



### Japan, the First Country in the World to Standardize Zero Gases for Calibration - JCSS (Japan Calibration Service System)

**Abstract:** Calibration gases used in Japan are often certified under the JCSS including Zero Gases, Air, N<sub>2</sub> as well as gas mixtures including NO, NO<sub>2</sub>, CO, CO<sub>2</sub>, SO<sub>2</sub>, Hydrocarbons, etc., with N<sub>2</sub> and Air as the balance gases. Japan is the first country in the world to have nationally adopted standards with a uniform definition for Zero Gases--this practice dates back to 1970s and has been in place since. This poster presents the process to produce calibration standards under the Protocol of the JCSS and the current Zero Gas specifications of the standard gases supplied by the registered organizations that fulfill the ISO/IEC 17025 requirements within JCSS.

#### 1. The History of Standard Gases in Japan

- 1960's** **<Main Trend>**
  - Pollution in Japan was a serious concern of the nation. Air pollution monitoring regulations began.
  - Automobile exports to US increased and emissions test was required by EPA (US Environment Protection Agency) prior to exporting.

- <1963>** JARM (Japan Association of Reference Materials), an advisory board to help build JIS (Japan Industry Standard) for chemicals including calibration gases, was founded, and Masashi Egami, present Takachiho Chairman, was one of the founder-Vice Chair.
- <1966-7>** Government and automotive companies conducted a collaborative emissions measurement experiment using domestic (Takachiho's) and US standards. The accuracy of Takachiho's standards was proven to be equivalent to those of US suppliers.
- <1967-8>** Scott Research Lab (SRL) conducted International Cross Reference Service where Takachiho participated, and Takachiho began its own Cross Check Service inside Japan which led to improve the analytical capability of each participating organization.

- 1970's** **<Main Trend>**
  - Industrial activities led to a demand for national traceability standards--government and related industries supported this trend.

**<1972>** Takachiho developed an ultra-precise 'air bearing' (instead of knife edge as fulcrum) gravimetric giant balance inspired by NASA to produce precise calibration standards traceable to SI, and another balance, both with help from Shimadzu.

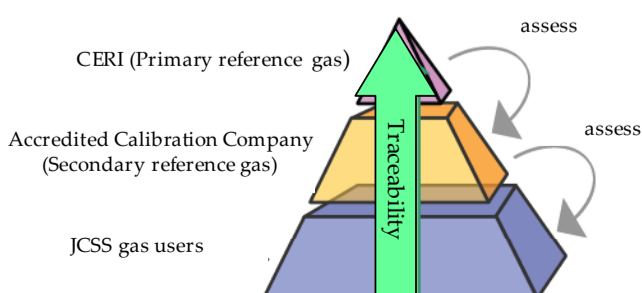
**<1973>** CITI, predecessor to Chemical Evaluation and Research Institute (CERI), established the standard gas evaluation system, & started certifying accredited gas producers' mixtures as national standards--procedurally almost identical to the current JCSS.

**<1979>** Zero Gas Specifications were decided within the industry together with JARM, and Zero Gas Testing by CITI began

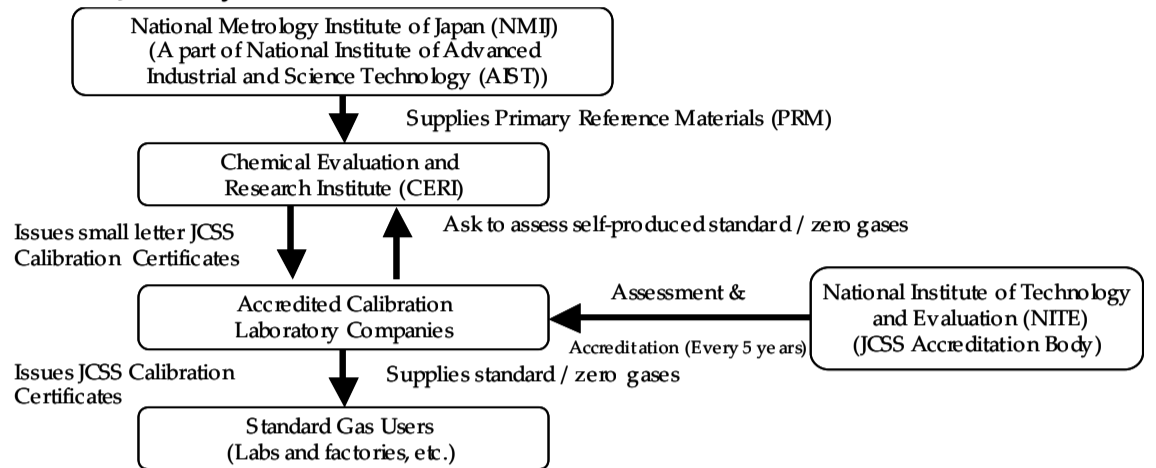
#### 2. The Traceability System - JCSS (Japan Calibration Service System)

In 1993, JCSS system was re-founded--this is the currently adopted domestic system for traceability of calibration gases. A company must pass the examination by NITE (National Institute of Testing and Evaluation) including ISO/IEC 17025 fulfillment to become a Registered Calibration Laboratory Company in Japan, and only then can a company issue the nationally approved certificates, which assures the traceability and quality of the calibration gas. Only three laboratory companies (including Takachiho) are currently registered.

#### <JCSS Calibration Certificate> <JCSS Traceability Structure>



#### <JCSS System Flow>



#### 3. Specifications of Standard Zero Air or N<sub>2</sub> Gases in JCSS

The items and specifications of the standard zero gases which the JCSS Registered Laboratory Companies currently supply are shown below. Takachiho's own Lower Detection Limit (LDL) and analysis methods for the zero gases are shown below right.

JCSS certification for Zero Gases at CERI--gases are made at the Registered Laboratory Company using CERI certified standards, but cylinder samples are also physically brought into CERI (1 out of every 100 cylinders), qualified, then certifications are issued.

Item	JCSS Specifications	
	Gases	Impurity Concentration
For Source of Pollution (Air or N <sub>2</sub> )	CH <sub>4</sub>	< 0.5 vol ppm
	CO	< 1.0 vol ppm
	CO <sub>2</sub>	< 1.0 vol ppm
	SO <sub>2</sub>	< 0.1 vol ppm
	*NO, NO <sub>2</sub>	< 0.1 vol ppm
For environment (Air)	SO <sub>2</sub>	< 0.005 vol ppm
	*NO, NO <sub>2</sub>	< 0.005 vol ppm

Takachiho's Own Specs.	
LDL (ppm)	Analytical Method
0.01	FID-GC
0.05	GC-MTN
0.05	GC-MTN
0.01	UV pulse
0.01	CLA
0.005	UV Pulse
0.005	CLA

\*Note: As NOx

#### 4. Who uses JCSS Certified Zero Gases in Japan?

Automobile manufacturers, local incinerator plant operators, electric power plant operators, chemical and/or environment research labs, etc. are the main users of the JCSS zero gas. The number of zero gas cylinders which CERI inspected and certified over the last five years were about 6,000 every year. This is about 21% of all JCSS certified calibration gases per year.

#### 5. Conclusion

Since the 1960's Takachiho has played an integral role in building gas standards and its specifications in Japan prior to, during, and after the Japanese Calibration Gas Standard System came into place. Zero Gases with clear specifications are important inclusion in this system, and it makes up 21% of the current cylinder volume of JCSS. In MACPoll, Takachiho hopes to make a contribution to forming an international Zero Gas Standard by demonstrating what has worked in Japan for over thirty years.

Sources: CERI, AIST (NMIJ), NITE



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