

Introduction of Metrology Training in Japan

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Abstract

Metrology Training Center of National Measurement Institute of Japan is an organization of legal metrology training for people from local governments in Japan and of training for certified measurers from private enterprises. There are two state examinations of metrology in Japan. One is Environmental Certified Measurer (of concentration measurement or of acoustic noise and vibration) and another is General Certified Measurer. Some of the General Certified Measurers are responsible for inspection of specified measuring instrument in legal metrology, for example, scales used in a supermarket and so on and half of them work for quality control and measurement control in private enterprises. The cost of the trainings for people of local governments in Japan is paid by the government of Japan and there are many courses of from 3-days to 3-months trainings for legal metrology. Outlines of the curriculum and the trainings of these courses are introduced.

1. Introduction

Metrology Training Center in Japan is an organization which performs legal metrology training for local government employees and training for the certified measurers of private enterprises. It was founded in 1952.

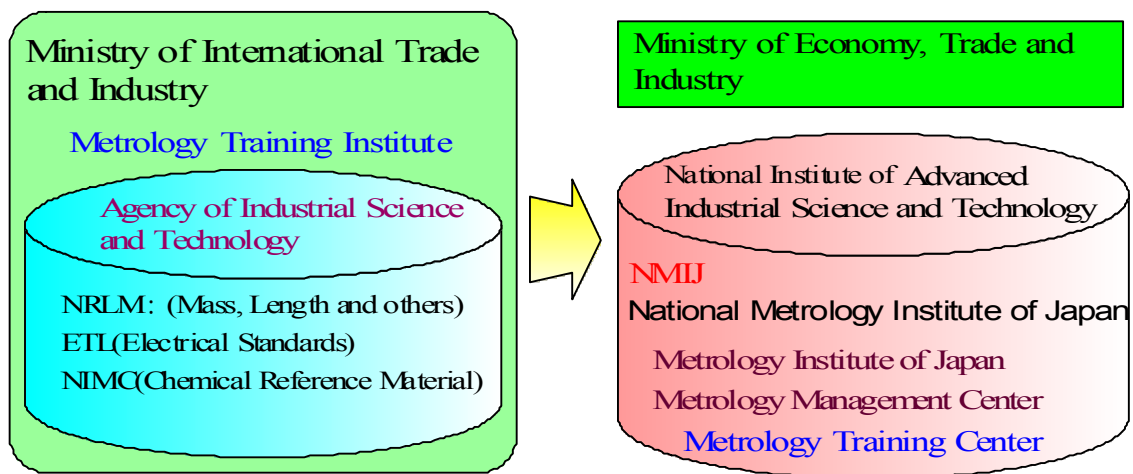


Figure 1. Reorganization of Laboratories of AIST and establishment of NMIJ

There are two kinds of certified measurers as state examinations in Japan, that is, an Environmental Certified Measurer (concentration, and acoustic noise and vibration) and a General Certified Measurer.

Two ways are accepted as the method of qualification acquisition; to pass the state examination and to take a lecture on the measurement training course for five months of the Metrology Training Center and take 60 or more points out of a possible 100 to all the internal examinations.

Qualification holder is authorized as a certified measurer by registering with Ministry of Economics, Trade and Industry. For that purpose, five years of experience of business is required for a General Certified Measurer. For an Environmental Certified Measurer two years of experience of practical business and success of an oral examination on the technical knowledge of the atmosphere or water quality analysis and the fundamental knowledge of the measurement law and measurement control.

The trainees of local governments, who take part in the measurement training courses of five months in the metrology training center, is 40 % in the class.

Some of General Certified Measurers make inspection of specified measuring instruments of legal metrology service, and others work in the charge of quality control and measurement management in enterprises.

Many of Japanese enterprises are interested in quality control in the production process and people in charge might hope to obtain the qualification for the self-education.

The Japan's government pays the cost of legal measurement training for local government employees, for example, the legal metrology course for three months, the short metrology training course of a month and a super short course of one subject for three or four days.

The outline of these courses, curriculum and training are introduced.

2. National Institute of Advanced Industrial Science and Technology and Metrology Training Center

The National Institute of Advanced Industrial Science and Technology of Japan went independent of the Ministry of Economy, Trade and Industry as an independent administrative agency in April, 2001.

Fifteen research institutes under the Agency of Industrial Science and Technology and Metrology Training Institute united to Advanced Industrial Science and Technology (AIST). The AIST includes the

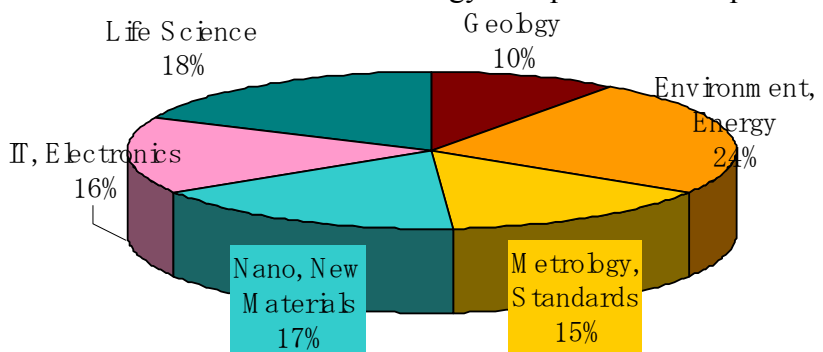


Figure 2. Pie chart of number ratio of researchers

National Metrology Institute of Japan (NMIJ) and NMIJ consists of a research section and a Metrology Management Center which performs an establishment of traceability, international cooperation activity, metrology training and so on (see Figure1). The Metrology Training Center belongs to this Metrology Management Center.

Figure 2 shows the composition of researchers of AIST. Three hundred people (15% of 2,500 researchers of AIST) work in the field of measurement standards, measurement technology and traceability system.

AIST has 3,225 personnel in all with 700 personnel of administration and 5,300 external researchers stay in a year.

3. Legal metrology and duty of local government employee in Japan

A local government takes charge of the legal metrology administration in each of the local administration zone, and conducts verification and inspection of specified measuring instruments, especially weighing equipment of a large-scale retail store, taximeter, oil meter and so on.

One of problems of legal metrology administration of local government in Japan is that the administrative district regions are divided remarkably small. Therefore, it may be said that there are too few staffs of verification and inspection office in an administrative district, and the technical patrimony to young workers does not work well.

To be more precise, the area of Japan is one thirtieth of that of U.S.A. and the national land of Japan is divided into the local administration area of 47 prefectures. This was caused by the policy of the then government of Japan 135 years ago, in the end of the era of Samurai. At that time, three hundred or more territories of the feudal system which was all over the country shifted to the prefecture, when it shifts to parliamentary democracy from Samurai era. Those were united and decreased to 70 prefectures soon and was set to 47 prefectures ten years later. And it remains today almost as it was. Each prefecture does not carry out activity over the border of the prefecture in principle. It keeps an organization of verification institute small.

The policy of relaxation of regulations of the Japan's government causes the decrease of the trainees of legal metrology training courses because the participation is no longer duty. Therefore, metrology training for the local government employees is becoming still more difficult.

The amendment of the Measurement Law is being advanced now for reforming this situation now. Specified verification and inspection organizations will be accredited and the prefectures entrusts business to the organizations. The organization will be required to meet the conditions of ISO 17025 as well as an accredited calibration laboratory. And those local governments will hold the responsibility of legal metrology and inspect the performance of their verification and inspection business.

Table 1. Facilities of Metrology Training Center

◇ **Lecture rooms** **5**

- | | |
|---|---|
| • Practical training rooms | • Thermometer Training Room |
| • Length Training Room | • Integration-type Volumemeter Training Room |
| • Pressure Training Room | • Atomic Absorption Spectroscopy Training Room |
| • Balance Training Room | • Gas-chromatography Training Room |
| • Volume and Density Training Room | • SO_x Analysis Training Room |
| • Weighing Machine Training Room | • <i>Dioxin Concentration Analysis Training (the other Division)</i> |

4. Outline of Metrology Training Center

The Metrology Training Center has four lecture rooms, training rooms and instruments as shown in Table 1.

Table 2. Training Courses of Metrology Training Center

Course		Duration	Number of participants
Basic Training Course	The first term	3 months	31
	The Second Term	3 months	37
Advanced Training Course for General Certified Measurer		2 months	39
Intensive Course for Legal Metrology		1 months	40
Advanced Training Course for	Concentration Measurement	7 weekd	13
	Acoustic Noise & Vibration	2 weeks	8
Special Course	Intensive Course for New Directors	3 days	15
	Intensive Course for Executive Officer	3 days	18
	Specified Manufacturer Course	2 weeks	20
	Intensive Course for Environment Measurement	2 weeks	12
	Course for Verification of Weighing Instrument	3 days * 4 times	76
	Course for Accreditation Examiner	1 week	75
Environmental Measurement Course	Concentration Measurement	4 days * 15 times a year	565
	Acoustic Noise & Vibration	5 days * 4 times a year	116
International Project of JICA Group Training	Legal Metrology Course	2 months	5
		Total	1070

The environmental certified measurers of acoustic noise and vibration measurement and of pollution concentration measurement of air and water were trained in each of the classes.

The trainees for the General Certified Measurers and the local government employees were trained together in the classes of measurement law, measurement technology, legal metrology system and so on. Table 2 shows the names of courses, duration and total number of participants of fiscal year 2005.

Total number of participants is over one thousand in the year 2005 and the number of local government employees is 210. Maximum number of participants is that of Environmental Measurement Course in which the people passed the state qualification examination and were not good enough of experience of chemical analysis.

Table 3. Curriculum for Certified Measurer Fundamental Course				
	Lectures	Times (h)		
○	Measurement law	24		
○	Measurement Units	15		
○	Technical regulations	9		
	Taximeters	3		
	Tolerance of Pre-packaged Goods	4	Practical Training	Times(h)
	Metrological Policy in Local Government	4	Taximeters	3
	Dissemination of Measurement Standards	3	Spot Inspection for Checking Tolerance of Pre-packaged Goods	6
○	Physics	21	Water Meters	4
○	Measurement Management, Fundamentals	15	Gas Meters	4
○	Advanced Measurement Management	15	Oil Meters	4
○	Electronics	12	Weights and Mechanical Balance	8
○	Measurement System, Fundamentals	9	General Theory of Weighing Machine	4
	Conformity Assessment	6	Electronic Precision Balance	4
	Introduction to ISO 9000	3	Length Measurement	4
○	Mass Measurement	21	Volumetric Measurement	4
○	Length Measurement	15	Temperature Measurement	4
○	Thermometers	12	Mass Substitution Method	4
○	Volume Measurement	12	Sampling Theory	8
○	Weighing Instrument	21	Electronic Measurement	8
○	Volumetric Instrument	24	Long length Measurement	8
	Quality Engineering (Taguchi Method)	6		
Note) Open circles indicate that trainees must pass the examinations.				

5. Curriculum of Training for General Certified Measurer

Local government employees and people from the private enterprises, who hope to get the qualification of the Certified Measurer, are trained together at first. Basic course of 3 months and advanced course of 2 months are necessary for the certified measurer. Curriculum of basic course is shown in Table 3.

Subjects marked in the left column require trainees to pass the test and the most of practical trainings require them the report of practical experiments.

The subject of Measurement Management includes basic statistics, quality control, measurement uncertainty and quality engineering. Quality engineering is called “Taguchi Method” in U.S.A. and has many enthusiasts also in Japan. However, its main purpose is the improvement of dispersion of manufacturing products or process. Then, quality engineering is not so popular in the field of measurement in Japan.

6. Course for Environmental Certified Measurer

Air and water pollution is the important problem also in Japan. Many people hope to get the qualification of the Environmental Certified Measurer. About 8,000 people took the examination and 1300 people (about 16%) passed it in the year 2005. There is another way that the qualification could be obtained by taking the course and passing the internal examinations and the oral examination by the experts. Table 4 shows the contents of the training course for Environment Certified Measurer of concentration measurement.

Table 4. Contents of Environmental Course

Lecture	Training
◆ Environment measurement administration	Verification of concentration meter
◆ the Water Pollution Prevention Act	Gas-chromatography measurement
◆ Chemistry	Measurement of pH
◆ Instrumental analysis	Atomic absorption spectrometry
◆ Measurement of air pollution	Measurement of CODMn
◆ Reference material for pollution measurement	Measurement of GC-MS
◆ Environmental measurement certification business	Inductively coupled plasma-atomic emission spectroscopy
◆ Role of environmental certified measurer	

Traceability system for measurement of infinitesimal pollutant concentration is called Specified Measurement Laboratory Accreditation Program (MLAP) and a proficiency test is done among the calibration service laboratories using standard materials including infinitesimal pollutant material, for example, dioxin contamination. The chemical analysis engineer for dioxin should be trained after getting the Environmental Certified Measurer.

Figure 3 shows a view of the new training building and a picture in which an instructor is explaining how to use a noise-meter and analyzing instruments.



Figure 3. Metrology Training Center
(New Training Building)



7. Conclusion

Measurement Training Courses and its curriculum of Metrology Training Center of NMIJ in Japan are introduced.

The Measurement Law of Japan is being discussed to be amended and a specified verification organization will be accredited. The Metrology Training Center will continue to offer measurement training needed for society focusing on legal measurement training and the establishment of traceability in Japan.