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QUALIFICATION AND SURVEILLANCE LABORATORY  
FOR CONSUMER ELECTRONIC PRODUCTS

DP/CPR/81/028

THE PEOPLE'S REPUBLIC OF CHINA

Terminal report\*

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

Based on the work of CEPREI  
National Counterpart

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United Nations Industrial Development Organization  
Vienna

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Annex: List of Reports from Consultants, Study Tours  
and Fellowships

## I. Objectives of the Project

- a) The development objective of this project is to improve the reliability level of consumer electronic products and increase their variety through exercising qualification, evaluation, surveillance and inspection on the quality of products so as to meet the demands of people's daily living.
- b) The immediate objectives are:
- 1/ To improve the Laboratory with key measuring instruments and equipment, improve its technical means of quality evaluation and bring it up-to-date;
  - 2/ To introduce into the Laboratory advanced techniques of evaluation testing and failure analysis as well as to improve the experiences and procedures of management of the testing laboratory;
  - 3/ To train the technical personnel of the Laboratory and improve their theoretical, technical and operational levels in reliability and quality control, evaluation and scientific research.

## II. Outputs

- 1/ The Laboratory has acquired the capability of performing reliability evaluation and certification tests on general electronic components such as resistors, capacitors, diodes, transistors, relays, connectors, small and medium scale integrated circuits. The following table shows the items of evaluation tests performed:

<u>Test Category</u>	<u>Test Item</u>
Climatic Environmental Test	High Temperature, Low Temperature, Temperature Cycling, Hi-Lo Temp/Lo Pressure, Constant Damp Heat, Cycling Damp Heat, Salt Spray, Mold Growth, Industrial Atmosphere and Autoclave tests

<u>Test Category ( Cont'd )</u>	<u>Test Item ( Cont'd )</u>
Mechanical Environmental Test	Fixed Frequency Vibration, Variable Frequency Vibration, Random Vibration, Shock, Impact, Acceleration, Free Fall and Transportation tests
Physical Performance Test	Visual Inspection, Dimension, Weight, Lead Strength, Solubility, Resistance to Soldering Heat, Solderability, Hermiticity, Flam- mability, Explosion Proof and Particle Impact Noise Detection tests
Life Test	Constant Temperature/ High Tempe- rature Storage and Constant Temp./ High Temperature Loaded life tests

- 2/ The Laboratory has strengthened its capability of performing failure analysis on consumer electronic products. In 1984, it performed 831 cases of failure analysis; in the first half of 1985, it performed 330 cases. Through failure analysis and research, it helped component manufacturers improve their manufacturing processes of tantalum capacitors, high power transistors, small size hermetic sealed relays, etc. For example, it helped manufacturers of small volume solid tantalum electrolytic capacitors improve their anodization process efficiency by 3 times and transistor manufacturers update their yield of plastic encapsulated transistors by 20% with a reliability level raised by half an order of magnitude.
- 3/ The accuracy of calibration and metrology of AC/DC voltage, small current and environmental parameters in the Laboratory is improved and calibration services to end-users are frequently provided so as to enable manufacturers who have no calibration facilities to maintain accuracy of their in-house equipment and instruments, thus ensuring the quality of their products and satisfying the requirements of calibration put on the manufacturers by the Chinese Production Licensing System.

- 4/ As a result of experts' training, the engineering staff of the Laboratory have gained further knowledge of the testing and evaluation of electronic components, the operation and management of test laboratories and the principles, methods and procedures of failure analysis.
- 5/ The Laboratory is able to provide technical consultant services to component manufacturers with the result that 8 manufacturers have passed the certification examination of the Chinese Quality Certification System in compliance with the IECQ requirements. Ten products have been awarded the title of Good Quality Product, of which 7 have won the National Gold Prize.

During the period, the Project was reviewed twice by the representatives of UNDP, UNIDO and the Chinese Government with the participation of the Chief Technical Advisor. The conclusion finally reached is that it is a well implemented project with satisfactory achievements.

From the above outputs it is clear that through implementation of the Project the Laboratory is primarily established and has been successfully undertaking qualification and surveillance of electronic components. In some respects, the outputs actually realized exceed both in quality and quantity of those envisaged in the Project Document. It is not exaggerating if we say that the Project contributes much to the improvement of the quality and reliability of Chinese consumer electronic products.

The significance of the Project also lies in the fact that the Laboratory has been appointed the Laboratory of the National Supervising Inspectorate (NSI) of the Quality Certification Committee for Electronic Components of China, a full member now of the Inspection Co-ordination Committee of the International Electrotechnical Commission's Quality Assessment System ( IECQ ). The building of the institution, the activities being carried out and the outputs so far realized greatly strengthen China's position as a full member country of the IECQ System.

### III. Activities

#### a) Consultants

Six consultants arrived on time for service as per schedule.

They are:

- 1/ Mr. William R. Byars, P. E.  
President  
Viking Laboratories  
440 Bernardo Avenue  
Mountain View, CA 94043, U. S. A.
- 2/ Mr. Abe M. Okun, P. E. ( CTA of the Project )  
Consulting Engineer  
11431 Betlen Drive  
Dublin, CA 94568, U. S. A.
- 3/ Mr. Yuji Gomi  
Head of the Inspection Department  
Reliability Center For Electronic Components of Japan ( RCJ )  
Shin-Daiichi Bldg.  
3-4-13, Nihonbashi, Chuo-ku, Tokyo 103, Japan
- 4/ Dr. Jean-Michel Dumas  
Failure Analysis Expert  
Centre National D'Études des Télécommunications ( CNET )  
Centre Lannion B  
Route de Trégastel BP 40, 22301 Lannion, France
- 5/ Mr. Carl L. Quinn, P. E.  
President  
SIMCO Electronics, Inc.  
382 Martin Avenue  
Santa Clara, CA 95050, U. S. A.
- 6/ Dr. Orlin D. Trapp, P. E.  
President  
Technology Associates, Inc.  
51 Hillbrook Drive  
Portola Valley, CA 94025, U. S. A.

The topics of seminars they respectively gave at CEPREI are:

- 1/ The Organization, Operation and Management of Independent Test Laboratories;

- 2/ Certification and Evaluation of Electronic Components;
- 3/ Quality Surveillance and Inspection of Electronic Components;
- 4/ Failure Analysis Techniques of Transistors;
- 5/ Calibration and Metrology of Electronic Equipment;
- 6/ Failure Analysis of LSI and VLSI IC's.

In the course of the seminars, besides lectures and Q/A sessions, there were some laboratory demonstrations with hands-on guidance. The total number of students attending the seminars ( including observers ) amounted to 197, of which 133 from CEPREI and the rest from factories, test stations, research institutes, universities and other institutions scattered in different parts of China. In addition, there were five presentations made by four consultants, with more than 400 attendees participating in these open lectures.

As a result of the consultancies given by the CTA and the experts, CEPREI has improved the operation and management of its laboratory, worked out better schedules for its test programs, strived for better test quality and service, maintained complete test records and documents, further trained its engineers and technicians, kept close relations of information feedback and cooperation with manufacturers and end-users and put more emphasis on cost-effectiveness. All these improvements contribute to CEPREI's position as the NSI of IECQ and to its laboratory as the NSI Laboratory. The entire electronics industry is likewise benefited by the new concepts, techniques and processing technologies introduced by the experts.

b) Training

There are six fellowships as per Project Document.

Five fellowships have been implemented. They are: Mr Yu Hanglin's half a year training on " Reliability Testing Techniques of Relays and Connectors " at Centre Lannion B of CNET, Lannion, France, Mr Shen, Guoliang's four month training in " Surveillance and Ins-



pection of Electronic Components " at the Reliability Center for Electronic Components of Japan ( RCJ ), Tokyo, Japan, Messrs. Yu Songqiao and Gu Guanhua's four month training respectively in " Failure Analysis of Microcircuits " and " Scanning Electron Microscope ( SEM ) Failure Analysis Techniques " at Microelectronics Center, Middlesex Polytechnique, London, U. K. and Mr. Liang Qiongchong's four month training in " Calibration and Metrology of General Purpose Electronic Equipment " at Viking Labs/Honeywell, Mountain View, California, U. S. A. The sixth fellowship which is also in the field of calibration and metrology of electronic equipment has been moved upon approval from UNDP/UNIDO into the follow-on Project due to delay in arrangements.

Through training, the students have gained a fair knowledge of the new concepts and techniques employed by their foreign colleagues in their respective fields as well as the trends of technological development. After returning to CEPREI, they continue their research and development with new knowledge gained and new impetus received. For example, progress has been made in Mr. Yu Hanglin's research and development of the automatic test equipment for relays and connectors and the application of micro-processors in test and measurement. Mr. Sheng Guoliang, during his study period in Japan, learned the Japanese practice in implementing the IECQ System and the conditions, requirements, methods and means of exercising quality certification and approval of manufacturers, independent test laboratories and distributors. The Japanese experience can serve as a good reference in our implementation of the IECQ System in China. Mr. Yu Songqiao and Mr. Gu Guanhua learned respectively the design of VLSI cells ( circuit units ) and related failure analysis with SEM in the stroboscopic mode. Now they can perform failure analysis of some LSI and VLSI circuits. Mr. Liang Qiongchong, during his four month stay at Viking Labs/Honeywell, have learned from senior technicians and engineers in the calibration laboratory the skill of calibrating electronic test and measurement equipment. After returning home, Mr. Liang put forth a number of proposals regarding the operation and management of our own calibration laboratory and the

calibration service we render to our own test labs and those in the industry. These proposals have attracted strong attention from CEPREI management and some of them have been accepted and put into practice.

c) Study Tours

Two groups each composed of three engineers from the Laboratory made two study tours as per schedule to Japan, Federal Republic of Germany and France. The group to Japan consisting of Mr. Ma Huaizu, Chief Engineer of CEPREI, Mme. Liu Shizhen, Engineer and Director of Testing Center, CEPREI, and Mr. Yang Weiguang, Engineer in the Chief Engineer's Office, CEPREI, visited twelve organizations including test laboratories, inspection and surveillance authorities and manufacturers. Following is the list of organizations they visited:

- 1/ Kanto Office, The Japanese Institution of Mechanical and Electrical Inspection ( JMI )
- 2/ Engineering Center, Sharp Corporation
- 3/ Murata Manufacturing Company, Ltd.
- 4/ Fukuchiyama Factory, Tabai Manufacturing Corporation, Ltd.
- 5/ Production Engineering Research Laboratory, Hitachi Ltd.
- 6/ Yokohama Works, Hitachi Ltd.
- 7/ Musashi Works, Hitachi Ltd.
- 8/ Tokyo Office, The Reliability Center for Electronic Components of Japan ( RCJ )
- 9/ Environmental Testing Laboratory of RCJ
- 10/ Musashino Electrical Communication Laboratory, Nippon Telegraph & Telephone Public Corporation
- 11/ Zama Works, Akasi Manufacturing Corporation
- 12/ The Electrotechnical Laboratory, Agency of Industrial Science and Technology, Ministry of International Trade and Industry ( MITI )

The duration of their stay in Japan was from Sept. 30 to Oct. 15, 1982 and a report on study tour was submitted to the UNDP in China after their coming back home.

The group to Federal Republic of Germany and France consisting of Mr. Yi Zhiyun, Engineer, Head of the Chief Engineer's Office and National Project Director of DP/CPR/81/028, Mr. Xie Chongshen, Senior Engineer and Director of the Failure Analysis Center, CEPREI, and Mr. Qiu Zudong, Engineer, Deputy Head of the Chief Engineer's Office and Deputy National Project Director of DP/CPR/81/028, visited twelve organizations including quality certification associations, test laboratories and manufacturers. The list of organizations they visited is as follows:

In Federal Republic of Germany:

- 1/ Deutsche Gesellschaft für Qualität ( DGQ )
- 2/ TÜV Rheinland
- 3/ VDE-Prüfstelle
- 4/ Firma Seifert

In France:

- 1/ Service National de la Qualité ( SNQ )
- 2/ Union Technique d'Electricité ( UTE )
- 3/ Laboratoire Central des Industries Electriques ( LCIE )
- 4/ Centre National d'Études des Télécommunications ( CNET )
- 5/ Thomson/CSF
- 6/ CIT/Alcatel
- 7/ Enertec/Schlumberger
- 8/ So-Guin-Tel

The duration of their stay in FR Germany and France was from Oct.23 to Nov. 17, 1982 and a report on study tour was submitted to the UNDP in China after their return to China.

Through these visits, both groups studied the state-of-the-art of reliability testing, evaluation, surveillance and inspection of electronic components in these countries, learned their modern techniques and methods and investigated their procedures of operation and management. They made user investigations of some of the key equipment and instruments listed in the Project Document as Government and UNDP inputs, had discussions with

foreign counterparts on the IECQ requirements for a qualified NSI laboratory and selected two experts to come to the Project as consultants ( Mr. Yuji Gomi of RCJ, Japan and Dr. Jean-Michel Dumas of CNET Lannion B of France ). The study tours did play an important role in the execution of the Project.

#### IV. Equipment

As per Project Document, the UNDP input on equipment consists of twenty-two items valued at US\$561,700. The Government input on equipment consists of ten items valued at RMB¥ 1,440,000. All of them have arrived, inspected and put into operation.

These equipment, as they are technically advanced, play a very important part in strengthening the capabilities of testing, measurement and failure analysis of the NSI Laboratory. Equipment such as the Network Analyzer Type 8507S/D, the Semiconductor Parameter Analyzer Type 4145A and the X-Ray Photographic System Type 43855A of Hewlett-Packard, USA, the Micro-probe Test Station Type 6000HCSM of Micromanipulator, USA, the Helium Leak Detector Type 936-71SP of Varian, USA and the IC Burning System Type 500A-75 of EG&G Wakefield, USA are contributing heavily to the successful fulfillment of the Laboratory's testing, measurement and failure analysis requirements and the production of test results.

During the course, however, the problems we have encountered with the equipment are as follows:

##### 1/ Delay of Delivery due to Export License:

As we can not control the time required for obtaining an export license from the producer country, especially from Concom countries including U.S.A., delay of delivery has happened more than once which affects the schedule of test programmes.

##### 2/ Delay of Feedback Information:

In March 1984, we placed an order with Hewlett-Packard for the Network Analyzer Type 8507S/C. However, in July 1985 Hewlett-Packard (HK) informed us that they had stopped production of the controller Type 9845B used with 8507S/C and suggested we change our order into

Network Analyzer Type 8507S/D with the controller Type 9836S. This feedback information from the manufacturer took more than a year to reach us. We understand there might be several reasons, but the delay of feedback information is a factor causing procrastination.

### 3/ Repair Service:

Repair service for imported equipment and instruments has been somehow or other a problem to the Chinese end-users, though the situation is steadily improving. Some equipment can be repaired in China by the Service Stations established by original manufacturers, but the time required for repair service is quite lengthy. For example, the Pulse Signal Generator took a long time to repair.

Sometimes, especially during warranty period, we have to send the equipment to the producer country. We had a case where a Tektronix Oscilloscope Type 7603 was found defective during incoming inspection. It was sent to the Service Department of Tektronix GMBH in Vienna, Austria via air cargo freight in November 1984. Unfortunately the equipment was severely damaged during air freight and a lot of efforts were made to get it repaired and restored.

## V. Inputs by the UNDP and Government

Both the UNDP and Chinese Government have duly contributed their inputs as per Project Document.

## VI. Conclusion and Suggestion

In light of our attainments, it is justifiable to conclude that the Project " Qualification and Surveillance Laboratory For Consumer Electronic Products " ( DP/CPR/81/028 ) is a well executed Project. The Project has successfully realized the objectives listed in the Project Document with satisfactory outputs.

The entire electronics industry ( including manufacturers, test laboratories, companies and research organizations ) has been sharing the benefits of the Project since its establishment. The Project has a positive effect on the improvement of our people's daily living.

It is our opinion that as the Chinese Government is making efforts to extend the construction of the Laboratory and its technological area to include the reliability testing, evaluation, certification and analysis of large scale integrated circuits so as to meet the requirements of the IECQ System on a certified NSI Laboratory, it is necessary to establish a follow-on project heavily oriented to the testing, evaluation, certification and analysis of large scale integrated circuits and consumer electronic products so as to further improve their reliability and quality levels to meet the increasing demands of our people's daily necessities. In this respect, further aid from the UNDP and UNIDO is invaluable.

#### VII. Acknowledgement

The Project Directors and the Project Team would like to take the opportunity to express their sincere thanks to:

Mr. Albertus W. Sissingh, Senior Industrial Development

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Mme. Li Qiming, Senior Programme Officer of UNDP in China;

Dr. Hans H. Seidel, Senior Industrial Development Officer

of UNIDO in Vienna and

Mr. Abe M. Okun, Professional Engineer of the State of Cali-

ifornia, U.S.A. and Chief Technical Advisor

of the Project

for all their invaluable guidance, support and co-operation in making the Project a success.

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Annex: List of Reports from Consultants, Study Tours  
and Fellowships

I. Reports from Consultants

- 1/ William R. Byars: " The Organization, Operation and Management of Independent Test Laboratories " ( Report Date: January 24, 1983 )
- 2/ Abe M. Okun: " Certification and Evaluation of Electronic Component Parts " ( Report Date: September 7, 1983 )
- 3/ Yuji Gomi: " Surveillance and Inspection of Electronic Components" ( Report Date: November 11, 1983 )
- 4/ Jean Michel Dumas: " Failure Analysis of Transistors" ( Report Date: December 7, 1983 )
- 5/ Carl Quinn: " Calibration and Metrology of Electronic Equipment " ( Report Date: May 1984 )
- 6/ Orlin D. Trapp: " Failure Analysis of IC's (LSI and VLSI) " ( Report Date: July 1984 )

II. Reports from Study Tours

- 1/ Ma Huaizu et al: " Report on Study Tour to Japan " ( Report Date: November 1982 )
- 2/ Yi Zhiyun et al: " Report on Study Tour to France and F. R. Germany " ( Report Date: December 1982 )

III. Reports from Fellowships

- 1/ Yu Hangling : " Report from Fellowship Training in Failure Analysis of Electronic Components " ( Report Date: March 1984 )
- 2/ Shen Guoliang : " Report from Fellowship Training in Quality Certification of Electronic Components " ( Report Date: August 13, 1984 )
- 3/ Gu Guanhua & Yu Songqiao : " Report from Fellowship Training in Failure Analysis of Microcircuits and Scanning Electron Microscopy " ( Report Date: October 1985 )
- 4/ Liang Qiongchong: " Report from Fellowship Training in Calibration and Metrology of Electronic Equipment " ( Report Date: March 5, 1987 )