigon", in a weekly trade union magazine and in a youth periodical.

The monthly publication, "Science and Development", the magazine of the Ho Chi Minh City authorities, is contributed to by the Director of Centre III as industrial section editor, and author of periodical articles dealing with quality control problems, self control, sampling and testing.

With the exception of the above-mentioned outputs, anticipated and set out in the Project Document, a considerable volume of the documentary outputs have been produced during the project implementation by experts, and by national staff as well. The list of these technical papers, instructions, lectures, programmes and reports is attached as Annex 5.

IV. ACHIEVEMENT OF IMMEDIATE OBJECTIVES

A. Overall capability of GDSMQ - Centre III

The expected results of the project seem to have been achieved at an adequate rate in general, and in some aspects even better than anticipated (refer to outputs Nos. 1, 4 and 6). The original assumptions laid out in the project design proved to be reasonable and have scarcely been modified in the implementation process. The Centre III has been conspicuously strengthened by the establishment and extension of its' testing facilities, as explained above in rating the output No. 1, and by the whole scheme of improvements adopted in the course of the project execution, to almost all key aspects of the Institution, and in particular to:

- programme of activities to produce the outputs
- physical resources
- human resources, and
- organization and management

The Institution has undergone a considerable transformation by reconstruction and re-equipping of the existing laboratories for food testing, light industrial products, mechanical and partially electrical, and by establishing the new laboratories for civil engineering materials, chemical and physio-chemical testing, microbiology and rubber testing sections, the complex of metrology laboratories, and the workshop.

A diversified, interrelated linkage has been established with industry, administration departments, universities, research centres and provincial committees.

The testing and calibration services provided for local and provincial clients from different sectors have been extended in scope and number. New forms of co-operation with industry have been initiated in quality testing and supervision, by long-term contracts and agreements for the services demanded, as described in chapter III B item 4 (ii). Training schemes for a certain number of students from university, polytechnical and agricultural faculties have been agreed upon and exercised at the Centre III laboratories at Bien Hoa in addition to a continuous training of local and provincial staff.

Administrative and functional improvements have also been introduced in the main offices of the Centre III. The library and conference room have been conveniently rearranged. Previous problems with everyday transportation of the staff to Bien Hoa, as well as power supply limitations for the office buildings and laboratory centre at Bien Hoa have been overcome and entirely eliminated. This fact has greatly influenced the organization of work and increased its efficiency.

B. Component Aspects

1. Programme of activities

Following the augmented capability of the Centre III, the programme of activities in quality testing, inspection and standard measurement services have been additionally extended on:

a) In quality testing:

- civil engineering materials, i.e. cement, sand and aggregates, asbesto-cement products, ceramics
- mechanical non-destructive ultrasonic and magnetic particle tests
- chemical flame photometric analyses
- sulphur content analyses of fossil fuels
- chemical determinations of freezing points for liquid solutions, melting points for plastics and chemicals, and flash points for petroleum products
- physio-chemical determinations of heavy metal contaminations in foodstuffs and analyses of metal alloys by AA Spectrophotometer
- analysis of alcohols by Gas Chromatograph
- fibres, yarn and textile tests: Presley index test, crimp rigidity, yarn friction, colour fastness for light and washing, colour measurements in different scales, accelerated weathering and multiple aging determination tests
- rubber abrasion and relaxed moduls tests
- tintometer measurements of coloured materials and food products
- automated counting of bacterial and mould colonies in micro-biological tests
- electrical tests of portable and ceiling fans, dry cells, batteries, household appliances like heaters and irons
- testing of low voltage electrical components, small transformers 25 VA to 6300 VA, wires and cables.

b) In metrology and calibration services:

- force machines and gauges calibrations
- viscosity measurements
- volume standard flasks calibrations
- surface finish measurements
- calibration of thermocouples
- calibration of optical pyrometers
- measurements of resistances by means of Wheatstone and Kelvin bridges
- calibration of AC and DC voltage and current measuring instruments.

- c) Maintenance and repair services for various types and models of laboratory instruments have been undertaken as a permanent activity of the Centre III. The work is carried out by project personnel trained in this field through fellowships abroad.

A separate group for the maintenance of the air conditioning equipment has also been organized to take care of current services required.

- d) The project workshop at Bien Hoa has assumed the fabrication of weight standards for provincial clients, and manufacturing or machining of different spare parts and accessories for laboratory equipment.

2. Human resources

The project objectives in the aspect of human resources have been achieved to a great extent as originally assumed. The following changes expressed in qualitative and quantitative terms have been attained:

- a) Twelve persons from project national staff have passed their 2 to 4 month training abroad, and all of them have resumed and continued their employment in the maternal institution Centre III or Centre I of the GDSMQ. The knowledge acquired by the fellows is effectively utilized in:
- electrical testing and quality inspections (Nguyen Ngoc Tho and Le Dinh Cuong)
 - mechanical ultrasonic testing initiation and quality inspection (Nguyen Duc Cuong)
 - civil engineering and light industries quality control planning and execution (Chu Hanh Phuc)
 - mechanical metrology and testing, planning and co-ordination (Huynh Van Quang)
 - electrical metrology (Do Thi Mai)
 - temperature calibration (Lo Nghiem Trang)
 - installation of the equipment, repair, maintenance and service (Pham Quoc Tam, Dao Ly)

Three fellows: Nguyen Ba Ha, Bui Thanh Nha and Le Anh Tuan have been transferred to their jobs in GDSMQ - Centre I in Hanoi.

- b) Four management personnel participated in a one and half month study tour in developed (France, Sweden) and developing (India) countries, which permitted them to get acquainted with metrology, quality control and testing problems and organization in other countries, and then apply some of their observations and useful patterns in their institution or department in Viet Nam.
- c) About 34 persons listed in Annex 3 from the project staff had passed different forms of in-service training conducted by international experts. The practical aspects of problems and indirect applications were emphasized in these on-the-job training courses. The results were immediately utilized in trial tests and measurements, and then again repeated, exercised and mastered in the course of permanent laboratory work.

d) The number of personnel of the Centre III has been increased during the last year as follows:

- technical staff of the laboratories - 15 persons, 5 of them graduated from university or equivalent, one with doctor degree
- technical staff of quality inspection division - 2 persons, both graduated, one with doctor degree
- administration and support personnel - 2 persons

The total actual number of personnel employed in the Institution amounts to 136, seven persons among them having doctorates, 49 persons graduated from university or equivalent, 12 technicians and 68 laborants and workers.

3. Organization and management

The multilateral ties that have been settled with industry, scientific and educational institutions and research centres are described in outputs Nos. 2, 3, 4, 5 and 6. The role of the Centre III as an important reference establishment in the south of Viet Nam for problems concerned with quality, standards, measurements and testing, has also been elevated as a result of the organizational and structural improvements adopted internally in different technical and administrative sections and in the laboratory centre at Bien Hoa.

In order to enhance the operational efficiency, the extended laboratory complex has been sub-divided into three divisions. Responsible persons were nominated to be in charge of:

- Division 1 - mechanical, electrical, civil engineering and light industrial testing sections
- Division 2 - chemical, physio-chemical and food testing sections
- Division 3 - four metrology sections, briefly called: Length, Force Mass and Volume.

An active, dynamic approach to all exercises has been adopted by the managing personnel of the Centre III, and explicitly positive changes in attitudes and relationships have been observed as a result of the project tasks and duties performed.

V. UTILIZATION OF PROJECT RESULTS

The attached results and performance of the project have already been utilized in:

- testing and calibration services provided for the clients;
- technical services in standardization problems, quality supervision and testing, based on contracts and agreements concluded with industrial outfits;
- production of some standards and simple measuring tools in the project workshop;
- dissemination activities through "Vinatest" Association, press publications, seminars, film shows, industrial visits, library services and personal contacts;
- laboratory training and courses provided for external local and provincial personnel;
- co-operation, supervision and support rendered to provincial committees of science and technology;
- repair and maintenance services of laboratory equipment afforded for own instrumentation stock as well as for external industrial laboratories.

™ detailed descriptions of the performances and its rating have been given in chapter III, B items 4 and 5.

Much of this work is related indirectly to the development objectives a) and b) identified in the Project Document, quoted in chapter II,A of this report. Tests carried out for export products such as bicycles and their components, electric portable and ceiling fans, canned fruit products, canned shrimps, cement, some textile fabrics, are given a priority attention in laboratory work. This work should be extended in the near future on the new products designated for export, such as natural and synthetic rubber, alcohols, sea frozen food products.

Other tests like those of chemicals, textiles, rubber products, food, fodder and nutrition components, construction materials, electrical and mechanical tests, service for a determination of actual qualities, for a classification of products, pricing and for improvements of the production processes. They serve, by the same for the wider common purpose which is the protection of the users,

domestic Vietnamese consumers of these products.

Mentioned above, the aspects of the testing services, together with the remaining activities enabled to be carried out through the accomplishment of the project, should contribute directly toward the development objectives c), and d) that are:

- increase industrial rationalization and economy through the inherent virtues of applied standardization, and
- improve applied technology and research in Viet Nam.

With the purpose of ensuring that the project outputs are fully and properly utilized and will continue to be available to the intended beneficiaries in the future, the following follow-up actions are necessary to be undertaken and carried out:

a) by the United Nations system:

- continue the assistance programme already approved for the second phase, aiming at the extension of the project to also cover the regional Centre I for standardization, metrology and quality control, to provide more training opportunities for national staff from both centres, and to supply complementary equipment items and accessories for metrology and testing;
- consider the future allocation for the new project or extension, conceived as a support in maintenance and service problems for the stock of equipment acquired in the first and second phases.

b) by the Government:

- prepare the long-term programme of training for the laboratory staff and quality inspection personnel in co-ordination with the other local testing centres, and continue this training in all testing and metrology branches;
- intensify the activities concerned with preparation and adaptation of the national and branch standards, to fill the gaps existing at present in different industrial and sectorial branches;
- speed up the progress of the whole complex of work aimed at the introduction and extension of quality certification mark system;
- emphasize the importance of the servicing and maintenance of laboratory equipment and undertake the actions to reduce the shortages of simple instruments like drying ovens, lower accuracy balances, air pumps, laboratory fittings, simple measuring tools, etc., from domestic sources;
- strengthen the quality inspection division of the Centre III by qualified personnel, to increase the indirect impact of the project on industry, and to improve the efficiency of the inspection work.

c) by industry:

- introduce by legal status, and to carry out the permanent production process control, make periodical analyses of the result and undertake proper and realistic corrective measures;
- improve the industrial laboratories arrangements, furnishings and personnel, preferably with the advice and consultancy due to be rendered by the Centre III;
- introduce the more effective stimulating system for quality ameliorations, involving the manufactured products and personnel engaged in the production process, including a supply of materials and components.

VI FINDINGS

1. The Centre III of the GDSMQ , through the strenghtening of its physical, human and organizational potential, is in a position to take up its assigned role as the strongest regional centre of the national network for standardization, metrology, quality control and calibration. The capability and the competence of the institution will be additionally elevated by the implementation of the next phase of the UNDP assisted project in this field.
2. The young, enthusiastic, sincere and devoted to work personnel, guided by the dynamic management, is the best asset of the Centre III. This asset should be carefully protected, properly utilized, and multiplied in the future by provision of possibly greatest support in improvements of working conditions, living conditions and earnings.
3. Deficiency of long-time experience, and tradition in different kinds of precise, sometimes extremely sophisticated laboratory works and measurements, call for augmented insistence on all forms of continuous training and practice required for personnel.
4. Conveniently planned, modern building complex, accomodating the laboratories at Bien Hoa has greatly contributed to the performance of the project and the whole institution.

5. Much effort, always finally successful, has been made by the management and the staff of the Centre to overcome the problems of permanent power supplies for the laboratories at Bien Hoa, and for main offices in the City, to solve the question of personnel transportation to Bien Hoa, and to eliminate periodical shortages of the simple accessories, fuels, laboratory fittings, etc.
6. The stock of equipment acquired for the project has been in the majority, selected from the most advanced manufacturers of laboratory instrumentation in highly developed countries. This advantageous fact imposes the obligation and responsibility on the users, for attentive necessary care during operation, cautions and consequent maintenance routines required to reduce to a minimum the cost of servicing, spare parts and consumable standard materials.
7. It was a highly beneficial event, that the project was prolonged in the second phase, in which more training opportunities are provided for managing personnel and the staff, many complimentary items of equipment will be added, and the present project outputs are going to be consolidated and utilized again more efficiently.
8. The great demand and interest of different sectoral units at various levels, including applied technology research centres, have been observed, for the introduction and development of modern scientific methods using advanced instrumentation tools to study and verify the properties of materials and products, to apply progressive achievements of the other developing and developed countries, in domestic practice in Vietnam, and to adapt the results of theoretical and scientific work for the improvements of technology and manufacturing processes.

VII RECOMMENDATIONS

1. The co-ordination of all testing activities on regional as well as on the national levels seems to be one of the most importance issues on the way to increasing the role and efficiency of the laboratory techniques in improvements of the quality of products manufactured in the country. The establishment of the regional Association of Testing Laboratories "Vinatest" and its spontaneous expansion, makes a good beginning and an example on how to tackle the problem locally. It deserves full support in its development. Similar associations should cover the remaining regions and be unified in a framework of a national co-ordinating organization.
2. National standard specifications, testing methods and codes of practice missing in some importance fields like textiles, rubber, plastic, electronics, chemical branches, civil engineering, food products, etc., are being promoted by the national standardization council, but ought to be enforced before long to relieve the drawbacks and to prevent unjustified losses of materials and resources. More uniform national level policies are also needed to be finalized urgently in respect of the adaptation of foreign standards.

A complex in-depth investigation has to be performed by GDSMQ to determine the kinds, levels and number of lacking national standards and then the planned long-term action must be carried on to gradually fill the gaps, in a sequence of importance for national and international trade, exchange and development, and for the protection of the health and interests of the domestic consumer.
3. In order to promote the self-motivation for improvements in the quality of products, the pricing policy needs elasticity and modifications to reflect more adequately the quality factors and features and to encourage the efforts for ameliorations.

4. The work aimed at the introduction and extension of a national quality certification mark system should be continued to cover the greatest possible number of commodities. This important reference system for the determination of the technical values of products, is also usually being proved as an extremely essential stimulator for quality advancements.
5. For the purpose of securing the full participation of all the economic sectors and production units of the country in efforts to advance the quality level of products and to increase the precision and accuracy of measurements applied in industry and trade, the Inter-institutional co-operation between GDSMQ and the Ministries and other National Agencies should be negotiated and concluded in solid and precise agreements, enforcing the steps and sequence of the necessary improvements.
6. Considering that metrology is one of any country's essential tools in achieving technological development, there is a need as part of the national objectives to take necessary steps to create a metrological infrastructure in the country. This infrastructure should encompass all branches of metrology i.e. scientific metrology, industrial metrology, and legal metrology and should provide support for verification and calibration services in the entire country. The UNDP assisted project for a National Metrology Centre should therefore be prepared as envisaged in the Country Programme before long, and be commenced as soon as possible.
7. The arduous economic conditions of the country reflects on the rate of progressive movements in the field of science and technology. It is hoped however, that the problems concerned with the development of the technical educational and scientific infrastructure, that are highly ranked and well understood by the authorities and industrial managing personnel, will be preserved among the country's priorities and continuously promoted by all possible means.

FELLOWSHIPS

| Fellowship post | Duration (months) | Name of Fellow | Country of study | Subject of study | Training period | |
|---|-------------------|------------------|-----------------------|---|-----------------|-------------------|
| | | | | | Started (no/yr) | Completed (no/yr) |
| <u>Group 1</u> Training in metrology (5 persons) | 4 | Nguyen Ngoc Tho | 3 no-CSSR | mechanical and electrical metrology and calibration | 10/1980 | 2/1981 |
| | | Nguyen Van Quang | 1 no-GDR | | | |
| | | Do Thi Mai | | | | |
| | | Le Nghien Trang | | | | |
| <u>Group 2</u> Training in Lab. Testing (4 persons) | 4 | Chu Hanh Phuc | 4 no-CSSR | construction materials testing | 5/1981 | 9/1981 |
| | | Hui Thanh Nha | 4 no-CSSR | chemical testing | 5/1981 | 9/1981 |
| | 3 | Nguyen Duc Cuong | 2 no-GDR 1 no-CSSR | mechanical testing | 10/1981 | 1/1982 |
| | | Le Dinh Tung | 4 no-GDR | electrical testing | 11/1981 | 3/1982 |
| <u>Group 3</u> Training in maintenance and repair of lab. equipment (3 persons) | 3 | Dao Ly | 3 no-UK | maintenance and repair of lab. equipment | 4/1981 | 7/1981 |
| | 2 | Phan Quoc Tan | 2 no-UK | | | |
| | 3 | Le Anh Tuan | 3 no-UK | | | |

SHORT - TERM TRAINING COURSES

| No | Training activity | Duration | Date started | Date completed | Number of participants | |
|----|--|----------|--------------|----------------|------------------------|-----------|
| | | | | | Started | Completed |
| 1. | In-service training course on application of Atomic Absorption Spectrophotometer for determ. of heavy metals concentrations in canned food products. Concluded with the lecture and followed by seminar | 1 month | 20.6.81 | 25.7.81 | 4 | 4 |
| 2. | Training course on-the-job in metrology and mechanical non-destructive testing. Included 3 lectures, seminar and practical test demonstrations. | 5 weeks | 20.3.81 | 25.9.81 | 5 | 5 |
| 3. | Training course on-the-job in cement, aggregates and asbestos products testing, including participation in seminar and test demonstrations, and discussion the results. | 2 months | 27.7.81 | 25.9.81 | 4 | 4 |
| 4. | Training course on-the-job on electrical metrology applications of : - resistance bridges - DC potentiometer - standard cells - DC and AC calibration of indicating instruments - thermocouples calibration | 1 month | 10.10.81 | 10.11.81 | 4 | 4 |
| | Training in-service on operation of new instruments for fibres, yarns and textile fabric testing, including two seminars and test demonstrations. | 1 month | 27.1.82 | 25.2.82 | 5 | 5 |
| 5. | Training in-service on ceramic, sand, raw asbest and asbesto-cement products testing methods. | 2 months | 20.11.81 | 20.1.82 | 5 | 5 |

LIST OF PERSONNEL TRAINED ON PROJECT

- A. Chemical and Food Testing
 - 1. Mr Mai Xuan Canh , BS
 - 2. Mrs Le Cam Nhung , BS
 - 3. Mrs Nguyen Thi Le , BS
 - 4. Miss Le Thi Hoang Canh, chemist

- B. Mechanical Metrology and Testing
 - 1. Dr Huynh Van Quang
 - 2. Dr Nguyen Ngoc Tho
 - 3. Mrs Dinh Thi Huong, BS
 - 4. Mr Dinh Van Tra , BS
 - 5. Mr Nguyen Ba Ha , BS
 - 6. Mr Lo Anh Tuan , BS
 - 7. Mr Nguyen Duc Quang
 - 8. Miss Nguyen Ngoc Tran , Techn.

- C. Electrical Metrology and Testing
 - 1. Dr Nguyen Ngoc Tho
 - 2. Mrs Do Thi Mai , BS
 - 3. Mr Lo Dinh Tung , BS
 - 4. Mr Tran Van Hoa , BS

- D. Temperature Metrology
 - 1. Mrs Le Nghien Trang , BS
 - 2. Mrs Do Thi Mai , BS
 - 3. Mr Tran Van Hoa , BS

- E. Civil Engineering Materials Testing
 - 1. Mr Tran Van Dung , BS
 - 2. Mrs Vhu Manh Phuc , BS
 - 3. Miss Nguyen Ngoc Hu , Techn.
 - 4. Miss Nguyen Kim Lion , Techn.
 - 5. Mr Duong Huu Trung , Techn.

- F. Textile Materials Testing
 - 1. Mr Duong Hien Ho , BS
 - 2. Miss Nguyen Thi Van , BS
 - 3. Miss Nguyen Thi Ngoc Xuan, Techn.
 - 4. Miss Nguyen Thi Ngoc , Techn.
 - 5. Miss Nguyen Thi Thien , Tech.

- G. Airconditioning System Service and Maintenance
 - 1. Dr Nguyen Ngoc Tho
 - 2. Mr Lo Dinh Tung , BS
 - 3. Mr Tran Van Hoa , BS
 - 4. Mrs Do Thi Mai , BS
 - 5. Mr Nguyen Van Chien, Techn.

EXPERTS EFFECTIVE ASSIGNMENTS

| Budget Line Item No | Time Expert post title | 1961 | | | | | | | | 1962 | | | | | | |
|------------------------|--|--------------|------|------|------|-------|------|------|------|------|------|-------|-------|-----|------|------|
| | | May | June | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | March | April | May | June | Jul. |
| 01 | Chief Techn. Advisor (Constr. Mat.) | 2.5. | | | | | | | | | | | | | | |
| 02 | Chemical and Food Testing | 3.6. — 5.8. | | | | | | | | | | | | | | |
| 03 | Electrical Testing and Metrology | 4.10 — 13.11 | | | | | | | | | | | | | | |
| 04 | Mechanical Testing and Metrology | 16.8 — 13.10 | | | | | | | | | | | | | | |
| 05 | Textile and Paper Testing | 19.1 — 23.2 | | | | | | | | | | | | | | |
| 06 | Consult. on Establ. of Laboratories | 3.5 — 3.7 | | | | | | | | | | | | | | |

Note : dates mark the days of arrival and departure,
or job ceasing in the field

DOCUMENTARY OUTPUTS

| No | Title of report, paper, etc. | Description |
|-----|---|--|
| 1. | Installation, Operating and Maintenance Instructions for airconditioning equipment in metrology laboratories | Technical instruction manual in English final version distributed to project staff. (NS) |
| 2. | Counterpart Personnel Training Programme for airconditioning installation and maintenance | Technical data and description of the system installation layout, electric diagrams, training schedule. Final version in English distributed to project staff. (NS) |
| 3. | Final Report : Air conditioning services and facilities for Metrology and Testing Centre at Bien hoa | Technical report in English, final version distributed to UNDP Res. Rep., UNIDO, Government, project staff. (S) |
| 4. | Final Report on Assistance for Strengthening Chemical and Food Testing | Technical report in English, final version distributed to UNDP Res. Rep., UNIDO, Government, project staff. (S) |
| 5. | General Concept of Measurements. | Technical review papers in English, final version distributed to project staff. (NS) |
| 6. | Mechanical Destructive and Non-destructive Testing Methods | |
| 7. | Final Report on Assistance for Strengthening Metrology and Mechanical Testing | Technical report in English, final version distributed to UNDP Res. Rep., UNIDO, Government, project staff. (S) |
| 8. | Final Report on Assistance for Strengthening Electrical and Temperature Metrology and Electrical Testing | Technical report in English, final version distributed to UNDP Res. Rep., UNIDO, Government, project staff. (S) |
| 9. | The Role of Textile Testing Laboratories in the Evaluation of Materials and Assessment of Qualities as part of Quality Control Process | Technical paper in English, presented and discussed on seminar, final version distributed to participants from industrial and research institutions, and to project staff. (NS) |
| 10. | Principle and Application of Optical Testing Methods with : (a) Hunterlab Colorimeter, (b) Lovibond Tintometer, (c) Carbon Arc Lamp Weatherometer (d) Light Fastness Tester, (e) Launderometer, for Evaluation of Various Properties of Coloured Materials. | Technical paper in English, presented and discussed on seminar, final version distributed to participants from industrial companies and research units, and to project staff. (NS) |
| 11. | Final Report on Assistance for Strengthening Textile and Paper Testing Laboratory | Technical report in English, final version distributed to UNDP Res. Rep., UNIDO, Government, project staff. (S) |

LIST OF EQUIPMENT RECEIVED FOR PROJECT DF/VIE/76/013
(Actual in June 1982)

ANNEX 6

| No | Ref. | Number of items | Description | Purchase Order No | Supplier | Approx. cost as per purchase order (US\$ equiv.) | Delivery date (n/y) | Remarks |
|----|------|-----------------|--|---|---|--|-----------------------|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. | 80/1 | 1 | Universal Measuring Machine | 15-0-DO 589 | Societe Genov. (Swiss) | 90.295 | 5/81 | |
| 2. | 80/2 | 7 | Length Metrology: three gage blocks sets, stand height adjustor, two microcaters | 15-0-DO 694 | Johansson (Swo) | 11.405 | - | Lost in Haiphong port in April 1981, but to be reordored in phase II. |
| 3. | 80/3 | 20 | Length Metrology measuring tools, micronoters, gauges, calipers, indicators | 15-0-DO 726 15-0-DO 727 15-0-DO 724 | Noill Tools (UK) Normal (FRG) Tessa (Swiss) | 1.270 615 560 | 3/81 3/81 12/81 | Outstanding items no 7, 13, 14 and 19 requisitioned in June 1982 for additional order |
| 4. | 80/4 | 1 | Gas chromatograph | 15-0-DO 590 | Pyo Unicam (UK) | 64.020 | 3/81 | More chemicals and accessories to be ordered additionally |
| 5. | 80/5 | 1 | Atomic Absorbtion Spectrophotometer | | | | | |
| 6. | 80/6 | 21 | Chemical and food testing laboratory equipment | 15-0-DO 621 15-0-DO 621A | Gallenkamp (UK) | 119.045 17.915 | 3/81 7/81 | For minor complementary items requisitioned in June 1982 for additional order |
| 7. | 80/6 | 1 | Deep Freezer for food testing lab. | 15-0-DO 990 | Electrolux | 360 | 5/81 | |
| 8. | 80/7 | 25 | Equipment for chemical, food and mechanical testing and viscosity measurements | 15-0-DO 621 | Gallenkamp (UK) | | 3/81 | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----|-------|----|--|-------------|---------------------------------|----------|-------|--|
| 43. | 80/29 | 12 | Chemical laboratory glassware and accessories | 15-0-DO 631 | A. Pearson (UK) | 2.930 | 11/81 | |
| 44. | 80/29 | 5 | Chemical and food testing utensils and accessories | 15-0-DO 632 | Tomson-Moreau (UK) | 1.310 | 10/81 | Missing standard burettes 10 and 20 liters to be ordered in phase II |
| 45. | 80/30 | | Laboratory chemicals | 15-0-DO 589 | ADI Chemicals (UK) | 15.015 | 5/81 | |
| 46. | 80/31 | 1 | Air-conditioning system | 15-0-DO 342 | John Adcock (UK) | 55.607 | 6/81 | |
| 47. | 80/32 | 1 | Metals testing handbook | 15-1-DO 070 | | 500 | 11/80 | |
| 48. | 80/33 | 2 | Textile testing equipment : light fastness tester and wash wheel | 15-0-DO 783 | James H. Neal (UK) | 10.325 | 2/81 | |
| 49. | 80/33 | 3 | Textile testing equipment : Presley tester, comb sorter and tension meter | 15-0-DO 771 | Textest (Swiss) | 3.710 | 2/81 | |
| 50. | 80/33 | 1 | Hunterlab Colorimeter | 15-0-DO 920 | Le Groupe Scientifique (France) | 20.000 | 3/81 | |
| 51. | 80/33 | 1 | Weatherometer | 15-0-DO 929 | Ogawa Seiki (Japan) | 18.605 | 5/81 | |
| 52. | 80/33 | 2 | Textile testing equipment : crimp rigidity tester and yarn friction recorder | 15-0-DO 980 | Shirley (UK) | 7.915 | 6/81 | |
| 53. | 80/33 | 5 | Textile testing equipment : outstanding five items | - | | (55.710) | - | Items 1, 2 and 11 requisition prepared in June 1982 for additional order |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----|-------|----|--|-------------|--------------------------------|---------|------|---|
| 9. | 80/8 | 7 | Top loading and analytical balances, hotplates, water still, glassware | 15-0-DO 621 | Gallenkamp (UK) | | 7/81 | Two top loading Mettler electronic balances out of work, actually inspected |
| 10. | 80/9 | 25 | Civil Engineering materials testing equipment | 15-0-DO 623 | Engineering Lab Equipment (UK) | 113.430 | 3/81 | |
| 11. | 80/10 | 13 | | | | | | |
| 12. | 80/10 | 3 | Force Metrology: proving ring, load column, load measuring ring | 15-0-DO623A | " | 8.830 | 3/81 | |
| 13. | 80/11 | 5 | Length Metrology: block levels, polygon, autocollimator, talysurf | 15-0-DO 611 | Rank T. Johnson (UK) | 35.710 | 7/81 | More accessories required to be ordered in phase II. |
| 14. | 80/12 | 5 | Pressure Metrology: dead weight pressure gauge testers | 15-0-DO 855 | B. Budenberg (UK) | 12.980 | 5/81 | |
| 15. | 80/13 | 10 | Mass Metrology: weights, balances, hardness blocks, impact test gauges | 15-0-DO 610 | A vory (UK) | 47.270 | 5/81 | |
| 16. | 80/14 | 1 | Temperature Metrology: calibr. of thermocouples | | | | 8/81 | |
| 17. | 80/14 | 1 | Temperature Metrology: calibr. of visual pyrometers | 15-0-DO 749 | Land Pyrometer (UK) | 38.040 | 2/82 | |
| 18. | 80/15 | 1 | Length Metrology: vertical comparator | 15-0-DO 655 | H. Sigma (UK) | 1.375 | 5/81 | |
| 19. | 80/15 | 2 | Length Metrology: length bars | 15-0-DO 656 | Coventry (UK) | 5.370 | 2/81 | |
| 20. | 80/15 | 1 | Length Metrology: surface roughness standard block | 15-0-DO 657 | Rubert (UK) | 1.120 | 8/81 | |
| 21. | 80/15 | 2 | Length Metrology: straight edges and angle gauges | 15-0-DO 658 | Normal (FRG) | 1.955 | 2/81 | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----|-------|----|---|--------------|------------------------|----------|--------|--|
| 22. | 80/16 | 1 | Universal Milling Machine | 15-0-DO 1099 | Gridport (UK) | 19.710 | 9/81 | |
| 23. | 80/16 | 1 | bandsaw | 15-0-DO 1089 | Startrite Machine (UK) | 5.210 | 9/81 | |
| 24. | 80/17 | 1 | Laboratory Double Roll Mill for rubber | 15-0-DO 638 | Grabender (FRG) | 15.255 | 5/81 | |
| 25. | 80/17 | 4 | Equipment for rubber testing: relaxed modulus, buffing machine, abrasion tester, dies | 15-0-DO 639 | Wallace (UK) | 12.855 | 2/81 | |
| 26. | 80/18 | 4 | Equipment for paints testing: drying time, scratch tester, bond test, adhesion | - | | 12.000) | - | Outstanding requisition prepared in June 1982 for additional order |
| 27. | 80/19 | 15 | Electrical Metrology equipment | 15-0-DO 651 | Sullivan (UK) | | 2/82 | |
| 28. | 80/19 | 5 | Electrical Metrology equipment remaining 5 items: DC potentiometer, AC detector, DC mill detector, no. homometer, precision dec. bridge | -"- | -"- | 44.370 | 2/82 | Received in Labri and was to be dispatched to the project |
| 29. | 80/19 | 1 | Electrical Metrology: DC Voltage Calibrator D 2300 | 15-0-D 1067 | Sachsen (FRG) | 3.350 | (6/82) | Not yet delivered |
| 30. | 80/21 | 1 | Physico-chemical Metrology: standard viscosity fluids | 15-0-DO 580 | Baird (UK) | 425 | 1/81 | |
| 31. | 80/25 | 1 | Electrical Metrology: AC Oscillator | 15-0-DO 1186 | Farnell (UK) | 530 | 2/81 | |
| 32. | 60/25 | 2 | Electrical Metrology: AC Standards resistors, Standard cell bank | 15-0-DO 201 | Tinsley (UK) | 10.555 | 5/81 | |
| 33. | 80/25 | 9 | Electrical Metrology and testing equipment: outstanding nine items | - | | (50.650) | - | Items 1,4,5,8,11 and 12 - requisition prepared in June 1982 for additional order |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----|-------|----|--|--------------|------------------------|----------|-------|---|
| 34. | 80/25 | 6 | Chemical, food, testing and physico-chemical metrology equipment | 15-0-DO 873 | Townsend Mercer (UK) | 3.250 | 10/81 | |
| 35. | 80/26 | 1 | Inoculating Apparatus for food testing laboratory | 15-0-DO 875 | Dealey | 3.165 | 1/81 | |
| 36. | 80/25 | 10 | Chemical and food testing equipment : muffle furnace, colorimeter, vacuum oven, moisture meter, flame photometer, hydrometers, saccharometers etc. | 15-0-DO 877 | A. Hearson (UK) | 14.710 | 8/81 | Missing items, heating elements for furnace and filters for colorimeter to be supplied additionally |
| 37. | 80/25 | 4 | Chemical and mechanical testing : freezing point app., pyrometer, belt surfacer, diamond saw | 15-0-DO 1192 | Fisher Scientific | 7.890 | 8/81 | |
| 38. | 80/26 | 1 | Sulphur Analyser for chemical laboratory | 15-0-DO 1068 | " " | 10.905 | 11/81 | |
| 39. | 80/27 | 5 | Mechanical testing ultrasonic and magnetic particle test equipment | 15-0-DO 654 | Insp. Instruments (UK) | 26.460 | 7/81 | More transducers and accessories requisitioned additionally in June 1982 |
| 40. | 80/28 | 3 | Seed testing instruments : spoars, sample divider, seed blower and accessories | 15-0-DO 878 | A. Hearson (UK) | 3.500 | 10/81 | Originally missing seed blower received separately on claim in March 1982 |
| 41. | 80/28 | 6 | Seed testing instruments : outstanding six items | - | | (16.720) | - | To be ordered in phase II |
| 42. | 80/28 | 1 | Laboratory Jaw Crusher for stones and aggregates | 15-0-DO 916 | Pascall Eng. (UK) | 3.900 | 7/81 | |

DISPOSITION OF LABORATORY AREA

| No | Description | Working area (m sq) | Remarks |
|-----|--|------------------------|-----------------------------|
| 1. | Metrology : Geometrical Dimensions section (Length) | 59 | |
| 2. | Metrology : Mechanical section (Force) | 59 | |
| 3. | Metrology : Physical section (Mass) | 40 | |
| 4. | Metrology : Physio-chemical section (Volume) | 40 | |
| 5. | Metrology : Electrical and Temperature section | 90 | located in main office bldg |
| 6. | Calibration ancillary rooms | 160 | " " " " |
| 7. | Chemical Laboratory | | |
| | a) chemical section | 160 | |
| | b) physio-chemical section | 40 | |
| 8. | Mechanical Testing Laboratory | 150 | |
| 9. | Civil Engineering Testing Laboratory | 144 | |
| 10. | Electrical Testing Laboratory | 72 | |
| 11. | Light Industrial Testing Laboratory | | |
| | a) textiles, paints and paper section | 165 | |
| | b) rubber section | 120 | |
| 12. | Food Testing Laboratory | | |
| | a) food testing section | 240 | |
| | b) microbiology section | 40 | |
| 13. | Workshop | 160 | |
| 14. | Maintenance and repair of laboratory equipment | 64 | located in main office bldg |
| 15. | Storage and maintenance of airconditioning equipment | 72 | |
| 16. | Store for chemicals and glassware | 120 | |
| | Total area | 2003 m sq | |

