

[Environmental Technology Verification]

Summary of Verification Report for FY 2004

Ethylene Oxide Treatment Technologies

Ministry of the Environment of Japan

I. Introduction

What is the Pilot Project for Environmental Technology Verification?

Advanced environmental technologies, even though they are commercial-ready and seem to be useful, have not necessarily been pervasive widely since the users such as local governments, companies and citizens, cannot make selection of those technologies because of the lack in objective assessments, concerning the performance in environmental conservation.

Ministry of the Environment (MOE) of Japan, therefore, launched the Pilot Project of the Environmental Technology Verification (ETV) in fiscal year 2003 as a trial implementation of ETV, to verify objectively the performance of the advanced environmental technologies by third parties.

The expectations through this project are as follows;

- ❖ dissemination of the technologies verified in this project developed by venture companies etc. will be promoted,
- ❖ environmental conservation would be achieved,
- ❖ economic activity, such as those in the regional environmental industries would be stimulated,
- ❖ suitable method and system of ETV would be established.

Figure: Structure for Project Implementation

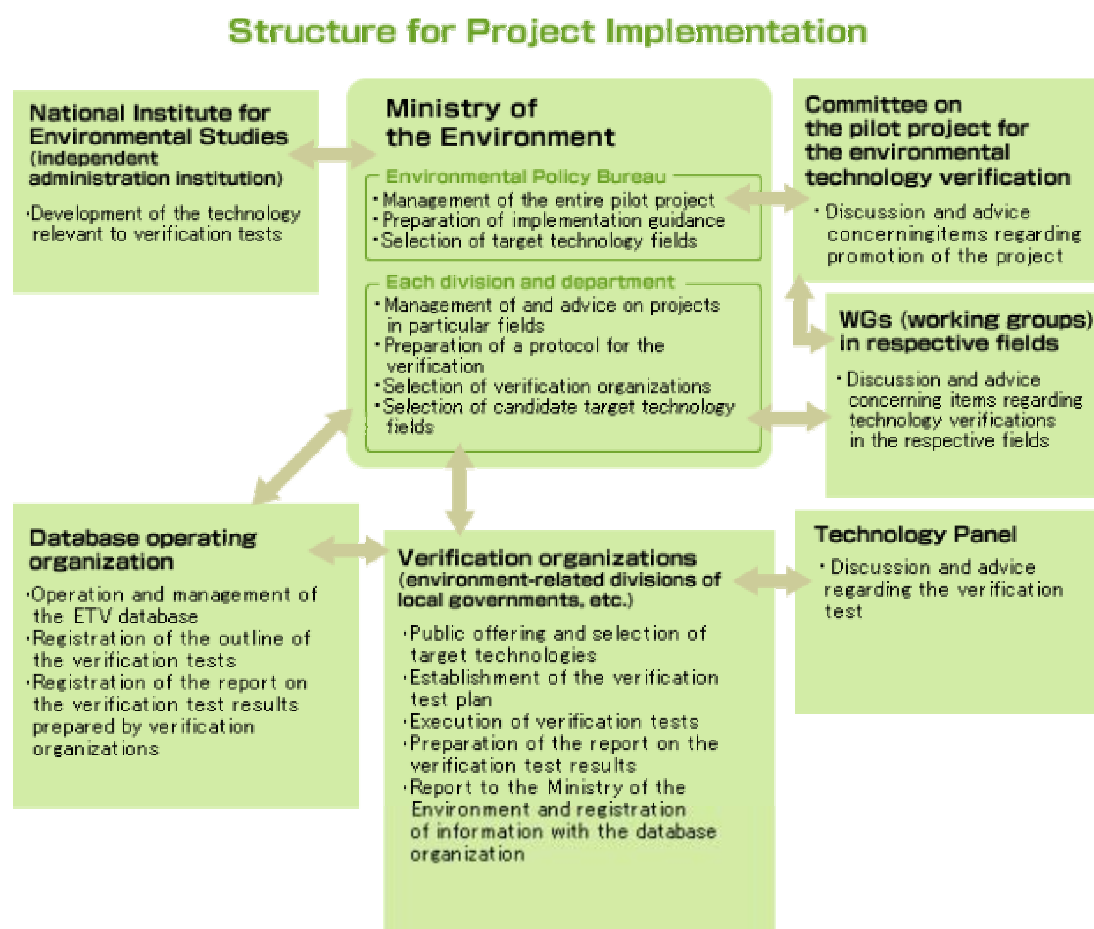
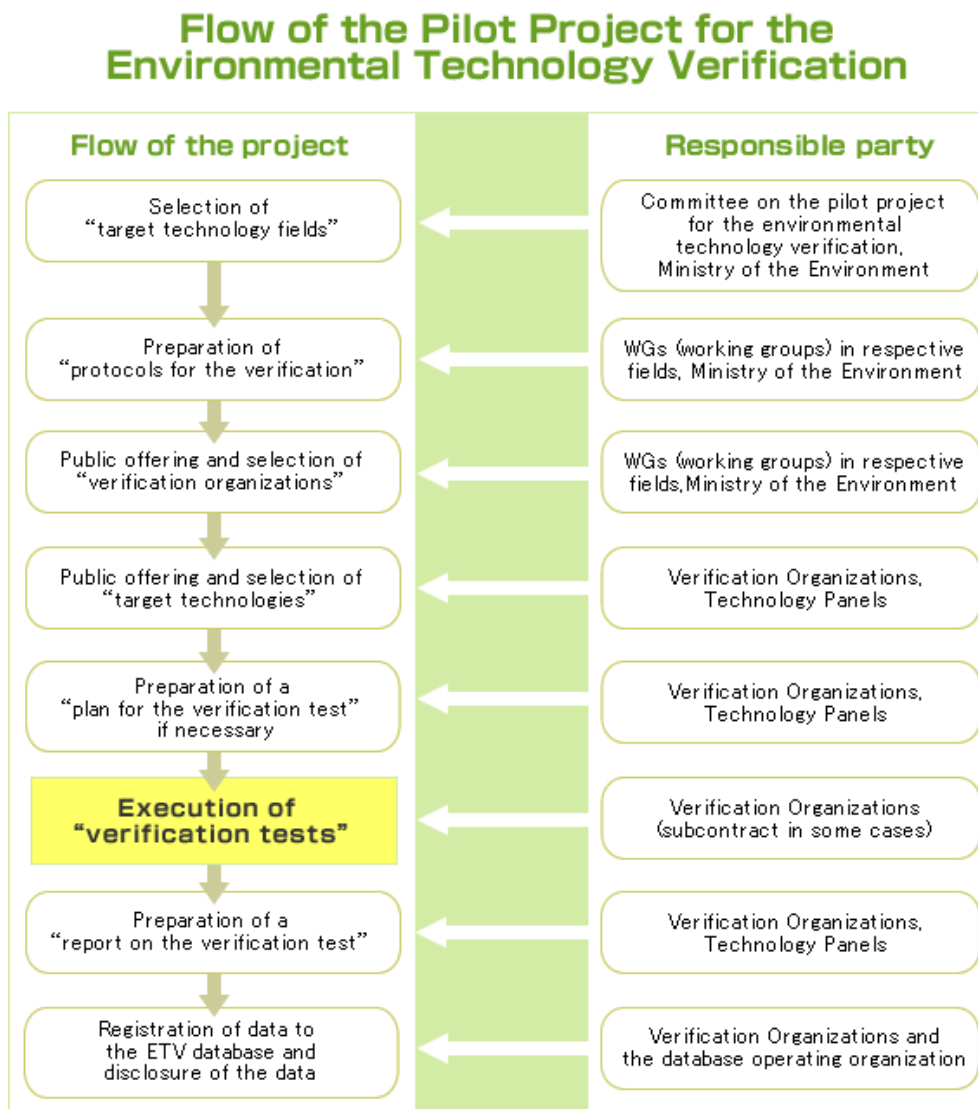


Figure: Flow of the Pilot Project for Environmental Technology Verification



Selection of target verification technology fields

In the implementation guidance for the Pilot Project for the Environmental Technology Verification in FY 2003, the scope of the selection of target technology fields was defined as follows:

- (1) Technology field whose developers and users (such as local governments, consumers) require verification.
- (2) Technology field for which technology verification is effective to promote their dissemination.
- (3) Technology field for which verification system such as technology certification, has not been implemented by other conventional systems.
- (4) Technology field for which verification is possible because;
 - a. Verification is possible in terms of budget and implementation system.
 - b. Verification test procedures can be established properly.

After discussions in the committee on the pilot project for environmental technology verification, the following target technical fields were selected.

- (1) Ethylene oxide treatment technologies
- (2) Organic wastewater treatment technologies for small-scale establishments

(3) Treatment technologies for human waste in mountain district

Contents of this report

This report summarizes the results of verification tests conducted in FY 2003 for the technical field of ethylene oxide treatment technologies. It contains the following contents.

- Summary of target technical fields
- Summary of verification tests and determination of the results
- Summary of the target technologies and results of verification tests conducted in FY 2003

The verification test results described in this report are only summaries. Details of the results for each technology are available in separate reports (in Japanese only, see the database described below). Please contact each manufacturer for more information.

Database of the Pilot Project for Environmental Technology Verification

The database of the Pilot Project for Environmental Technology Verification has been created at the website (URL <http://etv-j.eic.or.jp>), in order to provide information on the progress and results of the project, including reports on the verification tests. The following information is available at the website:

[1] List of verified technologies

The technologies verified in the pilot project and the verification results thereof, such as those for environmental-protection efficiency (reports on the verification test, etc.).

[2] Protocols of the verifications/Plan for the verification tests

The " protocols of the verifications," which specifies the basic concept, test conditions and methods, and the like in conducting verification tests, and the " plan for the verification tests," which specifies detailed experimental conditions and the like for each target technology based on a protocols of the verifications.

[3] Information on public offering for verification organizations and target verification technologies

Information on public offering including when applications for verification organizations or target verification technologies are invited publicly

[4] Information on the relevant committee and working groups

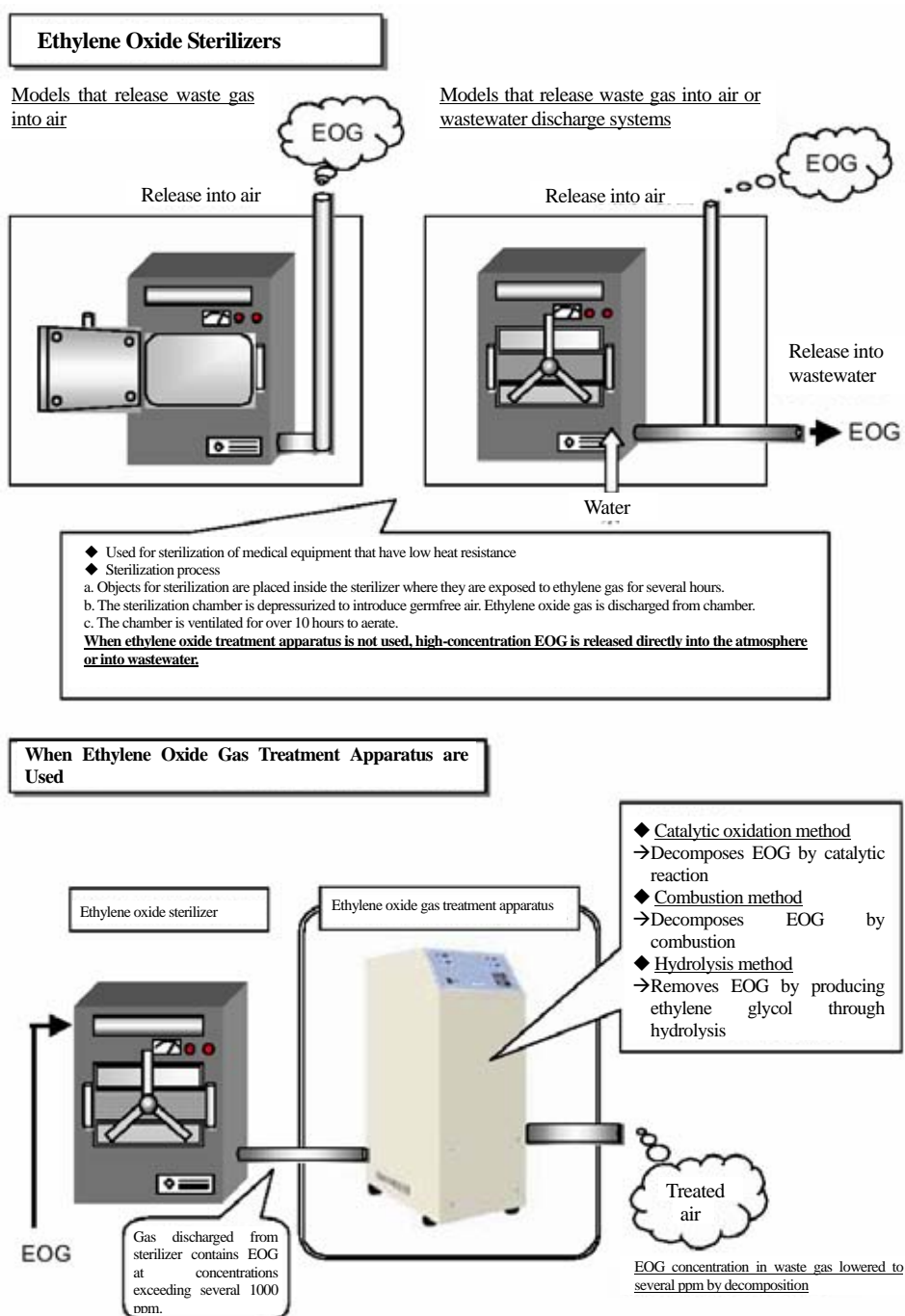
Documents delivered in and summaries of the meetings of the committee on the pilot project and its working groups, in which plans for implementing the pilot project are discussed.

II. Ethylene oxide treatment technologies

What are ethylene oxide treatment technologies?

Ethylene oxide treatment technologies specified in this pilot project for verification are those (equipment, etc.) that process waste gas from ethylene oxide sterilizers (with capacity of approximately 50 to 200 L) used in medical institutions, pharmaceutical plants, etc., by methods such as combustion, catalytic oxidation, hydrolysis, etc., and that may be additionally installed.

Figure: Ethylene oxide waste gas treatment apparatus



Why have the Ethylene oxide treatment technologies been selected for the target technology field?

Ethylene oxide gas is a neutral liquid or gas with a sweet odor (boiling point 10.4°C), and is used in surfactants, synthetic organic pigments, steam sterilizer gas, and disinfectants. It is toxic. In the “Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (Chemical Substance Management Law, also known as the PRTR Law),” ethylene oxide is categorized under Specified Class I Designated Chemical Substances*. According to FY2002 PRTR data, the total reported emission volume was 299 tons, and the unreported volume was estimated at 217 tons, totaling 516 tons released into the environment. Among Class I Substances, it ranks fourth in released volume, after benzene, arsenic and its inorganic compounds, and vinyl chloride. It is also specified as one of the priority target substances in the hazardous air pollutants in the Air Pollution Control Law.

Ethylene oxide gas enjoys widespread application as a sterilizer gas in ethylene oxide sterilizers used in medical institutions. Although the EOG concentration in waste gas discharged from EO sterilizers is extremely high, at several 1000 to several 10,000 mg/m³, few hospitals have installed treatment apparatuses for waste gas from EO sterilizers.

In light of these circumstances, it is important to provide technological support for waste gas reduction measures on a governmental level. However, such attempts should not rely only on regulatory measures, but should examine measures to reduce the volume of released waste gas. Therefore, we will conduct verification of ethylene oxide treatment technologies that may be additionally installed to existing facilities of businesses, and provide objective information regarding the effectiveness of various technologies on environmental preservation. We believe that efforts to promote the conservation of local environments and to promote and promulgate superior technologies (products) are of significant importance, and thus this field has been selected for target technologies for the environmental technology verification pilot project.

- Summary of the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (Chemical Substance Management Law, also known as the PRTR Law)

The PRTR is a system for collection, compilation, and publication of data on various types of hazardous chemical substances regarding their source, volume of release into the environment, and the volume contained in waste products that are disposed of by businesses. Businesses that manufacture or use any of the chemical substances listed in the PRTR Law must keep track of the volume of such released into the environment or removed from the premises for treatment as waste products and report the data to the government annually. The government compiles the data for the target chemicals, and combines the results with the estimated volume of emissions from households, farmland, and automobiles to produce a final report for publication.

- Class I Designated Chemical Substances*

Chemical substances which are hazardous (may pose a threat to human health and/or impair the life or growth of flora and/or fauna) and are recognized to exist in the environment over a considerably wide area. Presently, 354 chemical substances are listed by Cabinet Order.

- Specified Class I Designated Chemical Substances

Of the Class I Designated Chemical Substances, 12 substances are carcinogenic to humans, including benzene, asbestos, and dioxin.

- Summary of Air Pollution Control Law

The aim of the Air Pollution Control Law is to prevent air pollution by defining emission standards for chemical substances according to type and facility for air pollutants released from factories, businesses, and automobiles.

- Hazardous Air Pollutants

Chemical substances that may have adverse effects on human health even at low concentrations for long-term exposure. Presently, 234 substances are listed.

- Priority Target Chemicals

Among the hazardous air pollutants, 22 that are given special priority in creating countermeasures.

- ppm [parts per million]

A unit for representing composition or concentration. One ppm is equal to one (1) part in 1,000,000.

III.Verification Test Methods

Summary of Verification Test

The verification test for the present pilot project will follow the procedures defined in the “Verification Test Protocol,” common to all ethylene oxide treatment technology fields. The following items will be verified for each of the target apparatuses.

- Environmental protective effect under practical operational conditions in the range specified by an environmental technology developer
- Energy, materials, and cost required for operation
- Operational environment allowing normal operations
- Labor required for operations and maintenance

The verification test will primarily be conducted according to the steps specified below.

(1) Planning

The plan for the verification test (hereinafter referred to as the “Test Plan”) will be prepared for each target verification technology according to the Verification Test Protocol before the test is conducted. The Test Plan will be prepared by a Verification Organization in cooperation with an environmental technology developer.

(2) Verification testing process

In this stage, a verification test will be conducted according to the Test Plan described above. The verification test verifies the conformity of a target verification apparatus with its objectives specified in the planning stage. The Verification Organization may, if necessary, subcontract part of the verification test to external test organizations.

(3) Data assessment and reporting

In the final stage, all collected data will be analyzed for verification, and a report on the verification test (hereinafter referred to as the “Verification Report”) will be compiled. The Verification Organization will be responsible for analysis of the data and reporting. To accelerate the above process, the Verification Organization may subcontract an external organization to prepare a draft of the Verification Report.

The Verification Report will be submitted by the Verification Organization to the Ministry of the Environment. In the report, the suitability of the verification tests will be discussed by the working group on the ethylene oxide treatment technology (hereinafter referred to as the “Working Group”) of the committee on the pilot project for the environmental technology verification. After its approval by the Ministry of the Environment, the report will be returned to the Verification Organization. The approved Verification Report will then be issued by the Verification Organization to the environmental technology developer and simultaneously disclosed to the public.

The Verification Organization

In the “Pilot Project Implementation Guidance for FY 2003,” it was established that the Verification Organization will recruit businesses with target verification technologies for the Verification Test, select the technologies for the Verification Test, establish the Test Plans as required, verify the technologies (conducting of the Verification Test and preparation of the Verification Report), submit the Verification Report to the Ministry of the Environment, and register the results to the database operating organization. Thus, for each technology field, the Verification Organization was selected from among local public agencies (prefectural and government-decreed cities).

Below is the local public agency selected as Verification Organization for ethylene oxide treatment technologies in FY 2003.

○Tokyo Metropolitan Government

Target Verification Technologies

The selection of target verification technologies was made based on the contents of the applications for the technology/product submitted by businesses. The contents of the verification application were checked for the following points, and a comprehensive evaluation was made by the Verification Organization in the selection of the target technology, which then awaited approval by the Ministry of the Environment.

a. Technological requirements:

- Does the applied technology fall within a target verification technology field?
- Is the application form properly filled in?
- Is the technology in a commercialization stage?

b. Possibility of verification

- Is it possible to complete the verification from cost and organizational standpoints?
- Is it possible to establish a suitable Test Plan?

c. Environmental protective effect, etc.

- Is it possible to scientifically explain the principle and mechanism of the technology?
- Is there any possibility of the technology causing secondary environmental issues?
- Does it provide a high environmental protective effect?
- Is it an innovative technology?

Verification Items

The verification items for ethylene oxide treatment technologies can be largely divided into 3 categories—waste gas treatment performance, environmental load, and operations and maintenance.

The main objective of the verification items for waste gas treatment performance is to evaluate the waste gas treatment performance of the target verification apparatus. Below are the main items for this category. The Verification Organization will also determine whether any additional items are required to make a final decision on the verification items for waste gas treatment performance.

Table: Examples of verification test items regarding waste gas treatment performance

Verification items	Description
Ethylene oxide concentration	Ethylene oxide concentrations at the inlet and outlet ducts of the ethylene oxide treatment apparatus
Transition in treatment efficiency	Change in ethylene oxide treatment efficiency, calculated from the ethylene oxide concentrations at the inlet and outlet ducts of the ethylene oxide treatment apparatus
Average treatment efficiency (mass balance)	Mass balance, calculated from the total amounts of ethylene oxide entering into and discharged from the ethylene oxide treatment apparatus

The main objective of the verification items for environmental load is to evaluate the environmental load resulting from the operation of the target verification apparatus. Below are the main items for this category. The Verification Organization will also determine whether any additional items are required to make a final decision on the verification items for waste gas treatment performance.

Table: Examples of verification items regarding environmental load

Category	Verification item	Description
Environmental impact	CO concentration	CO concentration (ppm) in the waste gas
	NOx concentration	NOx concentration (ppm) in the waste gas
	Volume of secondary products generated	Volume of secondary products generated per operation (when secondary products such as ethylene glycol and the like are generated)
	Noise	Noise level (dB) during operation of apparatus (main unit)

The main objective of the verification items for operation and maintenance (O&M) is to make a quantitative and qualitative evaluation of O&M performance, as well as to make a cost estimation. Below are the main items for this category. The Verification Organization will also determine whether any additional items are required to make a final decision on the verification items for waste gas treatment performance.

Table: Verification items regarding O&M

Category	Verification item	Description
Material Consumption	Electricity consumption	Electricity consumption per operation (kWh/operation)
	Fuel consumption	Fuel consumption per operation (when utility gas, LPG, etc. is consumed)
	Water consumption	Water consumption per operation (when water is consumed for chemical reaction in treatment, cooling, etc.)
	Other consumables such as reactants, etc.	Chemical consumption per operation (when chemicals such as reactant are consumed)
O&M performance	Number of operators and the level of operator expertise required for O&M of the apparatus	Record the maximum number of operators and working days (man-days), special skills required, technical difficulties
	Safety of the target verification apparatus	Measures for ensuring safety (check valves, etc.)
	Measures in the event of emergency	Countermeasures in case of power failure, etc. and safety measures for the inflow of high-concentration ethylene oxide
	Consistency of treatment performance	Deterioration in treatment efficiency over extended use, the life, exchange frequency, etc. of components such as catalysts, etc.
	Method of restoring from a trouble state	Ease and problems in recovery procedures
	Evaluation of O&M instructions manual	Legibility, clarity, shortcomings, etc.

The “Protocol” defining the basic strategies, test conditions, test methods, etc. and the “Test Plan” containing the details of the test conditions, etc. based on the Protocol may be found at the website of the project (<http://etv-j.eic.or.jp/>).

IV. Results of Verification Tests in FY 2003

Verification Reports

The verification test results are to be submitted in the form of the Verification Report, which contains all information on the results of tests, records of all activities related to O&M, and changes in the results of tests performed on verification items during the Test Period.

The Verification Organization will first prepare a draft of the Verification Report, which will be reviewed by the Technology Panel, and then prepare the final version of the Verification Report. The Verification Report submitted to the Ministry of the Environment will undergo examination by the Working Group before it is approved by the MOE.

How to Look at the Summary of Verification Reports

In the present report, summaries of Verification Reports are given for each target verification technology. Here, we will introduce the items presented in the reports and provide explanations for each.

Purpose of Present Technology
Items that were set as goals in the development of the target apparatus

Treatment method adopted for the present apparatus

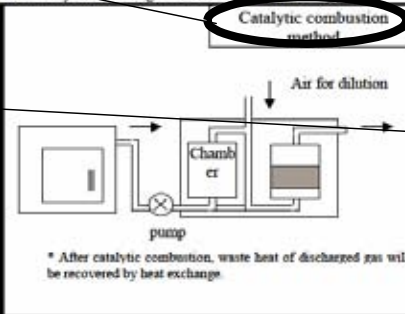
Principles
A brief description of how the target apparatus treats the ethylene oxide gas

Specifications of the Target Verification Apparatus
A summary of the design performance of the target apparatus
-Model no.: model no. in catalogue
-Dimensions and weight: the size of the main apparatus unit
-Capacity of compatible sterilizer: Capacity of the sterilizer that the target apparatus may handle
-Types of compatible sterilizers: Types of sterilizers that the target apparatus are compatible with

Settings of Verification Test Conditions
A summary of conditions for verification tests
The following two types of testing will be conducted for the present verification test. However, when the characteristics of the target apparatus prevent a test from being conducted, such test will not be required.
-Standard EOG treatment test: a constant flow of EOG is introduced into the target apparatus for 1 hour.
-Treatment test using exhaust gas from ethylene oxide sterilizer simulator: EOG produced by a simulator that reproduces the patterns of EOG exhaust from a sterilizer will be introduced into the target apparatus. Two types of patterns (A and B) will be tested.

Target verification technology / Environmental Technology Developer	Ethylene oxide waste-gas treatment apparatus MEJ-101A / Muraki Co., Ltd.
Verification Organization	Tokyo Metropolitan Government
Test period	Dec. 16, 2003 to Jan. 30, 2004
Purpose of present technology	a. Detoxification of ethylene oxide gas by decomposition using catalytic agents b. Emphasis has been placed on safe operation, and safety is secured even during power failures.

1. Summary of the Target Verification Technology



Principle

- EOG is decomposed into carbon dioxide and water by catalysis.
- Waste gas from the sterilizer is held inside a chamber in the unit and sequentially diluted by ejector air before introduction into the catalytic agent layer for treatment.
- The waste heat of the discharged gas is recovered via heat exchange.

2. Summary of verification test

2.1 Specification of the Target Verification Apparatus

Item	Specification and treatment capacity
Model no.	MEJ-101A
Dimensions & weight	W 380 mm × D 650 mm × H 1,000 mm, 67 kg
Capacity of compatible sterilizer	30 to 100 L (for 20% EOG; depends on waste gas conditions)
Compatible sterilizer type	Dry-pump types

2.2 Settings for Verification Test Conditions

[Standard EOG treatment test]

Item	Concentration	Flow rate	EOG volume
Set values	24%	4.6 L/min	Approx. 2.2 g/min

[Treatment test using exhaust gas from ethylene oxide sterilizer simulator]

➤ **Pattern A**

	Start evacuation	End evacuation	Start aeration	End cleaning
Elapsed time (min)	5	12	29, 41, 53, 65	75

➤ **Pattern B**

	Start evacuation	End evacuation	End of cleaning
Elapsed time (min)	9	16	97

▶ **Types of Test for Treatment of Waste Gas from Ethylene Oxide Sterilizer Simulator**

Pattern	Chamber capacity	Waste Gas Composition	Summary
A	Approx. 50 L and 150 L	20% EO/CO ₂ gas	Assumes a cylinder-type EO sterilizer
B	Approx. 50 L and 150 L	95-100% EOG	Assumes a cartridge-type EO sterilizer

Verification Items Regarding Waste-Gas Treatment Performance
 The results of measurements are tabulated for each verification item regarding waste-gas treatment performance. It will be possible to confirm whether the treated EOG satisfies the design conditions of the apparatus.

Change in Treatment Efficiency
 Presents the change in EO treatment efficiency calculated from the EO concentrations at the inlet and outlet ducts of the apparatus

Change in Concentration
 Presents the change in EO concentration at the inlet and outlet ducts of the apparatus

3. Verification test results

○ Verification Items Regarding Waste-Gas Treatment Performance

◆ Standard EOG treatment test

[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	21°C	36.5°C
Total EOG	140 g	0.30 mg
EOG concentration	Average 25% Max. 28%	0.04 ppm

[Results of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%
Treatment volume per unit time	Average 2.2 g/min Max. 2.5 g/min

◆ Treatment test using exhaust gas from ethylene oxide sterilizer simulator

➢ Pattern A

[Treatment time and chamber volume]

Item	Settings
Treatment time	75 min
Chamber volume	50 L

[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	19.5°C	36.6°C
Total EOG	30 g	3.5 mg
Average EOG concentration	-	0.37 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%

➢ Pattern B

[Treatment time and chamber volume]

Item	Settings
Treatment time	97 min
Chamber volume	50 L

[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	24.5°C	33.3°C
Total EOG	54 g	31.7 mg
Average EOG concentration	-	0.13 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%

Verification Items Regarding Environmental Load

The results of measurements are tabulated for each verification item regarding environmental load.

- CO concentration: Qualitative and quantitative measurement results of carbon monoxide concentration in waste gas
- NOx concentration: Qualitative and quantitative measurement results of concentrations of nitrogen oxides in waste gas
- Volume of secondary products generated: Qualitative and quantitative measurement results of the volume of secondary products generated per operation
- Noise: Qualitative and quantitative measurement results of the level of noise in the areas surrounding the apparatus

Verification Items Regarding Environmental Load

Item	Verification Result									
CO concentration	Not verified. The target apparatus adopts the catalytic combustion method, therefore CO is not produced when the catalyst is functioning properly.									
NOx concentration	Not verified. The target apparatus adopts the catalytic combustion method, therefore NOx is not produced when the catalyst is functioning properly.									
Secondary products	Not verified. The target apparatus adopts the catalytic combustion method, therefore secondary products are not produced when the catalyst is functioning properly.									
Noise (reference value)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Item</th> <th>During operation of main unit (after correction)</th> <th>Dark noise (background noise)</th> </tr> </thead> <tbody> <tr> <td>L_{Aeq}</td> <td>[49 dB]</td> <td>49 dB</td> </tr> <tr> <td>L_{Ceq}</td> <td>[66 dB]</td> <td>66 dB</td> </tr> </tbody> </table> <p> L_{Aeq}: Equivalent continuous sound level weighted for human auditory characteristics L_{Ceq}: Equivalent continuous sound level with equal weights for all frequencies </p> <p>Since both L_{Aeq} and L_{Ceq} are below the level of dark noise, they have no effect on the environment.</p> <p> + The highest value after correction for noise level among the measurements taken from 4 sides (front, rear, right, and left of unit) is given as the representative value. + Data in brackets represent noise levels which, after correction for background noise, are within +3 dB of the background noise, and are thus considered unreliable. </p>	Item	During operation of main unit (after correction)	Dark noise (background noise)	L_{Aeq}	[49 dB]	49 dB	L_{Ceq}	[66 dB]	66 dB
Item	During operation of main unit (after correction)	Dark noise (background noise)								
L_{Aeq}	[49 dB]	49 dB								
L_{Ceq}	[66 dB]	66 dB								

Verification Items Regarding O&M

Item	Standard EOG treatment test	Simulator Waste Gas Treatment Test	
		Pattern A (capacity: 50 L)	Pattern B (capacity: 50 L)
Electricity consumption	0.62 kWh/60 min (135 g of EG)	0.81 kWh/operation (75 min)	1.08 kWh/operation (96 min)
Fuel consumption		Not consumed	
Water consumption		Not consumed	
Consumption of reactants, etc.		Not consumed	

Verification Items Regarding O&M

A summary of the items required for operation and maintenance of the apparatus

- Electricity consumption: Electricity consumption per operation (kWh/operation)
- Fuel consumption: Volume of fuel consumed per operation
- Water consumption: Volume of water consumed per operation
- Consumption of reactants, etc: volume of reactants, etc. consumed per operation

Qualitative Observations

Item	Observation
Number of operators and level of operator expertise required for O&M of apparatus	Requires only one operator for operation. No expertise required for normal operation.
Evaluation of O&M instructions manual	Operation is simple and easy to understand for normal operation. User friendliness may be enhanced further by providing simple descriptions and figures on how to level off the concentration.
Others (such as heat generated by the apparatus)	Little heat is given off by the apparatus, and the top surface of the apparatus may be safely touched. The gas discharged by the apparatus is cooled by heat exchange, so that the gas temperature is also low and safe. In the energy-efficient mode (for low EOG concentration treatment), the flow rate is significantly lowered so that the heat generated is further reduced.

Qualitative Observations

A summary of items evaluated qualitatively by the Verification Organization on verification items for O&M

Information for Reference

The information provided on this page is not obtained as a result of a verification test, but is information supplied in the application form from the environment technology developer who is responsible for the contents.

For questions regarding the contents of this page, please contact the environment technology developer directly.

Product data

Presented here is information on the target verification apparatus supplied in the application form from the environment technology developer.

- Name/model: name and model of the target verification item
- Name of manufacturer (or distributor): the name of the company that manufactures or distributes the target apparatus
- Contact address: telephone no., e-mail address, etc. of manufacturer (environment technology developer)
- Dimensions/weight: size of the main unit of the target apparatus
- Necessity of pre-treatment or post-treatment: whether or not pre-treatment or post-treatment of EO waste gas is required
- Additional equipment: whether or not additional equipment is required for implementation of the apparatus besides its main unit
- Requirements for compatible sterilizer models: conditions that must be met for a sterilizer to be compatible with the target apparatus
- Safety of target apparatus: response of target apparatus to emergency situations
- Duration of treatment performance: effect of deterioration on treatment performance of target apparatus
- Restoring from a trouble state: method of restoration of target apparatus to operational mode after emergency shutdown
- Response to cases of emergency: response of target apparatus to emergency situations such as power failure.
- Life of target verification apparatus: average life of target apparatus for normal use
- Cost estimation: average installation and operational cost of target apparatus for normal use

(Information for Reference)
The information provided on this page has been submitted by the environment technology developer, who is solely responsible for its contents. Neither the Ministry of the Environment nor the Verification Organization may be held responsible for the information.

Product Data

Item		Information provided by environment technology developer	
Name/model no.	Ethylene oxide waste-gas treatment apparatus/MEJ-101A		
Name of manufacturer (distributor)	Muraki Co., Ltd.		
Contact address	Tel/Fax	int-81-3-3303-5988/int-81-3-5374-7817	
	Website	http://www.muraki.co.jp	
	E-mail	kudo@muraki.co.jp	
Dimensions/weight	380 mm × 650 mm × 1,000 mm, 67 kg		
Necessity of pre-treatment and/or post-treatment	Not required		
Additional equipment	Requires air compressor for dilution		
Requirements for compatible sterilizer models	Restricted to dry-pump types		
Safety of target apparatus	<p>Overheat alert: When the temperature of the catalytic agent layer rises above a set value, the apparatus will switch automatically to a safe treatment mode, and then gradually restore itself to normal operation. However, when the overheat alert continues for a long period of time, the apparatus will sound a unit emergency alert.</p> <p>Unit emergency alert: In cases where normal operation is inhibited by mechanical failures, etc., the apparatus will shut down automatically. In this situation, the EOG will remain untreated, therefore press the Circumvention button to discharge EOG directly from the apparatus without passing it through the catalytic agent layer after confirming safety around the outlet duct.</p>		
Duration of treatment performance	The target gas should not contain components other than ethylene oxide, carbon dioxide, and air, so there shall be no extensive deterioration of the catalytic agent. However, abnormally high temperatures may cause deterioration.		
Restoring from a trouble state	Press the Circumvention button to discharge gas through the bypass and directly out of the outlet duct. Press the Circumvention button again to restore to normal operation.		
Response in case of emergency	Equipped with power failure countermeasures. Can respond to high-concentration EOG inflow.		
Life of target verification apparatus	10 years after installation		
Cost estimation (yen)	Initial cost (for installation)		
	Price of main unit	1 unit	1,600,000
	Air compressor	1 unit	380,000
(Electricity consumption based on measurements by the Verification Organization)	Total		
	1,980,000		
	Running cost		
	Per operation (A)	0.81 kWh	12.6
Per operation (B)	1.08 kWh	16.8	
	Per treatment of 100 g of EOG	0.46 kWh	7.2

Miscellaneous Information Provided by the Manufacturer

Features

- a. Levels off the concentration of high-concentration EOG in initial waste gas inside the chamber
- b. Low-concentration EOG will bypass chamber and will be treated directly
- c. Running cost may be reduced in the energy-efficient mode
- d. The automatic operation unit will monitor the power source of the sterilizer and pump to enable automatic start-up and operation of apparatus.

Miscellaneous information provided by manufacturer

Information on target apparatus presented in the application by the environment technology developer other than the above

Summary of the Target Verification Technology

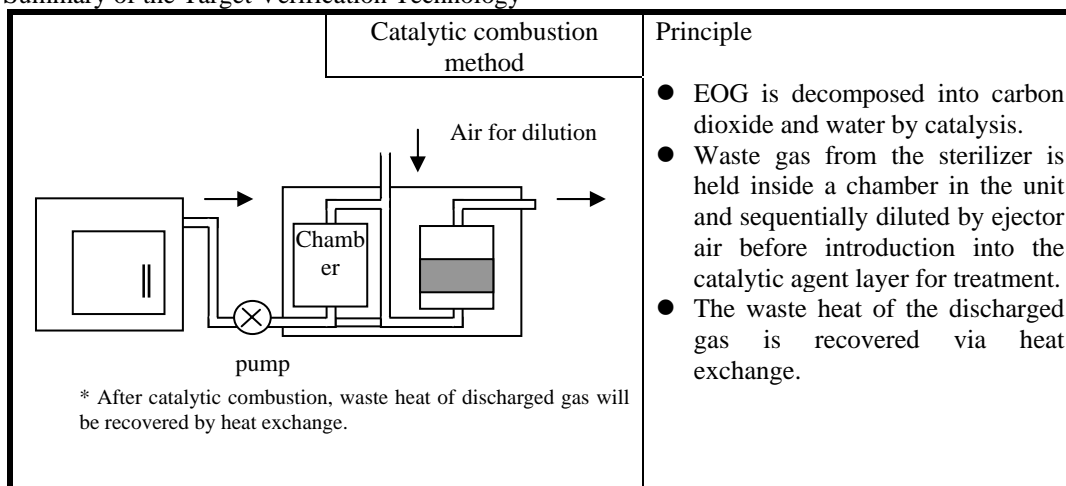
Below are the technologies for which Verification Tests were performed in FY 2003.

Verification Organization	Environmental Technology Developer	Name of Technology	Page
Tokyo Metropolitan Government	Muraki Co., Ltd.	Ethylene oxide waste-gas treatment apparatus MEJ-101A	17
	Nippon Shokubai Co., Ltd.	NS waste-gas treatment apparatus Model NS-EO-01	21
	Air Water Inc.	Desk-top ethylene oxide treatment apparatus AW-EOA25	25
	Miura Protec Co., Ltd.	Ethylene oxide gas remover AJ-100	29
	3M Health Care Co., Ltd.	3M EO waste gas treatment apparatus for Sterivac™ unit 3M EO Abator 50	33
	Pax Co., Ltd	Ethylene oxide gas remover CNES-150	37

Summary of Verification Reports concerning the Target Verification Technology

Target verification technology /Environmental Technology Developer	Ethylene oxide waste-gas treatment apparatus MEJ-101A / Muraki Co., Ltd.
Verification Organization	Tokyo Metropolitan Government
Test period	Dec. 16, 2003 to Jan. 30, 2004
Purpose of present technology	a. Detoxification of ethylene oxide gas by decomposition using catalytic agents b. Emphasis has been placed on safe operation, and safety is secured even during power failures.

1. Summary of the Target Verification Technology



2. Summary of Verification Test

○ Specification of the Target Verification Apparatus

Item	Specification and treatment capacity
Model no.	MEJ-101A
Dimensions & weight	W 380 mm × D 650 mm × H 1,000 mm, 67 kg
Capacity of compatible sterilizer	30 to 100 L (for 20% EOG; depends on waste gas conditions)
Compatible sterilizer type	Dry-pump types

○ Settings for Verification Test Conditions

[Standard EOG treatment test]

	Concentration	Flow rate	EOG volume
Set values	24%	4.6 L/min	Approx. 2.2 g/min

[Treatment test using exhaust gas from ethylene oxide sterilizer simulator]

➤ Pattern A

	Start evacuation	End evacuation	Start aeration	End cleaning
Elapsed time (min)	5	12	29, 41, 53, 65	75

➤ Pattern B

	Start evacuation	End evacuation	End of cleaning
Elapsed time (min)	9	16	97

3. Verification Test Results

○ Verification Items Regarding Waste-Gas Treatment Performance

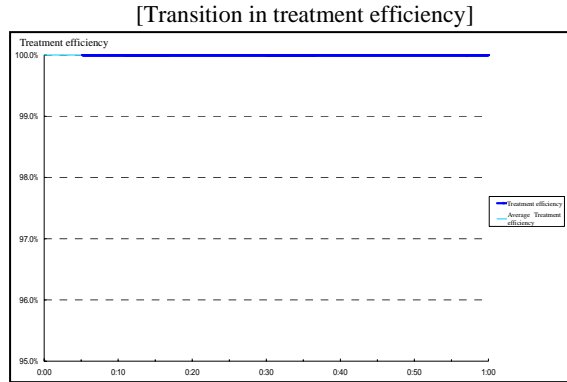
◆ Standard EOG treatment test

[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	21°C	36.5°C
Total EOG	140 g	0.30 mg
EOG concentration	Average 25% Max. 28%	0.04 ppm

[Results of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%
Treatment volume per unit time	Average 2.2 g/min Max. 2.5 g/min



◆ Treatment test using exhaust gas from ethylene oxide sterilizer simulator

➤ Pattern A

[Treatment time and chamber volume]

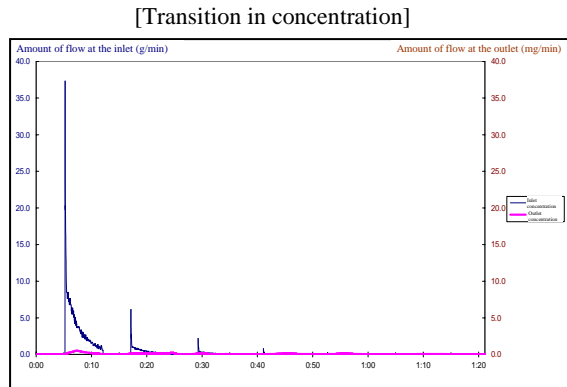
Item	Settings
Treatment time	75 min
Chamber volume	50 L

[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	19.3°C	36.6°C
Total EOG	30 g	3.5 mg
Average EOG concentration	-	0.37 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%



➤ Pattern B

[Treatment time and chamber volume]

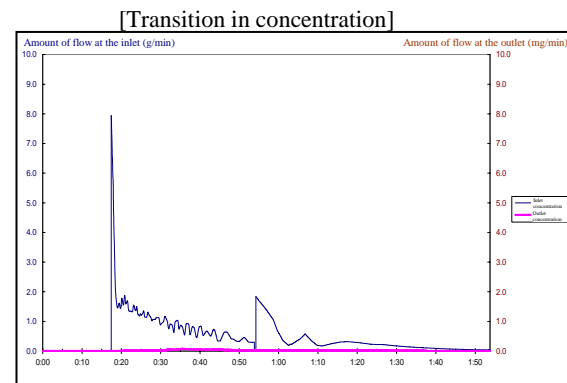
Item	Settings
Treatment time	97 min
Chamber volume	50 L

[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	24.5°C	33.3°C
Total EOG	54 g	31.7 mg
Average EOG concentration	-	0.13 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%



○ Verification Items Regarding Environmental Load

Item	Verification Result											
CO concentration	Not verified. The target apparatus adopts the catalytic combustion method, therefore CO is not produced when the catalyst is functioning properly.											
NOx concentration	Not verified. The target apparatus adopts the catalytic combustion method, therefore NOx is not produced when the catalyst is functioning properly.											
Secondary products	Not verified. The target apparatus adopts the catalytic combustion method, therefore secondary products are not produced when the catalyst is functioning properly.											
Noise (reference value)	<table border="1"> <thead> <tr> <th>Item</th> <th>During operation of main unit (after correction)</th> <th>Dark noise (background noise)</th> </tr> </thead> <tbody> <tr> <td>L_{Aeq}</td> <td>[49 dB]</td> <td>49 dB</td> </tr> <tr> <td>L_{Ceq}</td> <td>[66 dB]</td> <td>66 dB</td> </tr> </tbody> </table>		Item	During operation of main unit (after correction)	Dark noise (background noise)	L _{Aeq}	[49 dB]	49 dB	L _{Ceq}	[66 dB]	66 dB	<p>L_{Aeq}: Equivalent continuous sound level weighted for human auditory characteristics</p> <p>L_{Ceq}: Equivalent continuous sound level with equal weights for all frequencies</p> <p>Since both L_{Aeq} and L_{Ceq} are below the level of dark noise, they have no effect on the environment.</p> <ul style="list-style-type: none"> ✦ The highest value after correction for noise level among the measurements taken from 4 sides (front, rear, right, and left of unit) is given as the representative value. ✦ Data in brackets represent noise levels which, after correction for background noise, are within +3 dB of the background noise, and are thus considered unreliable.
Item	During operation of main unit (after correction)	Dark noise (background noise)										
L _{Aeq}	[49 dB]	49 dB										
L _{Ceq}	[66 dB]	66 dB										

○ Verification Items Regarding O&M

Item	Standard EOG treatment test	Simulator Waste Gas Treatment Test	
		Pattern A (capacity: 50 L)	Pattern B (capacity: 50 L)
Electricity consumption	0.62 kWh/60 min. (135 g of EG)	0.81 kWh/operation (75 min.)	1.08 kWh/operation (96 min.)
Fuel consumption		Not consumed	
Water consumption		Not consumed	
Consumption of reactants, etc.		Not consumed	

(Qualitative Observations)

Item	Observation
Number of operators and level of operator expertise required for O&M of apparatus	Requires only one operator for operation. No expertise required for normal operation.
Evaluation of O&M instructions manual	Operation is simple and easy to understand for normal operation. User friendliness may be enhanced further by providing simple descriptions and figures on how to level off the concentration.
Others (such as heat generated by the apparatus)	Little heat is given off by the apparatus, and the top surface of the apparatus may be safely touched. The gas discharged by the apparatus is cooled by heat exchange, so that the gas temperature is also low and safe. In the energy-efficient mode (for low EOG concentration treatment), the flow rate is significantly lowered so that the heat generated is further reduced.

(Information for Reference)

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○ Product Data

Item	Information provided by environment technology developer		
Name/model no.	Ethylene oxide waste-gas treatment apparatus/MEJ-101A		
Name of manufacturer (distributor)	Muraki Co., Ltd.		
Contact address	Tel/Fax	int-81-3-3303-5988/int-81-3-5374-7817	
	Website	http://www.muraki.co.jp	
	E-mail	kudou@muraki.co.jp	
Dimensions/weight	380 mm × 650 mm × 1,000 mm, 67 kg		
Necessity of pre-treatment and/or post-treatment	Not required		
Additional equipment	Requires air compressor for dilution		
Requirements for compatible sterilizer models	Restricted to dry-pump types		
Safety of target apparatus	Overheat alert: When the temperature of the catalytic agent layer rises above a set value, the apparatus will switch automatically to a safe treatment mode, and then gradually restore itself to normal operation. However, when the overheat alert continues for a long period of time, the apparatus will sound a unit emergency alert. Unit emergency alert: In cases where normal operation is inhibited by mechanical failures, etc., the apparatus will shut down automatically. In this situation, the EOG will remain untreated, therefore press the Circumvention button to discharge EOG directly from the apparatus without passing it through the catalytic agent layer after confirming safety around the outlet duct.		
Duration of treatment performance	The target gas should not contain components other than ethylene oxide, carbon dioxide, and air, so there shall be no extensive deterioration of the catalytic agent. However, abnormally high temperatures may cause deterioration.		
Restoring from a trouble state	Press the Circumvention button to discharge gas through the bypass and directly out of the outlet duct. Press the Circumvention button again to restore to normal operation.		
Response in case of emergency	Equipped with power failure countermeasures. Can respond to high-concentration EOG inflow.		
Life of target verification apparatus	10 years after installation		
Cost estimation (yen) (Electricity consumption based on measurements by the Verification Organization)	Initial cost (for installation)		
	Price of main unit	1 unit	1,600,000
	Air compressor	1 unit	380,000
	Total		1,980,000
	Running cost		
	Per operation (A)	0.81 kWh	12.6
	Per operation (B)	1.08 kWh	16.8
Per treatment of 100 g of EOG	0.46 kWh	7.2	

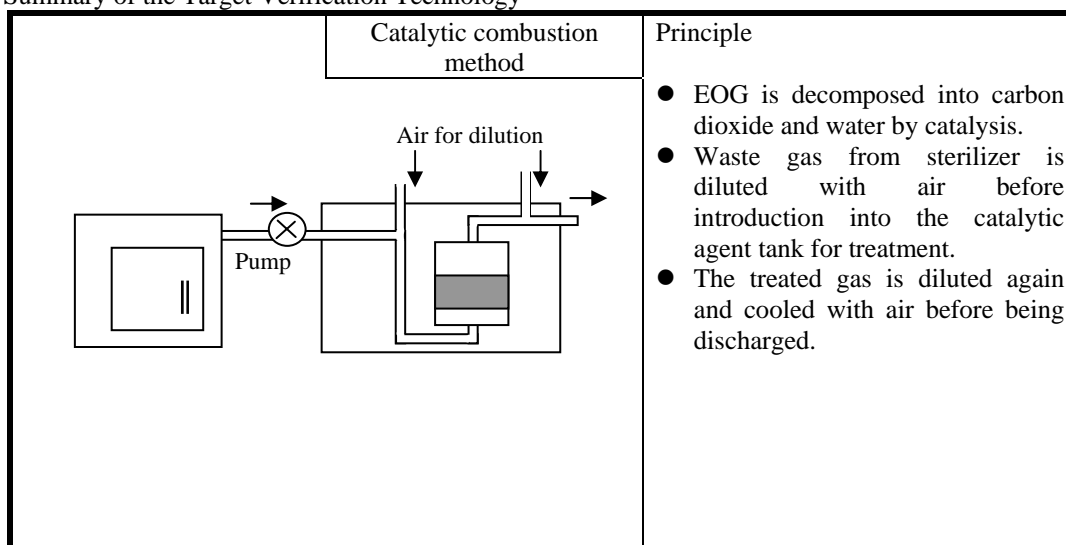
○ Miscellaneous Information Provided by the Manufacturer

Features

- a. Levels off the concentration of high-concentration EOG in initial waste gas inside the chamber
- b. Low-concentration EOG will bypass chamber and will be treated directly
- c. Running cost may be reduced in the energy-efficient mode
- d. The automatic operation unit will monitor the power source of the sterilizer and pump to enable automatic start-up and operation of apparatus.

Target verification technology / Environment technology developer	NS waste-gas treatment apparatus Model NS-EO-01 / Nippon Shokubai Co., Ltd.
Verification Organization	Tokyo Metropolitan Government
Test period	Jan. 7, 2004 to Jan. 15, 2004
Purpose of present technology	a. Detoxification of ethylene oxide gas by decomposition using catalytic agents b. Goals of development were compact design to allow easy installation, high operability, superior safety, and low running cost.

1. Summary of the Target Verification Technology



2. Summary of Verification Test

○ Specifications of the Target Verification Apparatus

Item	Specifications and treatment capacity
Model no.	Model NS-EO-01
Dimensions & weight	W 400 mm × D 500 mm × H 570 mm, 55 kg
Capacity of compatible sterilizer	50 to 100 L
Compatible sterilizer type	Dry-pump types

○ Settings for Verification Test Conditions

[Standard EOG treatment test]

	Concentration	Flow rate	EOG volume
Set values	23%	7.6 L/min	Approx. 3.4 g/min

[Treatment test using exhaust gas from ethylene oxide sterilizer simulator]

➤ Pattern A

	Start evacuation	End evacuation	Start aeration	End cleaning
Elapsed time (min)	16	34	39, 58, 77, 96	115

3. Verification Test Results

○ Verification Items Regarding Waste-Gas Treatment Performance

◆ Standard EOG treatment test

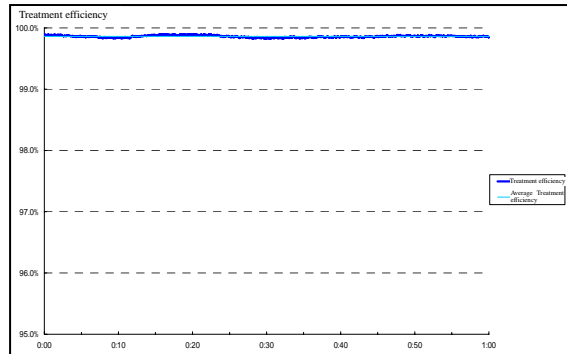
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	21°C	108.9°C
Total EOG	204 g	280 mg
EOG concentration	Average 23% Max. 28%	2.86 ppm

[Results of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%
Treatment volume per unit time	Average 3.4 g/min Max. 2.5 g/min

[Transition in treatment efficiency]



◆ Treatment test using exhaust gas from ethylene oxide sterilizer simulator

➤ Pattern A

[Treatment time and chamber volume]

Item	Settings
Treatment time	114 min
Chamber volume	50 L

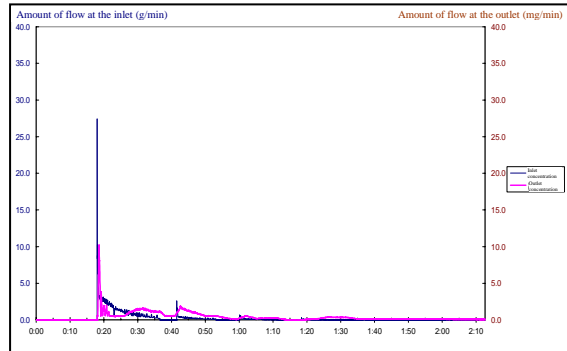
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	22.7°C	69.4°C
Total EOG	30 g	173 mg
Average EOG concentration	-	0.81 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	99.4%

[Transition in concentration]



○ Verification Items Regarding Environmental Load

Item	Verification Result									
CO concentration	Not verified. The target apparatus adopts the catalytic combustion method, therefore CO is not produced when the catalyst is functioning properly.									
NOx concentration	Not verified. The target apparatus adopts the catalytic combustion method, therefore NOx is not produced when the catalyst is functioning properly.									
Secondary products	Not verified. The target apparatus adopts the catalytic combustion method, therefore secondary products are not produced when the catalyst is functioning properly.									
Noise (reference value)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Item</th> <th>During operation of main unit (after correction)</th> <th>Dark noise (background noise)</th> </tr> </thead> <tbody> <tr> <td>L_{Aeq}</td> <td>65 dB</td> <td>52 dB</td> </tr> <tr> <td>L_{Ceq}</td> <td>[71 dB]</td> <td>70 dB</td> </tr> </tbody> </table> <p style="margin-left: 20px;">L_{Aeq}: Equivalent continuous sound level weighted for human auditory characteristics L_{Ceq}: Equivalent continuous sound level with equal weights for all frequencies</p> <p>The main source of noise is the fan on the left side of the unit, where the measured L_{Aeq} was 65 db. This is approximately the same level of noise as “air conditioning units in coffee shops,” therefore it is not regarded to have a serious effect on the environment. Since L_{Ceq} was approximately on the same level as the dark noise, it is considered to have no effect on the environment at low frequencies.</p> <ul style="list-style-type: none"> ✦ The highest value after correction for noise level among the measurements taken from four sides (front, rear, right, and left of unit) is given as the representative value. ✦ Data in brackets represent noise levels which, after correction for background noise, are within +3 dB of the background noise, and are thus considered unreliable. 	Item	During operation of main unit (after correction)	Dark noise (background noise)	L _{Aeq}	65 dB	52 dB	L _{Ceq}	[71 dB]	70 dB
Item	During operation of main unit (after correction)	Dark noise (background noise)								
L _{Aeq}	65 dB	52 dB								
L _{Ceq}	[71 dB]	70 dB								

○ Verification Items Regarding O&M

Item	Standard EOG treatment test	Simulator Waste Gas Treatment Test
		Pattern A (capacity: 50 L)
Electricity consumption	0.82 kWh/60 min. (204 g of EG)	1.90 kWh/operation (104 min.)
Fuel consumption		Not consumed
Water consumption		Not consumed
Consumption of reactants, etc.		Not consumed

(Qualitative Observations)

Item	Observation
Number of operators and level of operator expertise required for O&M of apparatus	Requires only one operator for operation. No expertise required for normal operation.
Evaluation of O&M instructions manual	Operation is simple and easy to understand for normal operation. Furthermore, the gas discharge lines are labeled for each operation pattern, adding to the user-friendliness of the apparatus.
Others (such as heat generated by the apparatus)	Little heat is given off by the apparatus, and the top surface of the apparatus may be safely touched.

(Information for Reference)

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○ Product Data

Item		Information provided by environment technology developer		
Name/model no.		NS waste-gas treatment apparatus/Model NS-EO-01		
Name of manufacturer (distributor)		Nippon Shokubai Co., Ltd.		
Contact address	Tel/Fax	Tel/Fax		int-81-6-6223-9201/ int-81-6-6201-2857
	Website	http://www.shokubai.co.jp		
	E-mail	keng-o@shokubai.co.jp		
Dimensions/weight		400 mm × 500 mm × 570 mm		
Necessity of pre-treatment and/or post-treatment		Not required		
Additional equipment		None		
Requirements for compatible sterilizer models		Restricted to dry-pump types		
Safety of target apparatus		A warning buzzer sounds in case of emergency such as abnormal temperatures at the reactor tank intake or outlet, anomaly in the main fan, or abnormal operational conditions, and in such case the EOG is directly discharged through the purge line to the outside without passing through the catalyst.		
Duration of treatment performance		The target gas should not contain components other than ethylene oxide, carbon dioxide, and air, so there shall be no extensive deterioration of the catalytic agent. However, abnormally high temperatures may cause deterioration.		
Restoring from a trouble state		Identify the malfunction or anomaly in the unit, and remove the cause. Then, confirm that the sterilizer is turned off before pressing the Restart button.		
Response in case of emergency		Equipped with power failure countermeasures. Can respond to high-concentration EOG inflow.		
Life of target verification apparatus		Approx. 5 years		
Cost estimation (yen) (Electricity consumption based on measurements by the Verification Organization)		Initial cost (for installation)		
		Price of main unit	1 unit	1,500,000
		Total		1,500,000
		Running cost		
		Per operation (A)	1.90 kWh	29.6
Per treatment of 100 g of EOG	0.40 kWh	6.2		

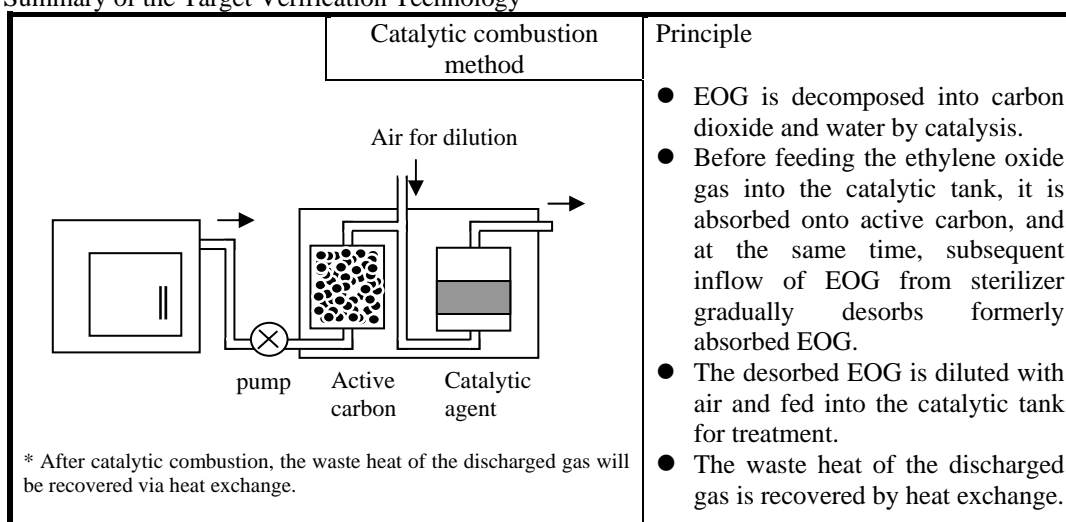
○ Miscellaneous Information Provided by the Manufacturer

Features

- a. High-concentration EOG is fed directly into the apparatus to eliminate the need for a buffer tank, thus allowing for the compact design.
- b. The orifice plate limits the intake of EOG gas, preventing any sudden influxes of gas.
- c. A variety of operation timers and pressure sensors enable automatic start-up and shutdown.
- d. Since no signals are shared with the sterilizer, only the power line and waste-gas line need to be connected to the sterilizer.

Target verification technology /Environmental Technology Developer	Desk-top ethylene oxide treatment apparatus AW-EOA25 / Air Water Inc.
Verification Organization	Tokyo Metropolitan Government
Test period	Jan. 29, 2004 to Feb. 5, 2004
Purpose of present technology	a. Detoxification of ethylene oxide gas by decomposition using catalytic agents b. Does not require flow rate adjustment of waste gas from sterilizer nor any utilities other than a 100-V power source. Compatible for capacity of 100 L/100 g or lower.

1. Summary of the Target Verification Technology



2. Summary of Verification Test

○ Specifications of the Target Verification Apparatus

Item	Specifications and treatment capacity
Model no.	AW-EOA25
Dimensions & weight	W 400 mm × D 650 mm × H 1,370 mm, 170 kg
Capacity of compatible sterilizer	100 L or less
Compatible sterilizer type	No restrictions regarding shape, etc.

○ Settings for Verification Test Conditions

[Standard EOG treatment test]

	Concentration	Flow rate	EOG volume
Set values	0.87%	89 L/min	Approx. 1.5 g/min

[Treatment test using exhaust gas from ethylene oxide sterilizer simulator]

➤ Pattern A

	Start evacuation	End evacuation	Start aeration	End cleaning
Elapsed time (min)	14	24	29, 42, 55, 68	81

➤ Pattern B

	Start evacuation	End evacuation	End of cleaning
Elapsed time (min)	14	17	77

3. Verification Test Results

○ Verification Items Regarding Waste-Gas Treatment Performance

◆ Standard EOG treatment test

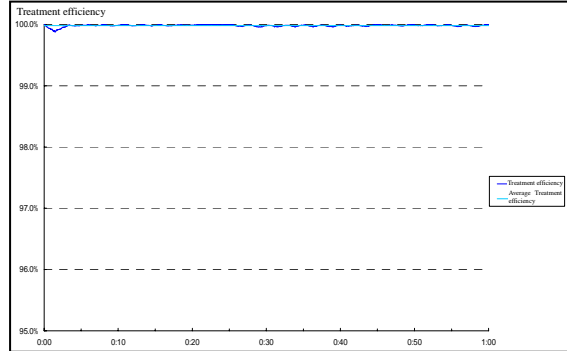
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	23.5°C	54.8°C
Total EOG	91 g	14 mg
EOG concentration	Average 0.87% Max. 0.93%	0.29 ppm

[Results of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%
Treatment volume per unit time	Average 1.5 g/min Max. 1.6 g/min

[Transition in treatment efficiency]



◆ Treatment test using exhaust gas from ethylene oxide sterilizer simulator

➤ Pattern A

[Treatment time and chamber volume]

Item	Settings
Treatment time	78 min
Chamber volume	50 L

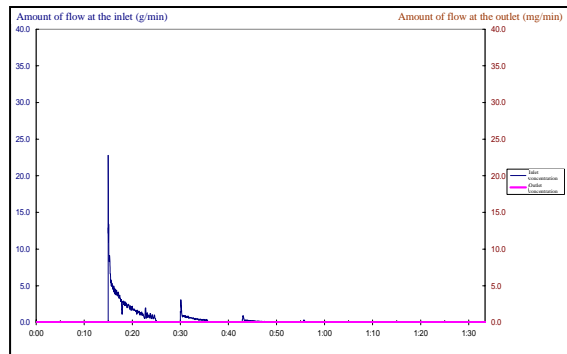
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	19.5°C	38.3°C
Total EOG	30 g	0.5 mg
Average EOG concentration	-	0.01 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%

[Transition in concentration]



➤ Pattern B

[Treatment time and chamber volume]

Item	Settings
Treatment time	63 min
Chamber volume	50 L

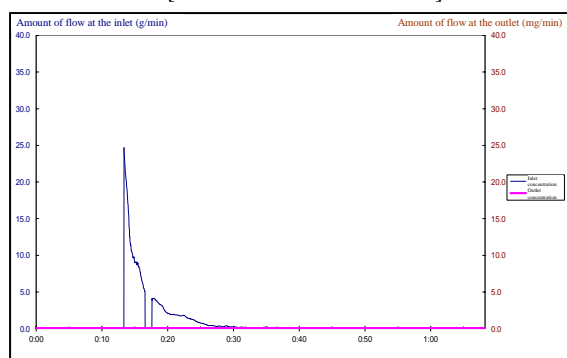
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	23.4°C	52.0°C
Total EOG	58 g	0.5 mg
Average EOG concentration	-	0.01 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%

[Transition in concentration]



Possibility of Ethylene Oxide Remaining in Apparatus

Since the present apparatus uses active carbon to absorb EOG, there is a danger of EOG remaining inside the apparatus. Therefore, after the test for standard EOG treatment was conducted, measurements were taken of the discharged gas with an influx of air rather than the standard EOG gas.

The results obtained showed that while the average concentration of EOG in discharged gas during the test was 0.29 ppm, it was reduced to 0.03 ppm under the above conditions. Thus, it was concluded that remnant EOG is not a significant concern. In this apparatus, active carbon is regenerated during the long aeration step (up to several hours) that is normally performed in sterilizers.

○ Verification Items Regarding Environmental Load

Item	Verification Result										
CO concentration	Not verified. The target apparatus adopts the catalytic combustion method, therefore CO is not produced when the catalyst is functioning properly.										
NOx concentration	Not verified. The target apparatus adopts the catalytic combustion method, therefore NOx is not produced when the catalyst is functioning properly.										
Secondary products	Not verified. The target apparatus adopts the catalytic combustion method, therefore secondary products are not produced when the catalyst is functioning properly.										
Noise (reference value)	<table border="1"> <thead> <tr> <th>Item</th> <th>During operation of main unit (after correction)</th> <th>Dark noise (background noise)</th> </tr> </thead> <tbody> <tr> <td>L_{Aeq}</td> <td>53 dB</td> <td>50 dB</td> </tr> <tr> <td>L_{Ceq}</td> <td>[66 dB]</td> <td>66 dB</td> </tr> </tbody> </table>	Item	During operation of main unit (after correction)	Dark noise (background noise)	L _{Aeq}	53 dB	50 dB	L _{Ceq}	[66 dB]	66 dB	<p>L_{Aeq}: Equivalent continuous sound level weighted for human auditory characteristics</p> <p>L_{Ceq}: Equivalent continuous sound level with equal weights for all frequencies</p>
	Item	During operation of main unit (after correction)	Dark noise (background noise)								
L _{Aeq}	53 dB	50 dB									
L _{Ceq}	[66 dB]	66 dB									
	<p>Since both L_{Aeq} and L_{Ceq} are below the level of dark noise, they have no effect on the environment.</p> <ul style="list-style-type: none"> ✦ The highest value after correction for noise level among the measurements taken from four sides (front, rear, right, and left of unit) is given as the representative value. ✦ Data in brackets represent noise levels which, after correction for background noise, are within +3 dB of the background noise, and are thus considered unreliable. 										

○ Verification Items Regarding O&M

Item	Standard EOG treatment test	Simulator Waste Gas Treatment Test	
		Pattern A (capacity: 50 L)	Pattern B (capacity: 50 L)
Electricity consumption	0.53 kWh/60 min. (91 g of EG)	0.86 kWh/operation (78 min.)	0.93 kWh/operation (63 min.)
Fuel consumption	Not consumed		
Water consumption	Not consumed		
Consumption of reactants, etc.	Not consumed		

(Qualitative Observations)

Item	Observation
Number of operators and level of operator expertise required for O&M of apparatus	Requires only one operator for operation. No expertise is required for normal operation.
Evaluation of O&M instructions manual	Operation is simple and easy to understand for normal operation. However, although detailed drawings of the apparatus are provided, there are few figures and photographs. More such figures and photographs should be added for clarity.
Others (such as heat generated by the apparatus)	Little heat is given off by the apparatus, and the top surface of the apparatus may be safely touched. The gas discharged by the apparatus is cooled via heat exchange, so that the gas temperature is also low and safe.

(Information for Reference)

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○ Product Data

Item		Item		
Name/model no.		Desk-top ethylene oxide treatment apparatus/AW-EOA25		
Name of manufacturer (distributor)		Air Water Inc.		
Contact address	Tel/Fax	int-81-263-78-0160/int-81-263-78-0065		
	Website			
	E-mail	obara-sat@awi.co.jp		
Dimensions/weight		400 mm × 650 mm × 1,370 mm, 170 kg		
Necessity of pre-treatment and/or post-treatment		Not required		
Additional equipment		Requires a gas compressor between the sterilizer and the target apparatus, although it may not be necessary for some sterilizers. (A pressure loss on the waste-gas side in the EOG waste-gas process of the sterilizer will result in an error.) A cooling fin tube is also required for cooling the waste gas fed from the gas compressor.		
Requirements for compatible sterilizer models		This apparatus is compatible with all sterilizers currently available with a chamber volume ≤70 L and ≤70 g of ethylene oxide. However, to properly treat EOG under the various conditions required by the different types of sterilizers, electronic signals must be output from the sterilizer for each step in the sterilization process. When the sterilization temperature is fixed, a timer may be used to synchronize the sterilizer with the treatment apparatus, but even in this case at least 2 signals (start signals) out of the 4 signals for the start of humidifying, the start/end of sterilization, and the start of gas discharge of the sterilizer will be required.		
Safety of target apparatus		A warning buzzer sounds for abnormal temperatures in the reactor tank, heat-up time overruns, and abnormally high temperatures in the pump, and the EOG is discharged from the apparatus through the emergency exhaust line without passing through the catalyst.		
Duration of treatment performance		The target gas should not contain components other than ethylene oxide, carbon dioxide, and air, so there shall be no extensive deterioration of the catalytic agent. However, abnormally high temperatures may cause deterioration. Furthermore, deterioration of active carbon will result in reduced absorption capacity, and so the active carbon must be replaced periodically.		
Restoring from a trouble state		In case of a trouble state, the apparatus shuts down and automatically switches to the cooling mode. It returns to the default mode after approximately one hour. Press the Reset button and check the state of the apparatus for malfunctions and abnormalities. After removing the cause of the trouble state, confirm that the sterilizer is turned off before pressing the Start Operation button.		
Response in case of emergency		Equipped with power failure countermeasures. Can respond to high-concentration EOG inflow.		
Life of target verification apparatus		Consumables for apparatus: Replace filters once a year; all other consumables should be replaced every 2 to 3 years. (Recommended length of cycle is 8,000 hours.) Catalyst: 2 to 3 years Absorbent: 1 year (for guaranteed safe operation)		
Cost estimation (yen) (Electricity consumption based on measurements by the Verification Organization)		Initial cost (for installation)		
		Price of main unit	1 unit	1,850,000
		Additional equipment	1 unit	300,000
		Total		2,150,000
		Running cost		
		Per operation (A)	0.86 kWh	13.4
Per operation (B)	0.93 kWh	14.5		
Per treatment of 100 g of EOG	0.58 kWh	9.0		

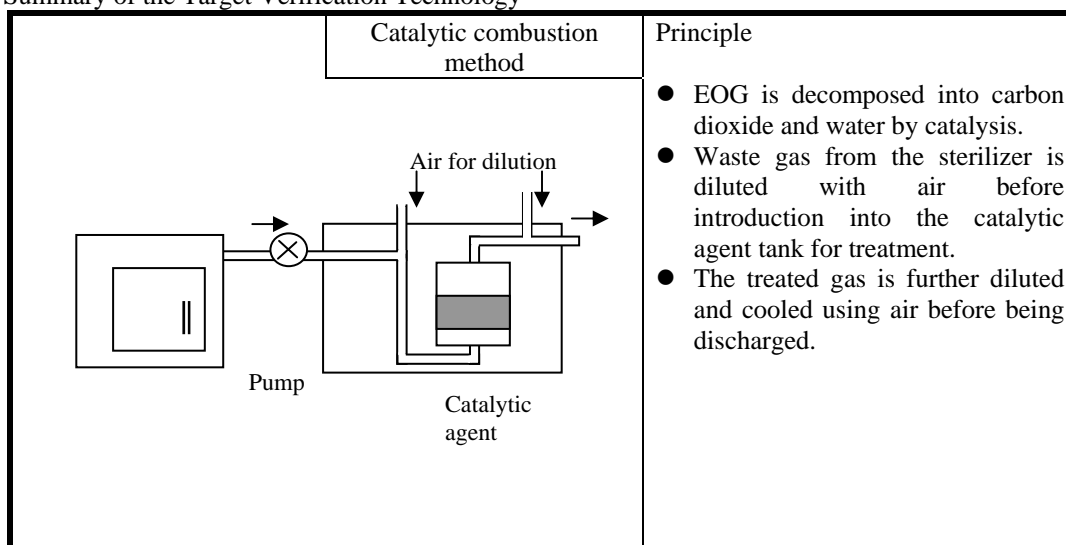
○ Miscellaneous Information Provided by the Manufacturer

Features

- Since the apparatus does not require flow rate control for waste gas from the sterilizer, no modifications in the sterilizer are necessary to pair it with the present apparatus.
- The apparatus can be made to handle waste gas from sterilizers with capacity of 50 L/100 g or lower simply by increasing the volume of absorbent, without changing the size of the apparatus.

Target verification technology /Environmental Technology Developer	Ethylene oxide gas remover AJ-100 / Miura Protec Co., Ltd.
Verification Organization	Tokyo Metropolitan Government
Test period	Feb. 5, 2004 to Feb. 13, 2004
Purpose of present technology	a. Detoxification of ethylene oxide gas by decomposition using catalytic agents b. Since this apparatus will be installed next to a sterilizer, it has been designed to assure safe operation even in a central resource room.

1. Summary of the Target Verification Technology



2. Summary of Verification Test

○ Specifications of the Target Verification Apparatus

Item	Specifications and treatment capacity
Model no.	AJ-100
Dimensions & weight	W 760 mm × D 765 mm × H 850 mm, 170 kg
Capacity of compatible sterilizer	76 to 215 L
Compatible sterilizer type	Compatible only with EMJ cartridge-type sterilizers by Miura Co., Ltd.

○ Settings for Verification Test Conditions

[Standard EOG treatment test]

	Concentration	Flow rate	EOG volume
Set values	2.8%	100 L/min	Approx. 5.0 g/min

[Treatment test using exhaust gas from ethylene oxide sterilizer simulator]

➤ Pattern B

	Start evacuation	End evacuation	End of cleaning
Elapsed time (min)	13	113	173

3. Verification Test Results

○ Verification Items Regarding Waste-Gas Treatment Performance

◆ Standard EOG treatment test

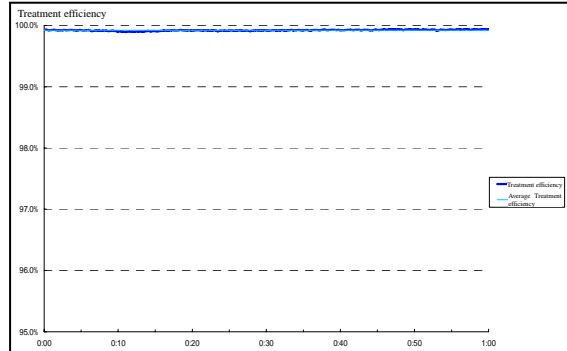
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	25.1°C	97.5°C
Total EOG	305 g	228 mg
EOG concentration	Average 2.8% Max. 2.9%	0.55 ppm

[Results of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%
Treatment volume per unit time	Average 5.1 g/min Max. 5.2 g/min

[Transition in treatment efficiency]



◆ Treatment test using exhaust gas from ethylene oxide sterilizer simulator

➤ Pattern B

[Treatment time and chamber volume]

Item	Settings
Treatment time	159 min
Chamber volume	150 L

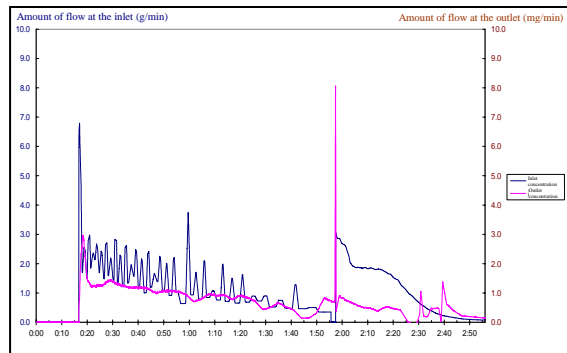
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	24,5°C	77.9°C
Total EOG	187 g	118 mg
Average EOG concentration	-	0.13 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%

[Transition in concentration]



○ Verification Items Regarding Environmental Load

Item	Verification Result									
CO concentration	Not verified. The target apparatus adopts the catalytic combustion method; therefore CO is not produced when the catalyst is functioning properly.									
NOx concentration	Not verified. The target apparatus adopts the catalytic combustion method; therefore NOx is not produced when the catalyst is functioning properly.									
Secondary products	Not verified. The target apparatus adopts the catalytic combustion method; therefore secondary products are not produced when the catalyst is functioning properly.									
Noise (reference value)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Item</th> <th>During operation of main unit (after correction)</th> <th>Dark noise (background noise)</th> </tr> </thead> <tbody> <tr> <td>L_{Aeq}</td> <td>59 dB</td> <td>51 dB</td> </tr> <tr> <td>L_{Ceq}</td> <td>[65 dB]</td> <td>70 dB</td> </tr> </tbody> </table> <p style="margin-left: 20px;">L_{Aeq}: Equivalent continuous sound level weighted for human auditory characteristics L_{Ceq}: Equivalent continuous sound level with equal weights for all frequencies</p> <p>The main source of noise is the fan on the left side of the unit, where the measured L_{Aeq} was 57.8 db. This is approximately the same level of noise created by the “cooler fan of a personal desktop computer.” Furthermore, the measurement was taken at a distance of 52 cm from the apparatus, and not 1 meter, so it is not regarded to have a serious effect on the environment. L_{Ceq} was approximately on the same level as the dark noise, thus, it was concluded to have no effect on the environment at low frequencies.</p> <ul style="list-style-type: none"> ✦ The highest value after correction for noise level among the measurements taken on four sides (front, rear, right, and left of unit) is given as the representative value. ✦ Data in brackets represent noise levels which, after correction for background noise, are within +3 dB of the background noise, and are thus considered unreliable. 	Item	During operation of main unit (after correction)	Dark noise (background noise)	L_{Aeq}	59 dB	51 dB	L_{Ceq}	[65 dB]	70 dB
Item	During operation of main unit (after correction)	Dark noise (background noise)								
L_{Aeq}	59 dB	51 dB								
L_{Ceq}	[65 dB]	70 dB								

○ Verification Items Regarding O&M

Item	Standard EOG treatment test	Simulator Waste Gas Treatment Test
		Pattern B (capacity: 50 L)
Electricity consumption	2.35 kWh/60 min. (305 g of EG)	7.50 kWh/operation (159 min.)
Fuel consumption		Not consumed
Water consumption		Not consumed
Consumption of reactants, etc.		Not consumed

(Qualitative Observations)

Item	Observation
Number of operators and level of operator expertise required for O&M of apparatus	Requires only one operator for operation. No expertise required for normal operation.
Evaluation of O&M instructions manual	Operation is simple and easy to understand for normal operation. The danger posed by ethylene oxide to human health and the principle of its removal from waste gas are given in detail, showing that consideration was given to the users in the preparation of the manual. There are ample figures and photographs of the main unit, but none for the degassing tank (not verified in present test). It is advised that figures and photographs for the degassing tank be included as well.
Others (such as heat generated by the apparatus)	Little heat is given off by the apparatus, and the top surface of the apparatus may be safely touched. Since the gas discharged by the apparatus is not cooled via heat exchange, the gas temperature is high (~ 100°C), so heat insulation measures are required in the ductwork.

(Information for Reference)

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○ Product Data

Item	Information provided by environment technology developer		
Name/model no.	Ethylene oxide gas remover / AJ-100		
Name of manufacturer (distributor)	Miura Protec Co., Ltd.		
Contact address	Tel/Fax	Tel/Fax int-81-89-960-2666/int-81-89-960-2667	
	Website	http://www.miura.co.jp	
	E-mail	Takahashi_yuichi@miuraz.co.jp	
Dimensions/weight	760 mm × 765 mm × 850 mm, 170 kg		
Necessity of pre-treatment and/or post-treatment	When connecting this apparatus to EJM-4, 5(W), or 8(W), use a degassing tank. The water inside the tank must be changed regularly, even though the apparatus drains the tank automatically. (Degassing tank is not included in the present verification test.)		
Additional equipment	A degassing tank is required when connecting to EJM-4, 5(W), or 8(W).		
Requirements for compatible sterilizer models	Is compatible only with EMJ cartridge-type sterilizers by Miura Co., Ltd.		
Safety of target apparatus	A warning lamp lights up in cases of abnormally high temperatures in the catalytic agent, abnormal chamber pressure, and abnormal conditions in the catalytic agents. In such cases, the route to the catalytic tank is closed and an emergency valve is opened to discharge waste gas directly from the apparatus. The dilution fan continues to operate for 10 minutes after the discharge of waste gas before shutting down.		
Duration of treatment performance	Normally, the flow rate into the catalytic tank is controlled by dilution. However, in abnormal situations where high-concentration ethylene gas entering the catalytic tank causes the catalytic agent to heat up abnormally, an emergency valve is opened to release EOG directly from the apparatus.		
Restoring from a trouble state	The apparatus may be manually restarted by pressing the Restart button. However, it is recommended that the manufacturer be contacted before shutdown or restart to determine the cause of the trouble state.		
Response in case of emergency	Equipped with power failure countermeasures. Can respond to high-concentration EOG inflow.		
Life of target verification apparatus	10 years after installation (when periodic inspections are made by Miura Protec)		
Cost estimation (yen) (Electricity consumption based on measurements by the Verification Organization)	Initial cost (for installation)		
	Price of main unit	1 unit	2,750,000
	Shakedown	1 set	500,000
	Total		3,250,000
	Running cost		
	Per operation (B)	7.5 kWh	79.4
Per treatment of 100 g of EOG	0.77 kWh	8.2	

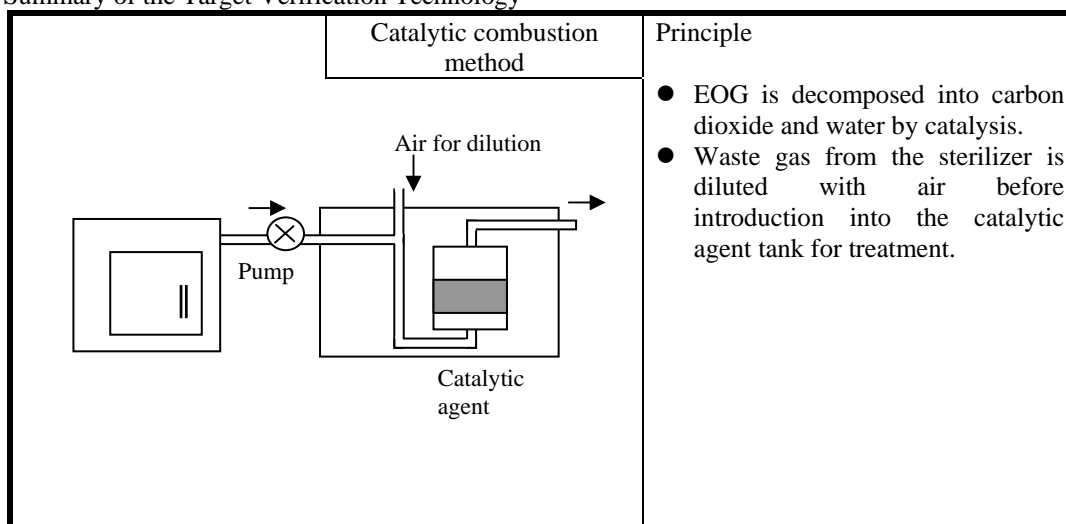
○ Miscellaneous Information Provided by the Manufacturer

Features

- a. Since the apparatus adopts the EOG dilution method the concentration of EOG is below the combustion level, and thus the danger of a fire is significantly decreased.
- b. The combustion gas is also diluted by air, so the temperature of the discharged gas is reduced to below 100°C.

Target verification technology /Environmental Technology Developer	3M EO waste gas treatment apparatus for Sterivac™ unit 3M EO Abator 50 / 3M Health Care Co., Ltd.
Verification Organization	Tokyo Metropolitan Government
Test period	Feb. 13, 2004 to Feb. 20, 2004
Purpose of present technology	a. Detoxification of ethylene oxide gas by decomposition using catalytic agents b. Developed as a highly-efficient, compact catalytic device that does not reduce the safety or performance of the 3M Sterivac™ gas sterilizer

1. Summary of the Target Verification Technology



2. Summary of Verification Test

○ Specifications of the Target Verification Apparatus

Item	Specifications and treatment capacity
Model no.	3M EO Abator 50
Dimensions & weight	W 900 mm × D 1,050 mm × H 800 mm, 163 kg
Capacity of compatible sterilizer	115 to 223 L
Compatible sterilizer type	Specially designed for 3M Sterivac™ gas sterilizer

○ Settings for Verification Test Conditions

[Standard EOG treatment test]

	Concentration	Flow rate	EOG volume
Set values	2.9%	87 L/min	Approx. 4.9 g/min

[Treatment test using exhaust gas from ethylene oxide sterilizer simulator]

➤ Pattern B

	Start evacuation	End evacuation	End of cleaning
Elapsed time (min)	15	75	135

3. Verification Test Results

○ Verification Items Regarding Waste-Gas Treatment Performance

◆ Standard EOG treatment test

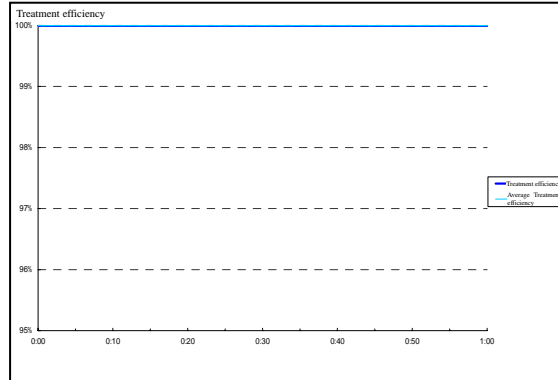
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	27.8°C	178°C
Total EOG	297 g	10 mg
EOG concentration	Average 2.9% Max. 3.1%	0.04 ppm

[Results of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%
Treatment volume per unit time	Average 4.9 g/min Max. 5.2 g/min

[Transition in treatment efficiency]



◆ Treatment test using exhaust gas from ethylene oxide sterilizer simulator

➤ Pattern B

[Treatment time and chamber volume]

Item	Settings
Treatment time	119 min
Chamber volume	150 L

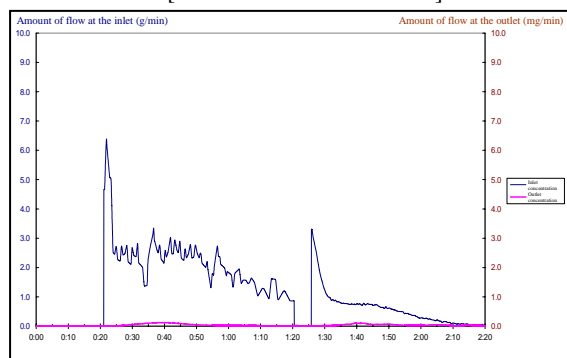
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	22.4°C	145°C
Total EOG	159 g	4.3 mg
Average EOG concentration	-	0.01 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%

[Transition in concentration]



Verification Items Regarding Environmental Load

Item	Verification Result									
CO concentration	Not verified. The target apparatus adopts the catalytic combustion method, therefore CO is not produced when the catalyst is functioning properly.									
NOx concentration	Not verified. The target apparatus adopts the catalytic combustion method, therefore NOx is not produced when the catalyst is functioning properly.									
Secondary products	Not verified. The target apparatus adopts the catalytic combustion method, therefore secondary products are not produced when the catalyst is functioning properly.									
Noise (reference value)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Item</th> <th>During operation of main unit (after correction)</th> <th>Dark noise (background noise)</th> </tr> </thead> <tbody> <tr> <td>L_{Aeq}</td> <td>50 dB</td> <td>47 dB</td> </tr> <tr> <td>L_{Ceq}</td> <td>[68 dB]</td> <td>66 dB</td> </tr> </tbody> </table> <p style="margin-left: 20px;">L_{Aeq}: Equivalent continuous sound level weighted for human auditory characteristics L_{Ceq}: Equivalent continuous sound level with equal weights for all frequencies</p> <p>The main source of noise in the audible range is the fan on the left side of the unit. However, for convenience, the measurement was taken in the extreme vicinity of the apparatus (80 cm), thus the noise produced is not regarded to have a serious effect on the environment. Furthermore, L_{Ceq} was approximately on the same level as the dark noise, and it was concluded to have no effect on the environment at low frequencies.</p> <ul style="list-style-type: none"> ✦ The highest value after correction for noise level among the measurements taken on four sides (front, rear, right, and left of unit) is given as the representative value. ✦ Data in brackets represent noise levels which, after correction for background noise, are within +3 dB of the background noise and are thus considered unreliable. 	Item	During operation of main unit (after correction)	Dark noise (background noise)	L _{Aeq}	50 dB	47 dB	L _{Ceq}	[68 dB]	66 dB
Item	During operation of main unit (after correction)	Dark noise (background noise)								
L _{Aeq}	50 dB	47 dB								
L _{Ceq}	[68 dB]	66 dB								

○ Verification Items Regarding O&M

Item	Standard EOG treatment test	Simulator Waste Gas Treatment Test
		Pattern B (capacity: 50 L)
Electricity consumption	3.65 kWh/60 min. (297 g of EOG)	8.30 kWh/operation (119 min.)
Fuel consumption		Not consumed
Water consumption		Not consumed
Consumption of reactants, etc.		Not consumed

(Qualitative Observations)

Item	Observation
Number of operators and level of operator expertise required for O&M of apparatus	Requires only one operator for operation. No expertise required for normal operation.
Evaluation of O&M instructions manual	Information is provided on the dangers posed by ethylene oxide and the principle of its removal from waste gas. A detailed checklist for installation is given, which should greatly facilitate the installation process. However, the contents appear to be direct translations from the original, and as such there may be some points of confusion among users in Japan (for example the use of inches instead of millimeters, and Fahrenheit instead of Celsius).
Others (such as heat generated by the apparatus)	A significant amount of heat is given off by the apparatus, and the top surface of the apparatus feels hot to the touch during operation. The discharged gas is also hot (~180°C) since it does not undergo heat exchange. The ductworks, however, will be insulated to prevent direct contact with the hot gas.

(Information for Reference)

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○ Product Data

Item		Information provided by environment technology developer		
Name/model no.		EO waste gas treatment apparatus / 3M EO Abator 50		
Name of manufacturer (distributor)		3M Health Care Co., Ltd.		
Contact address	Tel/Fax	int-81-3-3709-8264/ int-81-3-3709-8754		
	Website			
	E-mail	mhoshi@mmm.co.jp		
Dimensions/weight		900 mm × 1050 mm × 800 mm, 163 kg		
Necessity of pre-treatment and/or post-treatment		Not required		
Additional equipment		Ductworks for insulation, a 200-V & 28-A power source		
Requirements for compatible sterilizer models		Specially designed for 3M's Sterivac™ gas sterilizer		
Safety of target apparatus		The status of the apparatus (On/Off, ready, processing, insufficient flow, abnormal temperature, etc.) may be confirmed on the Indicator Panel. In case of catalytic temperature overheating (> 260°C) an alert lamp lights, the valve to the reaction tank closes, and the bypass valve opens.		
Duration of treatment performance		The target gas should not contain components other than ethylene oxide, carbon dioxide, and air, so there shall be no extensive deterioration of the catalytic agent. However, abnormally high temperatures may cause deterioration.		
Restoring from a trouble state		Manually press the Restart button and start operation after warm-up.		
Response in case of emergency		Equipped with power failure countermeasures. Can respond to high-concentration EOG inflow.		
Life of target verification apparatus				
Cost estimation (yen) (Electricity consumption based on measurements by the Verification Organization)		Initial cost (for installation)		
		Price of main unit	1 unit	3,500,000
		Insulation cost	1 set	
		Total		3,500,000
		Running cost		
		Per operation (B)	8.3 kWh	87.9
Per treatment of 100 g of EOG	1.23 kWh	13.0		

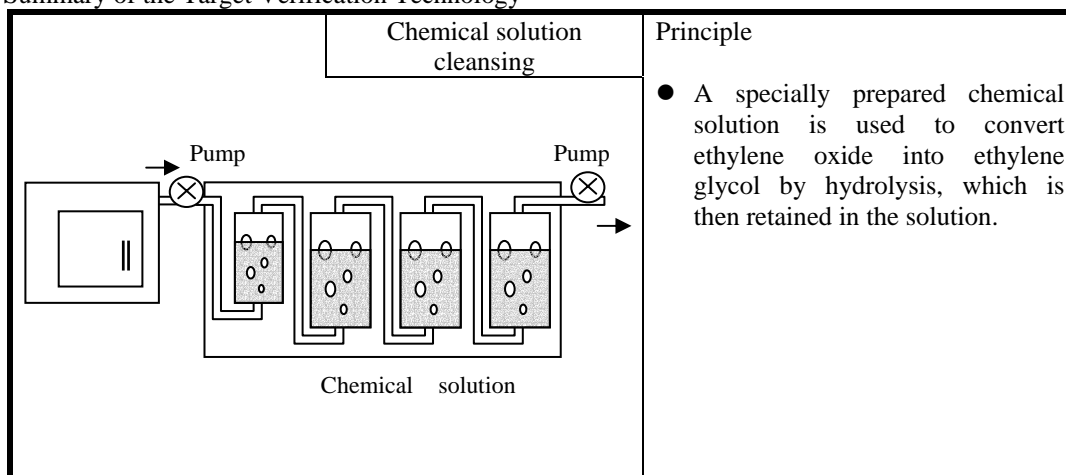
○ Miscellaneous Information Provided by the Manufacturer

Features

- a. When used together with the Sterivac™ gas sterilizer, this apparatus will detoxify EO gas without reducing the performance or safety of Sterivac™.
- b. A single Abator unit can process waste gas from 2 Sterivac™ units.
- c. More than 1000 units are currently used in facilities worldwide due to its easy maintenance and long catalyst life.

Target verification technology /Environmental Technology Developer	Ethylene oxide gas remover CNES-150 / Pax Co., Ltd
Verification Organization	Tokyo Metropolitan Government
Test period	Feb. 20, 2004 to Feb. 27, 2004
Purpose of present technology	a. Allows for safe and speedy treatment of high-concentration ethylene oxide gas through chemical solution cleansing.

1. Summary of the Target Verification Technology



2. Summary of Verification Test

○ Specifications of the Target Verification Apparatus

Item	Specifications and treatment capacity
Model no.	CNES-150
Dimensions & weight	W 696 mm × D 858 mm × H 1,188 mm, 175 kg
Capacity of compatible sterilizer	100 to 150 L
Compatible sterilizer type	Dry-pump types

○ Settings for Verification Test Conditions

[Standard EOG treatment test]

	Concentration	Flow rate	EOG volume
Set values	4.6%	73 L/min	Approx. 6.6 g/min

[Treatment test using exhaust gas from ethylene oxide sterilizer simulator]

➤ Pattern A

	Start evacuation	End evacuation	Start aeration	End cleaning
Elapsed time (min)	39	49	54, 67, 80, 93	106

➤ Pattern B

	Start evacuation	End evacuation	End of cleaning
Elapsed time (min)	18	32	92

3. Verification Test Results

○ Verification Items Regarding Waste-Gas Treatment Performance

◆ Standard EOG treatment test

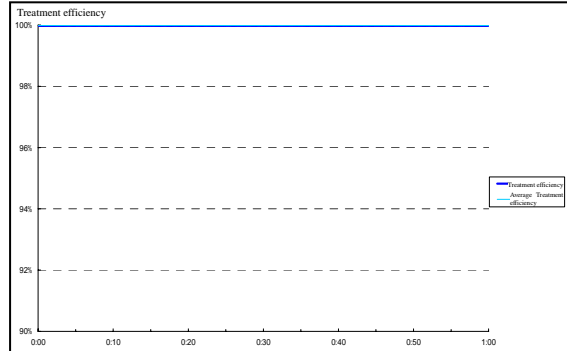
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	30.9°C	38.6°C
Total EOG	397 g	13 mg
EOG concentration	Average 4.6% Max. 4.8%	0.96 ppm

[Results of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%
Treatment volume per unit time	Average 6.6 g/min Max. 6.9 g/min

[Transition in treatment efficiency]



◆ Treatment test using exhaust gas from ethylene oxide sterilizer simulator

➤ Pattern A

[Treatment time and chamber volume]

Item	Settings
Treatment time	74 min
Chamber volume	150 L

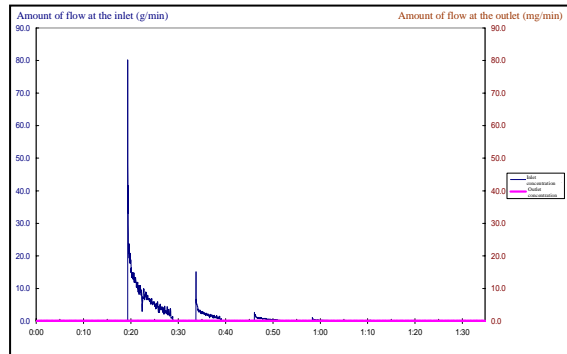
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	25.4°C	35.9°C
Total EOG	91 g	10 mg
Average EOG concentration	-	0.08 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%

[Transition in concentration]



➤ Pattern B

[Treatment time and chamber volume]

Item	Settings
Treatment time	74 min
Chamber volume	150 L

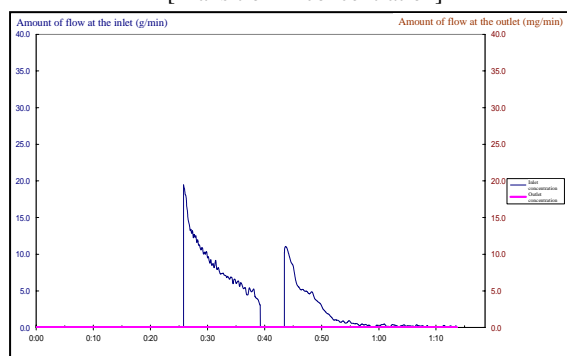
[Results of measurement of parameters at inlet and outlet ducts of target verification apparatus]

Item	Inlet	Outlet
Temperature	12.9°C	28.0°C
Total EOG	163 g	0.3 mg
Average EOG concentration	-	0.03 ppm

[Result of performance evaluation]

Item	Performance evaluation value
Treatment efficiency	> 99.9%

[Transition in concentration]



Possibility of Ethylene Oxide Remaining in Apparatus

In the present apparatus, EOG may remain inside the chemical solution tank. Therefore, after the test for standard EOG treatment was conducted, measurements were taken of the discharged gas with an influx of air rather than the standard EOG gas.

The results obtained showed that while the average concentration of EOG in discharged gas during the test was 0.96 ppm, it rose to 1.62 ppm after termination of standard EOG gas influx. However, after the test for Pattern A and termination of EOG waste gas influx, the readings of the EOG detector at the outlet duct were below the detection limit (0.1 ppm). Thus, it is concluded that the danger of residual or revitalization of EOG is minimal under normal operational conditions.

○ Verification Items Regarding Environmental Load

Item	Verification Result									
CO concentration	Not verified. The target apparatus adopts the chemical solution cleansing method; therefore CO is not produced when the catalyst is functioning properly.									
NO _x concentration	Not verified. The target apparatus adopts the chemical solution cleansing method; therefore NO _x is not produced when the catalyst is functioning properly.									
Secondary products	<p>Pattern A 50 g of ethylene glycol confirmed in solution (corresponds to 35 g of ethylene oxide: total EOG influx is 91 g)</p> <p>Pattern B 187 g of ethylene glycol confirmed in solution (corresponds to 132 g of ethylene oxide: total EOG influx is 163 g)</p> <p>Note: The small value of recovered ethylene glycol relative to total EOG influx is most likely the result of non-uniform sampling. The recovery rate in the laboratory was 95%</p>									
Noise (reference value)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Item</th> <th>During operation of main unit (after correction)</th> <th>Dark noise (background noise)</th> </tr> </thead> <tbody> <tr> <td>L_{Aeq}</td> <td>56 dB</td> <td>48 dB</td> </tr> <tr> <td>L_{Ceq}</td> <td>[66 dB]</td> <td>65 dB</td> </tr> </tbody> </table> <p>L_{Aeq}: Equivalent continuous sound level weighted for human auditory characteristics L_{Ceq}: Equivalent continuous sound level with equal weights for all frequencies</p> <p>Since L_{Aeq} and L_{Ceq} levels are lower than the dark noise, they have no effect on the environment.</p> <ul style="list-style-type: none"> ✦ The highest value after correction for noise level among the measurements taken on four sides (front, rear, right, and left of unit) is given as the representative value. ✦ Data in brackets represent noise levels which, after correction for background noise, are within +3 dB of the background noise and are thus considered unreliable. 	Item	During operation of main unit (after correction)	Dark noise (background noise)	L _{Aeq}	56 dB	48 dB	L _{Ceq}	[66 dB]	65 dB
Item	During operation of main unit (after correction)	Dark noise (background noise)								
L _{Aeq}	56 dB	48 dB								
L _{Ceq}	[66 dB]	65 dB								

○ Verification Items Regarding O&M

Item	Standard EOG treatment test	Simulator Waste Gas Treatment Test	
		Pattern A (capacity: 50 L)	Pattern B (capacity: 50 L)
Electricity consumption	1.22 kWh/60 min. (397 g of EOG)	1.65 kWh/operation (74 min.)	1.65 kWh/operation (74 min.)
Fuel consumption	Not consumed		
Water consumption	Not consumed		
Consumption of reactants, etc.	Since the present verification did not test the apparatus to its break point, the volume of spent reactant for a single operation is unknown.		

(Qualitative Observations)

Item	Observation
Number of operators and level of operator expertise required for O&M of apparatus	Requires only one operator for operation. No expertise required for normal operation.
Evaluation of O&M instructions manual	Operation is simple and easy to understand for normal operation. The manual contains numerous figures, showing that consideration was given to the users in the preparation of the manual.
Others (such as heat generated by the apparatus)	In the present verification test, the internal pressure was balanced by placing 2 dry pumps, one at the intake and another at the outlet duct of the apparatus, for ventilation. The pressure balance is created by installing external air intakes (with check valves) at the intake and outlet duct of the apparatus.

(Information for Reference)

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○ Product Data

Item		Information provided by environment technology developer		
Name/model no.		Ethylene oxide gas remover / CNES-150		
Name of manufacturer (distributor)		Pax Co., Ltd		
Contact address	Tel/Fax	int-81-3-3244-0509/int-81-3-3244-0509		
	Website	http://www.pax-eco.com		
	E-mail	pax@pax-eco.com		
Dimensions/weight		696 mm × 858 mm × 1,188 mm, 175 kg		
Necessity of pre-treatment and/or post-treatment		Treatment of ethylene glycol (secondary product)		
Additional equipment		A dry pump must be attached to the outlet duct.		
Requirements for compatible sterilizer models		Restricted to dry-pump types		
Safety of target apparatus		Since the present apparatus adopts a chemical solution cleansing method, there is no heat source. Thus, the danger of explosion is minimal. When a problem such as a blocked pipe, etc. causes the internal pressure to rise above a preset value, an emergency bypass vent is opened to release EOG directly from the apparatus.		
Duration of treatment performance		The catalyst contained in the chemical solution is not consumed. However, the ethylene glycol produced by hydrolysis causes reduced reactivity and increased viscosity. The evaporation of solution also leads to lowering of the solution level, and so the chemical solution must be replaced periodically. The manual instructs the user to replace the chemical solution tank once a month, and failure to follow this will reduce the consistency of treatment.		
Restoring from a trouble state		In case of automatic shutdown in an emergency situation, determine and remove the cause of the trouble state before pressing the Start Operation button to restart operation.		
Response in case of emergency		Equipped with power failure countermeasures. Can respond to high-concentration EOG inflow.		
Life of target verification apparatus		Approx. 6 years after installation		
Cost estimation (yen) (Electricity consumption based on measurements by the Verification Organization)		Initial cost (for installation)		
		Price of main unit	1 unit	4,200,000
		Total		4,200,000
		Running cost		
		Per operation (A)	1.65 kWh	26
		Chemical solution		1,535
		Total		1,561
		Per operation (B)	1.52 kWh	24
		Chemical solution		1,535
		Total		1,559
Per treatment of 100 g of EOG	0.31 kWh	5		
Chemical solution		1,535		
Total		1,540		

○ Miscellaneous Information Provided by the Manufacturer

Features

- a. No danger of explosion
- b. Can process large volumes of high-concentration EOG
- c. Starts up immediately
- d. May be adapted to work with various types of sterilizers

V. Concluding Remarks

The present pilot project will be continued into fiscal year 2004 and beyond. If necessary, changes and additions may be made to the items and contents of the verification test. The latest information and details of the modifications will be posted on the project's website (<http://etv-j.eic.or.jp>).