Japan
Environmental
Technology
Verification
ETV
Ministry of the Environment
http://www.env.go.jp/policy/etv/

Environmental Technology Verification Project Overview of the simplified VOC Measurement Technologies Field

Fiscal Year 2011

Environmental Policy Bureau,
Ministry of the Environment, Japan

Japan Environmental
Technology Association

1. Overview of the Environmental Technology Verification Project

What is the Environmental Technology Verification (ETV) Project?

Advanced environmental technologies, even if commercially viable and considered to be useful, have not necessarily been widely adopted, and end users, such as local governments, companies, and consumers are wary of using such technologies because objective assessments of their effect on environmental preservation have not been made.

The Environmental Technology Verification (ETV) Project employs third-parties to objectively verify the effects that such not-yet-widely-adopted advanced environmental technologies have on environmental preservation. Such third-party verification provides feedback on research, technology development, and proof of concept, and thereby promotes development and popularization of environmental technologies.

To date, the project has implemented the following technology fields:

(1) Human Waste Treatment Technologies in Natural Area
(2) Organic Wastewater Treatment Technologies for Small-Scale Establishments
(3) Non-Metallic Element Wastewater Treatment Technologies Division (technology for treatment of wastewater containing boron, etc.)
(4) Water Purification Technologies for Lakes and Reservoirs
(5) Water Environment Improvement Technologies in Enclosed Coastal Seas
(6) VOC Emission Reduction / Deodorizing Technologies (VOC Emission Reduction / Deodorizing Technologies for Small / Medium-Scale Establishments)
(7) Simplified VOC Measurement Technologies
(8) Heat-Island Mitigation Technologies (Technologies for Reducing Air Conditioning Loads by Using Building Envelope Systems)
(9) Heat-Island Mitigation Technologies (Technologies for Reducing Artificial Exhaust Heat from Offices, Houses, etc.): Green Technologies for IT Equipment
(10) Heat-Island Mitigation Technologies (heat pump air-conditioning systems utilizing geothermal heat, wastewater, etc.)
(11) Heat-Island Mitigation Technologies (technologies for suppressing sensible heat generation from air-conditioning external units)
(12) Simple Chemical Substance Monitoring Technologies

What is Verification?

Verification is when a third-party organization that is neither the environmental technology developer nor its end user presents objective data based on experiments and tests. These tests examine various attributes of the environmental technology including the effects that it has on environmental preservation and any secondary environmental effects.

Verification differs from certification, in which certain judgmental standards are established and compatibility with these standards is adjudged.

Environmental Technology Verification Logo

Environmental Technology Verification Project logos are issued to technologies that have been verified by the project.

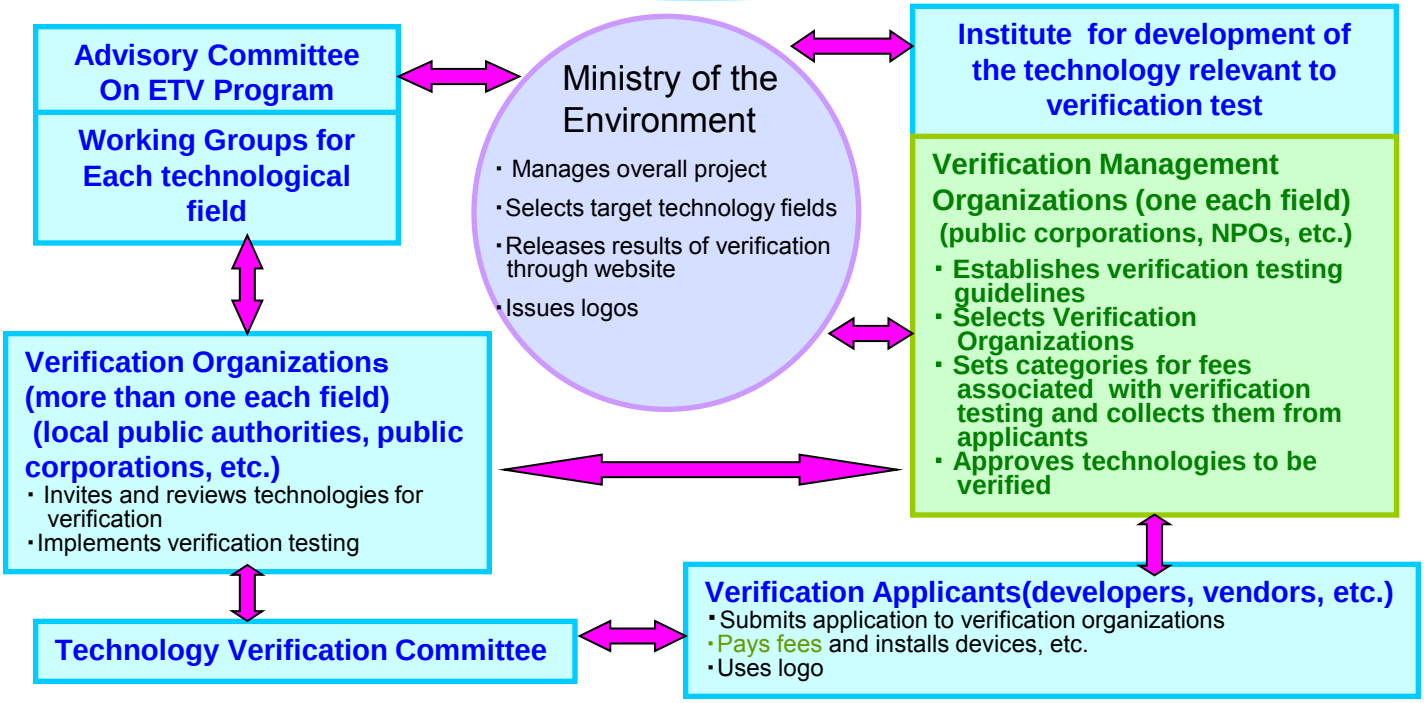
The two types of logo are a common logo incorporating information common to all technology fields and an individual logo decided by the technology field.

The abbreviation ETV incorporated into the logo design stands for Environmental Technology Verification.

*Use of the Environmental Technology Verification Project name and logo does not express a guarantee, certification, or authorization of the technology and its performance by the Ministry of the Environment.

Common logo

Structure of Environmental Technology Verification Program



Environmental Technology Verification Project Structure (content in green is fee-based system)

The Simple VOC Measurement Technologies Field is one of the technology divisions for which the government has borne a financial burden. Because approximately two years has passed since verification commenced, and because it is a technology field for which a verification system has now been developed, based on the principle of user pays, a fee-based system has been implemented whereby applicants must now bear the costs including the actual cost of verification testing.

Project Flow

Invitation and selection of Verification Management Organizations	Ministry of the Environment ETV Project Advisory Committee
Development/approval of verification testing guidelines	Verification Management Organizations Working Groups in each field / MOE
Invitation/selection/approval of Verification Organizations	Verification Management Organizations Working Groups in each field / MOE
Invitation/review/approval of target technologies	Verification Organizations / Technology Verification Committee / MOE (Verification Management Organizations)
Development of verification testing plans where required	Verification Organizations / Technology Verification Committee
Collection of fees	Verification Applicants / Verification Management Organizations
Implementation of verification testing	Verification Organizations
Compilation/approval of Verification Testing Findings Report	Verification Organizations / Technology Verification Committee / MOE
Release of test findings through website	MOE
Issuing/usage of logo and Verification No.	MOE / Verification Applicant

*(content in green is fee-based)

Fairness: Any developer, vendor, etc., of technology at the practical stage either in Japan or overseas can apply.

Impartiality: Verification Management Organizations and Verification Organizations are selected by open invitation and review based on organization or system, technological capability, fairness, impartiality, etc.

Objectivity: Verification test guidelines are publically announced, and objective verification testing is carried out by verification organizations.

Transparency: Verification testing methods and findings are disclosed on the Ministry of the Environment website.

2.Environmental Technology Verification Project: Overview of Simple VOC Measurement Technologies Field

Simple VOC Measurement Technology Field

The simple VOC measurement technologies targeted in this project are characterized by their ease of operation and management and their speed of quantitative determination. As such, at those businesses that handle VOCs, these technologies are useful for voluntary efforts to reduce VOC emissions through process management, equipment management, VOC treatment equipment management, and workplace environment management.

In particular they fall under the following conditions, bearing in mind the kind of measurements required by businesses.

- Those that can measure several VOC components simultaneously.*1
- Those for which operation and management are easy
- Those that are commercially available

Under the VOC concentration measurement law prescribed by the Ministry of the Environment (official method of analysis),*2 on account of the large number of VOC types emitted, comprehensive measurement as carbon numbers is required rather than measurement of individual substances. Concentrations obtained using such a method of measurement are expressed in units of carbon-equivalent ppm (ppmC).

- Technologies targeted in this project can be utilized in voluntary efforts appropriate to the situation at individual businesses, such as the types of solvents handled. On this account, comprehensive quantitative determination of VOCs (results of measurements expressed in ppmC) as prescribed in the official method of analysis is not one of the required conditions. As a rule, there is no limitation placed on measurement principles.

*1: With respect to “simultaneously”, it is acceptable if multiple components can be measured after introduction of the sample gas. Measurement values need not all be obtained simultaneously in time.

*2: Under the official method of analysis, measurement ranges are, for example, 0–500/1,000/2,000/5,000 ppmC ; however, the Environmental Technology Verification Project imposes no such requisite conditions regarding measurement range.

Verification Test Methods

Verification tests are performed based on the verification test guidelines prescribed by the Simple VOC Measurement Technologies Field. The following items are verified for the product submitted for verification by a Verification Applicant.

- Reliability of product performance
- Practicality when target VOCs are measured at a businesses using VOCs
- Simplicity of product operation

(1) Application for technology verification : A manufacturer possessing a simple VOC measurement technology fills in the outline of the technology whose verification is desired on a verification application form, and files an application with a Verification Organization.

(2) Verification test plan and verification test: The Verification Organization examines the content of the application, and if no problem is found, prepares a Verification Test Plan. A verification test is performed based on the Verification Test Plan. This verification test uses one of the typical gases that the verification target product can measure (individual gas: propane, toluene, dichloromethane, etc.), and basic performance tests such as repeatability and effects of interfering components (oxygen, carbon dioxide, moisture) are carried out. Furthermore, performance testing is conducted using a mixed sample (simulated gas) comprising multiple gas components based on gases surmised for the actual workplace (process). In addition, measurement using actual gases emitted from an enterprise may be optionally performed.

(3) Data evaluation and report: The Verification Organization analyzes and verifies the verification test data, and then prepares a verification test findings report.

Verification Items

Verification tests are conducted based on verification test guidelines, and the viewpoints, scope, items, and methods listed in the following tables are objectively verified for the technology (product) submitted by the applicant.

Viewpoint	Scope
Reliability	Whether reliable VOC measurements are possible within the range of precision demanded by the application of each verification target technology
Practicality	Whether product specifications and measurement performance, etc., are suitable for use in the areas of business where VOCs are emitted
Simplicity	Whether product specifications and operation methods, etc., are simple and easy

Item	Indicator	Viewpoint			Method	
		Reliability	Practicality	Simplicity	Documen–tation	Test
1. Evaluation items for measurement of individual substances (documentation check + actual measurement)						
①Measurement range		○			○	–
②Repeatability	deviation, etc.	○			○	◎
③Linearity	correlation, etc.	○			○	◎
④Interference effect test	ratio, etc.	○			○	◎
⑤Response time	time	○			○	◎
⑥Relative sensitivity	ratio, etc.	○			○	–
⑦Reproducibility	deviation, etc.	○			–	◎
2. Evaluation items for measurement of mixed substances (actual measurement)						
①Measurement range		○	○		○	–
②Repeatability	deviation, etc.	○	○		○	◎
③Linearity	correlation, etc.	○	○		○	◎
④Interference effect test	ratio, etc.	○	○		○	–
⑤Response time	time	○	○		○	◎
⑥ppmC equivalent		○	○		○	◎
3. Evaluation items for measurement of actual sample from business (option)						
①Repeatability	deviation, etc.	○	○		–	◎
②Comparison with other analytical methods (official methods, GC-MS, etc.)	correlation, etc.	○	○		–	◎

Note: The ◎ symbols under Method are priority items for verification, and data is obtained through actual measurement. For 1 and 2, measurement shall be performed using a gas prepared with substances that are the target of analysis or with commercial standard substances similar to them. For 3, measurement shall be done using a gas actually sampled at a business.

Verification Test Findings Outline

The Simple VOC Measurement Technologies Field was selected as a verification division in FY2009, and to date, the Japanese government has borne the burden of verifying five technologies.

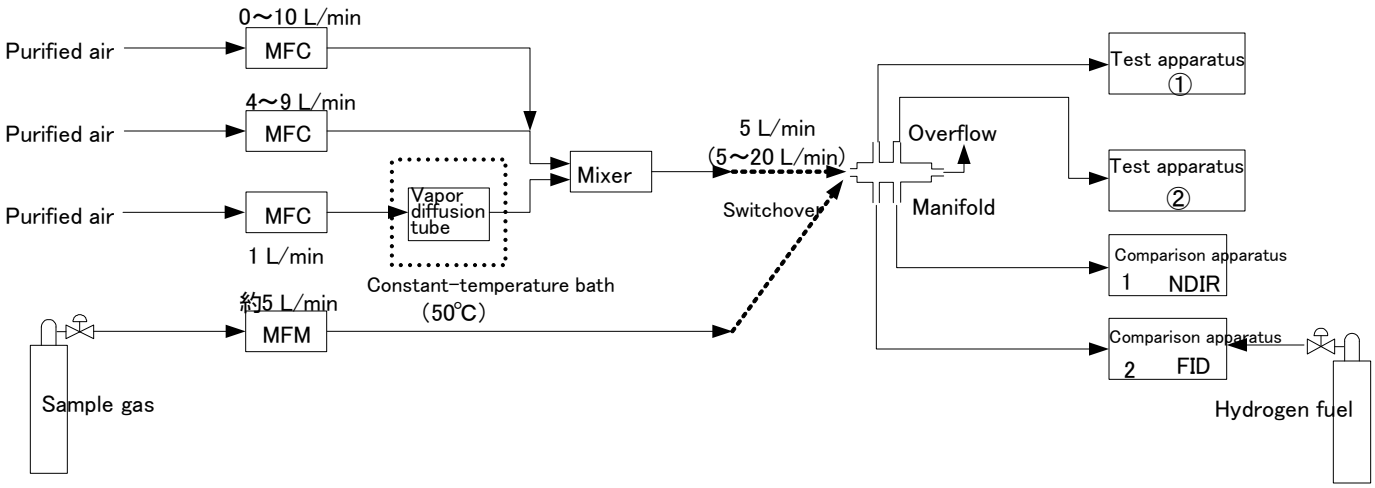
● Verification organization: Japan Environmental Technology Association (JETA)

● Target Verification Technologies

Verification no.	Verification year	Verification applicant	Verified technology	Measurement principle
100-0901	FY2009	Komyo Rikagaku Kogyo K.K.	Simple VOC measurement system (Model No. VOC-1)	Catalytic oxidation–detector tube method
100-0902	FY2009	O.S.P. Inc.	Handy VOC sensor (Model No. VOC-121H)	Interference-enhanced reflection (IER) method based on polymer thin film swelling
100-0903	FY2009	Figaro Engineering Inc.	Handy TVOC monitor (Model No. FTVR-02)	Oxide semiconductor-type gas sensor
100-0904	FY2009	Riken Keiki Co., Ltd.	Gas leak detector (Model No. GL-103)	Hydrogen flame ionization detector
100-1001	FY2010	O.S.P. Inc.	VOC monitor (Model No. VM-501)	Interference-enhanced reflection (IER) method based on polymer thin film swelling

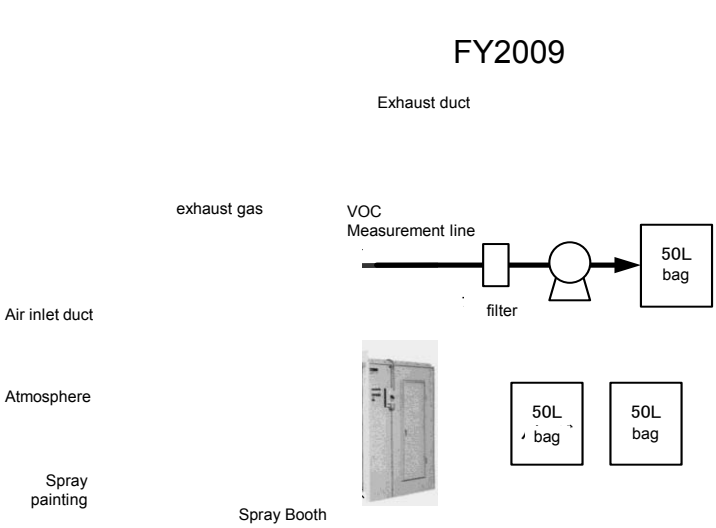
(1) Basic Performance Test

A test method was employed whereby the sample gas flowed into a manifold and was simultaneously introduced into, and measured by, the target technology to be verified and the comparison apparatus (measurement apparatus for official method of analysis). The representative gas used (toluene was used in these tests) was mostly prepared by the vapor diffusion tube method. The target technology was tested for repeatability, reliability, linearity, response time, and effects of interfering components (oxygen, carbon dioxide, moisture). In addition, in general, businesses (processes) handling VOCs are confronted the simultaneous presence of several types of VOCs, and in this verification testing, comprehensive measurements were conducted for simulated mixed gases (five-component VOC mixture, three-component VOC mixture, chlorine-based).



(2) Measurement tests of actual samples from businesses

In FY2009, emission gas from spray painting—a process in which paint is sprayed in a fine mist on to the surface to be coated—was collected in bags. In FY2010, samples from the gravure printing process were collected from a duct prior to VOC treatment. The sample bags were taken to laboratories were measurement was carried out.



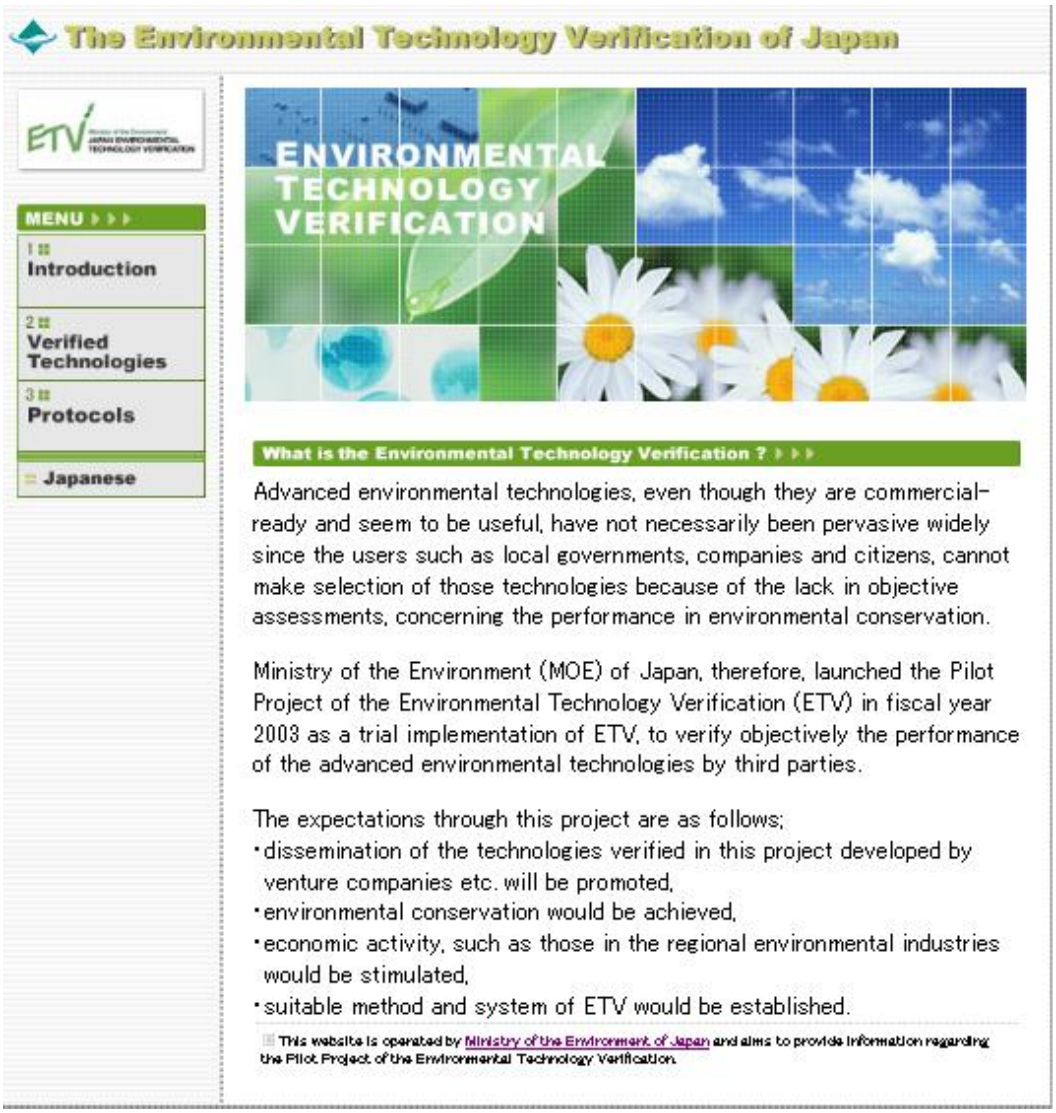
(3) Verification Test Findings Summary

Verification no.	100-0901	100-0902	100-0903	100-0904	100-1001
Verification technology	Simple VOC measurement system (Model No. VOC-1)	Handy VOC sensor (Model No. VOC-121H)	Handy TVOC monitor (Model No. FTVR-02)	Gas leak detector (Model No. GL-103)	VOC monitor (Model No. VM-501)
Applicant	Komyo Rikagaku Kogyo K.K.	O.S.P. Inc.	Figaro Engineering Inc.	Riken Keiki Co., Ltd.	O.S.P. Inc.
Product photo					
Reliability	Detector tubes for carbon dioxide are technologically developed, and reliability issues arise from their combination with the catalytic oxidation unit. In terms of catalyst performance, in some cases variations in oxidation efficiency occur due to the components of the measurement gas. For this reason, care is required to confirm beforehand the components and composition of the measurement gas. It is desirable to establish an easy method for checking catalytic efficiency.	Extremely good performance was exhibited for repeatability, linearity, and response time. An interference effect from moisture was observed. While the extent of this interference was not viewed as a problem for measurements in a typical environment, care is necessary. It is desirable to establish a simple span check method to ensure accuracy and reliability of the indicated values.	Room for improvement was evident in the reliability of measured values in terms of the measurement concentration range, response time, and effects of interfering components, etc. However, for the measurement range, it appeared that a certain degree of reliability can be ensured at toluene concentrations of less than 200 ppm. A moisture sensor is installed inside the equipment to mitigate the effects of moisture, but a problem remains in that compensation is not carried out for moisture in the sample gas line.	The FID principle is the same as the official method of analysis. However, the characteristics of influence of oxygen and relative sensitivity do not satisfy the performance standards of the official FID method of analysis (JIS B 7989: measurement method for automatic monitoring of volatile organic compounds [VOCs] in waste gas). However, basic reliability is sufficient for use as a simplified measurement apparatus (general measurement accuracy of ±20%).	Good performance was seen with respect to repeatability, linearity, effects of interfering components, response time, and reproducibility. In particular, the introduction of an air control unit achieved marked improvements with respect to the effects of moisture. However, blanks were found, the cause of which was thought to be the backing material (or contamination); therefore, care needs to be taken such as collection and measurement of background samples.
Practicality	Both the official method of analysis and this method can express measurements in ppmC, and this is useful for publication and evaluation of measurement findings. Background air measurements are required simultaneously with VOC sample measurement, and caution is required to ensure accuracy when the VOC concentration is low compared with carbon dioxide concentration.	This method is effective for single components or when the VOC composition at the measurement site is clear and does not vary. Other than for toluene, there is a need to convert other components by using conversion coefficients. When there are several components or when the composition changes, the components and composition of the measurement gas needs to be verified beforehand, and the indicative characteristics need to be understood prior to measurement.	This method is effective for single components or when the VOC composition at the measurement site is clear and does not vary. Other than for toluene, conversion based on relative sensitivity is required for each component. When there are several components or when the composition changes, the components and composition of the measurement gas needs to be verified beforehand, and the indicative characteristics need to be understood prior to measurement.	Both the official method of analysis and this method can express measurements in ppmC, and and this is useful for publication and evaluation of measurement findings. Being battery powered and utilizing a hydrogen canister means practicality is also good. Reading errors are large on account of the small display meter and coarse scale. The noise of the internal pump is loud and there are problems with indoor measurement.	This method is effective for single components or when the VOC composition at the measurement site is clear and does not vary. When there are several components or when the composition changes, the components and composition of the measurement gas needs to be verified beforehand, and sensitivity characteristics need to be understood prior to measurement.
Simplicity	There is a need to become accustomed to the set of operating procedures, but there are no major issues.	The operating procedures are simple and easy. A measurement value hold function would be convenient during continuous measurement.	The operating procedures are simple and easy. Built-in memory data collection is useful for trend management.	There is a need to become accustomed to the set of operating procedures, but the operating procedures are relatively simple and easy.	The operating procedures are simple and easy. An analog output terminal is included, and it is effective as a monitoring device.
Price	300,000 yen	Approx. 900,000 yen (reference market price)	198,000 yen	List price: 500,000 yen	Approx. 1.6 million yen (reference market price)
Weight	Approx. 5 kg (Attaché case set)	Approx. 400 g	Approx. 400 g	Approx. 4 kg	Approx. 5 kg

Environmental Technology Verification Project Website

The Environmental Technology Verification Project website (www.env.go.jp/policy/etv/en/) has been set up as a database and information portal for the project.

This website provides details of verification test guidelines, the deliberations of the committees and working group meetings, and verification test findings, etc



● Enquiries regarding Environmental Technology Verification Project,
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Verification Management Organization

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