Asia-Pacific
Economic Cooperation

Asia-Pacific
Legal Metrology Forum

Handbook on CNG Fuel Dispensers

APEC/APLMF Training Courses in Legal Metrology (CTI 11/2006T)

June 27-30, 2006
Shah Alam, Malaysia

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August 2006

Training Course on CNG Fuel Dispensers
June 27-30, 2006

Contents

Foreword

This booklet is one of the outcomes of the APEC Seminars and Training Courses in Legal Metrology titled 'Training Course on CNG (Compressed Natural Gas) Fuel Dispensers' that was held on June 27-30, 2006 at the Grand BlueWave Hotel in Shah Alam, Malaysia. This course was organized as a follow-up of the Training Course on Fuel Dispensers conducted in April 2005 in Thailand but intended to pursue specific understanding of CNG fuel dispensers. It was organized by the Asia-Pacific Legal Metrology Forum (APLMF) with a support fund of APEC-TILF (Trade and Investment Liberalization and Facilitation) program, CTI-11/2006T. The training course was also supported by (1) SIRIM Berhad, Malaysia; (2) Ministry of Domestic Trade and Consumer Affairs of Malaysia; (3) Department of Food and Agriculture, State of California, USA; (4) Petronas NGV Sdn. Berhad in Malaysia; (5) Metrology Corporation Malaysia Sdn. Berhad; and (6) National Metrology Institute of Japan (NMIJ). Having this result, I would like to extend my sincere gratitude to Mr. Md Nor Md Chik of SIRIM Berhad; Mr. Mohd Roslan Mahayuddin of the Ministry of Domestic Trade and Consumer Affairs, Malaysia; Mr. Ir. Hasmad B. Ahmad of Petronas NGV Sdn. Bhd.; Mr. Ismail Husin of Metrology Corporation (M) Sdn. Bhd.; Mr. Charles Nelson and Mr. Robert Norman Ingram of the Department of Food and Agriculture, State of California, USA; and the APLMF Working Group on Training Coordination chaired by Mrs. Marian Haire of National Measurement Institute Australia. Also, special thanks should be extended to the APEC Secretariat for their great contributions.

We have conducted the surveys among the APEC member economies concerning seminar and training programs in legal metrology to find their needs as well as possible resources which would be available for the region. The survey shows that there is a strong need for a new training course designed specifically on CNG fuel dispensers that is one of the categories of instruments in legal metrology; this field has becoming a great interest of the member economies due to the increasing demand for alternative source of fuel for automobiles. However, the legal metrological control on CNG fuel dispensers has been just started. International recommendation on such dispensers has not been standardized in the OIML Recommendations; the draft recommendation is under review. Taking account of such current situation, we considered it is essential for the member economies to learn a practical verification procedure from the United States where CNG has been widely used as well as to exchange information with all participants about the current situation of CNG in each economy. We believe such a training course will provide the APEC and APLMF economies an opportunity to have a common technical base of understandings that may lead to the next international step to enable a proper proposal to the International Standard such as ISO or

OIML Recommendation.

The main target of this training course was to assist the experts in charge of the legal metrological control on CNG in the APEC / APLMF member economies to develop deeper understanding of the current situation including the verification of CNG fuel dispensers in performing inspection procedures. Thus the training course would also help the experts to learn how CNG system is used and controlled in the major CNG markets.

In view of these situations, this training course concerning CNG fuel dispensers had been planned and completed successfully so as to settle a sure basis of confidence in legal metrology related to the measurement of CNG fuel dispensers within the Asia-Pacific region. I would like to say that this is certainly a valuable first step to fruitful activities in legal metrology related to CNG systems in the Asia-Pacific region.

I am really pleased to have this outcome from the training course and again deeply appreciate APEC Secretariat's generosity in contributing to the development in legal metrology among the APLMF member economies.

August 22, 2006

Dr. Akira Ooiwa
APLMF President

Summary Report on the APLMF Training Course for the Verification Inspection of Compressed Natural Gas Fuel Dispensers

While supplies are being exhausted as the worlds demand for petroleum increases, alternative sources of motor fuel are becoming more widespread. Compressed natural gas (CNG) is one of the alternatives on the rise. Some economies that have no CNG users currently have plans for implementing use within a short period of time. To help promote the continued confidence of an equitable marketplace in international trade, it becomes necessary to address measurement activities in relatively new technical arenas. Therefore, APEC and APLMF presented the training course on CNG Fuel Dispensers.

The APEC/APLMF Training Course on CNG Fuel Dispensers was held in Shah Alam, Malaysia from June 27 to June 30, 2006. Training course material was developed and presented by Mr. Charles Nelson and Mr. Robert Norman Ingram from Division of Measurement Standards, Department of Food and Agriculture, State of California, USA. The course was organized by the APLMF and APEC. Supporting organizations were: National Metrology Laboratory (NML) SIRIM Berhad, Malaysia, Ministry of Domestic Trade and Consumer Affairs, Malaysia, Petronas NGV Sdn. Berhad in Malaysia, Metrology Corporation Malaysia Sdn. Berhad, and National Metrology Institute of Japan (NMIJ). The course was attended by 36 trainees representing 14 economies.

The training course was designed to provide training on general safety, properties of CNG, dispenser components, requirements on dispensers, and procedures for inspection including necessary equipments and accessories. The course included a power point presentation with lectures in a classroom and field training at a facility with CNG dispensers. In addition, the course helped the member economies become more familiar with the processes involving technical requirements of pattern approval and verification inspection of CNG dispensers, and met the APEC and APLMF objective to harmonise with Organisation Internationale De Metrologie Legale (OIML) recommendations with an overview and comparison of OIML document TC 8 SC 7.

Each attending member economy contributed to the course with a presentation regarding the use of CNG and their experience associated with the management of pattern approval and/or verification inspection within their respective economies. These presentations revealed the diversifying use of CNG as a motor fuel, from projected use to a narrow scope of limited government fleet and local municipal transportation to widespread use in private vehicles. First day closure brought an enlightened and impressive tour of National Metrology Laboratory (NML) SIRIM Berhad, Malaysia who is the keeper of Malaysia's
Primary Physical Standards of Measurement.

Two days of lecture reinforced with a power point presentation gave the trainees an opportunity to interact and contribute to the training. The course was presented using the gravimetric procedure in verifying the dispenser delivery accuracy. This procedure incorporates the practice of determining the weighing element error in relation to its zero error. Once determined, the

weighing element error is applied as a correction to the net load of CNG. Mr. Do Viet Hung, the representative from Viet Nam offered an alternative method for determining the weighing element error, when considering the zero error. Although either method would result with the correct error, the alternative is perhaps more consistent with the OIML procedures laid out in OIML document R 76-2.

The field training was very successful due to a highly co-ordinated effort from Dr. Abdul Rahman Mohamed, Senior Metrologist and Head of Flow Measurement, National Metrology Laboratory (NML) SIRIM Berhad, Malaysia, who arranged for transportation, and critical equipment needs. Mr. Mohd Sherman Nabiel Bin Abdul Basit of Petronas NGV Sdn. Bhd. also contributed to the highly co-ordinated effort of supplying critical equipment needs as well as his personal assistance in handling the gas cylinders. The gravimetric method for delivery measurement accuracy presented by the trainers was demonstrated first. As in the lecture, the field training also yielded an opportunity for the trainees to interact and contribute with the demonstration by Dr. Abdul Rahman Mohamed on the use of a master meter as a transfer standard for delivery accuracy verification.

In between all the logistical and technical issues, the host in Malaysia provided for a wonderful time of international social interaction encouraging trade and investment liberalization by offering the most delicious cuisine representing a variety of international tastes as well as the best that Malaysia has to offer. Further enchasing opportunities of international social interaction, the host provided transportation for city tours of Kuala Lumpur and the luxurious new central government city Putrajaya, to be completed in 2010. For the farewell dinner, a most wonderful evening of entertainment, festivities, and cuisine were provided by the host & APLMF.

The sponsorships by the organizers and the host economies of the APEC/APLMF training courses provide not only an atmosphere of harmonization of the technical regulations that define parameters of measurement activities in commerce, but also perpetuate a true harmonization in togetherness of humanity.

R. Norman Ingram
State of California
Department of Food and Agriculture
Division of Measurement Standards

Asia-Pacific
Economic Cooperation

Asia–Pacific
Legal Metrology Forum

APEC/APLMF Seminars and Training Courses in Legal Metrology (CTI–11/2006T)
Training Course on CNG (Compressed Natural Gas) Fuel Dispensers

June 27–30, 2006
at the Grand BlueWave Hotel, Shah Alam, Malaysia

Program

Organizers:
1. Asia–Pacific Economic Cooperation (APEC)
2. Asia–Pacific Legal Metrology Forum (APLMF)

Supporting Organizations:
1. National Metrology Laboratory (NML), SIRIM Berhad, Malaysia
2. Ministry of Domestic Trade and Consumer Affairs, Malaysia
3. Department of Food and Agriculture, State of California, USA
4. Petronas NGV Sdn. Berhad in Malaysia
5. Metrology Corporation Malaysia Sdn. Berhad
6. National Metrology Institute of Japan (NMIJ)

Main Objective:

This training course intends to provide officials in charge of inspection and testing of retail motor fuel dispensers for Compressed Natural Gas (CNG) training on general safety, properties of CNG, dispenser components, requirements on dispensers, and procedures for inspection including necessary equipments and accessories. The training course includes both lectures in a classroom and field training at a facility with CNG dispensers. Thus, the present training course aims to help the member economies to meet the APEC and APLMF objective to harmonise metrology legislation on OIML international recommendations.

Trainers:
1. Mr. Charlie Nelson, Measurement Standards Specialist III, Measurement Compliance Program, Division of Measurement Standard, Department of Food and Agriculture, State of California, USA
2. Mr. Norman Ingram, Measurement Standards Specialist III, Type Evaluation Program, Division of Measurement Standard, Department of Food and Agriculture, State of California, USA

Registration:

Fill the attached "Registration Form" and send it to the APLMF secretariat by **June 1, 2006**.

Visa assistance:

If you need a visa to enter Malaysia, please fill up the bottom portion of the "Registration Form" for 'Visa information'. This information will be forwarded to the host by APLMF secretariat. Upon receipt of the information, the host will send an official letter of invitation for visa application.

Venue and Accommodation:

Grand BlueWave Hotel, Shah Alam
Persiaran Perbandaran, Seksyen 14, 40000 Shah Alam, Malaysia
Tel : +60-3-5031-3388, Fax : +60-3-5031-2288
http://www.bluewavehotels.com/

If you hope to reserve a room at the venue (USD48 net/night (single), USD54 net/night (twin-sharing)), please fill up the "Hotel Reservation Form" and send it to the host in Malaysia by **June 16**.

Access Information

The Grand BlueWave Hotel, Shah Alam is situated in the commercial centre of the city of Shah Alam which is located about 55 km from the Kuala Lumpur International Airport (KLIA). Participants are advised to arrive at the hotel directly by airport limousine taxi service (about 50 minutes ride). The taxi ticketing counter is located just before you exit the arrival hall after going through customs check point. If you miss this counter another counter is located in the airport lobby near exit door No. 2. Please note that there are two types of taxis available, the budget taxi costing RM58.30 (approx. 16 USD) from KLIA to Grand BlueWave Hotel and premier taxi costing RM77.30 (approx. 21 USD). An additional surcharge of RM17.00 and RM22.00 is levied for the budget taxi and premier taxi respectively after mid-night.

Contact Persons for the Training Course:

1. APLMF Secretariat (registration and travel support)
Dr. Tsuyoshi Matsumoto & Ms. Ayako Murata
APLMF Secretary
NMIJ/AIST Tsukuba Central 3-9, 1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan
Tel: +81-298-61-4362, Fax: +81-298-61-4393
E-mail: e.sec@aplmf.org & sec@aplmf.org

2. State of California (lecture and training materials)
Mr. Charlie Nelson and Mr. Norman Ingram
Division of Measurement Standard,
Department of Food and Agriculture, State of California, USA
E-mail: CNelson@cdfa.ca.gov & NIngram@cdfa.ca.gov

3. Host in Malaysia (visa assistance, accommodation and venue)
Mr. Chen Soo Fatt, Principal Metrologist
Dr. Abdul Rahman Mohamed, Head of Flow Metrology Section
National Metrology Laboratory, SIRIM Berhad
Lot PT 4803, Bandar Baru Salak Tinggi 43900, Sepang, Selangor Darul Ehsan, Malaysia.
Tel: +60-3-8778-1663, Fax: +60-3-8778-1661
E-mail: soo.fatt_chen@sirim.my & abd.rahman_mohamed@sirim.my

Program

Day 1: Tuesday, June 27, Venue: Grand BlueWave Hotel		
Time	**Details**	**Presenter**
09:00 – 09:30	• Opening ceremony - Opening address by Dr. Tsuyoshi Matsumoto, APLMF Executive Secretariat - Welcome address Mr. Md Nor Md Chik, Senior General Manager, NML-SIRIM - Take a group photo	APLMF and Host (NML-SIRIM)
09:30 – 10:00	*Coffee break*	
10:00 – 10:20	• Overview of the course	Mr. Nelson and Mr. Ingram
10:20 – 12:30	• Presentation of each economy on: - Current situation on the metrological control and verification of CNG fuel dispensers and future direction.	One representative from each of 14 economies
12:30 – 14:00	*Lunch break*	
14:00 – 15:30	• Overview of OIML draft on Compressed Gaseous Fuel Measuring Systems for Vehicles (TC8/SC7) *(highlighting requirements and test methods)* • Introduction to CNG • Dispenser components	Mr. Nelson and Mr. Ingram
15:30 – 16:00	*Coffee break*	
16:00 – 17:00	• General requirements • Visual inspection	Mr. Nelson and Mr. Ingram
Day 2: Wednesday, June 28, Venue: BlueWave Hotel and NML-SIRIM		
Time	**Details**	**Presenter**
9:00 – 10:10	• Functional test • Equipment for testing CNG	Mr. Nelson and Mr. Ingram
10:10 – 10:40	*Coffee break*	
10:40 – 12:00	• Scale verification • Performance tests • Question and answer session	Mr. Nelson and Mr. Ingram
12:00 – 13:00	*Lunch break*	
13:00	*Leave the hotel for the visit*	
14:00 – 18:00	• Technical Visit to National Metrology Laboratory, SIRIM Berhad. • Visit to Putrajaya (Federal Government Administrative Centre)	Host (NML-SIRIM)
18:30	*Return to the hotel*	

Day 3: Thursday, June 29, Venue: the Petronas CNG station near the Kuala Lumpur International Airport		
Time	**Details**	**Presenter**
8:30	*Leave the hotel lobby for the CNG station*	
9:00 – 10:00	• Demonstration of individual tests • Questions and answers	Mr. Nelson, Mr. Ingram, and Petronas NGV Sdn. Bhd.
10:00 – 10:30	*Coffee break*	
10:30 – 12:30	• Participants work in groups to conduct individual tests according to the tests procedures.	Mr. Nelson, Mr. Ingram, and Petronas NGV Sdn. Bhd.
12:30 – 14:00	*Lunch break at the Concorde Inn near the Kuala Lumpur International Airport*	Petronas NGV Sdn. Bhd.
14:00 – 16:00	• Question and answer session	Mr. Nelson and Mr. Ingram
17:00	*Return to the hotel*	
19:00 – 22:00	*Farewell dinner at the Kelab Shah Alam Selangor in Shah Alam*	APLMF and Metrology Corporation Malaysia Sdn. Bhd.

Day 4: Friday, June 30, Venue: Grand BlueWave Hotel		
Time	**Details**	**Presenter**
08:30 – 10:00	• Summary by the trainees about what they have learned during the course • Questions and answers	Mr. Nelson, Mr. Ingram and trainees
10:00 – 10:30	*Coffee break*	
10:30 – 11:30	• Continue the questions and answers	Mr. Nelson, Mr. Ingram and trainees
11:30 – 12:30	• Closing ceremony - Certificate presentation to all trainees - Closing address by Dr. Tsuyoshi Matsumoto - Closing address by Mr. Soo Fatt Chen (NML)	AMPLF and Host (NML-SIRIM)
12:30 – 14:30	*Lunch Break*	
14:30	*Leave the hotel lobby for the tour*	
15:40 – 18:45	• Half-day city tour to Kuala Lumpur *(Compliments of host for all foreign participants)*	Host (NML-SIRIM)
19:50	*Arrive at the hotel*	

Participants List of APEC/APLMF Training Course on CNG (Compressed Natural Gas) Fuel Dispensers
June 27–30, 2006 at the Grand BlueWave Hotel, Shah Alam, Malaysia

No.	Category	Economy	Full Name	Organization
1	Trainee	Cambodia	Mr. Sea Kimhoun	Department of Metrology (DOM), Ministry of Industry, Mines and Energy (MIME)
2	Trainee	Chile	Ms. Hilda Cabello Muñoz	Superintendencia De Electricidad Y Combustibles
3	Trainee	China, PR	Mr. Zhang Ze Hong	Chong Qing Academy of, Metrology and Quality Inspection
4	Trainee	Indonesia	Mr. Aripin Maskosoeditro	Directorate of Metrology, General Directorate of Domestic Trade, Ministry of Trade of Republic Indonesia
5	**APLMF**	Japan	Dr. Tsuyoshi Matsumoto	Executive Secretary of APLMF, National Metrology Institute of Japan (NMIJ), AIST
6	**APLMF**	Japan	Ms. Ayako Murata	Secretary of APLMF, National Metrology Institute of Japan (NMIJ), AIST
7	Trainee	Korea, DPR	Mr. Ko Hak Chol	Central Institute of Metrology, State Administration for Quality Management of the DPR Korea (SAQM)
8	Trainee	Korea, DPR	Mr. Ryu Il Su	Central Institute of Metrology, State Administration for Quality Management of the DPR Korea (SAQM)
9	Trainee	Lao. PDR	Mr. Kadingthong Singdala	Science technology and Environment Agency, Dept. of intellectual Property Standardization and Metrology (DISM)
10	**Host**	Malaysia	Mr. Anamalai Kuppan	National Metrology Laboratory, SIRIM Berhad
11	**Host**	Malaysia	Mr. Ir. Hasmad B. Ahmad	Manager, Operations and Services Dept., Petronas NGV Sdn. Bhd.
12	**Host**	Malaysia	Mr. Ismail Husin	Managing Director, Metrology Corporation (M) Sdn. Bhd.
13	**Host**	Malaysia	Mr. Lee Giok Seng	Senior Manager, Operations and Services Dept., Petronas NGV Sdn. Bhd.
14	**Host**	Malaysia	Mr. Md Nor Md Chik	Senior General Manager, National Metrology Laboratory, SIRIM Berhad
15	**Host**	Malaysia	Mr. Mohamad Rizal bin Zakaria	National Metrology Laboratory, SIRIM Berhad
16	**Host**	Malaysia	Mr. Mohd Roslan Mahayuddin	Director General of Enforcement Div., Ministry of Domestic Trade and Consumer Affairs
17	**Host**	Malaysia	Ms. Suliana Ghazalli	National Metrology Laboratory, SIRIM Berhad
18	Trainee	Malaysia	Mr. Abdul Rahim Bin Ngah	Metrology Corporation Malaysia Sdn. Bhd.
19	Trainee	Malaysia	Dr. Abdul Rahman Mohamed	Head of Flow Metrology Section, National Metrology Laboratory, SIRIM Berhad
20	Trainee	Malaysia	Mr. Azmi Bin Hamad	Metrology Corporation Malaysia Sdn. Bhd.
21	Trainee	Malaysia	Mr. M. Shahrul Izwan Bin Tami	Petronas NGV Sdn. Bhd.
22	Trainee	Malaysia	Mr. Mohd Fazlieyza Bin Din	Petronas NGV Sdn. Bhd.
23	Trainee	Malaysia	Mr. Mohd Khalis Bin Kasim	Director, Metrology Unit, Ministry of Domestic Trade and Consumer Affairs
24	Trainee	Malaysia	Mr. Mohd Sherman Nabiel Bin Abdul Basit	Petronas NGV Sdn. Bhd.
25	Trainee	Malaysia	Mr. Mohd Zaini Bin Md. Zain	UMW Industrial Power
26	Trainee	Malaysia	Mr. Muhd Khalid Bin Naim @ Ahmad	Metrology Corporation Malaysia Sdn. Bhd.

27	Trainee	Malaysia	Ms. Ong Gek Lin	Mogas Sdn. Bhd.
28	Trainee	Malaysia	Ms. Sapiah Mohd Nor	Metrology Unit, Ministry of Domestic Trade and Consumer Affairs
29	Trainee	Malaysia	Mr. Shahrulnizamakmar Bin Din	Petronas NGV Sdn. Bhd.
30	Trainee	Malaysia	Mr. Syahrul Manap	Flow Metrology Section, National Metrology Laboratory, SIRIM Berhad
31	Trainee	Malaysia	Mr. Thanabalan a/l Supramaniam	Tractors (M) Sdn. Bhd.
32	Trainee	Malaysia	Mr. Wan Yusri Bin Wan Nawang	ABA Gas Technology Sdn. Bhd.
33	Trainee	Malaysia	Mr. Zainal Badri Bin Sulaiman	Petronas NGV Sdn. Bhd.
34	Trainee	Malaysia	Mr. Zuraidi Yusof	Flow Metrology Section, National Metrology Laboratory, SIRIM Berhad
35	Trainee	Malaysia	Mr. Fedrick Anak Tembak	Metrology Corporation Malaysia Sdn. Bhd.
36	Trainee	Malaysia	Mr. Peter J. Berinus Agang	Metrology Unit, Ministry of Domestic Trade and Consumer Affairs
37	Trainee	Malaysia	Mr. Chen Soo Fatt	Principal Metrologist, National Metrology Laboratory, SIRIM Berhad
38	Trainee	Malaysia	Mr. Lee Choon Keong	Metrology Corporation Malaysia Sdn. Bhd.
39	Trainee	Malaysia	Mr. Yeoh Wee Theng	Flow Metrology Section, National Metrology Laboratory, SIRIM Berhad
40	Trainee	Mongolia	Mr. Dambasuren Davaa	Mongolian agency for Standardization and Metrology
41	Trainee	Papua New Guinea	Ms. Debbie Taitarae	PNG National Institute of Standards & Industrial Technology (NISIT)
42	Trainee	Peru	Mr. Abed Yamil Abdul Morales Quichua	Institute for the Defense of Competition and the Protection of Intellectual Property (INDECOPI)
43	Trainee	Philippines	Ms. Rhea Bumatay Banglay	National Metrology Laboratory, Industrial Technology Development Institute, Department of Science and Technology
44	Trainee	Singapore	Mr. Adrian Ang Pau Yuen	Weights & Measures Office, SPRING Singapore
45	Trainee	Thailand	Mr. Warachai Triarun	Central Bureau of Weights and Measures (CBWM), Department of Internal Trade (DIT)
46	**Trainer**	USA	Mr. Robert Norman Ingram	Measurement Standards Specialist III, Type Evaluation Program, Division of Measurement Standard, Department of Food and Agriculture, State of California
47	**Trainer**	USA	Mr. Charles Nelson	Measurement Standards Specialist III, Measurement Compliance Program, Division of Measurement Standard, Department of Food and Agriculture, State of California
48	Trainee	Viet Nam	Mr. Do Viet Hung	QUALITY ASSURANCE & TESTING CENTRE 3, (QUATEST 3)

* Names are listed in alphabetical order of their economies, last names and categories.

History of Alternative Fuel Pattern Testing

Pattern Approval Begins - 1922

Liquefied Petroleum Gas Meter Inspection – 1940's

Cryogenic meter Inspection – 1960's

Compressed Natural Gas Inspection 1980's

Hydrogen (liquid) meter inspection 1990's

Hydrogen (Hydrogen Gas) Meter Inspection 2000's

Compressed Natural Gas Training Overview

Course outline:

- Overview of OIML CNG TC8/SC7
- Introduction to CNG
- Properties and Characteristics of CNG
- Safety
- CNG Equipment
- Verification
- Test Procedures
- Demonstration
- Trainee Proficiency

DIVISION OF MEASUREMENT STANDARDS ★ CALIFORNIA ★

Compressed Natural Gas RMFD Training

Course Instructors

Charlie Nelson & Norman Ingram

Charlie Nelson and Norman Ingram will be presenting a power point presentation for the next two days on Compressed Natural gas dispenser Inspection and testing. There will be 8 segments through out classroom training. On the third day we will have a field presentation with hands on application.

General Overview

This module will:

Familiarize you with CNG program that relates to Weights & Measures

Introduce requirements that apply CNG systems.

Show basic steps in performing field inspection procedures

Compressed Natural Gas RMFD Training

Course outline:

- Introduction
- Properties and Characteristics
- Safety
- Equipment
- Verification
- Test Procedures

INTRODUCTION TO CNG

What is Natural Gas?

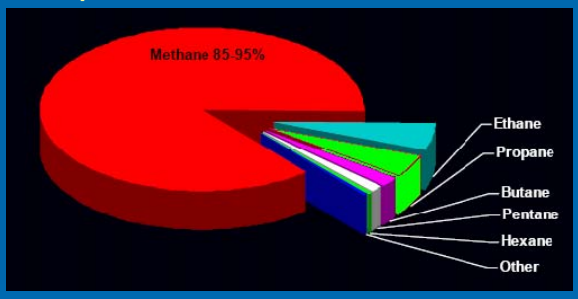
Natural gas derives from decayed matter over a long period of time and under tremendous heat and pressure

Natural gas is not pure methane or a homogenous mixture, but varies in composition seasonally and by location.

NATURAL GAS….Is naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geological formations beneath the earth's surface. Natural gas basically comes from organic material that was decomposed under pressure.

CNG Properties

Properties and Characteristics of CNG



Specific gravity of gas components (air = 1.0)

Methane 0.5
Propane 1.5
Butanes 2.0
Pentanes 2.4
Hexanes 2.9

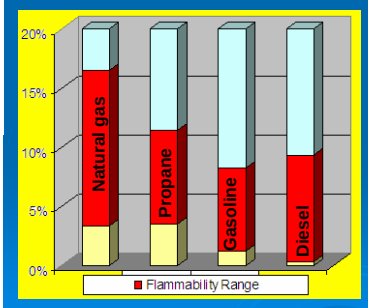
Others consist of…
CO2 1.5
Ethane 1.0
Nitrogen 0.9

As you can see the natural gas contains various compositions that vary from locations and sources. This pie is showing the approximation of what natural gas consist of.

CNG CHARACTERISTICS

Properties and Characteristics of CNG

Flammability range in air for ignition to take place



Natural gas 4% to 16%
Propane 4% to 9%
Gasoline 1.3% to 7.6%
Diesel 0.3% to 10%

Motor fuel components varied in their flammability range when an engine carbaration is adjusted it takes in consideration of the type of fuel it is using. For example, the ratio of air mix with Natural gas is lower than the mixture for gasoline.

CNG SAFETY

Importance of Safety

* Safety is EXTREMELY IMPORTANT *
* Re-stress in field training *
* Cannot be over-stressed *
* If you don't learn anything else…learn that safety comes first *
* Unsafe practices can harm not only yourself, but also others *

We all have been preached about Safety time and time again when working in dangerous elements. I can't emphasize enough your safety is important as well the individuals around you. If you see something that looks unsafe let the personnel at the site who are responsible for your safety to know what your concerns are.

CNG SAFETY

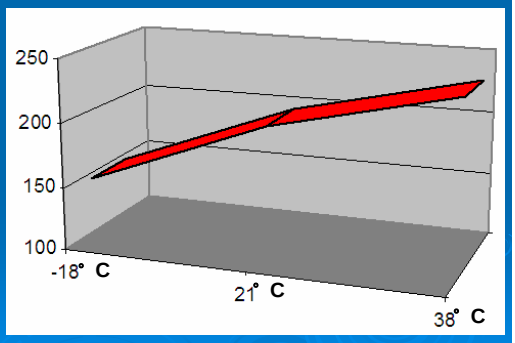
PRESSURE

Ambient temperature goes up or down…

Pressure also goes up or down

145 bar @ -18° C

240 bar @ 40° C



Typically filled to 200 Bar @ 21° C

If we recall CHARLES'S LAW…The volume of a gas at constant pressure is directly proportional to the temperature. As temperature changes so will pressure.

CNG SAFETY

PRESSURE

What is the pressure rating of your Test Cylinder?

200 Bar?

Or

250 Bar?

Let's talk about pressure rating of a cylinder that will be used in the testing …when you get a cylinder you will need to make a determination if that cylinder will be suitable for the application. What is the cylinder rated for? Cryogenic, propane or CNG? You can't have one for all. Every tank or pressure vessel are design for a specific application…there are good reasons why. What is the maximum pressure range of that vessel? 200 bar? Or is 250 bar?

CNG SAFETY

PRESSURE

What is the pressure rating of your Test Cylinder?

Markings are required…

To Identify pressure limits

Identification markings are required, if there are no markings to identify what the cylinder is rated for and its limit… I would not bother to use it if it does not have the qualifying statement required on pressure vessels. As I mentioned earlier Safety comes first.

CNG SAFETY

PRESSURE

Additional Safety feature…

NGV Nozzles and Connectors

Nozzles… Let's look at the fittings, notice the design of the connectors, they are not exactly identical with each other…there is a reason for this…The storage tanks varied in their pressure ratings, for example if you have a tank that is rated for 200 bar and you go to a CNG dispenser that dispenses at the rate of 250 bar you will obviously would over fill your tank and create a liability situation. Because the connectors are different, in this case, it is design to have the ability to only connect to matching nozzles that are dispensing at 200 bar. Now if this was the other way around…the tank rated at 250 bar you would still be able to connect to a 200 bar dispenser, the concept of the connector is so you could not connect to a higher pressure rating than your connector allowed.

CNG SAFETY

PRESSURE

Fuel storage cylinder types:

1: All metal (steel or aluminum)……..130kg
2: Hoop-wrapped steel or aluminum…….120kg
3: Fully-wrapped steel or aluminum…….115kg
4: All composite (non-metallic)……..85kg

Example: Cylinder holds 30kg of CNG

There are four types of CNG cylinders, Type 1 is the heaviest of all CNG cylinder types. Type 2 is metal liner wrapped reinforced by composite wrap in the mid section of the tank, so basically the pressure stress factor is supported by 50% on the metal liner and 50% on the composite wrap. Type 3 is the same as type 2, the only difference is the tank is fully wrapped. Type 4 is all non-metallic, normally the tank is a plastic liner with all composite wrapping.

CNG SAFETY

PRESSURE

Preventive maintenance…

Make a visual inspection of cylinder before use

Notice the lining around the tank? When you see damage from abrasion or other form of mishandling of pressure tanks it is best to have it repaired or replace. We basically leave the responsibility of the operator or maintenance personnel to provide the cylinder to accommodate the test.

CNG SAFETY

PRESSURE

Hazards from overfill or damaged linings

This particular tanks is made of composite type of material. Notice the white portion of the ruptured tank, That is the plastic liner. The second layer the graphite wrapping material and last and outer portion is the glass or carbon fiber material which is a protection layer of the tank. This rupture was due to defect or cuts in the composite lining, all it takes is a small cut in the lining to compremise the integrity of the pressure vessel.

CNG SAFETY

Properties and Characteristics of CNG

Properties & Hazards of CNG

Bleve
Boiling
Liquid
Expanding
Vapor
Exploding

AKA
Blowing and leveling everything very effectively

The term "BLEVE" Is an abbreviation of Boiling liquid expanding vapor exploding. Another word that fire departments say is Blowing and leveling everything very effectively. A BLEVE can occur in a vessel that stores a substance that is usually a gas at atmospheric pressure but is a liquid when pressurized (for example, liquefied petroleum gas). The substance will be stored partly in liquid form, with a gaseous vapour above the liquid filling the remainder of the container.

If the vessel is ruptured — for example, due to corrosion, or failure under pressure — the vapour portion may rapidly leak, dropping the pressure inside the container and releasing a wave of overpressure from the point of rupture. This sudden drop in pressure inside the container causes violent boiling of the liquid, which rapidly liberates large amounts of vapour in the process. The pressure of this vapour can be extremely high, causing a second, much more significant wave of overpressure (i.e., an explosion) which may completely destroy the storage vessel and project it as shrapnel over the surrounding area.

A BLEVE does not require a flammable substance to occur, and therefore is not usually considered a type of chemical explosion. However, if the substance involved *is* flammable, it is likely that the resulting cloud of the substance will ignite after the BLEVE proper has occurred, forming a fireball and possibly a fuel-air explosion. BLEVEs can also be caused by an external fire nearby the storage vessel causing heating of the contents and pressure build-up.

CNG SAFETY

Properties and Characteristics of CNG

Hazards of CNG

Bleve Causes this…

Aerosol can

As you can see, the aerosol can being suspended in the air by a string, when the can heats up this is what happens… the devastating results that can happen with compressed flammable products on a larger scale when dangerous elements comes into play. The reason I'm bringing this up is safety first and the realization of the hazard that are involve when working with flammable components.

CNG SAFETY

Properties and Characteristics of CNG

Hazards of CNG

Bleve Causes this…

Aerosol can

Heating the can

As you can see, the aerosol can being suspended in the air by a string, when the can heats up this is what happens… the devastating results that can happen with compressed flammable products on a larger scale when dangerous elements comes into play. The reason I'm bringing this up is safety first and the realization of the hazard that are involve when working with flammable components.

CNG SAFETY

Properties and Characteristics of CNG

Hazards of CNG

Bleve Causes this…

Aerosol can | **Heating the can** | **End result…**

As you can see, the aerosol can being suspended in the air by a string, when the can heats up this is what happens… the devastating results that can happen with compressed flammable products on a larger scale when dangerous elements comes into play. The reason I'm bringing this up is safety first and the realization of the hazard that are involve when working with flammable components.

CNG SAFETY

Safety Equipment

Static Discharge

Can cause an Explosion or Fire!

Grounding Test equipment Is mandatory!

This is a grounding cable or connector. The dispenser is grounded and the delivery hose which contains braided wire is also grounded. The tank is not grounded so you will need to make sure the metal part of your tank which is the valve portion of your cylinder to be grounded by use a grounding device similar to what is shown on the screen.

Code of Standards and Practice

USA – NFPA (30A, 52,57, 59A), ANSI

Malaysia – MS1096-1997, MS1204-1991

Japan – JGA NGV (01,02,03,04,05)

Australia – AG (807,601,901), AS/NZS (1869,2030.1, 2337.1, 2337.3, 2473, 2613, 2739, 2764, SAA MP48, ANSI/IAS NGV (2, 3.1), CSA B51 Part 2

Here are the list of Standards that have been used by other countries

NFPA standards – USA

National Fire Protection Association Standards:

NFPA 52 - Compressed Natural Gas Vehicular Fuel Systems Code - 1998
NFPA 57 - Liquefied Natural Gas Vehicular Fuel System Code - 1999
NFPA 30A - Motor Fuel Dispensing Facilities and Repair Garages - 2003
NFPA 59A - Standard for the Production, Storage, and Handling of Liquefied Natural Gas - 2001

Malaysia

MS1096-1997: Code of Practice for the Use of CNG Fuel in Internal Combustion Engines. (First revision)
MS1204-1991: Code of Practice for CNG Compressor and Refuelling Stations: On Site Storage and Location of Equipment.

Japanese

JGA NGV01-95: Technical Standards for Natural Gas Refuelling Appliances.
JGA NGV02-95: Design and Installation Standards for CNG Vehicular Fuel Equipment.
JGA NGV03-95: Safety Standards for Natural Gas Refuelling Stations.
JGA NGV04-95: Standards for CNG Vehicle Refuelling Connectors.
JGA NGV05-95: Standards for Water Content of Vehicle Fuel Natural Gas.

Australian Standards

Standards Australia (SAA) Email: intsect@standards.com.au As of May 3rd 2003: **AG 806** 1990 Approval Requirements for NGV Home Refuelling Appliances
AG 807 1992 Approval requirements for natural gas flexible hose and hose assemblies for pressures above 2.6 MPa.
AG 601 1998 Gas installation code
AG 901 1996 Code of practice for NGV refuelling stations
AS 1869 Hose and hose assemblies for liquefied petroleum gases (LPGas), natural gas and town gas.
AS/NZS 2030.1 1999 The verification, filling, inspection, testing and maintenance of cylinders for storage and transport of compressed gases. Part 1: Cylinders for compressed gases other than acetylene.
AS/NZS 2337.1 1999 Gas cylinder test stations. Part 1: General requirements, inspections and tests - Gas cylinders.
AS/NZS 2337.3 1999 Gas cylinder test stations. Part 3: Inspection and testing of fibre reinforced plastic (FRP) aluminium alloy gas cylinders - hoop overwrapped
AS 2473 1996 Valves for compressed gas cylinders (threaded outlets).
AS 2613 Safety devices for gas cylinders
AS/NZS 2739 1999 Natural gas (CNG) fuel systems for vehicle engines
AS/NZS 2764 Working areas for gas-fuelled vehicles
SAA MP48 Certified gas cylinder test stations **North American standards used in Australia ANSI/IAS NGV 1** Compressed natural gas vehicle (NGV) fueling connection devices.
ANSI/IAS NGV 2 American National Standard for basic requirements for compressed natural gas vehicle (NGV) fuel containers.
ANSI/IAS NGV 3.1 Fuel system components for natural gas powered vehicles.
CSA B51 Part 2 High pressure cylinders for the on-board storage of natural gas as a fuel for automotive use.

CNG SAFETY

What to do in case of an Emergency?

What do you do in an unlikely event that you have a accident or a fire? First thing you want to do have proper training to deal with application of your job. I would recommend that you deal with the jurisdiction in your country that deal with the safety protocol of fire management. What I mean by this, as an example, would be The fire Marshal or the qualified site safety personnel. When ever there is an emergency that requires a gas shut down to prevent a potential hazard the Emergency shut down device would be the first thing that would need to be activate.

CNG SAFETY

What to do in case of an Emergency?

Know where your extinguisher is

Class A, B, C or D?…

Class A: paper, wood, cardboard, and most plastics
Class B: Flammable Liquids
Class C: Electrical
Class D: Combustible metals

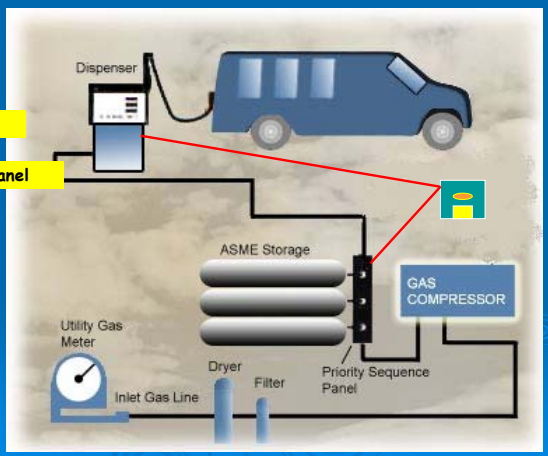
Now that we mentioned the ESD. What type of extinguisher do we need for CNG related fire? There are three different rating of fire extinguisher… Class A : are for ordinary combustible materials such as paper, wood, cardboard, and most plastics. Class B: are for flammable or combustible liquids such as gasoline, kerosene, grease and oil. Class C: are for fires involve electrical equipment, such as appliances, wiring, circuit breakers and outlets. Class D are for fires that involve combustible metals, such as magnesium, titanium, potassium and sodium, usually for labortories.

CNG Equipment Outline

- ✓ CNG Station Overview
- ✓ Station Types
- ✓ CNG Station Components
- ✓ Visual Inspection
- ✓ Test Equipment
- ✓ CNG Dispenser Functional Test

Overview of CNG Station

- Utility Meter
- Dryer & Filters
- Compressor Station
- Priority Sequence Panel
- Storage Tanks
- CNG Dispenser
- Controller



This is a general layout of the CNG station. (1) The first component is the utility meter which CNG stations pay for the gas that is supplied to them for resale to the public. When the station purchase gas through the pipeline they first have to be processed through a (2) gas dryer and filter otherwise you could have a potential engine problem due to contaminates. (3) from the filters the gas is then supplied to the compressor and from the compressor the compressed gas which is controlled by the (4) Priority sequencing Panel which can regulate the pressure (5) going into the various tanks. From the tanks, compressed gas is then supplied (6) to the dispenser. The operational function of the dispenser is controlled by the (7) system controller which is basically the brains of the station operation.

CNG Equipment Outline

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Station Type
CNG Stations

Types of CNG "Filling" Stations

CNG Dispensing Stations

Time Filled

Time-fill stations fill Multiple number of vehicles at one time over a six- to eight-hour period. Compressors compress natural gas from pipeline pressure (0.5-7 bar) to the required vehicle pressure (170-250 bar). These stations are generally for vehicles such as school buses and utility trucks that return to a central location and can fuel while parked for an extended period. But extended fueling time is needed because time-fill stations have relatively small compressors and no CNG storage.

CNG Dispensing Stations

Buffered Fill

Buffered fast-fill stations provide fast, continuous, high-volume fueling. Relatively large compressors run continuously during fueling, filling vehicles and, in the interval between vehicles, a CNG storage buffer. The storage buffer provides CNG to vehicles at the beginning of the fueling cycle and allows the compressor to run for long periods. Unlike CNG storage in cascade fast-fill systems, buffer storage is not separated into separate banks. Buffered fast-fill stations are suitable for quickly fueling large numbers of heavy-duty, high-fuel-capacity vehicles, such as transit buses.

CNG Dispensing Stations

Vehicle refueling appliances

Vehicle refueling appliances (VRAs) are like small time-fill stations, containing a small compressor and other equipment within a single unit. VRAs use natural gas from low-pressure pipelines found in many homes and businesses and require 220-volt, single-phase electricity.

CNG Dispensing Stations

Cascade Filled

Cascade fast-fill stations provide fast and convenient fueling similar to that provided by conventional liquid fuel stations. CNG storage vessels arranged in cascades, or banks, are used to quickly fill vehicles during peak fueling times, when the compressors alone cannot meet demand. During off-peak times, the compressors refill the CNG storage cascades. These stations are suitable for fueling light-duty vehicles at public access stations where use patterns are random. They are also suitable for fueling fleets of light-duty vehicles, such as taxis and police cars, that require a fast fill and have peak fueling periods. Cascade fast-fill stations are not appropriate for continuous, high-volume fueling because the compressors are not large enough to provide a fast fill once the CNG storage has been depleted. Most of the several hundred public access CNG stations in North America use a cascade fast-fill system.

CNG Equipment Outline

- ✓ CNG Station Layout
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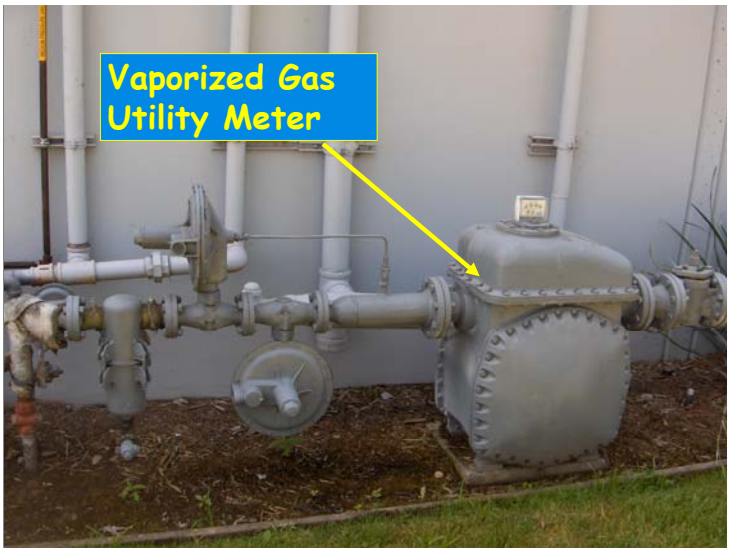
Equipment

CNG Station Components



To give you a visual view of what the system generally looks like…here are some of the photos. This is Utility meter own by the Gas Company.

Dryer/Cleaner

The gas dryer is used to remove water vapors from the gas and to dry it to a pressure dew point. Failure to dry the gas can result in vehicle engine problems.

Filters

Gas Filters are required and is recommended to be installed at various locations within the CNG compressor station otherwise there will be some serious maintenance issues as well as vehicles having plugged up fuel injector lines. They Filter out foreign particulates and solid matter.

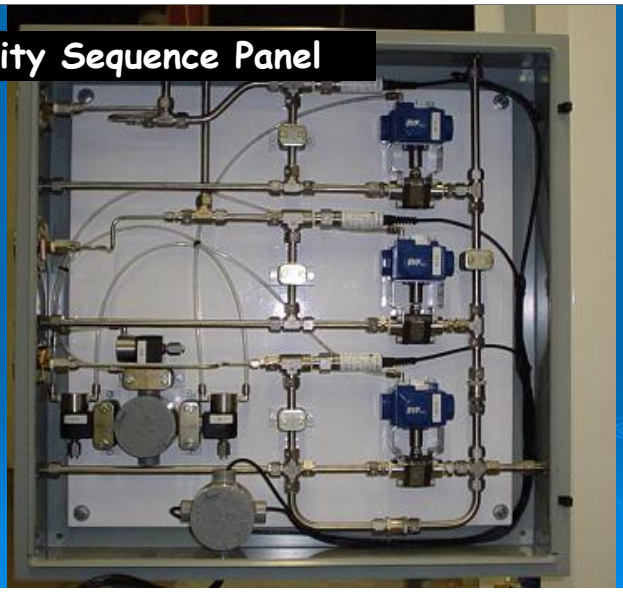
Compressor

Gas compressor basically sucks in natural gas from pipeline and then compresses it out into a storage tank.

CNG Storage Tanks/Cylinders

The Storage tank here are the most common system we see at public fueling stations. Although they can be a single tank or multiples stacked like a triangle but they are generally much slower to fill. Notice there are 3 tanks? This is used to store gas at pressure higher than the vehicle tank pressure. This differential pressure is used to transfer the gas from the cascade into the vehicle. This system is typically divided into three banks: high, medium, and low. Any number of cascades can be connected together to increase storage capacity.

Priority Sequence Panel



The Priority system is used to divert gas from the compressor to the storage tank and is also integrated in the Emergency shutdown system which is used to isolate the storage cascade from the quick fill dispenser in the event of emergency shutdown.

System Controller

This component controls all of the operational features of the compressor and dispenser characteristics. This unit can also carry some of the metrological functions. Such as calibration of pulse counts,

CNG Dispensers

The CNG dispensers comes from different manufactures which may or not use the same station compressor system.

Point of Sale Systems

Station Attendant Presented
For Direct Sales

The first type of “service” station is the attended site Point of sales systems comprised of multiple components such as a printer, scanner and a monitor screen that can also function as a touch screen.

Self – Serve CNG Stations

Card Reader

Customer interfaced

The second type of “service” is the unattended Station which is mostly a customer interface system. This component of the station is operated and controlled by the consumer using a credit card or fleet type card.

Equipment and Parts

CNG Dispensers

Primary Indication Display

CNG dispenser - Primary customer indication consists of three major displays 1) Total Sale, 2) Volume delivered, 3) Price unit.

Equipment and Parts

CNG Dispensers

Card Reader

One major component is the “Card Reader” it may be internal within the dispenser or it may be external.

Equipment and Parts

CNG Dispensers

Break away coupling

Breakaway couplings are generally located at the base of the hose where it is connected to the dispenser. They are designed as safety feature to prevent someone from taking the dispenser home. There is a check valve that will snap closed when the downstream portion of the hose is dislocated from the downstream side of the coupling.

Equipment and Parts

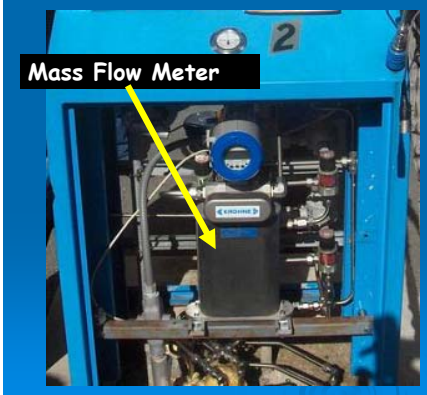
CNG Dispensers

Identification Plate

Identification plate is another major part of the Identity of the dispenser. This plate contains the critical marking requirements Weights & Measures required.

Equipment and Parts

CNG Dispensers



Coriolis Mass Flowmeters
Coriolis meters are the most widely used gas flow measuring device in CNG dispensers today. The measurement is based on the Coriolis force. The vibrating tubes are deformed by gas flowing through the tubes. The phase shift caused by the deformation of the vibrating measurement tubes is proportional to the mass flow rate of the gas and hence the meter provides true mass measurement.

Equipment and Parts

CNG Dispensers

Transmitters… They are the pulse or signal generator that sends gas flow measurement information via transmitter to the system controllor or primary customer display.

Equipment and Parts

CNG Dispensers

Metrological sealing and Calibration

The next major component is the sealing provisions of the meter. The sealing can be in many forms…1) lock and wire seal, 2) tamper proof seals, or audit trails.

Equipment and Parts

CNG Dispensers

Metrological sealing and Calibration

Drilled hole screws

Equipment and Parts

CNG Dispensers

Nozzles

The last component of the dispenser are the nozzles. Nozzles comes in different types….

Equipment and Parts

CNG Dispensers

Nozzles
Types

Activation is by…

Type 1

Lever at the nozzle or Dispenser

Equipment and Parts

CNG Dispensers

Nozzles
Types

Activation is by…

Type 2:

3-way valve nozzle

There are three types of nozzles, Type 1, the activation of the gas going through the nozzle is initiated by opening valve directly at the nozzle. Type 2, is similar to type one except it is a 3 way valve. Type 3, there is no valve at the nozzle, it basically is a snap-on type, the gas flow is initiated at the dispenser.

Equipment and Parts

CNG Dispensers

Activation is by…

Nozzles Types

Type 3:

No Shut Off Valve at Nozzle nozzle

There are three types of nozzles, Type 1, the activation of the gas going through the nozzle is initiated by opening valve directly at the nozzle. Type 2, is similar to type one except it is a 3 way valve. Type 3, there is no valve at the nozzle, it basically is a snap-on type, the gas flow is initiated at the dispenser.

CNG Equipment Outline

- ✓ CNG Station
- ✓ Station Types
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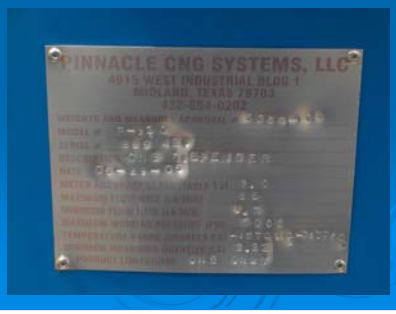
- ✓ Visual Inspection
- ✓ Test equipment
- ✓ CNG Dispenser Functional Test

Visual Inspection

Where do I begin?

Collect information from I.D. Plate



What do I need to collect from a "Visual Inspection"? Information needed prior to testing comes at different levels. Collecting information from Identification plate located on the CNG dispenser, Determine if internal dispenser components meet Pattern Approval, example of this would be verifying Measuring element meets Pattern Approval.

Visual Inspection

Verify device/components meet Pattern Approval

What do I need to collect from a "Visual Inspection"? Information needed prior to testing comes at different levels. Collecting information from Identification plate located on the CNG dispenser, Determine if internal dispenser components meet Pattern Approval, example of this would be verifying Measuring element meets Pattern Approval.

Visual Inspection

Are there defective components?

Check for leaks

Odor will tell you if there is a potential hazard.

Check Hoses and connections

Do they show signs of abuse or damage?

Visual Inspection consist of preliminary investigation to verify device or components meet satisfactory criteria prior to actual testing. Hidden leaks are identified by their odorant, and hissing sounds, they also can be seen by the oily substance around the leaks which looks like oily dirt.

Visual Inspection

Labeling requirements?

Do Labels conform marking requirements?

Does the dispenser have all of the required markings? An example would be “ON” and “OFF” marking on button or switches, Nozzles are also required to have markings. Both dispenser and nozzles are required to have some form or marking to identify operational functions.

Visual Inspection

Check Safety Criteria…

Is it safe to test?

Electricity

Water

Make a visual inspection for safety concerns. Things to look out for…Leaks, Exposed wiring, Defective components that can cause injury in event of a rupture.

CNG Equipment Outline

- ✓ CNG Station
- ✓ Station Types
- ✓ CNG Station Components
- ✓ Visual Inspection
- ✓ **Test Equipment**
- ✓ CNG Dispenser Test

General Requirements Learning Objectives

- Distinguish the difference between retroactive and nonretroactive requirements
- Understand when to apply acceptance and maintenance tolerances
- Understand some special circumstances related to devices that meet tolerances.

Number 1, explain what retroactive and nonretroactive means. 2. explain when acceptance tolerances apply. 3. Explain when a device meet tolerance how it may not really be within tolerance.

General Requirements

- Application of general requirements

This refers to what types of devices are subject to the general and specific codes. There is further explanation in the specific code that defines what that code is applicable to. Basically, the codes apply to: (a) commercial weighing and measuring equipment; that is, to weights and measures and weighing and measuring devices commercially used or employed in establishing the size, quantity, extent, area, or measurement of quantities, things, produce, or articles for distribution or consumption, purchased, offered, or submitted for sale, hire, or award, or in computing any basic charge or payment for services rendered on the basis of weight or measure.

(b) To any accessory attached to or used in connection with a commercial weighing or measuring device when such accessory is so designed that its operation affects the accuracy of the device.

(c) To weighing and measuring equipment in official use for the enforcement of law or for the collection of statistical information by government agencies.

General Requirements

- Application of maintenance and acceptance tolerances

In the U. S. There are two types of tolerances, acceptance and maintenance and there are different application to each. Typically, acceptance tolerances apply to devices undergoing pattern or type approval. Maintenance tolerances apply to devices that have been in service that have pattern approval, but not always. The requirements are that acceptance tolerances shall apply to:

(a) equipment to be put into commercial use for the first time;

(b) equipment that has been placed in commercial service within the preceding 30 days and is being officially tested for the first time;

(c) equipment that has been returned to commercial service following official rejection for failure to conform to per-formance requirements and is being officially tested for the first time within 30 days after corrective service;

(d) equipment that is being officially tested for the first time within 30 days after major reconditioning or overhaul; and

(e) equipment undergoing type evaluation.

(f) Maintenance tolerances shall apply to equipment in actual use, except as provided above.

General Requirements

- Accessibility for inspection

This is one of my favorites. Accessibility for inspection, testing, and sealing. The requirement is that a device shall be located, or such facilities for normal access thereto shall be provided, to permit:

(a) inspecting and testing the device;

(b) inspecting and applying security seals to the device; and

(c) readily bringing the testing equipment of the weights and measures official to the device by customary means and in the amount and size deemed necessary by such official for the proper conduct of the test.

Otherwise, it shall be the responsibility of the device owner or operator to supply such special facilities, including such labor as may be needed to inspect, test, and seal the device, and to transport the testing equipment to and from the device, as required by the weights and measures official.

There is a sister code for this section entitled assistance in testing operations and the requirement is that if the design, construction, or location of any device is such as to require a testing procedure involving special equipment or acces-sories or an abnormal amount of labor, such equipment, accessories, and labor shall be supplied by the owner or operator of the device as required by the weights and measures official.

General Requirements

- Unattended money operated devices

This is a requirement for devices that accept cash or coin and are unattended. The requirement for money operated devices, other than parking meters, shall have clearly and conspicuously displayed thereon, or immediately adjacent thereto, adequate information detailing the method for the return of monies paid when the product or service cannot be obtained. This information shall include the name, address, and phone number of the local responsible party for the device. This requirement does not apply to devices at locations where employees are present and responsible for resolving any monetary discrepancies for the customer.

General Requirements

- Maintenance of equipment
- Use of adjustments

Lastly, my most favorite, the maintenance of equipment. It states that all equipment in service and all mechanisms and devices attached thereto or used in connection therewith shall be continuously maintained in proper operating condition throughout the period of such service. Equipment in service at a single place of business found to be in error predominantly in a direction favorable to the device user shall not be considered "maintained in a proper operating condition."

Another complement to this code is the use of adjustments:

Weighing elements and measuring elements that are adjustable shall be adjusted only to correct those conditions that such elements are designed to control, and shall not be adjusted to compensate for defective or abnormal installation or accessories or for badly worn or otherwise defective parts of the assembly. Any faulty installation conditions shall be corrected, and any defective parts shall be renewed or suitably repaired, before adjustments are undertaken. Whenever equipment is adjusted, the adjustments shall be so made as to bring performance errors as close as practicable to zero value

Learning Objectives for Required Test equipment

- 1. Identify the required test and safety equipment
- 2. Identify the purpose of such equipment
- 3. Explain the selection criteria requirements of the test equipment

In this part of the module, the objectives are to identify what is required to test a CNG dispenser and identify the related safety equipment. Be able to identify the purpose of each piece of required equipment. Be able to explain the selection criteria for each piece of required test equipment.

Test Equipment Requirements

- Grounding Strap
- Cylinder to Hold Product
- Weighing Element
- Mass Standards - including fractional mass standards

The purpose of the grounding strap is to ground the cylinder to ground. The cylinder to hold product is self explanatory, as is the weighing element for the purpose of gravimetric testing and the mass standards for the purpose of verifying the weighing element.

Cylinder Requirements

- Pressure rating 200 to 250 Bar (20,685 – 24,822 kPa)

As mentioned previously, the markings on the cylinder should state the pressure rating of the cylinder and a visual inspection should always be performed prior to use. Verify the presence of a pressure gauge fitted on the cylinder to prevent overfilling. In addition, it is good to check the fittings to see that they are compatible with the fittings from the nozzle at the end of the hose. Typically, a representative of the gas supplier, dispenser manufacturer, owner/user, or station maintenance will supply the cylinder and handle the gas. But sometimes they become involved in routine and overlook the simple and obvious, so it doesn't hurt to double check.

Cylinder Requirements

- Size suitable to hold product flowing for 1 minute at the highest flow rate.

In the U.S. the requirement for a cylinder size suitable to hold enough product flowing for one minute at the highest flow rate is a must for pattern or type approval but may not always be practical for routine tests, so our minimum requirement is a cylinder that will hold a 3 kg draft.

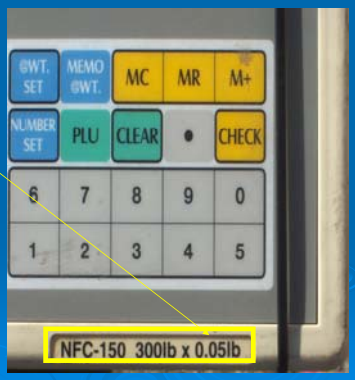
Weighing Element Selection Criteria

- Inherently safe – Suitable for explosive environments
- OR
- Located outside of classified area (1.5 metres from hose connection)

If an intrinsically safe weighing element can not be obtained, then the weighing element must be located at least 1.5 meters outside of the classified area. The classified area is considered to be the hose connection to the dispenser. Another option is to have a battery powered weighing element.

Weighing Element Selection Criteria

- Increment is dictated by:
- Applicable tolerance on net load of draft



The size of the weighing element increment relative to the net load has a significant effect on the accuracy to which a device can be tested. The increment size will also affect the size of the test draft required. Therefore, part of the weighing element selection criteria is to have an increment value that is small enough to resolve this issue.

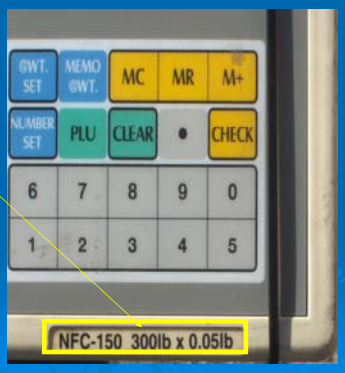
Applicable Tolerance Relationship to Weighing Element Increment

- Assume 2% tolerance on estimated draft of 10 kg = 0.20 kg allowed on 10 kg draft
- 0.2 kg, x 0.1 =
- Maximum weighing element increment of 0.02 kg

We must keep the error, which is caused by reading the weighing element, to an acceptably level for a single weighing. Therefore the value of the increment should not exceed 1/10 of the tolerance applied to the dispenser. Due to the fact that the errors occur at both the gross and tare weights, errors could represent as much as 20% of the tolerance.

Weighing Element Selection Criteria

- Capacity is dictated by:
- Gross load of cylinder



A combination of three approaches may be used to satisfy the selection criteria. Either a high resolution weighing element, the use of fractional weights, or a larger test draft is required. If the size of the test draft must be small due to the available cylinder, then the weighing element must have the appropriate division size.

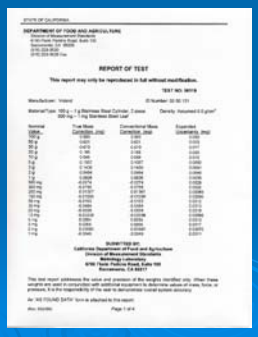
Mass Standards

- NIST 105-1, class F
- OIML R111, class M1

The required amount of test weights should be of sufficient amount to verify the weighing element to the capacity of the gross load of the cylinder when it is full. The fractional weights should be small enough to resolve 1/10 of the weighing element increment.

Mass Standards

- Traceable to an accredited laboratory



Accreditations begin with the International Laboratory Accreditation Cooperation (ILAC) and the U. S. equivalent is the National Cooperation for Laboratory Accreditation (NACLA). In the U. S. if a laboratory has NACLA, they get ILAC. These bodies empower other agencies the right to give accreditations to metrology laboratories. When accreditation is achieved, it signifies that the laboratory has demonstrated that they have measurement proficiency through training and interlaboratory comparisons, as well as traceable standards. Our own state laboratory meets these requirement.

Learning Objectives for Weighing Element Verification

- 1. Understand the specific procedure to determine weighing element errors for tolerance testing a CNG dispenser.
- 2. Determine weighing element errors at tare and gross loads
- 3. Apply these errors to determine net value of CNG when tolerance testing

In regards to number one, how to determine the error through the use of fractional mass. Explain the zone of uncertainty, and it's role in determining the error as well as the role of the zero load error.

Number 2, Self explanatory, how to apply number 1 in determining the weighing element error (uee of the formula). Number 3, understand specifically the methodology (what you do, how you do it and at what points you do it, at as well as why).

Weighing Element Verification

Level the weighing element

Before we begin this part I would like to add a footnote that this is going to be the most time consuming part of the procedure. The scale verification may even take as long as all the dispenser tests combined. It is the whole basis of the dispenser tolerance test. Therefore, be extremely careful and precise and do not hesitate to suspend testing if you have any doubts about the weighing elements performance or the environmental conditions under which you are testing. Choose a suitable location such as a flat smooth surface to place the weighing element. Check to see that when the cylinder is placed on the weighing element, both will be stable and not roll, tilt, or move. Chocks or wooden blocks may be used to help stabilize the cylinder. Every effort should be made to protect the weighing element from environmental factors such as wind and rain.

Weighing Element Verification

- The indication is 80.0 kg

As you use the fractional mass, you may experience the display "flickering" between increments. This is normal and indicates that you are in the "zone of uncertainty". The zone of uncertainty is the display electronics interpretation of being between two different values (based on the load, the display cannot discern on what value to display). Ideally, in digital electronics, this occurs at the exact midpoint between two values. However, there are limits to this as well. When you first enter the zone, if you experience that the zone of uncertainty continues with the addition of fractional mass equal to more than 3/10 of the value of the increment, the weighing element is unsuitable for use. You may remedy this situation by changing the filtering of the weighing element. However, again this requires knowledge of changing configuration parameters or having sufficient technical data relating to the weighing element.

Weighing Element Verification

A fractional mass value of 0.250 kg is added to the weighing element

For the purpose of this demonstration we will leave the zero tracking on to assure a zero error at zero and to assure a good return to zero. To verify that the zero tracking is on, place a mass in the amount equal to 0.3 weighing element increment on the weighing element. You may see this value displayed for an instant and then a zero value or you may see the zero value continuously displayed. If the mass value remains displayed, the zero tracking is turned off and will have to be addressed. It may be addressed by changing the configuration parameter of the zero tracking to have it activated. Of course this requires that one have the technical data to have the ability to change this parameter. If not, then the zero error will have to be addressed in the same manner as determining the weighing element error at load condition. Example: it is determined that the weighing element indicates 0.050 kg high at zero. Then at load, the weighing element indicates 0.100 kg high. Effectively, the error at load is 0.050 kg high. Another way to say this is the effective error at load is equal to the error at load minus the error at zero. 0.1 – 0.05 = 0.05

Weighing Element Verification

The indication remains 80.0 kg

What we are looking for here is what amount of fractional mass is required to bring the indication into the zone of uncertainty? If the zone is very narrow, you may see the indication increment upward without any flickering. Under ideal laboratory conditions a fractional mass value of 1/10 of the weighing element increment may be used, as environmental conditions are precisely controlled to allow for this. However, in the field where environmental conditions are as they are and uncontrollable, ¼ of the weighing element increment will be sufficient. Although as mentioned previously, efforts should be made to protect the weighing element from environmental conditions anyway, so that stable readings may be obtained when performing the verification on the weighing element as well as when performing the tolerance tests on the dispenser.

Weighing Element Verification

Fractional mass increased to 0.300 kg and the indication increases to 80.5 kg

The fractional mass value required to achieve entry into the zone of uncertainty is the fractional mass value we use to determine the weighing element error. As a point of note, most digital weight indicators of recent times will have a very narrow zone of uncertainty so that you may not see it at all. In this case the fractional mass value required to cause the display to increment upward to the next indication will be the value used to determine the error.

Weighing Element Error

- Error = Indication + (0.5 x increment value) – Fractional Mass Value – Standard Load
- Determine the error at zero
- Determine the error at load
- Calculate the effective error at load

For the purpose of tolerance testing the dispenser, we should calculate the weighing element error in kg so that we may apply this error directly to the values of gross and tare (as opposed to calculating the error in fractions of the increment, which would require the additional step of converting the error back into kg).

Weighing Element Error

- The weighing element is 500 kg x 0.5 kg
- The standard mass on weighing element is 80 kg, the display is 80.0 kg
- The fractional mass required to enter the zone of uncertainty or increment the display to 80.5 kg is 0.300 kg

To keep our errors in kg we use kg values in the formula. As opposed to calculating the error in fractions of the increment.

Weighing Element Error

- Error = Indication + (0.5 x increment value) – Fractional Mass Value – Standard Load
- Error = 80.0 kg + (0.5 x 0.5 kg) – 0.3 kg – 80.0 kg
- Applying the formula, the error is determined to be -0.05 kg

Therefore, 80 kg + 0.25 kg – 0.3 kg -80 kg = -0.05 kg. Remember, these examples assumed a zero error at zero load.

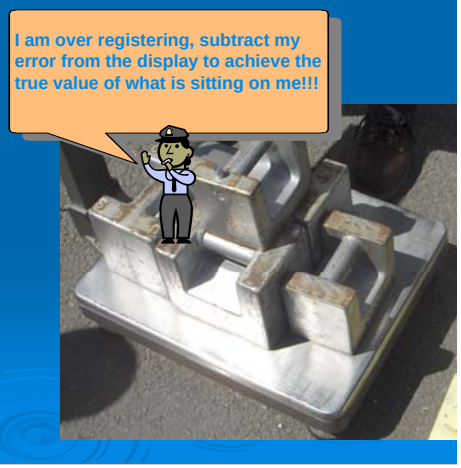
Weighing Element Correction

- Therefore, the correction would be to add 0.05 kg to the indicated value of the test draft (at 80 kg)

Remember, the correction is always in the opposite direction as the error. In this case, the weighing element is under registering so we must add this value back into the numbers we will see during the actual test because this is the actual value of the mass on the weighing element. It is like the weighing element is telling us "I am under registering, so add my error to the display to achieve the true value of what is sitting on me".

Weighing Element Correction

- Values of over registration



Of course the opposite is true in the case of an over registration. The weighing element would say " I am over registering, so subtract my error from the display to achieve the true value of what is sitting on me".

Weighing Element Verification

- Determine error at tare load
- Determine error at gross load

The purpose of determining error at both tare and gross is due to the fact that during the actual tolerance testing of the dispenser, we will do a corrected net calculation to obtain the weight of the draft.

Weighing Element Verification

- Repeat this procedure to include loads above and below the target tare and gross loads

Typically, this procedure is the same as conducting increasing and decreasing load tests at load values of 1500 to 2000 divisions in increments of 500 divisions above and below the target tare and gross values (three to four test points above and three or four test points below target). This may require a trial run of weighing the cylinder empty to obtain the tare weight, then filling the cylinder to see what your target gross values will be. The reason for choosing 4 points above and below the target tare and gross is because the cylinder will not always be emptied to the exact same tare value every time. Therefore, your gross values for a full cylinder will not be exactly the same on subsequent drafts.

Weighing Element Verification

- Repeat complete procedure to verify repeatability of weighing element

Whatever your target values or tests points for the weighing element verification are, they should be performed two to three times. Conducting the procedure in this way tells you if the weighing element repeats or gives the same results for the same target weight values. In reality you may not repeat errors of the weighing element exactly for each of the three increasing/decreasing load tests and this is normal due to environmental conditions. However, the errors should repeat within a couple tenths of each other. It is acceptable to average the errors for each load. If you see excellent repeatability (exactly the same errors), it is acceptable to conduct only two increasing/decreasing load tests.

Weighing Element Correction as Applied to Tolerance Testing

- Corrected calculated net value of CNG = Corrected gross – Corrected tare

Let's say we have a gross values of 92.00 kg and a weighing element error of minus 0.70 kg. The corrected gross value is 92.70 kg. The tare value is 72.00 kg and a weighing element error of plus 0.30 kg. The corrected tare value is 71.70 kg. Therefore the corrected net value is 21.00 kg. I am sure that some of you may have already noticed that there is another method to derive the corrected calculated net value. You may use the actual gross and net values you see on the weighing element and calculate the net value. Then apply the same method discussed earlier in regards to applying the zero error at load. Again, the error at the gross load is minus 0.70 kg and the indication is 92.00 kg. The error at tare load is plus 0.30 kg and the indication is 72 kg. Therefore 92 kg minus 72 kg equals 20 kg net load. Now, the error at gross load (-0.70 kg) minus the error at tare load (+ 0.30 kg) equals minus 1.00 kg. So you would add 1.00 kg to the net value of 20 kg to derive a corrected net value of 21.00 kg. Either one of these methodologies may be applied to derive the net load of the draft, AS LONG AS YOU KEEP THE SAME METHOD THROUGHT YOUR PROCEDURE!!!

CNG Equipment Outline

- ✓ CNG Station
- ✓ Station Types
- ✓ CNG Station Components
- ✓ Visual Inspection
- ✓ Test Equipment
- ✓ CNG Dispenser Test

Functional Tests vs Performance Tests

Functional tests

are tests that verify the device operates in a specified manner

Functional test is testing the dispenser's functionality. Every make and model has its own unique capabilities.

Functional Tests vs Performance Tests

Performance tests

Verify Device's Accuracy

Functional Test

- Wet hose Test
- Interlock Test
- Manual over-ride
- Card Reader
- Computation Test

Functional tests, we will conduct at least five tests to verify the device's performance characteristics. They are:

Wet Hose/ Indication advancement compliance which basically means the hose must be charged prior to delivery and customer display remains "Zero" indication prior to delivery into test cylinder. The Interlock function, depending on some models and system functionality, when the nozzle is in the dispenser receptacle the device should be completely deactivated, in other words, you should not be able to dispense until the device is manually activate. Manual over-ride function, This function is performed during the accuracy test. Card reader function, How stack sales performed, Mathematical agreement with the calculator. Last test, computation test can be performed during accuracy testing.

Functional Test

Wet Hose Test

1) Remove Nozzle from receptacle

Wet hose and indication advancement test – Removing nozzle from receptacle, some require you to engage the connector locking mechanism to disengage from receptacle.

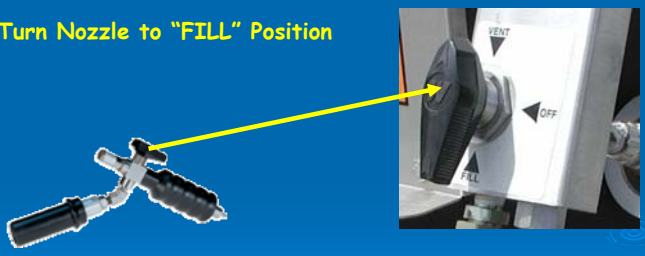
Functional Test

2) Attach Nozzle to Test cylinder

Connect delivery hose nozzle to test cylinder, make sure cylinder is properly grounded before making the connection.

Functional Test

3) Turn Nozzle to "FILL" Position



Opening the nozzle to release gas in delivery hose. Some models do not require manually turning the valve (type 3 nozzles).

Functional Test

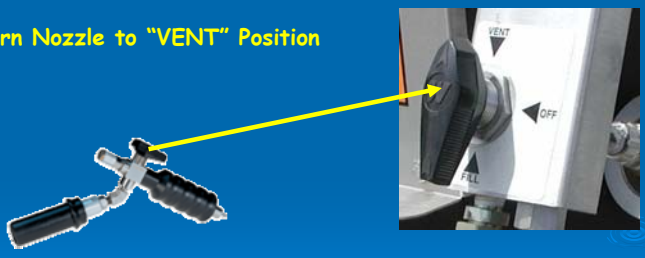
When Hose has been discharged of gas

When hose is discharged you will hear the hissing of the gas leaving the hose into the cylinder, when hissing ceases you may turn off nozzle.

Functional Test

4) Turn Nozzle to "OFF" Position

5) Turn Nozzle to "VENT" Position



Turn off nozzle. Some models (type one may not have a valve) in this case simply disengage the nozzle.

Functional Test

6) Remove Nozzle from Test cylinder

Disconnect nozzle from the CNG cylinder.

Functional Test

7) Hold on to nozzle

Remember safety…

Treat the nozzle as if it were a loaded weapon

DO NOT POINT AT ANYONE

Don't worry! All connectors require check valves

Hold nozzle as shown in diagram for preparation to activate dispenser.

Functional Test

8) Activate dispenser

When hose is filled deactivate dispenser

(Some models will shut off automatically)

While holding nozzle activate dispenser as shown in diagram. Some models may have different type of activation such as turning a lever.

Functional Test

9) Return Nozzle to receptacle

After deactivation of nozzle return nozzle to the dispenser hanging receptacle.

Performance Test

1O) Check for advancement of Display

View the dispenser display screen and see if there are any indications other than "Zero", if there are values displayed then customer has paid for product he or she has not received in vehicle. There are various different ways the manufacturer can resolve this issue. Usually through software, circuit relays and solenoids.

Performance Test

Wet hose Test

Advancement of Display indicates customer is paying for hose fill.

Test we have just completed was the Wet Hose/ Indication advancement compliance test.

Functional Test

Interlock Test

Dispensers are required to have "ON?OFF" mechanism

Pressure sensor automatically shuts device off.

Interlock deactivates dispenser when nozzle is returned to receptacle

Object of this "INTERLOCK" test is to make sure we someone uses a credit card the next customer does not take a "Free Ride" on another person's account.

Performance Test

Interlock Test

Must not be able to dispense product without manually activating

Dispenser display must automatically return to zero

After nozzle is returned to its hanging position it must automatically deactivate. If you can remove nozzle and connect to cylinder and dispensed product then this Interlock is defective.

Functional Test

Manual over-ride

This test can be performed by filling cylinder at a partial fill

Cylinder is manually turned off prior to top fill.

Manual over-ride test dispenser must be accurate. This test is performed by manually deactivating the dispenser prior to full fill.

Performance Test

Manual over-ride

After manual deactivation

Apply tolerance to delivered quantity

Manual over-ride test dispenser must be accurate

Functional Test

Card Reader

Customer display must have agreement of indications (digital) with card reader's printed ticket or receipt

This function is performed during the accuracy test. Card reader function, How stack sales performed, Mathematical agreement with the calculator. All indications must agree.

This function is performed during the accuracy test. Card reader function, How stack sales performed, Mathematical agreement with the calculator.

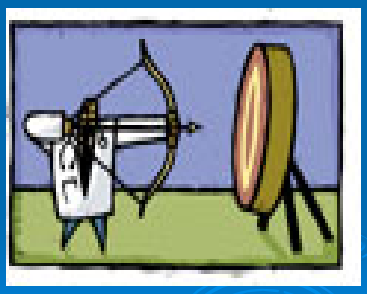
Learning Objectives for Performance Testing

- 1. Be able to apply the results of the weighing element verification and error determination to the tolerance testing of a CNG dispenser
- 2. Be able to determine the error of delivery of a CNG dispenser and how to apply repeatability tolerance
- 3. Explain other functional tests to be performed when tolerance testing a CNG dispenser
- 4. Understand the methods and application of sealing including the different categories

Self explanatory

Performance Tests

- Verify tolerance
- OR
- Delivery accuracy



Performance Tests

- Preliminary – data from weighing element verification

We have established the weighing element corrections for all the tare and gross values that may be applied. Now, we apply the corrections to the actual weight values we see during the delivery of product into the cylinder for the performance part of the test. Remember, corrected gross minus corrected tare equals the calculated corrected net delivery.

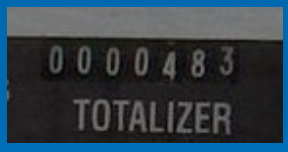
Performance Tests

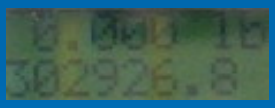
- Record tare weight of cylinder

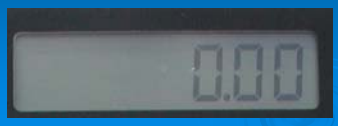
Start with an empty cylinder. This will be indicated on the pressure gauge and anything below 1379 kPa (13.5 bar) will be considered empty. At this time make necessary correction to the tare weight and record the corrected tare value.

Performance Tests

- Start dispenser and proceed to fill the cylinder.







At this time, you perform several tests at once. When you start the dispenser, verify the zero starting position of the display and that the zero is displayed correctly. That is all zeros to the left of the decimal and at least one zero to the right of the decimal. Verify the zero starting position for both mass and total sale. You may also verify the increment of the mass value to 0.001 kg and verify the unit price display. Record the totalizer reading to be compared with the final draft for correct cumulative recordings. The flow rate may be viewed by manipulating the transmitter display or other controls on the dispenser for verification that the dispenser is operating within the parameters of the measuring element.

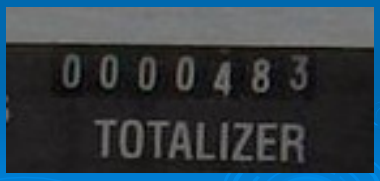
Performance Tests

- Record gross weight of draft when fill is completed

At the completion of the fill, disconnect the hose from the cylinder and record the gross weight. Make the necessary corrections to the gross weight and record corrections.

Performance Tests

- Record end totalizer reading



Record end totalizer reading to check the cumulative value of the totalizer in succession at the end of each tests draft.

Performance Tests

- Determine delivery error
- Error in percent equals dispenser indication minus the corrected net mass of CNG (m_c) divided by m_c times 100

$$\text{Error} = \frac{\text{indication} - m_c}{m_c} \times 100$$

The delivery error is calculated by subtracting the corrected gross weight from the corrected tare weight to result in the corrected calculated net weight. Subtract the corrected calculated net weight (standard) from the dispensers indicated delivery. Divide the results by the corrected calculated net weight (standard) and multiply by 100 to obtain the results in percentage. Meter minus the standard divided by the standard times 100 equals percent error of indicated delivery.

Performance Tests

- Check the zero-set-back interlock

Check the function of the zero-set-back interlock. A device shall be constructed so that:

after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements, and recording elements if the device is equipped and activated to record, have been returned to their zero positions;

the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and

in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.

Performance Tests

- Check receipt


Mineta San Jose International Airport
(915) 694-0202

Date: 6/24/2003
Time: 11:54:29 AM
Location# 00SJA5004

Pinnacle CNG Card
Acct# XXXXXXXXXXXX
Auth#
Reference# 05004 77 4 0

Credit

Gallons	2.353
Pounds	13.318
Total Pounds	1428.657
Price/Gal	$ 1.89
CNG Sale	$ 4.44
Total Sale	$ 4.44

Thank You!
Have a nice day!

At this time you may also compare the printed receipt to the dispenser indications (total delivered amount, unit price, total sales price, and the product identity (by name, symbol, abbreviation, or code number). Additional receipt requirements such as a receipt identification number, time, date, and the name of the seller shall also be printed. The printed values must be identical to the indicated values.

Performance Tests

- Return product to storage

Our requirements are that the site have provisions to return the product to storage. CNG is non toxic and poses no health risks unless you are in a confined space (confined spaces causes asphyxiation), it dissipates in the atmosphere. However flammability limits are a concern, so venting to the atmosphere has been prohibited. In the past we have allowed representatives of the gas supplier to use vent stacks (at least 4 meters in height) to vent to atmosphere, but this practice is being discontinued. In any case (product venting or returning to storage) we as weights and measures inspectors do not handle the gas. We have a representative of the gas supplier, owner/user, or station maintenance personnel handle the gas. You must check with your local jurisdictions regarding these requirements. Provisions to return the product storage is a user requirement, not a device requirement. When enforcement action is necessary, typically the device owner will have the gas supplier or the dispenser manufacturer add plumbing to either the main gas supply or the compressor phase.

Performance Tests

- Prepare for next delivery

While the product is being returned to storage, this is a good opportunity to verify the functional requirements of retaining the last transaction. The total price and quantity delivered shall be displayed on the face of the dispenser for at least 5 minutes or until the next transaction is initiated.

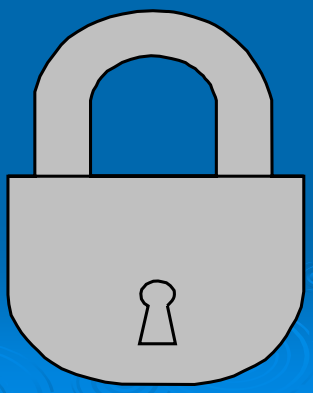
Performance Tests

- Repeat the previous delivery performance

Tests for repeatability should include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as, temperature pressure and flow rate are reduced to the extent that they will not affect the results obtained. When multiple tests are conducted at approximately the same flow rate and draft size, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance and the results of each test shall be within the applicable tolerance. U.S. requirements for maintenance tolerance is 2% therefore our results for repeatability should be 0.8% or less. This means that all drafts should be within 0.8% of each other such that if one test is minus 1.5% and the next test is minus 0.7%, the device is at the tolerance limit for repeatability.

Sealing Requirements

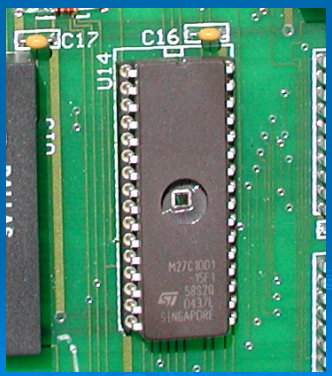
- Sealing provides for security
- U.S. requirements allow for three categories



In the U.S., there are three categories for sealing. They are: Category 1: No remote configuration capability sealed by physical seal or 2 event counters: 1 for calibration parameters and 1 for configuration parameters. Also refer to handout NCWM Publication 14 Appendix A.

Sealing Requirements

- Category 1 example



In this example, the manufacturer hard coded all the configuration parameters into an E-PROM (erasable programmable read only memory) that had to be removed and sent back to the manufacturer for reprogramming, so there is no remote configuration. Due to the fact it is located inside the dispenser under a control panel, in proximity of other electronics, a self-destruct tamper evident paper seal is used.

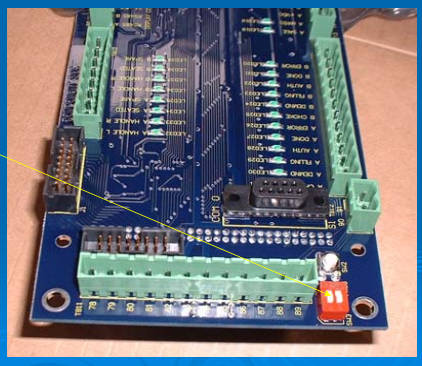
Sealing Requirements

- Category 2, remote configuration example

In this example the transmitter has remote access but controlled through the position of a switch that is under a physical seal.

Sealing Requirements

- Category 2, remote configuration example



In this example the circuit board in inside an explosion proof housing that is sealed with a physical seal.

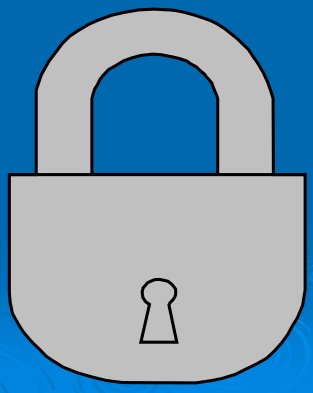
Sealing Requirements

- Explosion proof housing physically sealed

The explosion proof housing showing a physical seal.

Sealing Requirements

- Sealing provides for security
- Category 3



Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password). [Nonretroactive as of January 1, 1995]

The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.

[Nonretroactive as of January 1, 2001]

Nonretroactive as of January 1, 2005, all devices with remote configuration capability must comply with the sealing requirements of Category 3. For sealing Category 3 an event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available through the device or through another on-site device. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. (Note: Does not require 1000 changes to be stored for each parameter.)

Report
on
Compressed Natural Gas (CNG) Fuel Dispensers
in Cambodia

1- History

-1964 Establishment of the National service of Weights and Measures, under the Ministry of Industry.
-1975-79 No activities.
-1995 Re-Establishment of Weights and Measures Unit, under the Ministry of Industry, Mines and Energy (MIME).
-1999 The Weights and Measures Unit upgraded to the Department of Metrology.
-2000 Corresponding member of the International Organization of Legal Metrology (OIML).
-2002 Member of Asia Pacific Legal Metrology Forum (APLMF).

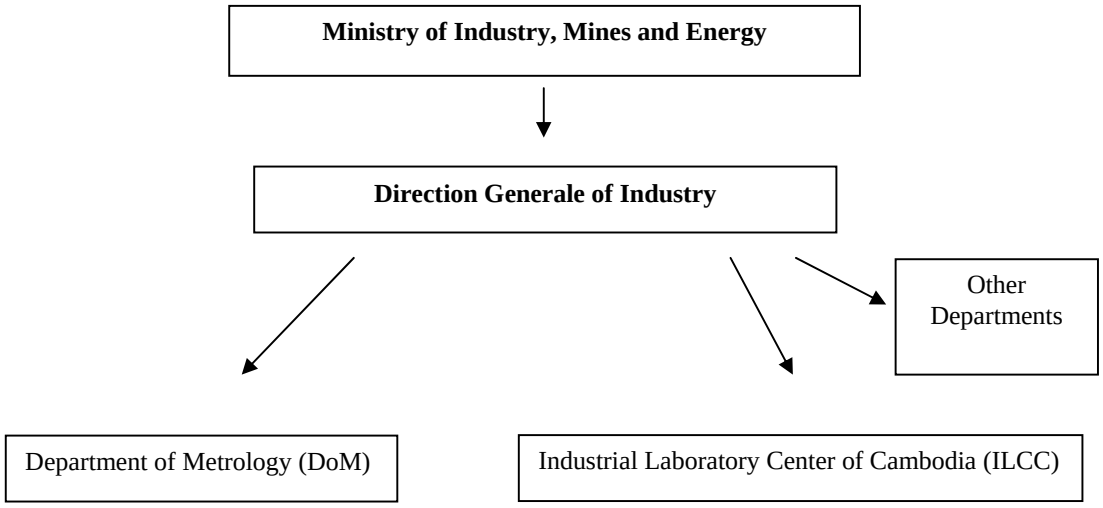
2- Structure of Metrology

Recently, the Metrology of Cambodia is split between the Department of Metrology (DOM) and Industrial Laboratory Center of Cambodia (ILCC).

DOM has the responsibility for all Legal Metrology Activities and keeps the Secondary and Working Standards.

ILCC keeps the Primary Standard and also implements the Industrial and Scientific Metrology requested by DOM. Our structure is as below.

3- Organization Chart



* Under DoM:

*Under ILCC:

1-There are five offices

a- Admin. and Legislation.

b- Control-Verification.

c- Technological Development of Metrology.

d- Provincial Management Metrology.

e- Tax-Accounting.

-There are two Laboratories

a- Food, Microbiology, Chemical Lab.

b- Scientific, Industrial Metrology Lab.

2-Room Verification of DoM, consists of

a- Mass Section.

b- Volume Section.

c- Temperature Section.

d- Pressure-Force Section.

e- Dimensional Section.

f- Electricity Section.

3- Five Regional Verification Centers (Regional).

4- Twenty-four Provincial Metrology Offices (Local).

Note:

-DoM acts as the Legal Metrology Body.

-DoM maintains and keeps secondary and working standards.

-ILCC keeps primary standards and implements scientific, industrial metrology requested by DoM.

4- Presentation the Non-LPG Fuel Dispensers situation

1-1- My name is SEA Kimhoun. I work as an Inspector of Department of Metrology (DOM), Ministry of Industry, Mines and Energy (MIME). Presently, my position is Chief of Control and Verification Office in charge of verification and inspection of all kinds of weighing and measuring instruments.

1-2- I need train the others. Some time, I have to train also for provincial verification officers.

1-3- Yes. I have some experience verifying fuel dispensers for petrol (every types of dispensers: for example gasoline and D.O...). The most dispenses are automatically and mechanical.

The procedure is as below:

A- Visual Inspection

A-1- Required Data:

To record the date of test, registered trading name, the mark, model, pump number.

A-2- Assessment of Fuel Dispensers:

A-2-1- External inspect the Fuel Dispensers:

To check the fuel dispenser is firmly fixed on its foundation, all indications are visible under conditions day and night, nozzle must terminate the delivery ….

A-2-2- Internal inspect the Fuel Dispenser:

To check the apparent leaks at the pump, hose, meter, gas elimination device, the components are located and fitted in accordance with the certificate and verification mark and seals are in place ….

B- Performance Tests:

- Volume for testing is 05 litre.
- Display of indicator of Fuel Dispenser is compared with Working Standard Vessel
- The MPE is +/- 0.5%.

5- Current situation about Verification of CNG Fuel Dispensers

Why not the CNG Fuel Dispensers are verified?

While there are more than 200 Non-LPG stations and more than 200,000 vehicles in the country, there are less than 7 LPG stations recently installed and about 100 vehicles mostly taxis vehicles are powered by LPG. They sold LPG to the public without limitation by volume. We don't know the method and the equipment requirements for the implementation of the measuring system.

DOM will regulate and verify of Non-LPG and LPG. We performed the verification by gravimetrically (by weighing).

The subject of the CNG Fuel Dispenser has not implemented yet. It is new subject for my economy, but we hope to carry out in the future.

6- Conclusion

Cambodia has opportunity as a member of APLMF and always received support technical and financial assistance from the APLMF executive secretary and all friends' members made Cambodia upgrade herself to participate in the regional and international metrology activities.

On behalf of DOM, Cambodia I would like to express my gratitude to APLMF and APEC secretariat and the host country for their sponsorship and organizing this training course.

Thank you for your kind attention.

Country Report
of
the Kingdom of Cambodia

Training Course on
Compressed Natural Gas Fuel Dispensers
from June 27-30, 2006

by
Mr. SEA Kimhoun
Chief Office, Control and Verification,
Department of Metrology
Ministry of Industry, Mines and Energy

Country Report

1-Introduction

-1964 Establishment of the National service of Weights and Measures, under the Ministry of Industry.

-1975-79 No activities.

-1995 Re-Establishment of Weights and Measures Unit, under the Ministry of Industry, Mines and Energy (MIME).

-1999 The Weights and Measures Unit upgraded to the Department of Metrology.

-2000 Corresponding member of the International Organization of Legal Metrology (OIML).

-2002 Member of Asia Pacific Legal Metrology Forum (APLMF).

2- Law and Regulations

Presently, there is no Weights and Measures or National Metrology Law giving power to the Department of Metrology to curry out Legal Metrology Activities.

In order to ensure and strengthen administration of legal metrology, we have review the draft Law of Metrology and submitted to the Council Ministers Office for adoption and promulgated some necessary legislations relating to the metrology management as below:

-Ministerial Circular on Management of Weights and Measures.

-Ministerial Prakas of SI Unit

-Ministerial Prakas of Pre-Packaged products

-Ministerial Prakas of Management of Standards and Equipments of Liquid Volume.

3- Structure of Metrology

Recently, the Metrology of Cambodia is split between the Department of Metrology (DOM) and Industrial Laboratory Center of Cambodia (ILCC).

DOM has the responsibility for all Legal Metrology Activities and keeps the Secondary and Working Standards.

ILCC keeps the Primary Standard and also implements the Industrial and Scientific Metrology requested by DOM. Our structure is as below (See annex No. 1).

Department of Metrology

The Department of Metrology operates under the General Direction of Industry of the Ministry of Industry, Mines and Energy (MIME) and is in charge of Registration, Calibration, Verification, Inspection of measuring equipment and issuing licenses to manufacturers, importers repairer and seller of weighing and measuring instruments.

Functions and Duties

- To implement the National Metrology Policy and issue documents concerning manufacture, import, export, and repair manufacturing equipments;
- To ensure the proper design, verification and use of measuring instruments;
- To review the need, establish the work plan and monitor the implementation;
- To carry out evaluation and supervision of measuring equipment to ensure their effectiveness and efficiency;
- To disseminate and improve the national technology of metrology;
- To organized the training of metrological staff;
- To administer metrological laboratories; and
- To cooperate with international metrology organizations.

Provincial Metrology Office

The Department of Metrology provides technical advice to the provincial metrology office that operates in the 24 provinces and cities of Cambodia. Every province and city has an office of metrology and shares the responsible with Department of Metrology as follow:

- Verification, Re-Verification and Inspection of the weighing and measuring instruments used in business transaction in their local levels.
- Supervision the lower technology of weighing and measuring instruments in their local levels.
- The provincial metrology offices maintain the Working Standards.

4- Verification of Non-LPG Dispensers in Cambodia

A- Visual Inspection

A-1- Required Data:

-To record the date of test, registered trading name, the mark, model, pump number.

A-2- Assessment of Fuel Dispensers:

A-2-1- External inspect the Fuel Dispensers:

-To check the fuel dispenser is firmly fixed on its foundation, all indications are visible under conditions day and night, nozzle must terminate the delivery ….

A-2-2- Internal inspect the Fuel Dispenser:

-To check the apparent leaks at the pump, hose, meter, gas elimination device, the components are located and fitted in accordance with the certificate and verification mark and seals are in place ….

4- Verification of Non-LPG Dispensers in Cambodia (con't.)

B- Performance Tests:

- Volume for testing is 05 litre.
- Display of indicator of Fuel Dispenser is compared with Working Standard Vessel
- The MPE is +/- 0.5%.

The subject of the CNG Fuel Dispenser has not implemented yet, but we hope to carry out in the future. At present, we have practiced only LPG Product for cook. The procedure for implementation is by weighing.

5-Conclusion and Acknowledgment

Cambodia has opportunity as a member of APLMF and always received support technical and financial assistance from the APLMF executive secretary and all friends' members made Cambodia upgrade herself to participate in the regional and international metrology activities.

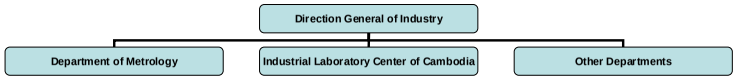
On behalf of DOM, Cambodia I would like to express my gratitude to APLMF and APEC secretariat and the host country for Their sponsorship and organizing this training course.

Thank you for your kind attention.

Annex 1

Organization Chart

Ministry of Industry, Mines and Energy



Under DoM:

1-There are five offices

- a- Admin. and Legislation.
- b- Control-Verification.
- c- Technological Development of Metrology.
- d- Provincial Management Metrology.
- e- Tax-Accounting.

2-Room Verification of DoM, consists of

- a- Mass Section.
- b- Volume Section.
- c- Temperature Section.
- d- Pressure-Force Section.
- e- Dimensional Section.
- f- Electricity Section.

3- Five Regional Verification Centers (Regional).

4- Twenty-four Provincial Metrology Offices (Local).

Under ILCC:

-There are two Laboratories

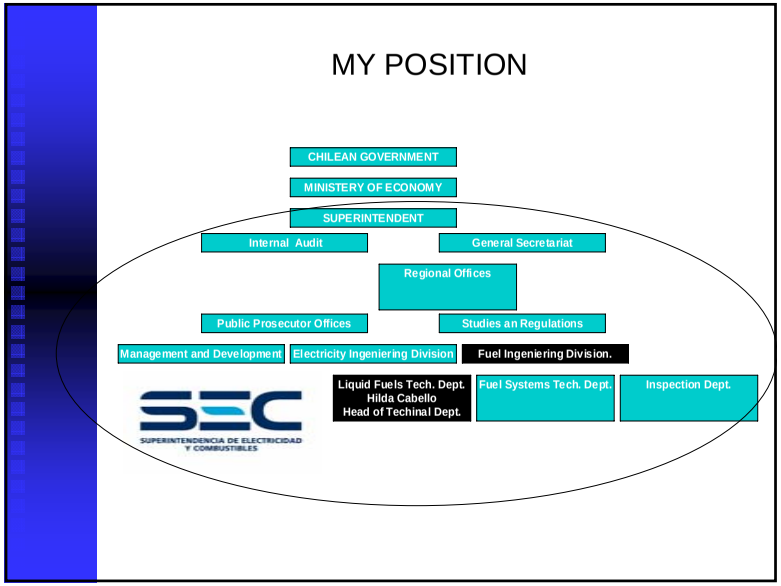
- a- Food, Microbiology, Chemical Lab.
- b- Scientific, Industrial Metrology Lab.

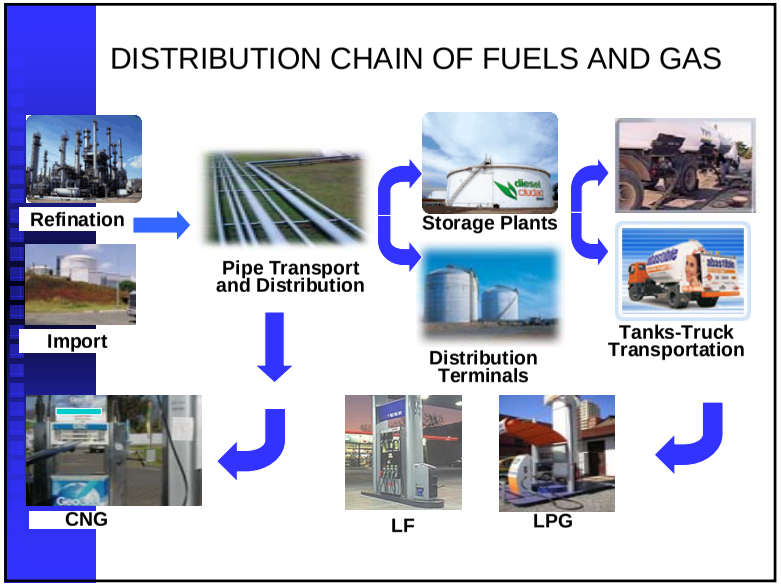
Note:

- -DoM acts as the Legal Metrology Body.
- -DoM maintains and keeps secondary and working standards.
- -ILCC keeps primary standards and implements scientific, industrial metrology requested by DoM.


CHILE


WORLD
LOCATION
PERU
BOLIVIA
Arica
Iquique
Desierto de Atacama
Ollagüe
Calama
Océano
Pacífico
Antofagasta
Catalina
Copiapó
Ojos del Salado
CHILE
La Serena
Vallenar
Coquimbo
ARGENTINA
Viña del Mar
Quilpué
Isla
Valparaíso
SANTIAGO
Juan Fernández
Rancagua
Puente Alto
Talca
Chillán
Talcahuano
Concepción
Los Angeles
Temuco
Valdivia
Puerto Montt
Chiloé
Archipiélago
Chonos
Puerto Cisnes
Coihaique
Océano
Atlántico
Isla Wellington
Islas
Malvinas
Puerto Natales
Estrecho de Magallanes
Punta Arenas
Tierra del
Fuego
Cabo de Hornos


MY POSITION
CHILEAN GOVERNMENT
MINISTERY OF ECONOMY
SUPERINTENDENT
Internal Audit
General Secretariat
Regional Offices
Public Prosecutor Offices
Studies an Regulations
Management and Development
Electricity Ingeniering Division
Fuel Ingeniering Division.
Liquid Fuels Tech. Dept.
Hilda Cabello
Head of Techinal Dept.
Fuel Systems Tech. Dept.
Inspection Dept.
SEC
SUPERINTENDENCIA DE ELECTRICIDAD
Y COMBUSTIBLES

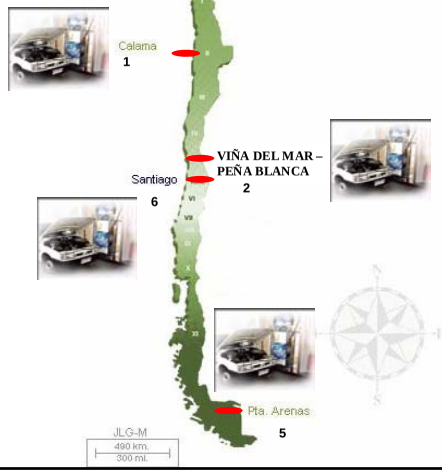

DISTRIBUTION CHAIN OF FUELS AND GAS
Refination
Import
Pipe Transport
and Distribution
Storage Plants
Distribution
Terminals
Tanks-Truck
Transportation
CNG
LF
LPG

COMPRESSED NATURAL GAS (CNG) IN CHILE

- ✓ CNG TYPICAL USING: TAXI
- ✓ CHILEAN AUTOMOTIVE FLEET: 10.000.000 VEHICLES APP.
- ✓ 6 151 VEHICLES ARE POWERED BY CNG



CNG CURRENT OPERATING FACILITIES IN CHILE



CNG IN CHILE

✓ GNC SUPPLY REQUIREMENTS:

- ILIMITATED SUPPLY (No Contracts between users and gas distributors is required)
- VEHICLE TECHNICAL REQUIREMENTS, By National Standard NCh 2109 Of.1998.

"Gas natural comprimido - Sistema para el uso de GNC como combustible de vehículos motorizados - Requisitos mínimos de seguridad".

CNG FACILITY

CNG FACILITIES REQUIREMENTS AND APPROVALS

- REQUIREMENTS:
  - Technical: NCh. 2110 Of. 1998.
    "Gas natural comprimido - Estaciones surtidoras de GNC - Requisitos mínimos de seguridad".
  - Safety and registration: Resolución SEC N° 414/ 2004

- ✓APPROVALS NEEDED:
  - Certification type of completed dispenser unit. (Issued in origin)
  - Certification type of volumetric issues.

Registration (SEC).

TECHNICAL CHARACTERISTICS

- ✓ ASPRO y SULZER Brand systems.
- ✓ Pressure supply: 20 MPa.
- ✓ Devices:
  - Check valves.
  - Pressurre regutaion valves.
  - Hand shut off valves.
  - Overflow valves.
  - Masic meters.
  - Hose Retention valves (Break away)
  - Manometers.
- ✓ Sale dispensing unit: m^3

GNC FACILITIES

NON PUBLIC FACILITIES (INDUSTRIALS AND TRANSPORTATION OWNERS)

PUBLIC FACILITIES

PUBLIC CNG FACILITIES	PUBLIC LF FACILITIES	NON PUBLIC LF FACILITIES
14	1525	1242

Self-introduction

- I'm very happy to come here and join you.
- My name is Zhang Ze Hong.
- I come from the People's Republic of China.
- I'm an engineer and work in ChonqQing Academic of Metrology and Quality Inspection.

Use of CNG in my Country

- In our country, users of CNG are almost taxies and autobuses. In most city, these two vehicle are forced to use CNG for the natural environment.
- In China, about 30 cities use CNG fuel. Almost 200,000 autos use CNG to substitute oil.
- Company with the oil price's growing fastly, many more CNG stations and CNG dispensers are builded. This will go to high tide in several years to use CNG.

Legal metrological control on CNG dispensers

- The units of measure used for CNG is mass: Kilogram.
- In our country, the type approvals and verifications is must required. The organizations are belong to metrology supervised department. They are supervised by government.
- In ChongQing city, my unit is the only designated department to do the CNG dispensers' type approvals and verifications.
- The reverification interval is half year and it works at the place of service.
- The methods we used are performed gravimetrically and standard meter （Level 0.2）.

CURRENT SITUATION ON METROLOGICAL CONTROL AND VERIFICATION OF CNG FUEL DISPENSERS AND FUTURE DIRECTION
June 27th~30th, 2006
in MALAYSIA

Presented by
ARIPIN

DIRECTORATE OF METROLOGY
DIRECTORATE GENERAL OF DOMESTIC TRADE
THE MINISTRY OF TRADE OF THE REPUBLIC OF INDONESIA

Autobiography

- Name : A R I P I N
- Family name : Maskosoeditro
- Place & date of birth : Garut, August 12th, 1958
- Address : Bukit Permata Cimahi Blok F7 No.9
  Bandung Regency – West Java – INDONESIA
- Present place of employment : Directorate of Metrology (DOM)
  Directorate General of Domestic Trade
  Department of Trade

- Position and Responsibility : Inspector of legal metrology and responsible for all of the measuring instruments which are using for commodity transaction
- Experience :
  - Only to verify fuel dispensers for petrol.
  - Generally, the type of dispensers are positive displacement meter
  - To verify in the accuracy testing of weighing elements for about 22 years.
    The type of weighing elements, among other things:
    Type: MC-30 Class : I Capacity : 200 g Division : 1 mg
    Type: PK- 60 Class : II Capacity : 60 kg Division : 1 g
- After following the training course :
  - To Be required to make a book report completely
  - To Be required to train to metrology inspectors of DOM pass trough in house seminar and to inspectors of metrology province or metrology regency pass trough up-grading in connection with CNG fuel dispensers.
    This up-grading is organized by Education and Metrology training office and centered in Bandung, West Java.

CNG in Indonesia

- Approximately, Number of vehicles are powered by CNG :
  - In Banten province, Jakarta, Bogor and Bekasi for about 10 thousands or 25 % to all vehicles,
  - In Bandung and Cirebon for about 2 hundreds or 10 % to all vehicles,
  - In Surabaya (East Java) for about 6 hundreds or 4 % to all vehicles,
    and there are not information for another places.
- The typical user of CNG are oil company of state and Gas company of state.
- CNG is sold to the public without limitation.
- Approximately, number of CNG fuel dispensers in my country for about 22 dispensers and there are not information about number of CNG stations.
- CNG used for other purposes are among other things ;
  - To let water evaporate on oil company,
  - Chemical production companies,
  - Artificial fertilizer manufactures,
  - To cooked (the public society)
  - etc.

Legal Metrology Control on CNG fuel dispensers

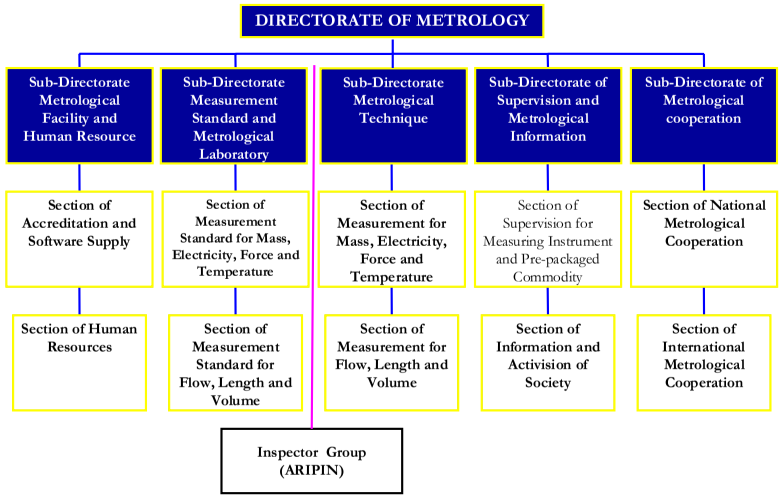
- The units of measure used for CNG are International system units (kg, L)
- Each measuring instruments which are using for commodity transaction in Indonesia to be required to get a type approval first, so for CNG fuel dispensers.
- Organization regulate type approval of CNG fuel dispensers is Directorate of Metrology.
- Verification, re-verification of CNG fuel dispensers are carried out by Metrology province or Metrology regency (a local Metrology).
- The re-verification interval is once in a year.
- Verifications are performed on meters at the place of service.
- Verification are able to be performed either gravimetrically or volumetrically.

Future Direction in Indonesia

- Crude oil production is more decrease, so in foreign exchange.
- Price of fuel oil is more expensive even degree of economy is very late growth.
- Approximately, number of vehicles are increased for about 15 % in a year.
- President has been suggesting to public society to use the CNG fuel for their vehicles, specially for public transportation.
- In this case, there is an opportunity to increase neither the number of stations nor the number of CNG fuel dispensers.

Thank you for your attention

The Organizational Chart of Directorate of Metrology



● Directorate of Metrology is located in Bandung

General Overview of Indonesia

- Official Name: Republic of Indonesia
- Population: ± 238.452.952
- Capital City: Jakarta
- Languages: National language (Bahasa Indonesia) and native language
- National Anthem: Indonesia Raya
- Official Currency: Rupiah
- Location: Southeastern Asia, between Australia and Asia Continents, archipelago between the Indian Ocean and the Pacific Ocean,
- Main Islands: Sumatera, Java, Kalimantan, Sulawesi & Irian
- Provinces: Indonesia has 33 provinces
- Climate: tropical; hot, humid; more moderate in highlands,S Seasons: dry and wet
- Surface area : ± 1.900.000 km^2
- Latitude/Longitude : 6º 18S, 106º 83E

International Organization Membership

- **Indonesia became a Member State of the Organisation Internationale de Metrologie Legale (OIML) in September 1960, and**
- **has been a Member State of the Asia Pacific Legal Metrology Forum (APLMF) since it establishment in 1994**
- Reference :
  as a consequence became a member state of the OIML, almost of Indonesian's regulations refer to OIML Recommendation

Current Situation about the Use of CNG (Compressed Natural Gas) in Japan

June 27, 2006

By Tsuyoshi Matsumoto
National Metrology Institute of Japan (NMIJ)
National Institute of Advanced Industrial Science and Technology (AIST)

AIST

Brief Introduction of
National Institute of Advanced Industrial Science and Technology (AIST)

- About **8,000** employees including permanent (2500), assistant staffs and guest scientists.
- Established in **2001** as a semi-private institute by amalgamating 16 government institutes.
- Headquarters are located in **Tsukuba** and **Tokyo** plus there are 8 local branches.
- **NMIJ** is a part of 60 research units in AIST with about **400** employees.

AIST

National Metrology Institute of Japan (NMIJ)

Director	Deputy Director	Principal Research Scientist	Unit Staff
Time and Frequency	Time Standards	Electricity and Magnetism	Electricity Standards 1
	Wavelength Standards		Electricity Standards 2
	Frequency Measurement Systems	Electromagnetic Waves	Radio-Frequency
Lengths and Dimensions	Length Standards		Electromagnetic Fields
	Dimensional Standards	Photometry and Radiometry	Laser Standards
Mechanical Metrology	Mass and Force Standards		Optical Radiation
	Pressure and Vacuum Standards	Quantum Radiation	Ionizing Radiation
	Legal Weighing Metrology		Radioactivity and Neutron
Acoustics and Vibration Metrology	Acoustics and Ultrasonics	Inorganic Analytical Chemistry	Inorganic Standards
	Vibration and Hardness		Environmental Standards
Temperature and Humidity	Thermometry	Organic Analytical Chemistry	Organic Standards 1
	Cryogenic Thermometry		Organic Standards 2
	Radiation Thermometry		Bio-Medical Standards
	Humidity Standards	Materials Characterization	Surface and Thin Film Standards
Fluid Flow	Gas Flow Standards		Nanopore Standards
	Liquid Flow Standards		Polymer Standards
	Legal Flow Metrology	Reference Materials System	
Material Properties and Metrological Statistics	Thermophysical Properties	Legal Metrology	
	Fluid Properties	Dissemination Technology	Calibration and Verification
	Metrological Statistics and Particle Measurement		Pattern Approval
Metrology Management Center			
Metrology Management Center	Metrology Planning Office	Reference Materials Office	Metrology Training Center
	Metrology Quality Office	International Metrology Cooperation Office	

AIST

1. Self-introduction *of Tsuyoshi Matsumoto*

1.1. What is your position and responsibility in your economy? *Executive Secretary of APLMF. As a staff of NMIJ, I am in charge of international affairs in legal metrology. Previously, I worked on the measurements of thermo-physical properties in high temperatures.*

1.2. Will you be required to train others? Yes If so, how will you train? *As an organizer of APLMF training courses.*

1.3. Do you have any experiences verifying fuel dispensers for petrol or LPG or CNG? *No. But attended two APLMF training courses on fuel dispensers.*

1.4. Have you experienced in the accuracy testing of weighing elements? *No. But attended two APLMF training courses on NAWI.*

AIST

2. Use of CNG in your economy

2.1. How many number of vehicles are powered by CNG?

*Total about **27,600** (0.065% of all vehicles).*

2.2. Who is the typical user of CNG in your economy?

Vehicles owned by government (including local), public organizations, schools, gas companies, truck companies, postal offices, delivery companies, and taxi companies.

*Use of CNG by **private vehicles** is **quite rare**.*

AIST

CNG-Powered Vehicles in Japan*

Type of Vehicle ↓ / User / Owner →	Central & local governments	Gas company	Companies for other than gas	Total
Light vehicles <550cc	1,111	2,827	1,868	5,806
Passenger cars	342	590	453	1,385
Small trucks	954	1,625	1,217	3,796
Large trucks	461	37	11,426	11,924
Garbage trucks	1,432	0	1,151	2,583
Buses	679	16	510	1,205
Folk lifts	2	15	889	906
Total (% to all vehicles)	4,981	5,110	17,514	**27,605** (0.034%)

* As of March 31, 2006 (http://www.gas.or.jp/)

AIST

2.3. How many CNG stations in your economy?

CNG stations in Japan

Type of Stations	Number*
Eco-stations**	265
Natural gas stations for public	18
Natural gas stations for private company/organization	28
Total (% to all stations)	**311** (0.65%)

* As of March 31, 2006 (http://www.gas.or.jp/)

** **Ecological-Stations**, which sells energy for vehicles only in the form of CNG, LPG, electricity, and methanol.

AIST

2.4. If CNG used for other than vehicles, please specify other purposes.

NO.

However, **imported LNG** (Liquidized Natural Gas) is widely used as a source of energy for private houses, offices, factories, and electricity power plants in large cities which is distributed via a network of gas lines.

(Photo: http://www014.upp.so-net.ne.jp/pilot-ak/)

AIST

3. Legal metrological control on CNG dispensers in your economy

3.1. What are the units of measure used for CNG?

Nm^3 : Normal cubic meters corresponds to 0 ºC and 1 atm.

3.2. Are type approvals and verifications required for CNG dispensers in your economy?

No.

METI (Ministry of Economy, Trade and Industry) is looking for a possibility to include CNG dispensers into legal metrology control, but it is not decided. Besides metrology, other kind of regulations on the **safety of CNG facilities** already exist. There are several **industrial standards** in JIS (Japanese Industrial Standards) related to the general measurement of natural gas (not only for CNG).

AIST

3.3. What organization(s) regulate type approvals and verifications of CNG dispensers? N/A.

However, METI is responsible of general safety related to compressed gases.

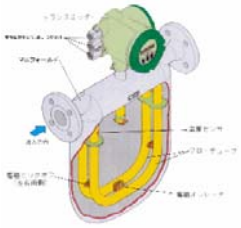
3.4. How long is the reverification interval? N/A

3.5. Are verifications performed on meters at the place of service? N/A

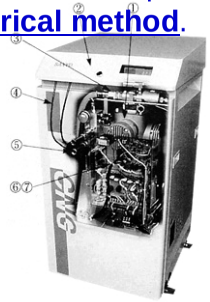
3.6. Are verifications performed gravimetrically? or volumetrically? N/A

AIST

Additional Comments: Many of CNG dispensers in Japan uses **mass flow meters** based on the **Coriolis effect** or a heat-transfer effect. Several manufacturers are producing CNG dispensers or flow-meters. They usually calibrate their dispensers by themselves using a **gravimetrical method**.



Coriolis Flow Meter



AIST

Thank you for your attention

“ Training courses on CNG Fuel Dispensers
in Shah Alam ,Malaysia on June 27 – 30 , 2006 ”

Country Report on CNG Fuel Dispensers Activities in Lao PDR

Presented: **By Mr. Kadingthong Singdala**
Metrology Division
Department of Intellectual Property, Standardization and Metrology(DISM),
Science, Technology and Environment Agency(STEA).

Chairman.
Distinguished Ladies and Gentlemen,

On be half of Lao PDR I'm very Pleased to be here with you to present some information on the activities for the Metrology Management in Lao PDR

I would like to express my sincere thank to the all of organizers for assisting and providing us the opportunity to participate to the Training Course on CNG Fuel Dispenser in Shah Alam, Malaysia.

I. Basic Country Data.

The Lao People's Democratic Republic (Lao. PDR) is a land-locked and mountainous country which borders China to the north, Cambodia to the south, Vietnam to the east, Thailand to the west and Myanmar to the northwest.

Lao PDR has a total area of 236,800 square kilometers with a population of 5 million (1998),it's capital is Vientiane. The Lao PDR was established on December 2,1975.

The climate is tropical and dominated by the southwest monsoon which brings high rainfall, high humidity and high temperatures between mid-April and mid October. While over 70% of the rain falls during wet season, the climate is characterized by high inter-annual variability with relatively frequent occurrence of flooding and drought. Average temperatures ranges around $20^{\circ c}$ in the mountainous areas and on the highland plateaus to $25^{\circ c}$ - $27^{\circ c}$ in the plain. Gross Domestic product (GDP) per capita: 380 US$
(1997).

Trade and Current Account Balance Deficits:

While imports have been increasing with growth, exports have been subject to fluctuations caused by variations in world prices (fuel or coffee for example).Export policy is generally given more attention than import policy , although the value of import is two or three times the value of exports. Export are mainly of garments, electricity, timber, wood products, coffee, cardamom, mining output, and forestry and agriculture products. Import of food have generally declined, but imports of factory raw materials, and vehicles, agricultural equipment and machinery have increased. Raw materials make up 63% of all imports. The biggest import drain on hard currency in 1999 was fuel, costing US$ 70 million. Vehicles, machinery, raw materials, garments, construction materials, pharmaceutical products and food followed this.
Up to now, the imported goods except drug and food are not controlled and inspected by any concerned bodies yet.

II. The Present Status And Problems on the activities of Fuel Dispenser in Lao. PDR.

- **Organizational Chart of DISM (see annex1).**
- **Organizational Chart of Metrology Division (MD) (see annex2).**

Department of Intellectual Property, Standardization and Metrology (DISM) under Science Technology and Environment Agency (STEA) are a National Standards Body (NSB) and a Government Body . The DISM was established in 1993 under STEA, which advises and manage the issues of intellectual property, standardization and metrology management for the whole republic.

The main priority task of DISM is to improve standards and quality awareness in all economic sectors as to:

- Prepare plans, law, rules and regulation on QSTM and submit them to the higher authorities for approval;
- Organize the supervision and central on the implementation of the approved law, rules and regulations;
- Establish organization system on QSTM and provide methodological guidance for all activities of the above system;
- Organize formulation of national standards and maintain national metrology standards;
- Provide and implement quality system and product certifications, testing and calibration, verification of metrology equipment and laboratory accreditation. Implement the supervision and inspection on quality of goods and products and measuring instrument;
- Conduct studies on QSTM;
- Improve the technical level of employees, training and cooperate with regional and international organizations in the field of QSTM management.

The local management agency (Provincial and Municipal level) has the role in activities regarding QSTM matters as well as central activities but according to the recommendation of the central management agency.

Legislation :

In order to ensure and strengthen administration of QSTM matters, Lao PDR has promulgated some necessary legislation relating to the standardization, quality and testing metrology management are the following :

- Decree on Metrology Management issued by the Prime Minister in October 26,1993.
- Regulation on Registration of Measurement Instruments (No 233/STEA. March 10,1994).
- Guidelines on Registration and Testing of fuel Dispenser(February 07,2001).
- Regulation on Prepackages goods (Drafted)
- Regulation on Fuel Truck Tank registration (Drafted)

However, all legislation mentioned above are relating with some activities of the management only, but still absence of the right inspection and testing system with Legal Metrology conformance .

CNG Fuel Dispensers Activities in Lao .PDR:

Regarding the fourteen questions asked me about the activities on CNG Fuel dispensers, they are only the part I which we have the activities on it. Others parts such as part II and III we haven't yet.

As you know Lao PDR is a land lock country and no sea and no oil sources at all. Therefore CNG Fuel is a new matter for Lao and I frankly said that we have no any experience on it. And I am pleased here and be happy that APLMF and NIMJ who have gave me the opportunity to be here and get experiences and lessons on CNG Fuel on how do they perform or control on both theory and pratice in this field .many countries in the world now they are seeking for the alternative source like CNG to replace petrol as currently the price is increase days by days . we also are seeking to find the way out and it is under our responsible on how to control ,perform and used in reality .

As I have mentioned Metrology division is under the department of Intellectual Property Standardization and Metrology and we had experience only on Petrol and LPG Fuel dispensers and not CNG Fuel dispensers yet . Also some experience on the accuracy testing of weighing for a year and the class range from class I to IV.

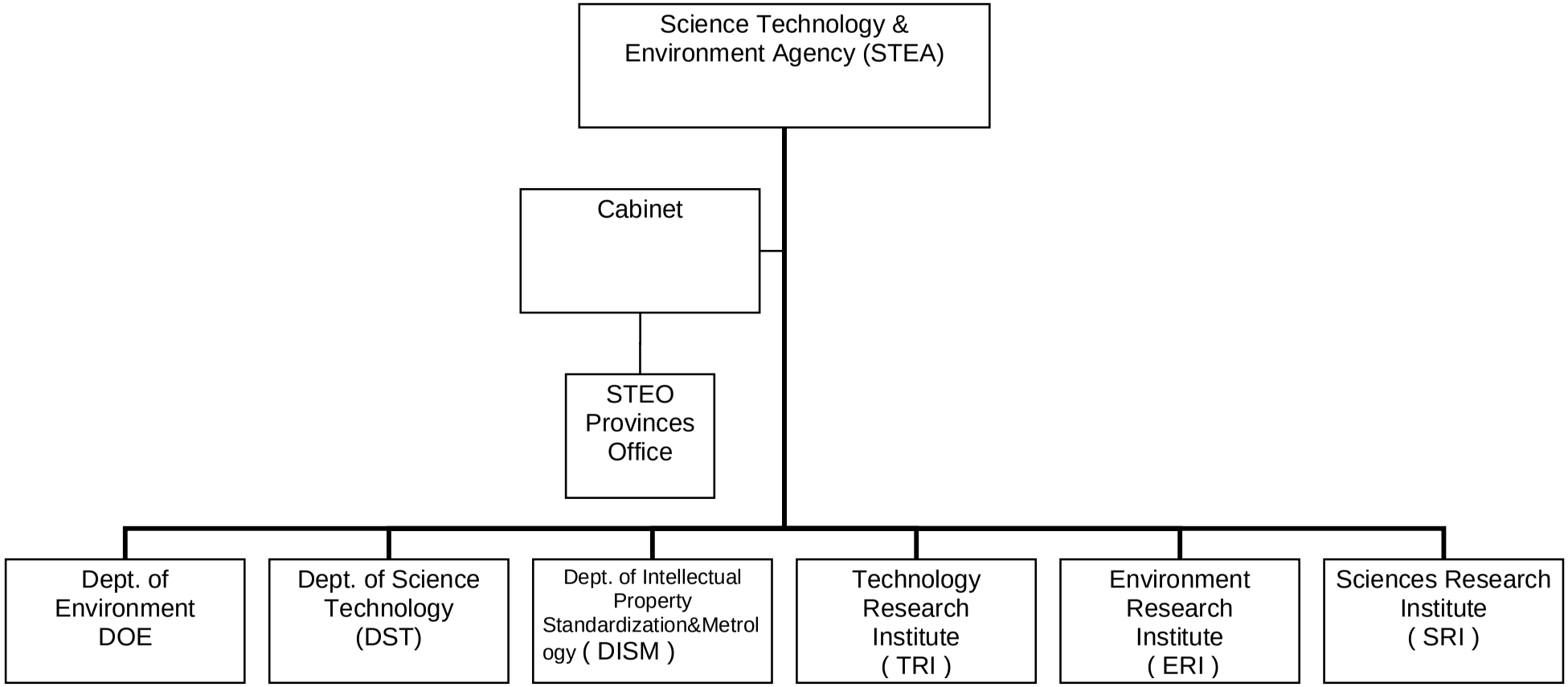
And in general to perform the activities on metrology we have based only the Decree on Metrology Management issued by the Prime Minister in October 26,1993 and the Regulation on Registration of Measurement Instruments (No 233/STEA. March 10,1994).

Finally on behalf of myself, I would like to express my sincere thank the government of Japan particularly National Institute Metrology of Japan who has supported me even it is not fully due to lao current situation condition I still have felt happy to be part of this meaningful training course and also many thanks to all of organizers who had a good relationships in contacting and facilitating me before and during the training course. And I thank a lot to all of my colleagues participants in this training courses who have always assisted and gave me their experiences without limitation during the course.

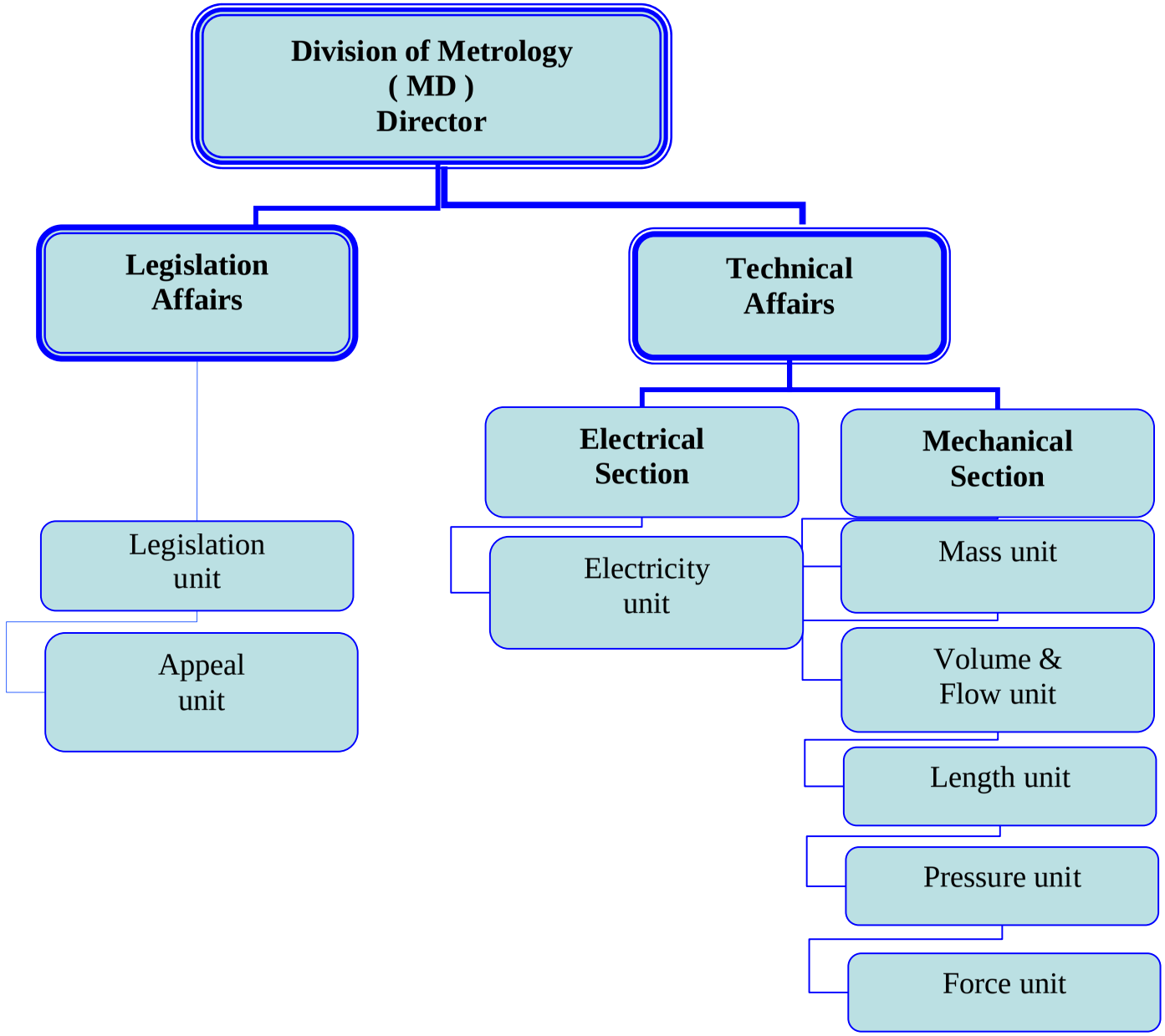
Thank you for your patience attention.

Annex I

Science Technology & Environment Agency Chart



Annex II
Metrology Division Chart

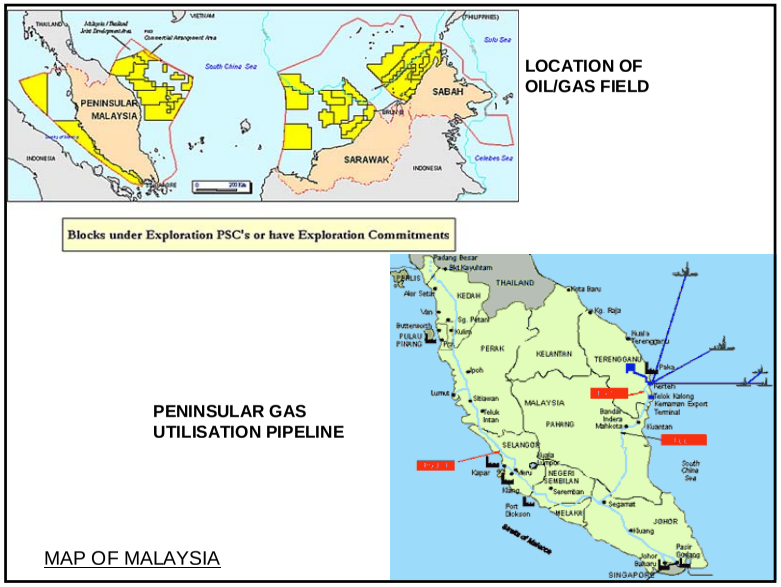


APLMF TRAINING COURSE ON
CNG FUEL DISPENSER

27 – 30 JUNE 2006, SHAH ALAM, MALAYSIA

COUNTRY REPORT
(**MALAYSIA**)

PRESENTED BY:
DR ABDUL RAHMAN MOHAMED
NATIONAL METROLOGY LABORATORY
SIRIM BERHAD, MALAYSIA



LOCATION OF OIL/GAS FIELD

PENINSULAR GAS UTILISATION PIPELINE

MAP OF MALAYSIA

Metering for the CNG is an important aspect in NGV industry since these are the cash registers that measure the revenues of the energy delivered by Petroleum companies. Whilst the suppliers are interested in the monetary return for their investments, the users or motorist have to be ensured that they are getting what they paid for. Neither seller nor buyer likes to bear the risk of measurement errors.

In Malaysia, similar to most other countries, legislatives are introduced to facilitate trade as well as ensuring the activities are conducted in a fair manner. Among requirements in the Regulation is that the measurement instrument used must be reliable where their errors have to be within prescribed limits. This means that the instrument should be capable of maintaining the required accuracy over a certain period of time, longer than normal calibration schedule of one year.

WEIGHTS AND MEASURES ACT, 1972 (ACT 71)

Stipulate:

1. Verification and Inspection of every weight and measures and instrument for weighing or measuring for use for trade.
2. Type approved by the Custodian of Weights and Measures (SIRIM Berhad)

METROLOGICAL CONTROL PROCESS

TYPE APPROVAL

- TESTING
- TECHNICAL DESCRIPTION
- CERTIFICATE OF APPROVAL

Regulatory organization

MASTER METER CALIBRATION
- INTERVAL : 1 YEAR
- ACCURACY : 0.5% by Gravimetric

CUSTODIAN(SIRIM BERHAD)

VERIFICATION

DISPENSER VERIFICATION
- INTERVAL : 1 YEAR
- ACCURACY : 2% by Master meter method, at the place of service

MCM / MDTCA

INSPECTION

DEVELOPMENT IN NGV ACTIVITIES (JUNE 2006)

- NUMBER OF STATION : 48 (OWNED AND OPERATED BY PETRONAS NGV SDN BHD)

- NUMBER OF VEHICLES INTALLED
  CARS (MAINLY TAXI) : 19 000
  BUSES : 4 (expected to be 25 by year end)

Major (widely used) components:

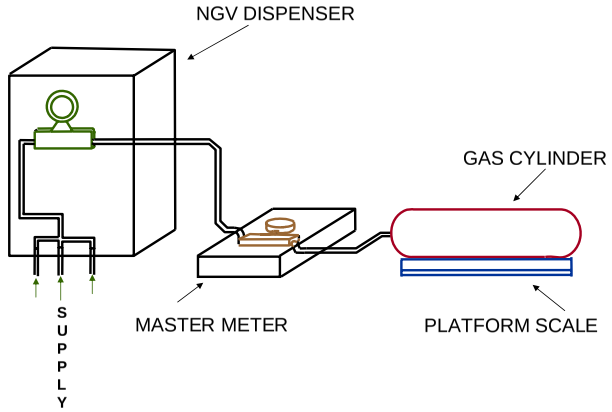
FLOWMETER : Endress and Hauser Promass 64
Micromotion CNG050

CALCULATOR/INDICATOR
: Micon 500CN (Kraus Industries)

GAS FILLING: DISPENSER INTO TAXI'S CYLINDER

MARKING ON THE DISPENSER FRONT PANEL

DISPENSER TYPE APPROVAL PROCESS



SET-UP FOR MASTER METER CALIBRATION

MASTER METER CALIBRATION PROCESS

SEALING OF MASTER METER

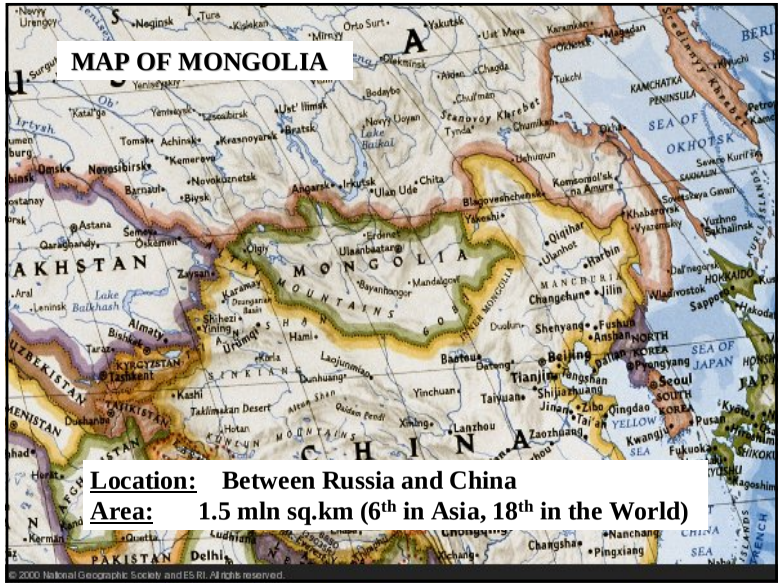
MASTER METER CALIBRATION PROCESS

CURRENT SITUATION OF LPG DISPENSER IN MONGOLIA

Davaa DAMBASUREN
Verification officer for volume laboratory
Metrology department
Mongolian Agency for Standardization and Metrology
E-mail: masm@mongol.net
d_dambaa78@chinggis.com
Tel: + 976 11 263792
Fax: + 976 11 458032

Brief introduction of MASM

Mongolian Agency for Standardization and Metrology was established in 1924. The organization is located in the central part of the country in the capital city of Ulaanbaatar.



Quick facts about Mongolia

-Population: 2,8 mil.(with low density of 1,5 persons per sq.km)
- More than 10 ethnic groups, (75%-Khalkha, 7%-Kazakhs and others)
- Language: Mongolian
- Religion: More than 90%-Tibetian Buddhist Lamaism, 6%-Muslim
- Climate: Extreme continental, 4 distinct seasons

Brief introduction of MASM

The MASM is a government regulatory body responsible for coordinating and managing the activities of Metrology, Standards, Certification and Accreditation throughout the country.

The highest decision making body of the center is MASM Council which consists of 20 members, who represent government and non-government organizations and approved by the government. The center executes its activities with 120 employees and implements its policy via the local centers for standardization and metrology in 21 aimags (provinces).

Mongolian Agency for Standardization and Metrology

Measurement Standards

The metrology center maintains the Mongolian national measurement standards for the SI units of mass, time and frequency, voltage, solid density, temperature and volume.

Main activities include:

- Development of national measurement standards system
- Dissemination of national measurement standards
- Development of Certified Reference Materials
- Calibration of measurement standards and instruments

Use of LPG in Mongolia

- I am a verification officer of volume measurement laboratory.
- I have an experience verifying fuel dispensers for petrol and LPG.
- I have experienced in the accuracy testing of weighing elements. Class-II, capacity 25-150 kg.
- In my country, we don't use CNG. However, approximately 1 000 vehicles powered by LPG. Its about 1% of all vehicles in Mongolia.
- Usually taxi companies use LPG. They make contract to buy LPG from the importer company. There are 10 LPG stations. A few restaurants and organizations use LPG other than vehicle purposes.
- Kg is the measure unit for LPG.
- Verification on LPG dispensers is one of the most difficult issue which occurs to our organization. Because, lack of measurement instrument.
- Our organization regulate type approvals and verifications of LPG dispensers. And reverification interval is 6 months. There are no verifications performed on meters at the place of service. Verification performed gravimetrically.

Legal Metrology

- Pattern approval of measuring instruments
- Verification of mandatory instruments as required by law
- Licences for manufacture, repair and sale of measuring instruments
- Control of packaging/quantities

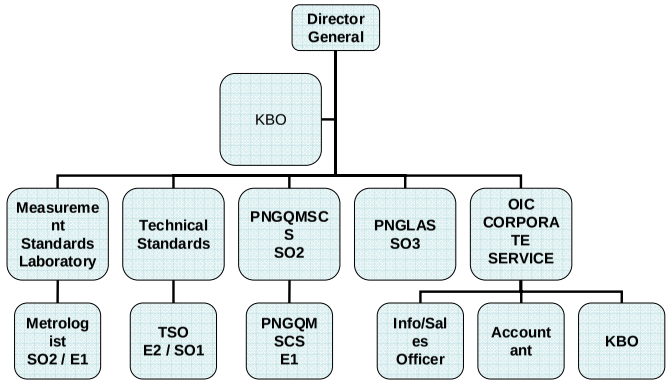
The metrology department verifies over 50 thousand measuring instruments per year.

PAPUA NEW GUINEA NATIONAL INSTITUTE OF STANDARDS & INDUSTRIAL TECHNOLOGY (NISIT)

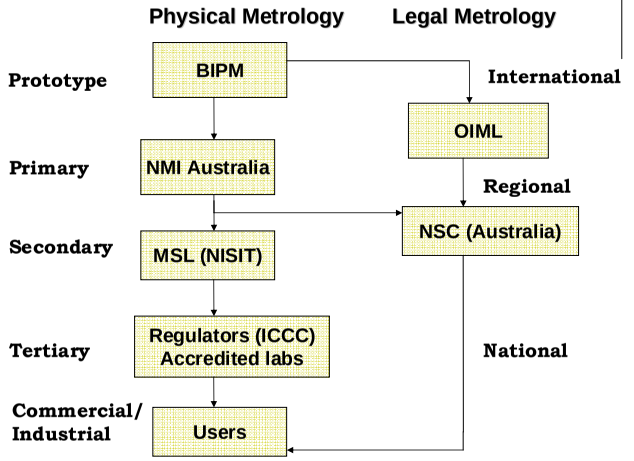
NISIT in Brief

- An Act Passed By Parliament in 1993 known as the NISIT Act 1993
- Measurement Standards Laboratory (MSL) – department in NISIT
  - Establishment and Maintenance of the National Measurement System
  - Dissemination of the National Measurement Standards, and
  - Providing Technical Support & Training

The NISIT Structure



Traceability of Measurement



TRAINING

NISIT provides trainings to Trade Measurement Inspectors and other Interested parties

Under the NISIT Act 1993:

NISIT is mandated to carry out and implement legal metrology in the country

Experience in Verifying Fuel Dispensers

- Fuel Dispensers and LPG Fuel Dispensers
  - Also provide training to Trade Measurement Inspectors to conduct verification of fuel dispensers.

USE OF CNG IN PNG

- Though PNG Mines and exports Natural Gases, we do not have vehicles that are currently using CNG gas as fuel. However due to high prices of petroleum fuel in the country, PNG is likeable to introduce cars that will use Gas in the near future.
- Otherwise most gas products are exported to overseas markets in Australia, Asia, US, Canada, and Europe.

LEGAL METROLOGICAL CONTROL ON CNG DISPENSERS

- PNG does not have vehicles running on CNG fuel however as mentioned, in the near future this will be introduced and NISIT would like to use this opportunity to prepare for this type of testing when the use of CNG is taken on board and through this training we hope to learn and train inspectors in the country at the appropriate time so that we are prepared in advance by the time we start using CNG fuel to run vehicles and we will be able to do verification on the CNG fuel dispensers.

Way Forward

- NISIT hopes to gain from this training:
  - Procedures and techniques on verification procedures of CNG dispensers which will come to play in the future
  - Through the NISIT Act 1993, work with Trade measurement inspectors and train them at the appropriate time when there is a need to provide metrological services on CNG dispensers as this is a plan that will come into reality as PNG has Gas mines to provide for a cheaper and alternate fuel for vehicles

END!

Thank you very much for your kind attention!

indecopi

TRAINING COURSE ON CNG FUEL DISPENSERS SHAH ALAM, MALAYSIA

ECONOMY: PERU

ORGANIZATION: INDECOPI - NATIONAL METROLOGY SERVICE

TRAINEE: Abed Morales.

indecopi

LOCATION

PERU IS PART OF LATIN AMERICA.

IT IS LOCATED IN THE OCCIDENTAL PART OF SOUTH AMERICA

indecopi

Peru is the land of the INCAS Empire

indecopi

INFORMATION

- Country (long form): Republic of Peru
- Capital: Lima
- Total Area: 1 285 215 square kilometers
- Population: 27 483 864 (July 2001 est.)
- Languages: Spanish (official), Quechua (official), Aymara
- Religions: Christians (Catholic and anothers) 99 %
- Government TypeConstitutional Republic
- Currency: 1 Nuevo Sol (S/.) = 0,30 US$
- Industry: mining of metals, petroleum, fishing, textiles, clothing, food processing, cement, steel, metal fabrication
- Agriculture: coffee, cotton, sugarcane, rice, wheat, potatoes, coca; poultry, beef, dairy products
- Peru has the biggest biodiversity of the world
- Natural Resources: copper, silver, gold, petroleum, wood, fish and others

INTRODUCTION

INDECOPI

- What is your position and responsibility in your economy?

I am head of Volume and Density laboratory in National Metrology Service – INDECOPI. My responsibility is to keep measurement standards and to transmit traceability to the industry. Also to establish standards methods in coordination with normalization area of INDECOPI. Then, these methods are used by laboratories or fiscalization offices.

INTRODUCTION

- Will you be required to train others?

  Yes, but in medium or large period, when the State decides the fiscalization of CNG service stations. At first, there will be more stations and the fiscalization office will need to buy the standards.

- Do you have any experiences verifying fuel dispensers?

  Only the training course about verification of petrol and LPG dispensers, last year in Thailand. I don´t have any experience in CNG dispensers.

Use of CNG in my economy

- How many number of vehicles are powered by CNG?

  There are 688 vehicles only, this is very new for us.

- How many CNG stations?

  There are 2 stations only recently installed. And there are 4 stations in construction now.

Use of CNG in my economy

- Who are the typical users of CNG?

  The typical users of CNG are a few factories, a few vehicles and a few houses, because of the installations and the use began last year but it will grow each year.

- Is CNG sold to the public without limitation?

  There is no legal restrictions, only technicals restrictions. Only buy who have the equipment for receiving it.

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Legal Metrological Control on CNG dispensers in my economy

- **What are the units of measure used for CNG?**

  The units of measure used is the cubic meter and its submultiples.

- **Are type approvals and verifications required for CNG dispensers in your economy?**

  The type approvals and verifications are not required for CNG dispensers in my economy. But in medium or large period, when the State decides the fiscalization of CNG service stations, the verifications will be required.

indecopi

Thank you!

Abed Morales Q.
INDECOPI - PERU
amorales@indecopi.gob.pe

COUNTRY REPORT

APEC/APLMF Seminar and Training Courses in Legal Metrology (CTI-11/2006):

TRAINING COURSE ON CNG FUEL DISPENSERS

June 27-30, 2006 (4days)
ASIA-PACIFIC LEGAL METROLOGY FORUM

RHEA B. BANGLAY
Science Research Specialist I
National Metrology Laboratory
Industrial Technology Development Institute
Department of Science and Technology

Metrology Bldg., DOST Cmpd.,
General Santos Avenue
Bicutan, Taguig City
(632) 8372071
rbanglay@yahoo.com

National Metrology Laboratory of the Philippines -Industrial Technology Development Institute (NML-ITDI)

I. The NML-ITDI

The mission of the National Metrology Laboratory is the establishment, maintenance and dissemination of standards of units of measurements.

The NML-ITDI is the organization responsible for establishing and maintaining national physical standards for basic and derived quantities such as mass, length, temperature, volume, force, time interval, voltage and resistance. Dissemination of standard values to users at the best uncertainty levels attainable is performed through the calibration and measurement services offered by the laboratory.

I.I. Metrology Services Offered by the NML-ITDI

The NML-ITDI is equipped with high precision standards and measuring instruments for use in its calibration and measurement activities. National standards are regularly calibrated abroad to ensure international traceability.

NML-ITDI has five major labs, which keep and maintain the national standards in the different fields of metrology. Each of these laboratories disseminates the standard units of measurement through our calibration services.

1. ***Volume/Density/Viscosity/Moisture Standards***
2. ***Mass Standards (Force and Pressure Standards)***
3. ***Length and Engineering Metrology Standards***
3. ***Electrical/Time/frequency Standards***
4. ***Thermometry and Hygrometry Standards***

Each of these laboratories disseminates the standard units of measurement through our calibration and testing services. Our clientele include hospitals, schools, manufacturing companies and calibration laboratories.

I.II. Metrology Training Center

The NML-ITDI has three on-going programs to help us develop and strengthen a pyramidal metrology infrastructure appropriate for the country.

One of these programs is the Metrology Training Program.

Through the Metrology Training Center, we conduct on-site trainings and in-house trainings on metrology. On-site trainings are trainings conducted at the premises of the requesting company while in-house are trainings conducted at the ITDI.

Trainings offered usually last for 3 days with lectures and laboratory work. The MTC Project has served 170 participants from various sectors such as the

academe, private calibration laboratories, food manufacturers, traders of agricultural products, manufacturing industries, industrial equipments, etc.

As part of our service obligation when sent to trainings abroad, metrology staffs are also given a directive to conduct technical forums on the trainings we have attended.

NATURAL GAS INFRASTRUCTURE IN THE COUNTRY

I. USE OF CNG IN THE PHILIPPINES:

I.I. Natural Gas Vehicles (NGV's)

There are about 12 NGV's here in the Philippines with another 200 privately-owned units expected to be delivered from China by August 2006.

- *The Philippine government currently owns about 12 units of CNG Vehicles.*

2 demo units of these are owned by the Department of Energy (DOE) and acquired form Korea and India. The other 4 are NGV's converted by DOE and are undergoing further testing. The Philippine National Oil Company (PNOC) owns 6 Original Equipment Manufactured taxis from Petronas, Malaysia

These NGV's have undergone on-road testing to asses the technical viability to local conditions. They are also used to inform and educate the people of the benefits of NGV's

.

- *The 200 NGV's are owned by several accredited transport groups with provincial routes plying near the Malampaya onshore gas plant.*

The 200 public utility buses (PUBs) are low-emission buses powered by Cummins Westport engines.

Use of CNG in the public transport will increase with the arrival of the 200 PUBs. The national government, with its policy to promote the Clean Air act through use of environmentally friendly fuels, has launched the **Natural Gas Vehicle Program for Public Transport (NGVPPT)** aiming to convert public transport vehicles such buses, taxis and jeepneys to run on CNG.By offering incentives, income tax holidays and providing preferential franchise, the government in encouraging more public transport operators to use natural gas as fuel alternative.

I.II. GAS SUPPLY-CNG REFUELING STATIONS

There are currently 3 refueling stations constructed in the country.

- *Gas supply from the San Antonio, Isabela Gas field*

The first and only operational refueling station is the PNOC-Exploration Corporation's CNG Refueling Station in Echague, Isabela. The gas supply is from the San Antonio, Isabela Gas field. This station was constructed initially to supply the 12 demo units owned by Doe and PNOC.

- *Gas supply from the Malampaya Gas field*

A mother-daughter refueling system is constructed to transport natural gas from the Malampaya Gas field**.** The CNG mother station is located within the Malampaya on-shore gas plant in Batangas with the daughter in Batangas City. The mother station serves the CNG requirements of the daughter stations, which in turn will supply the gas needs of the above mentioned 200 CNG-fed public utility buses.

The Natural gas supplied by the Malampaya gas field is to be utilized by the public transport sector and gas powered plants

I.III. (POTENTIAL) GAS DEMAND AND MARKET

Power Generation

Gas demand comes mainly from the power sector.

Gas from Malampaya is used to fuel three power plants in Batangas with a combined capacity of 2700 MW. These power plants are the 1200 MW CCGT Ilijan Power Plant, the 500 MW San Lorenzo Power Plant, and the 1000 MW Sta. Rita Power Plant.

Industrial Sector (Potential)

Industries along the proposed pipeline routes linking Batangas province and the Bataan peninsula to Metro Manila are expected to be a natural gas market. Natural gas will be used for their process heat, air conditioning and power requirements.

Commercial and Residential Sector (Potential)

Gas can be an alternative to electricity for their air-conditioning and lighting use. Principal opportunity for gas use in the residential sector is as a replacement for LPG as a cooking fuel.

II. LEGAL METROLOGICAL CONTROL ON CNG DISPENSERS IN THE PHILIPPINES

The DEPARTMENT OF ENERGY in consultation with appropriate government agencies issued and promulgated the DEO CIRCULAR NO. 2002-08-005 or the Interim *Rules and Regulations* Governing *the Transmission, Distribution and Supply of Natural Gas.*

This circular applies to supply and distribution of natural gas. It also applies to the roles and responsibilities of the DOE with other government agencies and private participants in the Natural Gas Industry.

II.I. MEASUREMENT OF NATURAL GAS

Units of measurement for natural gas and standard conditions where measurements is done is stated in Rule 4 of the **DOE Circular No. 2002-08-005.** The Rule 4 is as Stated below:

Section 1. Measurement of Natural Gas

Unless otherwise approved by the DOE and for the purpose of this Circular, the volume and energy value of Natural Gas will be measured according to the relevant standards as developed and maintained by the Organization for Standardization (ISO)and in particular:

(a)The volume of Natural Gas will be measured in cubic meters under standard conditions specified in Section 2 below and all reporting will be in units of standard cubic meter (SCM);

(b)The energy value of Natural Gas will be measured in Joules and all reporting will be in joules (J) with a quantity prefix, such as megajoules (MJ), terajoules (TJ), etc. as appropriate.

Section 2. Standard Conditions

Standard conditions for the purpose of this Circular shall mean the conditions of Natural Gas at a temperature of 15.5 degrees Celsius (°C) (288.15° Kelvin) and an absolute pressure of 0.101325 megapascal (MPa) or 1013.25 millibars.

II.II. TYPE APPROVAL AND VERIFICATION

The Department of Energy in **Rule 3 of the DOE Circular No. 2002-08-005** have the overall responsibility of supervising and regulating the development and operation of the Natural Gas industry by granting permits for the operation and maintenance of Transmission- and Distribution-related facilities.

The DOE is tasked to verify and type approve fuel dispensers with the national standard for the particular field maintained by the NML-ITDI.

All other government agencies shall assist and cooperate with DOE as may be necessary

COUNTRY REPORT

RHEA B. BANGLAY

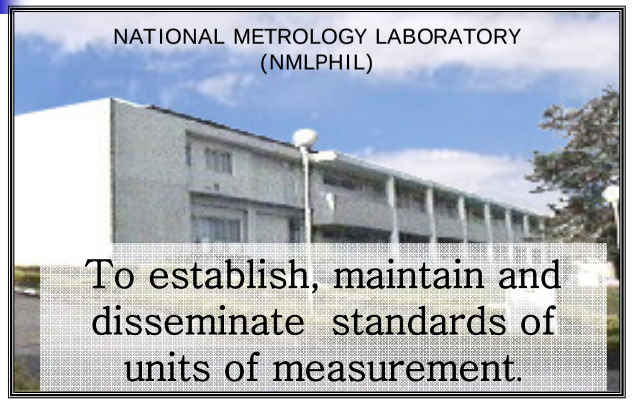
NATIONAL METROLOGY LABORATORY

INDUSTRIAL TECHNOLOGY DEVELOPMENT INSTITUTE

DEPARTMENT OF SCIENCE AND TECHNOLOGY

PHILIPPINES

MISSION



National Metrology Laboratory

→ It is the organization responsible for establishing and maintaining national physical standards for basic and derived quantities such as mass, length, temperature, time interval, voltage and resistance.

NMLPhil has five major laboratories which keeps the national standards and disseminates the standard units of measurement through calibration services.

- ❖ Mass, Force and Pressure Standards
- ❖Length Standards
- ❖Thermometry and Hygrometry Standards
- ❖Volume/Density/Viscosity/Moisture Standards
- ❖Electrical/Time and Frequency Standards

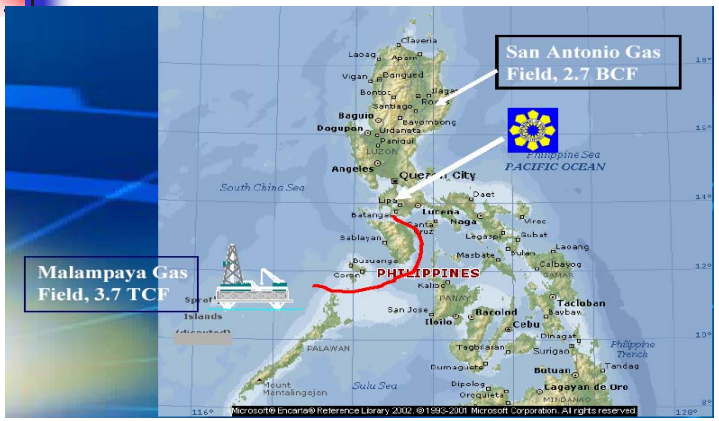
Volume, and Density Laboratory

Viscosity Laboratory

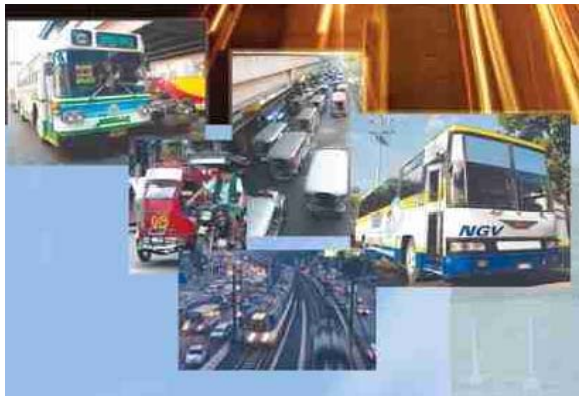
MOISTURE LABORATORY

Metrology Training Center

The Philippine Gas Industry



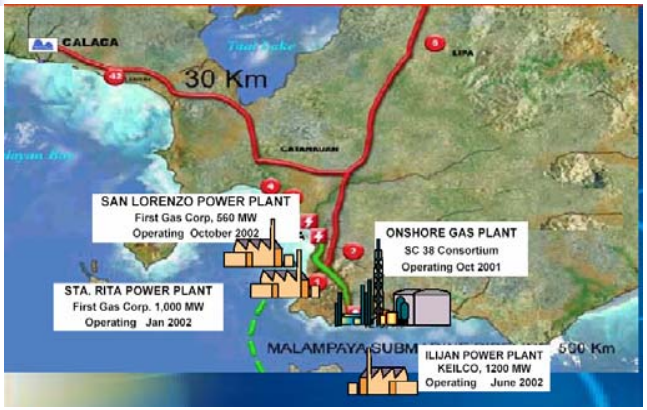
NATURAL GAS VEHICLES



PNOC-EDC REFUELLING STATION

Expanded Use of Natural Gas

GAS for POWER

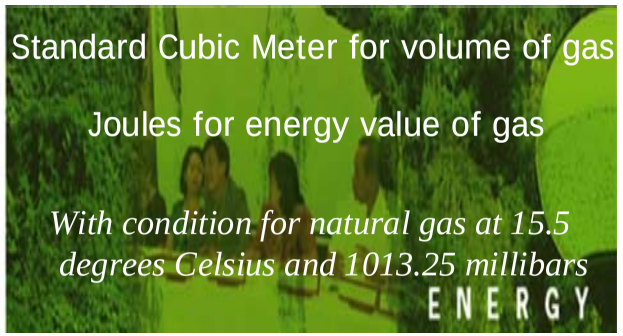


Gas for non-power

Metrological Control on CNG Fuel Dispensers

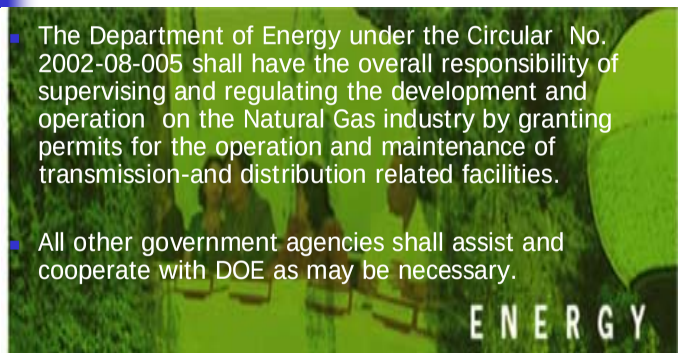
Interim Rules and Regulations Governing the Transmission, Distribution and Supply of Natural Gas

Measurement of Natural Gas



Type Approval and Verification of Fuel Dispensers

- The Department of Energy under the Circular No. 2002-08-005 shall have the overall responsibility of supervising and regulating the development and operation on the Natural Gas industry by granting permits for the operation and maintenance of transmission-and distribution related facilities.
- All other government agencies shall assist and cooperate with DOE as may be necessary.



NML

Maraming Salamat !

(Thank you very much!!!)

ITDI

Weights and Measures Programme

by

Adrian Ang

Weights and Measures Office

SPRING Singapore

Weights and Measures Programme

- Introduction
- Objectives
- Organisation Chart
- Standards
- Activities
- Verification of fuel dispensers
- Requirements
- Pre-verification
- Preparation for verification
- Actual verification
- Sealing

Introduction

Weights and Measures Office(WMO)- authority for legal metrology

Metric system with the exception of Chinese unit (tahils)- for trading in Chinese herbs/ medicines

Objectives

To ensure uniform and accurate system of weights and measures used in Singapore

Protecting consumers and traders

Organisation Chart

Standards

National standards- National Metrology Centre

Secondary to working standards- WMO

Activities

Appointment of Authorised Verifiers
Registration of instruments
Training
Inspection/ spot-checks
Investigation
Education
Verification of instruments
- –Flowmeters
- –Liquid capacity measures
- –Linear measures
- –Non-automatic weighing instruments
- –Fuel dispensers

Verification of fuel dispensers

Types of fuel

- Petrol
  - Private cars, motorcycles, vans
  - Commercial goods vehicles
- Diesel
  - Commercial goods vehicles, i.e. lorries, vans, etc.
  - Taxis
  - Public transportation, i.e. buses, vans, etc.
  - Inspection / spot-checks

Breakdown

- 5 oil companies
- Est. 220 petrol stations

Requirements

Re-verification period
- –5 years
- –> mpe

Maximum Permissible Errors
- –Initial & subsequent verification
  - -0.3% to +0.3%
- –In-service inspection
  - -0.5% to +0.5%

Pre-verification

Break seal
Service/ repairs/ adjustments

a) For AVs
Verification
Sealing

or

b) For non-AVs
Locking of dispenser
Ready for actual verification

Preparation for verification

Required equipment
Reference Standards
- –Seraphin tank

Measuring cylinder
Safety equipment
Evaluation report

Actual verification

Following are carried out during actual verification:

Pre-delivery requirement
- –Visual inspection

Accuracy test
- –3 runs

Functional tests (concurrently)
- –Nozzle cut off
- –Interlocks
- –Hose dilation
- –Price computing

Results

Sealing

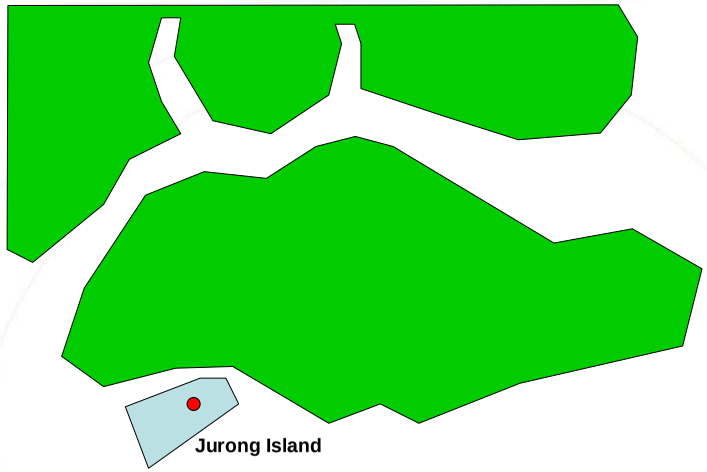
Sealing devices & stamping plate

- Sealing carried out by means of wire and lead seals
- Stamping plate bearing the letter 'RS' with the verification number affixed.

RS A1234567

CNG Fuel Dispensers

- Introduced in April 2002
- Pilot project by ENV, SembGas & SBS Transit
- CNG refuelling station- Jurong Island
- CNG Taxis were later introduced



CNG Fuel Dispensers

Objective

- To establish technical & commercial viability of operating CNG buses in Singapore.
- Plan to extend use of CNG to other diesel vehicles.


THANK YOU
SPRING
singapore

APEC/APLMF Training Course on CNG Fuel Dispensers
June 27-30, 2006 Shah Alam Malaysia

Current Situation of CNG Fuel Dispensers in Thailand

Warachai Triarun
Central Bureau of Weights and Measures
Department of Internal Trade
Ministry of Commerce

Using of CNG Fuel

Approximately 13,184 vehicles are now CNG fueled in Thailand.

Gasoline vehicles are converted to Bi-Fuel and Dedicated CNG vehicles such as taxis and sedan cars Approx. 11,906 units


Information updated on 5 June 2006 by PTT Public Company Limited

Using of CNG Fuel

Diesel vehicles are converted to Diesel Dual Fuel, Dedicated Retrofit and Re-Powering such as trucks, buses, vans, pickups Approx.1,278 units




Information updated on 5 June 2006 by PTT Public Company Limited

Number of CNG Stations

There are currently 63 Serviced CNG stations in Thailand and will be increasing to 200 stations in the end of this year.

Nowadays, the CNG stations are all owned by PTT Public Company Limited.

Information updated on 5 June 2006 by PTT Public Company Limited

Regulation for CNG Fuel Dispensers

The regulation is now being drafted by Central Bureau of Weights and Measures, Department of Internal Trade, Ministry of Commerce.

The aim of regulation is essential to initial verification, subsequent verification and inspection of CNG fuel dispensers used for trade.

The Draft of the Regulation

The legal unit

The unit used in sale of CNG fuel is kilogram (kg).

Reverification interval

The CNG fuel dispensers shall be reverified every 2 years.

The Draft of the Regulation

Maximum Permissible Errors

The maximum permissible errors for initial and subsequent verification apply to complete measuring systems for all temperatures and all pressures of the product and all flow rates are as follows

Quantity (M), kg	MPEs
0.1 to 0.2	0.08 M
0.2 to 0.4	16 g
0.4 to 1	0.04 M
1 to 2	40 g
Not less than 2	0.02 M

Testing Procedures of CNG Fuel Dispensers

The test procedures have not been determined yet, however, we are learning and looking for the suitable testing procedures for our country.

For learning and practicing, we have cooperated with APLMF.

For domestic visiting, we have cooperated with PTT Public Company Limited.

Thank you..

DIRECTORATE FOR STANDARDS AND QUALITY
STAMEQ – VIET NAM

VIETNAM NATIONAL REPORT

Presented by : Do Viet Hung.

Part 1
Legislation and Regulation of Fuel dispensers

At the present, our country mainly verify fuel dispensers for petrol, fuel oil . . . Not yet for LPG & CNG

- **4 offices of STAMEQ (QUATEST 1; 2 & 3, VMI)**
- **64 offices of province & city (Branches of STAMEQ)**

Regulations: Follow to OIML R117

- **DLVN 10-2003 : Methods and means of verification**
- **DLVN 97-2003 : Methods and means of test**
- **Re-verification interval :1 year**

- **The Standard for measuring Volume Volume Rate: 2; 5; 10; 20; 50 ;100 ; 200 L**
- **Accuracy class: 0,1**
- **Approval of fuel dispensers in Vietnam 2 type of fuel dispensers: SKD and IKD**

Part 2
Self-introduction

1.1 What is our position and responsibility in our economy?

- **I am working in Quality Assurance & Testing centre 3 (QUATEST 3) which is belonging to Directorate for Standardization & Quality (STAMEQ).**
- **I am working in the Volume & Flow measurement laboratory and verifying some metrology instruments such as: Fuel dispenser, Petroleum meter, Water meter . . .**

1.2 Will you be required to train others? If so, how will you train?

Yes, I will train to others so that I participate this course to get the knowledge, training documents and practical skills..

1.3 Do you have any experiences verifying fuel dispensers for petrol or LPG or CNG? If "Yes", please give the type of dispensers.

Yes I verified so much fuel dispenser for Gasoline, Kerosene and diesel oil but not yet for LPG & CNG. In the market of Vietnam, some Fuel dispenser were imported from USA, UK, Korea Japan and China with Bennett, Gilbarco, Tatsuno, Tokico brand and others which are assembled in Vietnam.

1.4 Have you experienced in the accuracy testing of weighing elements? If so, years or months experience and what type of weighing elements (class, what capacity, what division)?

In our QUATEST 3 has the Mass laboratory which has some mass class E1, E2, F1, F2 and M1 and some comparators up to 1 200 kg.

Part 2

Use of CNG in your economy

In the present, my country has not use CNG yet. So sorry, I can not reply these questions.

Part 3

Legal metrological control on CNG dispensers in your economy

I think in the future if the CNG will be produced in Vietnam then they will be controlled the same as fuel dispensers

Thank you for your attention !