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ASSISTANCE TO THE SERVICE CENTRE OF TESTING TECHNOLOGY IN EAST CHINA

DP/CPR/81/030

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 Mr Ji Ming Yan
National Project Director

Backstopping officer: H. Seidel, Engineering Industries Branch

United Nations Industrial Development Organization
Vienna

585

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TABLE OF CONTENTS

I. Objetives of the project

The development objective of the project is to improve the research and development of industrial testing technology to disseminate and popularize the new testing technology, and to develop and distribute standard reference materials(SRMs), by gradually establishing a centre responsible for testing and analytical services, training testing technicians and studying testing methods in East China

The immediate objectives of the project are,

1. To improve the servicing abilities in inorganic analysis, surface analysis and material structure analysis, and reinforce the study on the new methods of material microzone quantitative analysis.

2. To substantiate an organic substance analytical laboratory specializing in the synthesis and purification of organic SRMs and in high efficiency separation of organic substance and in the techniques of detecting organic trace components.

3. To reinforce the research and development of SRMs.

4. To transfer the technology in the fields given above from more advanced institutions abroad through the Centre to the industry in China through consultancy and training.

II. Activities and outputs

1. Activities

(1) Consultants

Four experts visited China during the project period. Thry are ;

Dr. J.K. Taylor

Dr. C.J. Powell

Dr. W.E. May

These three are from the National Bureau of Standards of the USA and Dr. Ted Chang from American Cynamid Company of the USA

A total of 203 persons from various parts of China attended the seminars given by these four experts.

For international project staff, please see Annex A.

(2) Study Tour

Five professionals made a study tour to the USA and Japan.

During the tours, they kept informed on the recent development abroad of modern analysis and test methods and standard reference materials(SRMs). They also made comparisons on the performances and costs for the equipment to be purchased according to the Project and thus saved 95,000 US dollars. They collected a great number of scientific theses, special publications, annual reports, categories and other materials, which provided us much information and can be used for our reference. Arrangements about the visits to China of the four experts and specific decisions about the fellowships were also made during the visits.

For project study tours, please see Annex C.

(3) Fellowship

Six engieers were sent to the USA for advanced training.

Major achievement of their studies are,

* The Structure Reliability of Brittle Materials at High Temperature
* Microcracks and Micro-Twins in Partially Stabilized Zirconia Alloys
* Concentration Measurement of Hg in Water — An Interlaboratory Comparison
* A comparison of Three Bandwidth Measurement Techniques for Optical Fibers
* Fiber Bandwidth Measurement Using Pulse Spectrum Analysis
* A Test on the Precision of Optical Power Meters
* Pulse Spectrum Analysis Method of Measuring Fiber Bandwidth

Besides, they have all brought back a lot of technical documents and books, which will benefit the establishment of the new National level regional testing center. It is planned to translate and publish the valuable books in order to spread the technology.

To continue their studies abroad, they are planning such programs as " Development of the SRM of Benzo(a)pyrence in Methenol " and "Research on Standard Measurement Methods of Optical Fiber Bandwidth". We are considering to organize a group to work on the research of statistical analysis of measurement data. A seminar on "Statistical Analysis of Measurement Data and Quality Assurance for Chemical Analysis " will be held at the end of next year. Liu Dezhong has been assigned leader of the Shanghai co-operation group for ESCA maintenance.

Because of the need of our work and according to the practical possibility, with the approval of relevant organizations, the Centre has sent three more engineers to NBS for further training. This was also covered by fellowship.

For Project Fellowships, please see Annex D.

(4) Equipment

After installing and debugging the GC-MS(Gas Chromatography/mass Spectrometry), we continued to practise the operation instructions of the instrument and plan to do the following work.

1) Using the instrument as an important means to analyze and certify organic standard reference materials prepared by our institute.

2)Application to environmental sciences for monitoring and analyzing atmospheric, water and soil contaminants such as pesticide residues, phenols, organic mercury pollutants, polycyclic aromatic hydrocarbons in various samples.

3)Structure determination of pharmaceuticals and toxicants, research on metabolite and analysis of the level of pharmaceuticals and poisons in blood.

4) with adoption of appropriate process of chemical derivative reaction to determine sterols and steroids such as estradial, testosterone, progerterone……

5) Sample analyses of vitamins, amino-acids, bio-polymer (peptides, ribonucleotides, sacchrides)

(5). Government Inputs

	Planned Input(RMB)	Actual Payment(RMB)
40. Instrumental Equipment	1,810,000	2,052,498
40. Building Construction	4,500,000	4,640,000
40.Auxilliary Facilities	20,000	229,801
50. Installation of Equipmeants	40,000	54,000
50. Tools	30,000	30,000
50. Transportation Vehicle	20,000	181,000
50. For Foreign Experts	20,000	19,200
10. Salaries	430,000	490,000
10. Maintenance	20,000	36,600
50. Overhead	60,000	70,000
50. Expendable Materials	220,000	230,000
50. Training in China	10,000	10,700
50. Others	60,000	72,000
Total	7,24,000	8,133799

For national project staff, please see Annex B.

2. Outputs

(1) Scientific Research

During implementation of the Project, the Center fullfilled 61 research projects on local and national levels. 9 of them were awarded with a national prize or a local one.

Here are some examples,

i. Research of the application of micro electeonic testing pattern on CMOS technology.

ii. Quantitative testing method by electron paramagnetic resonance with fixed internal standard.

iii. Research of analytical method for the micro elements in fruit trees in Shanghai area.

iv. Research of analytical method for the micro elements in human blood and tissue.

v. Measurement of silicon monocrystal by IR absorption method and research of the activation calibration of charged particles in the oxygen and carbon content in silicon polycrystal.

vi. Development of SRMs for the organic elements in acetanilid.

vii. Development of SRMs for the organic elements in fencholic acid.

viii. Development of SRMs for single ions of copper, zinc, lead, cadmium, nickel, chromium, mercury, amino nitrogen and cyanogen in water.

ix. Development of SRMs for mixed gas composer by carbon dioxide, oxygen, and nitrogen.

x. Development of SRMs for low resistivity standard in borondoped silicon monocrystal.

xi. Research of computer management system for the super quality products in Shanghai.

xii. Research of application of computer on gas chromatograph. for the number of research projects finished, see Annex E.

(2) 55 SRMs have been developed

i. 25 SRMs as standards of trace elements analysis in water.

ii. 6 SRMs as standards used for electron probe.

iii. 7 SRMs as standards of acidity.

iV. 5 SRMs for organic elements.

v. 5 SRMs as standards used for x-ray diffractometer.

vi. 4 standard gases.

vii. 2 SRMs as standards for silicon resistivity.

viii. 1 standard grating ruler.

For the number of SRMs developed by SITT, see Annex F.

(3) A number of research papers published 114 and 158 papers from the Center were published on local and national journals respectively. Here are some of them,

i. XPS study of the surface activity of concreting particles.

ii. XPS study of the composition of viscous liquid film on electro-polished copper surface.

iii. The charge transfer in metallic glass pd-ni-p.

iv. A binding energy round robin of x-ray photoelectron spectrometers.

v. The study of Cr20Mn8Ni4Si3N stainless steel by ESCA and AES.

vi. The study of the basicity of oxode system by ESCA.

vii. Sturface analysis of the Ni substrate in kinescope by AES.

viii. Study of valence Band structure of hydrogenated amorphous silicon-cabon alloys by photoelectron spectroscopy.

ix. Quantitative determination of some trace elements in low alloy copper by ion micro probe.

x. Ion micro probe analysis of surface composition on Ag-CdO alloy contact materials.

xi. A FABMS study on surface absorption of residual gas and gas solid reaction.

xii. ESR studies on r-irradiated tetrafluoroethylenehexafluoropropylene copolymer(F46).

XIII. Quantitative studies of free radicals trapped in vacuum at room temperature.

xiv. Autooxidation processes of free radicals trapped in vacuum at room temperature.

xv. Determination of elements in annual ring of trees by ICP-AES.

xvi. Effects of additive Ce on reaction diffusion process and superconducting properties of Nb3Sn by Tin-rich method.

xvii. Studies of the nature of chemisorption boned using very low energy ion beam, N+ ON ci/ni(100) and CO/Cu(100).For the number of paper published, see Annex G.

(4) Four papers from the Center were submitted to the international "First Beijing Conference and Exhition on Instrument Analysis" held from 18 to 27 of November. 1988. They are,

i. Determination of Trace Impurituy Elements in Uranium Tetra-fluoride by ICP-AES.

ii. Positron-A new probe for surface analysis.

iii. Electron paramagnetic resonance and electron microprobe studies on iron-containing turquoise.

iv. Analysis of steel materiels by ion analyzer.

(5) During the implementation of the Project 15 technical courses and seminars were held by the Center solely or jointly with other organizations. Total attendance is about 2,400. The courses and

seminars are:
i. Electron paramagnetic resonance spectroscopy.
ii. Surface area determination.
iii. Quantitative analysis by motellograph.
iv. Electron probe and scanning electron microsecopy.
v. Surface analysis.
vi. Microprocessor ane computer(3 times)
vii. x-ray diffraction analysis.
viii. Electron microscopy.
ix. Ion probe.
x. IR spectrophotometry(2 times).
xi. UV spectrophotometry.
xii. IPC and laser spectrscopy.

(6) Two sets of standard pattern of imperfections, one is for silicon materia land the other is for wafer, were compiled in cooperation with some relavent units. These two sets of standard pattern will be approved as National Standards.

(7) Four calibration curves of oxygen and carbon in silicon for infrared absorption by charged particle activation analysis have been established in cooperation with Shangnai Institute of Nuclear Research and E-Me Institute of Semiconducdtor Materials. These curves have been approved as National Standards by National Bureau of Standards.

(8) Standard pattern used for determination of elements by laser spectrometry have been compiled and sold more than a thousand volumes. A judgement of stablization mode for measurig multimode optical fiber attenuation has been established.

(9) A long wavelength optical time domain reflectometer and a long wavelength optical power meter have been developed.

(10) An appratus for measuring dielectric constants in the range of 0.4-2GHz has been developed.

(11) A book of "Statistics and Quality Assurance in Chemical Analysis" will be publishsed.

III. Achievement of immediate objectives

(1) During the implementation of the Project, the Center has made testing and analysis on 49007 sampls. These samples were from approxomately 5000 units of more than 20 provinces and cities. The testing service provided by the Center has provided scientific data for enterprises research institutes and universities and colleges in their improvement of product quality and technology and cost reduction. This kind of service has achieved good economic efficiency. In the year of

1983, this service helped the industry in Shanghai get an increase of 40,000,000 Yuan in the output. Here are two examples,

Using its electron probe, the Center made a systematic analysis on the coating copper interface of steel wire which is a product of Shanghai Steel Wire Factory and found the reason why the adhesion was not strong enough. Based on testing data from the Center, the factory improved their process procedure and developed an optimum technology to guarantee the adhesion between steel wire and rubber. This made the Factory get an annual economic efficiency of 10,000,000 Yuan.

The Center helped Shanghai . Thermos Bottle Factory in solving the problem of direct measurement of the thickness of the silver coating layer. This work successfully reduced the silver layer thickness from 0.xx um to 0.0x um while the thermo-insulation capability remained the same. The measurement service provided a method to control the silver layer thickness based on theoretical principle. Now this new control technology is widely spreading in China. The annual save of silver nitrate goes up to 25 ton which amounts to 15,000,000 Yuan.

(2) During the past few years the Center intensified its efforts in the development and disseminatin of SRMs. The Center has developed 55 SRMs of Class B. And it sold 19,000 bottles of water quality SRMs, 1400 bottles of standard gases, 240 permeation tubes and 100 bottles of organic SRMs to 195 units of 28 provinces, cities and autonomous regions. This dissemination of SRMs has played an active part in calibration of instrument and measurement method and value unificatin. Here are two examples,

In 1983, the Center finished its development of SRM of 1ppm mercury in water. The specifications of theis SRM was very compatible with SRM-1641(1ppm mercury in water) sold by the National Bureau of Standards of USNA. 1500 bottles of SRM were sold in 1983. This SRM was displayed in a exhibition held by Ministry of Environmental Protection. Entrusted by the Ministry, the SRM was used as a standard to judge which was the best of the 9 mercury meters produced by 9 different factories in China.. The products of Xi An No. 8 Radio Factory was approved the best.

The SRM of resistivity developed by the Center has the same level of the National Bureau of Standards of USA. The measurement method and system conformed the requirement set by ASTM-F84 Standard Test Method. The calibration accuracy is better than 1%, the standard deviation is 0.5% better than the requirement of resistivity quadruple probe. It is very practical in use.

IV. Utilization of project result

1. Through consultancy and fellowship activities, the Center has established good relations with a number of famous experts both in China and abroard. This helps a lot in continuously improving the ability of our analytical personnel.

For the brief introduction, see Annex II

2. As seminars and symposiums are now held frequently, people working in the analysis field often have chances to exchange their new ideas. This is very good for building up a work force with both theoretical and practical knowledge specialized in analysis and testing.

3. During the implementation of the project, the Center imported about ten sophisticated precision instruments incolding electron self-spin resonance spectrometer, gas and liquid chromatograph, gas isotope mass spectrometer, ion chromatograph, X—ray diffractometer and the instrument for determination of particle distribution .The project input a mass spectrometer-chromatograph system. These equipments have capabilities to make synthetic analyses and testing which are very useful for the digestion of technology introduced from abroad, R&D of new prodsdcts, adoption and application of new technology and development of new energy resources.

4. With its purpose of providing services for scientific research, construction of our natioal ecnomy, abtaining both ecnomic and social efficiency, the Center is now undertaking the following work, preparation and dissemination of SRMs;research and spread of analytical technology and standard testing methods; providing analysis and testing services and technological bases for the correct specifications of industrial products, quality control of production, importation and exportation trade, rational implementation of environmental protection regulatios and security of people's health and safety.

5. In order to strengthen the capability of the Service Center of Testing Technology in East China, our national Commission of Science and Technology approved that the Center be promoted to higher level i.e. national level in May, 1985. The Center will be a center for providing services, researching testing methods and training testing personnel.

V. Problems and Suggestions

1. Organic analysis is always a weak point for the center. Though the proficiency in this area has been improved after the project, we still have to make great efforts to meet the requirements of the economic and social development in East China, 2. The Center has a good foundation

with respect to technical professional and instrtumental equipment. It is the result of the support and aid offered by the Government and UNDP. After being promoted to a national level testing center, higher priority will be given to it. We are quite confident that with some improvements, we can take the task of training testing professinal from the third world countries.

Annex A International Project Staff

name	nationality	subject	duty period
Dr. J.k. Tyler	USA	quality assurance in chemical analysis	April 13, 1984-April 28, 1984
Dr. C.J. Powell	USA	material surface analysis	May 21, 1984-June 7, 1984
Dr. W.E. May	USA	chromatograph & high efficiency seperation	Sept. 16, 1984-Sept. 28, 1984
Dr. Ted Chang	USA	analytical technology of composition of organic compound	May 7, 1985-May 18, 1985

Annex B National Project Staff

name	title	full/part time	duty period
Ni Bin Liang	project director	part	April, 1982-Dec. 1983
Yu Heng De	deputuy director	full	April, 1982-April, 1984
Jiang Zhi Chang	secretory	part	April, 1982-April, 1984
Ji Ming Yan	deputy director	full	April, 1984-Dec. 1987
Wang Zhi Huan	secretory	full	April, 1984-July, 1984
Wang Gen Rong	secretory	full	April, 1982-Dec, 1987
Wang Xue Dong	accountant	part	April, 1982-July, 1986
Wang Jie	accountant	Part	July, 1986-Dec, 1986

Annex C Study Tour

name		units visited	
Mi Bin Liang	USA	1. NBS 2. Bureau of Foods,	
Yu Hong De		Food and Drug Administration	from
Jiang Zhi Chang		3. Vepenics 4.Jarrell Ash	Jan.12, 1983
Gu Guo Liang		5. Texas A & M University	to
Huang Chen Ji		6. Finnigan 7. Hewlett Packard	Feb.3,1983
		8. Varian	
	Japan	1. Chemistry Technology Insti-	from
		tute of Japan 2. Agriculture	March 27, 1983
		Technology Institiute of Japan	to
		3. Osaka Industry Institute 4.	April 7, 1983
		Osaka University 5. Shimadzu 6.	
		Waters 7. Yokogawa Electric Works	

Annex D Fellowships

fellow	subject	place	time
HaoZhen Dao	statistical analysis of measurement data	NBS	July, 1984- May, 1985
Liu Hui Cong	organic analysis	NBS	DO
Lu Yi Ming	micro zone analysis	NBS	July, 1984- Sept. 1985
Zhang Yung Zhu	atomic spectrum analysis	NBS	July, 1984- Oct. 1985
Yang Shao	measurement of optical	NBS	July, 1984- Sept. 1985
Liu De Zhang	maintenance of ESCA Perkin Elmer		Sept. 1984- July, 1985
Yuan Wei Ren	computer application	NBS	Nov., 1985- June, 1986
Xu Yong Ming	micro zone analysis	NBS	DO
Cai Ti Xiong	radiio quantity measurement	NBS	Nov., 1986- Sept, 1988
Jiang Zhi Chang	CNSS	EL Co.	Nov. 26, 1984- Dec. 10, 1984
Ji De Liang	CNSS operation	do	do
Yan Shu Ping	do	do	do

Annex E Number of Research Projects Finished

year	1983	1984	1985
number	11	18	21

Annex F CERTIFIED REFERENCE MATERIALS PREPARED & ISSUED BY THE SHANGHAI INSTITUTE OF TESTING TECHNOLOGY

NO	CRM	NAME	PHYSICAL FORM	SPECIFICATION	APPLICATION	UNIT OF ISSUE
1	SB 0101	#45 Carbon Steel	Chip	Chemical Composition (Nominal Weight Percent) C 0.430, Mn 0.620, Si 0.280, P 0.023 S 0.009, Ni 0.073, Cr 0.156, Cu 0.140	Primarily for use in calibration and as standards of steel constituents.	120g each bottle
2	SB 0201	Acetanilide	Crystal	Certified Constituent (Nominal Weight Percent) C 71.09, H 6.71, N 10.36	For use as elemental standards for conventional quantitative analysis in the synthesis of organic compounds..., and for use in calibration of micro-elemental analyzer and micro-analytical methods.	2g each bottle
3	SB 0202	Anisic Acid	Crystal	Certified Constituent (Nominal Weight Percent) C 63.15, H 5.30, O 31.55 CH_3O- 20.40, -COOH 29.59		
4	SB 0203	Benzoic Acid	Crystal	Certified Constituent (Nominal Weight Percent) C 68.85, H 4.95, O 26.20		
5	SB 0204	Nicotinic Acid	Crystal	Certified Constituent (Nominal Weight Percent) C 58.54, H 4.09, N 11.38		
6	SB 0205	Triphenyl Phosphate	Crystal	Certified Constituent (Nominal Weight Percent) P 9.49		
7	SB 0301	Silicon (X-ray Diffraction Standard)	Powder	Purity: 99.9% Average Particle Size: $8.8\pm0.5\mu$ Lattic Constant: $a=5.43107$ Å $\sigma=0.00004$ Å $\lambda=1.5405981$ Å (CuK_{α}) $T=23.9°C$	For use as internal standard in accurate determination of lattice constant or external standard in calibrating instrument.	10g each bottle
8	SB 0302	α-Aluminum Oxide (X-ray Diffraction Standard)	Powder	Purity: 99.9% Average Particle Size: 1μ	For use in quantitative phase analysis with X-ray diffractometer.	
9	SB 0303	α-Silicon Oxide Standard Reference Material (A-type)	Powder	Purity: 99.9% Particle Size: $\leq20\mu$ Average Particle Size: 7.4μ Lattic Constant: $a=4.91339$ Å $\sigma=0.00003$ Å $c=5.405$[illegible]5 Å $\sigma=0.00008$ Å $T=25.6°C$	For use in analysis of X-ray diffraction intensity and calibration of X-ray camera, and use as standard in measuring crystaline grain.	

10	SR 0304	α-Silicon Oxide Standard Reference Material (B-type)	Powder	Purity: 99.99% Particle Size: [illegible]μ Average Particle Size: ?.7μ Lattic Constant: a = 4.91339 Å σ = 0.00003 Å c = 5.40506 Å σ = 0.00008 Å T = 25.6°C	Dito	Dito
11	SR 0305	α-Silicon Oxide Standard Reference Material (C-type)	Powder	Purity: 99.99% Particle Size: 10~20μ Average Particle Size: 17.2μ Lattic Constant: a = 4.01339 Å σ = 0.00003 Å c = 5.40506 Å σ = 0.00008 Å T = 25.6°C		
12	SR 0401	Grating Replica Scale	Solid Membrane	1200 lines/mm, Constringence(mean)2.6% 600 lines/mm, Constringence(mean)0.4%	For calibrating magnification of TEM and accurately measuring the size of micro-particles.	One piece each box
13	SR 0501	Sulfur Dioxide Permeation Tube	SO_2 Liquid	Range of Permeation Rate: 0.3 ~ 2μg/min(25°C) Gravimetric Method Standard Error(relative): ±1% Validity Period: One Year	As standard source of SO_2 below 10 ppm, and for calibrating air pollution monitoring apparatus and verifying SO_2 analytical methods and procedures.	In teflon tube Length: 40,60, 80,100mm Diameter: 3,4mm
14	SR 0502	Nitrogen Dioxide Permeation Tube	NO_2 Liquid		As standard source of NO_2 below 10 ppm, and for calibrating air pollution monitoring apparatus and verifying NO_2 analytical methods and procedures.	
15	SR 0503	Ammonia Permeation Tube	NH_3 Liquid	Range of Permeation Rate: 0.5 ~ 2μg/min(25°C) Others: Dito	As standard source of NH_3 below 10 ppm, and for calibrating air pollution monitoring apparatus and verifying NH_3 analytical methods and procedures.	
16	SR 0504	Hydrogen Sulfide Permeation Tube	H_2S Liquid	Range of Permeation Rate: 0.1 ~ 0.7μg/min(25°C) Others: Dito	As standard source of H_2S below 10 ppm, and for calibrating air pollution monitoring apparatus and verifying H_2S analytical methods and procedures.	In stainless steel tube Tube size: dito
17	SR 0601	Iodine-131 Radioactive Standard Reference Material	Liquid	Radioactive Purity: 99.9% Total Uncertainty of Radioactivity: 1%	For calibration and efficiency scaling of well-type scintillation detector (Model FT-603 & Model THS-7 etc.)	1g each ampoul
18	SR 0701	pH Standard Buffer Solution	Liquid	pH 1.68±0.01 (25°C)	For use in calibrating acidimeter and providing pH standard solution for laboratory.	Pack in plastic bottle

19	SB 0702	pH Standard Buffer Solution	Liquid	pH 4.00±0.01 (25°C)	Dito	Dito
	SB 0703	pH Standard Buffer Solution	Liquid	pH 6.86±0.01 (25°C)		
20	SB 0704	pH Standard Buffer Solution	Liquid	pH 7.382±0.005 (25°C)	For use in calibrating the analyser of blood acidity-alkalinity and accuracy.	2ml each ampoul
21	SB 0705	pH Standard Buffer Solution	Liquid	pH 9.18±0.01 (25°C)	For use in calibrating acidimeter and providing pH standard solution for laboratory.	Pack in plastic bottle
22	SB 0706	pH Standard Buffer Solution	Liquid	pH 12.46±0.01 (25°C)		
23	SB 0707	pH Standard Buffer Solution	Liquid	pH 6.84±0.01 (25°C)		
24	SB 0801	Mixture Gas in Steel Cylinder	Gas	CO_2, CH_4 (in N_2) 10, 50, 100ppm.	For use in environmental protection, energy resource, medical hygiene and instrumentation.	Steel cylinder
25	SB 0901a	Mercury in Water	Liquid	1.Level: 9.99ug/ml 2.Uncertainty: ±0.20ug/ml 3.Stability: one year	For use in calibrating mercury-testing apparatus & method, and providing trace mercury standard solution.	15ml each ampoul
26	SB 0901b	Mercury in Water	Liquid	1.Level: 0.99ug/ml 2.Uncertainty: ±0.09ug/ml 3.Stability: one year		
27	SB 0902	Copper in Water	Liquid	1.Level: 4.99ug/ml 2.Uncertainty: ±0.05ug/ml 3.Stability: one year	For use in calibrating spectrophotometer, atomic absorption spectrometer and testing method.	100ml packed in plastic bottle
28	SB 0903	Zinc in Water	Liquid	1.Level: 9.98ug/ml 2.Uncertainty: ±0.12ug/ml 3.Stability: one year		
29	SB 0904	Lead in Water	Liquid	Dito		
30 31 32	SB 0905 0905b 0905c	Cadmium in Water	Liquid	1.Level: 3.99, 1.01, 0.108ug/ml 2.Uncertainty: ±0.06, 0.02, 0.14ug/ml 3.Stability: one year		
33	SB 0906	Nickel in Water	Liquid	1.Level: 10.00ug/ml 2.Uncertainty: ±0.20ug/ml 3.Stability: one year		
34	SB 0907	Total Amount of Chromium in Water	Liquid	1.Level: 10.00ug/ml 2.Uncertainty: ±0.32ug/ml 3.Stability: one year		
35	SB 0908	Cyano in Water	Liquid	1.Level: 49.6ug/ml 2.Uncertainty: ±0.9ug/ml 3.Stability: one year	For use in calibrating ion electrodes, spectrophotometers and testing methods.	

36	SB 0909	Amino-nitrogen in Water	Liquid	1.Level: 49.8ug/ml 2.Uncertainty: ±0.6ug/ml 3.Stability: one year	Dito	Dito
37	SB 0910	Nitrate in Water	Liquid	1.Level: 10, 20, 50ug/ml 2.Stability: one year		
38	SB 0911	Nitrite in Water	Liquid			
39	SB 0912	Fluorine in Water	Liquid	1.Level: 0.50, 1.00, 10.0, 100.0ug/ml 2.Stability: one year		
40	SB 0913	Chlorine in Water	Liquid	1.Level: 1.00, 5.0, 10.0ug/ml 2.Stability: one year		
41 42	SB 0914a 0914b	Arsenic in Water	Liquid	1.Level: 5.01, 0.498ug/ml 2.Uncertainty: ±0.10, 0.016ug/ml 3.Stability: two year	For use in evaluating accuracy of testing trace elements in filtered fresh water, and calibrating testing apparatus.	100ml packed in plastic bottle
43 44	SB 0915a 0915b	Hexavalent Chromium in Water	Liquid	1.Level: 5.02, 0.492ug/ml 2.Uncertainty: ±0.14 0.018ug/ml 3.Stability: two year		
45	SB 0920	Phenol in Water	Liquid	1.Level: 10.0ug/ml 2.Uncertainty: ±0.03ug/ml 3.Stability: one year	An standard reference material for testing phenolic material in environmental protection,hydrology, hygiene,and for checking analytic method and operation of analysts.	20ml each ampoul
46	SB 0925	Phosphate in Water	Liquid	1.Level: 0.50, 5.00, 50.0ug/ml 2.Uncertainty: ±0.02, 0.20, 2.0ug/ml 3.Stability: one year	For use in calibrating analytical methods in environmental protection,water quality,checking testing apparatus and operation of analysts.	100ml packed in plastic bottle
47 48	SB 1001 1002	Copper, Lead, Cadmium and Zinc in Water	Liquid	1.Level: Cu 5.01, 0.501ug/ml Pb 5.03, 0.503ug/ml Cd 5.02, 0.499ug/ml Zn 5.01, 0.499ug/ml 2.Uncertainty: Cu ±0.09, 0.013ug/ml Pb ±0.10, 0.011ug/ml Cd ±0.08, 0.013ug/ml Zn ±0.09, 0.013ug/ml 3.Stability: four year	For use in evaluating accuracy of testing trace elements in filtered, acidified fresh water, polarograph and calibrating other testing apparatus.	

49	SN 1004	Copper, Zinc Lead, Cadmium and Nickel in Water	Liquid	1. Level: Cu 1.00ug/ml Zn 5.00ug/ml Pb 1.01ug/ml Cd 0.101ug/ml Ni 0.500ug/ml 2. Uncertainty: Cu ±0.04ug/ml Zn ±0.09ug/ml Pb ±0.06ug/ml Cd ±0.006ug/ml Ni ±0.011ug/ml 3. Stability: three year	For use in testing trace elements in exhausted waste water and calibrating apparatus.	100ml packed in plastic bottle

Annex G Number of Papers Published

year	1983	1984	1985
local	32	42	48
national	65	48	45

Annex H

Shanghai Institute of Testing Technology(SITT)
(National Center of Testing Technology NCTT)

An Introduction to its Scipe of Business

SITT (CITT) is one of the institutions which were firstly authorized by China's National Bureau of Metrology to undertake type test on new measurement instruments.

The Institute has quite a rich force which is technologically advanced for measurement and calibration in the fields of optics, radio quantities, time & frequency, chemics , material analysis and gas analysis.The Istitute is well equipped wich a number of sophisticated analytical instruments and has a specially trained staff. It is a nationlevel center for providing testing and analysis services, studying testing methods and training personnel.

Business Undertaken by the SITT (NCTT)

1. Measurement and Tasting of Radio Quantities

R & D and reproducyion of measurment standard etalon and standard devices used for measuring the following radio parameters, RF voltage, devices used for measuring the following radio parameters, RF voltage,depth of modulation, impedance, distortion, phase ,power , attenuation ,dielectric constant , pulse and noise .

And also the research of measurement method , value transferring , comparison testing and inspection on product quality.

2. Measurement and Testing of Optical Ouantities

R & D and reproduction of measurement standard etalion and standard devices used for measuring the following optical characteristics, optical parameters, light intensity , luminous flux , luminance , colour temperature , chromaticity , spectral radiance , spectral irradiance , laser power ,beam divergence angle and glossiness .

And also the research of measurement method , value transferring, comparison testing and inspection on product quality .

3. Measurement and Testing of Time & Frequency Quantities

Value transferring and comparison testing for time & frequency quantities . Research of measurement devices and research of measurement method .

And also providing the following products , high precision quartz crystal oscillator and calibrator of colour TV sub—carrier frequency .

4. Products on Which Type Tests are Undertaken by the SITT (CITT) Authorized by the National Bureau of Metrology

Power meter , signal generator , oscilloscope , phase generator , phasemeter , attenuator , frequency meter , timer , laser medium power meter , glossiness meter , optical fibre measurement device , conducticity gauge , acidimeter , ionometer , quantity moniter , polargraph , colorimeter , photometer , spectrophotometer and chromatograph .

5. Material Analysis

Qualitative and quantitative analysis of micro zone , micro quantity , trace quantity , surface , interface and impurity elements in the bepth of inorganic materials and semiconductor materials .

Chemical structure analysis of high polymer organic materials and inorganic materials .

Valence state analysis of solid materials .

Research on microelectronic test pattern . Quality analysis and process control of integrated circuit .

6. Chemical Analysis

Analysis of trace metal elements in various matrices , determination of normal and trace anions in inorganic materials .

Quantitative analysis of elements in organic compounds .

Determination of trace water , acidity and basicity , and radio surf ace area .

7. Gas Analysis Impurity analysis of highly purified gases , composition analysis of mixed gases , determination of stabilized isotope abundance in gases .

8. Research of Transducer and its Application

R & D of 1/SL series quartz force transducer used for the measurement of dynamic force and short period static force.

Research of application of various transducers on measurement instrument .

R & D of force measuring meter used for surgical miniapparatus , quartz temperature sensor and their intelligence testing instruments .

R & D of JZ series quartz crystal oscillator and GBA series high precision quartz resonator.

9. Application of Computer Technology

Research of application of computer technology on expanding the functions of measurement instruments , on processing the data obtained from analytical instruments , on the management of measurement instruments and on intelligence apparatus and related performance testing .

10. Shanghai product quality inspection stations for electronic product, cemiconductor materials and elector—optical sources , Shanghai Instrument Service and Shanghai CAMACA electroc probe maintenance station are affiliated to the SITT (NITT)

11. Standar Gas and RMs supply

SITT (NITT) also supplies standard mixed gas of hydrogen sulfide, sulfur dioxide and nitrogen dioxide and reference materials (RMs) of ammonia permeation tubes, silicon (used for x—ray diffractometer), d—aluminium oxide , d—silicon oxide , noble metals (used for electron probe), acetanil , PH standard buffer solution , mercury in water , copper , zinc , cadmium , nickel , total chromicyanide , amino nitrigen , phenol phosphonic acid radical and fencholic acid , nicotinic acid triphenyl phosophate ect .

SITT (NITT) also supplies 5MHz and 10MHz high precision quartz trs onator and 500g——100T series quartz force measurement transducers .