

Success of “Voluntary Emissions-Reduction Programs” in reducing VOCs emissions in Japan

What are VOCs ?



VOCs stands for “Volatile Organic Compounds”. Examples are toluene, xylene and ethyl acetate which are found in paint, printing ink, glue, detergent, gasoline or paint thinner, which are commonly known substances. Photochemical reactions involving these substances is considered to be one of the causes of photochemical smog.

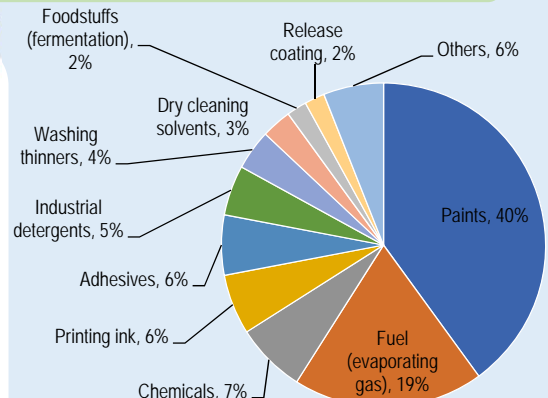


Figure: Sources of VOCs in FY 2014

(Source) Ministry of Environment Japan “VOCs Emissions Inventory”

Why do we have to reduce VOCs emissions ?



When VOCs are emitted into the atmosphere, photochemical oxidants are formed in the lower atmosphere through photochemical reactions which **cause photochemical smog**. Smog is **harmful to people’s health**. Besides VOCs, substances like NO_x , SO_2 or NH_3 are also known as components of photochemical smog. Besides smog, VOCs also cause health hazards including **sick building syndrome (SBS)** and **multiple chemical sensitivity (MCS)** in working environments and housing spaces.

To reduce emissions of VOCs...

In FY 2010, emissions were reduced by more than 40% compared to FY 2000 ! (the target was 30%)

Legal regulations

For the following six facility types, a minimum threshold for ventilation capacity was introduced. Reference values for VOCs concentration levels were established for facilities in which these thresholds are exceeded.

- Manufacturing facilities for chemical goods
- Painting and coating facilities
- Glue-related facilities
- Printing facilities
- Facilities using industrial detergents
- VOCs storage

VOCs Voluntary Emissions-Reduction Programs

Industries and companies can voluntarily create plans to take measures that suit their own circumstances.

Industry groups set their target for emissions reductions in their VOCs Voluntary Emissions-Reduction Programs. Members of the industry group implemented actions that suited them and worked together with others by sharing effective methods for reducing VOCs emissions.

Let us show you some examples of the voluntary efforts



In the revised Air Pollution Control Act (implemented from April 2006), the reduction of VOCs emissions is promoted through the combination of legal regulations and the VOCs Voluntary Emissions-Reduction Programs.

Effect of the Voluntary Emissions-Reduction Programs?

"Results" shown in numbers

About 0.182 million tons of VOCs emissions were covered by the voluntary emissions-reduction programs in 2014, which was 66% less than the figure in 2000. The total amount of VOCs emissions in Japan for 2014 was 0.692 million tons. The reduction rate for the same period was 50%, demonstrating that the programs had an outstanding effect.

By reducing VOCs emissions, the program not only contributes to air pollution control, but has also positive impacts on the points listed on the right.

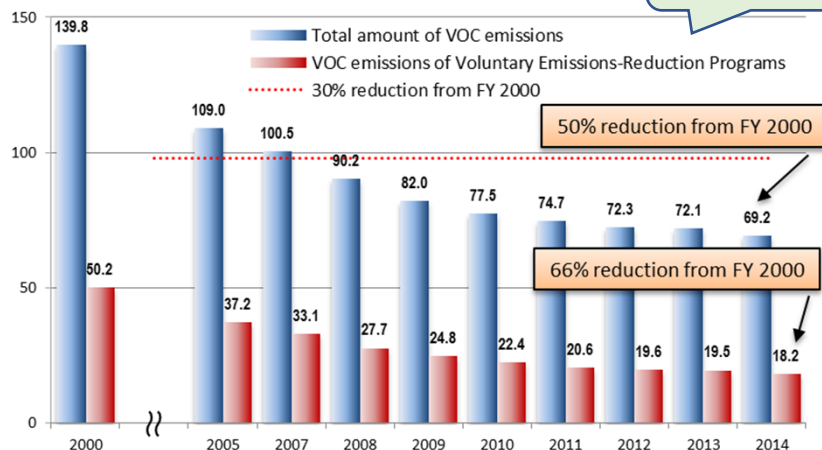


Figure: VOCs emissions in units of 10,000 tons VOCs
(Source) Voluntary Emissions-Reduction Programs

Costs	• Saving raw material expenses by avoiding evaporation of products containing VOCs
Work environment	• Reducing odor and hazardous gases • Less risk of fire and other hazards
Neighborhood	• Less trouble with local residents due to odor
Public evaluation	• Efforts count towards corporate social responsibility

Here are some voluntary efforts by companies

Case 1 : Change to VOCs-free Material

Chemistry

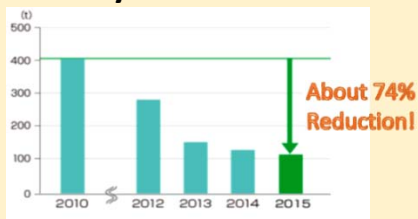
Company : A Ltd.
Industry : Chemistry

VOCs reduction target processes

- Metal and rubber adhesives
- Cleaning process for urethane foam products
- Coating process

Effects

● **Usage of chlorine-based VOCs: Reduced by 74% from 2010-2015 !**



(Source) Company A

- **Reduced risk !**
- **Improve working environment !**

Key efforts

● Change to water-based adhesives

Developed an emulsion adhesive in cooperation with an adhesive manufacturer and changed from organic solvents to water-based adhesives. This required new drying equipment, but in some cases it can be achieved without the equipment, if the process is reviewed appropriately.

● Change to VOCs-free detergent

The reduced cleaning power of the VOCs-free detergent is compensated by buying stock parts and bathing the parts in warm cleaning water for several hours.

● Change to original water-based paint

[Main challenges !]

- Purchase drying equipment and spare parts
- Review of processes
- Obtain approval from customers to use new material



Case 2 : Development of portable VOCs-decomposition equipment

Car maintenance

Company : B Ltd.

Industry : Coating line of automobiles and other products

VOCs reduction target processes

- Open-air paint and body work

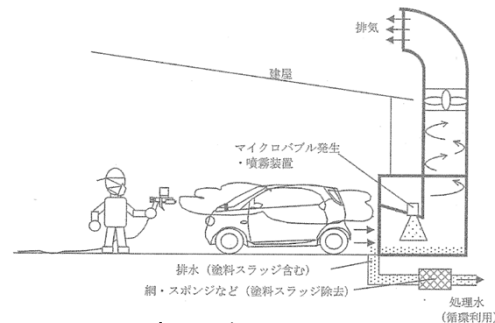
VOCs decomposition Scrubber (purchase available)

- Emission volume: 95m³ / minutes (1.5kW)
- Price: Bellow 3 million yen
- Maintenance: no absorbent, no chemical agent, (water, electricity, waste treatment are necessary)
- Compared to ordinary scrubber, water and energy cost is about one third, and total cost including maintenance and installation is about one third.

Key efforts

- Installation of the in-house-developed VOCs-decomposition scrubber
Installed a suction hood adjacent to car parts and body coating workspace. Placed a in-house-developed microbubble generator into the hood (cost about 4 mil. yen). This device decomposes the VOCs in exhaust gas.

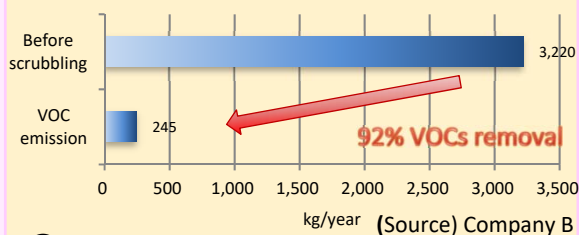
Pic: Scrubber



(Source) Company B

Effects

- Cut VOCs emissions by 92% with the installation of the scrubber and other efforts. (2008)



- Better working environment due to less odor.
- Patent for the scrubber (sold over 30 devices)
- Demand in overseas and other industries (e.g. steel industry) and need in other process are also prospected.

- Making a new painting area

New painting area can generate air flow in the direction from ceiling to floor and absorb air including VOCs in the floor. This absorbed air is appropriately treated by water scattering and microbubble. In addition to cleaning air in a new painting area, this new area also contributes to the improvement of working environment in adjacent workspace because this room also absorbs air in that workspace.



New Painting Area

(Source) Company B

Case 3 : Gasoline Vapor

Company : C Ltd.
Industry : gas station

First step

Company C explored if installation of VOCs recovery facility could gain return through receiving subsidies from the government and business circle.

VOCs reduction target process

- Vapor during fueling at gas station
- Vapor in unloading from tank truck into underground gas tank.

Effects

- **Economic benefit from recovery at gas station**
—100 -300 thousand yen / year by fueling recovery
—Average recovery rate in unloading is 0.1 %. Initial investment cost is expected to be recovered in 7-8 years.

【Attention!】

- Investment recovery may be difficult at low sales gas station and in cold regions.



Key efforts

● Installed new fueling facilities with vapor recovery for fueling

Installed 7 new facilities for fueling vapor reduction. Each unit costing 2.7 million yen.



Vapor recovery facility

(Source) Company C

● Installed vapor recovery system for unloading.

Installed 10 new facilities for unloading vapor reduction. Each costing 7 million yen.



Unloading from truck

Recovery facility

(Source) Company C

Case 4 : Improvement of the process with alarm and awareness

Company : D Ltd.

Industry : Offset printing

Background

Company D tried to get "green printing certification to differentiate his products. It raised green awareness, initiating various VOCs reduction efforts.

VOCs reduction target process

- Offset printing
- Volatilizing from solvent and waste

【Challenge !】

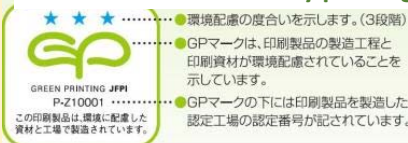
- Cost for alarm
- Increase in cost for materials
- Worsening of Work efficiency



Effects

- Half solvent use!
- Got certification of green printing

GP mark is for eco-friendly printing



- Enhancement of workers' safety-consciousness (all workers wearing masks)

Key efforts

● Introduction of alarm

Installed nine VOCs detection alarms (ringing over 200ppm). Each costing 40,000 yen.

"This enabled workers to understand which action leads to an increase in VOC density, which could reduce emissions."



VOC alarm

● Capacity Building for workers

Workers received technical training on how to deal with organic solvents, enhancing understanding of VOCs.



● Review on solvent distribution and delivery cycle

Easy management of solvents led to reduction of VOCs. Installed storage tank with cover for waste.



Storage tank with cover

● Change of solvent

Changed solvent to an environmentally better one.

● Advise from experts

Above action was advanced with free advice from experts dispatched by Tokyo local government.



New solvent

Case 5 : Change paint and painting process

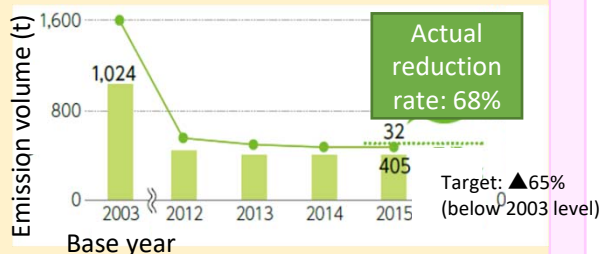
Company : E Ltd.
Industry : Automobile parts

VOCs reduction target process

- painting process
- coating process

Effects

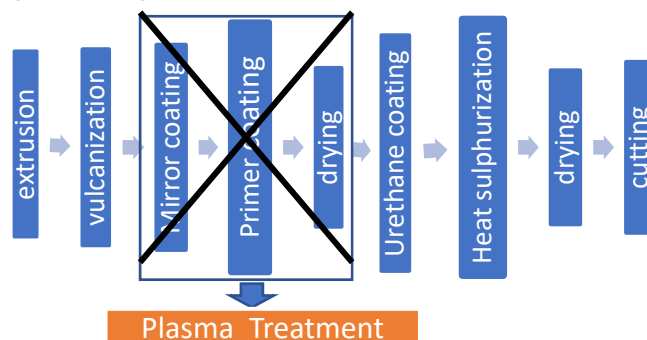
- VOCs emission was reduced by 68 % in 2015 FY compared to 2003 FY.



(Source) Company E

Key efforts

- **Change constituent of paint**
Developed 100% silicon coating material (no solvent)
- **Change painting process**
Installed plasma treatment facility.
(process improvement)



- Introduction of water based painting and UV painting
- Adoption of water based release agent (no solvent use)

Case 6 : Installation of eco-friendly devices

Company : F Ltd.
Industry : Offset printing

VOCs reduction target processes

- Offset printing (especially printer cleaning)
- Volatilization from stock solutions and waste cloth

Effects

- ISO14001 certification
- VOCs emissions reduced by about 2/3 in 3 years from 30ppm to 10ppm
- Improvement of employee awareness

Key efforts

- Employee education on risks and the need to control VOCs, i.e. sealed containers.
- Installation of a new detergent dispenser which sprays the proper quantity.
- Measure the VOCs concentration every two weeks with a new device and keep the concentration below 200ppm.
- Installation of UV printers. Mainly for improving production efficiency but with a positive effect on VOCs emissions reduction.



Making employees awarded



New detergent can

(Source) MRI

Case 7 : Installation of VOCs disposal facility

Company : G Ltd.

Industry : soft packaging gravure printing

VOCs reduction target process

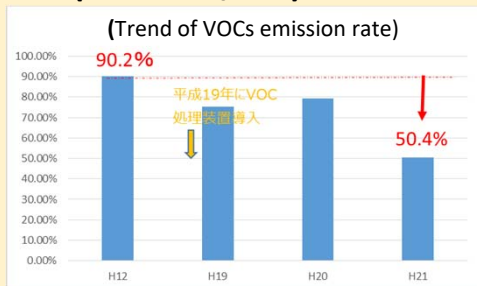
- gravure printing
- dry laminate printing

[Challenge !]

- High initial investment cost for VOCs disposal facility (270 million yen)
- Increase in maintenance cost

Effects

● Reduction of VOCs emission rate (emission/use)



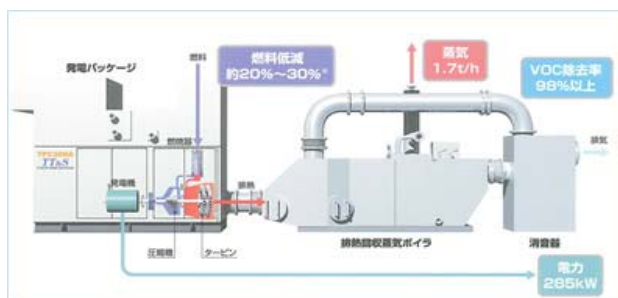
(Source) Company G

- Save energy cost
- Improvement of workers' environmental consciousness

Key efforts

● Installed micro gas turbine VOCs disposal facility

Burning VOCs in exhaust gases at high temperatures. Can conserve electricity and steam.



(Source) Company G

- Installed catalyst device
This could dispose residual VOCs after burning.
- Developed gravure proof printing
This conserved film, ink, energy and time.
- added covers to a printing facility
- Storage of waste with cover

Case 8 : Adoption of no solvent powder paint

Company : H Ltd.

Industry : Construction

VOCs reduction target process

- Finishing process of aluminum curtain wall

Effects

- Reduction of VOCs by using no solvent powder paint
- Adoption of low temperature painting can reduce CO2 emissions during painting.

Key efforts

- Adoption of powder paint
Baking paint is generally used as a finishing process of aluminum curtain walls, but a no solvent powder paint was adopted on a large scale.



Inspection of aluminum curtain wall

(Source) Company H

Characteristics of the Japanese VOCs Voluntary Emissions-Reduction Programs

Legal regulations (direct or as frameworks), economic instruments and voluntary efforts are representative instruments for environmental policies. There are justifiable concerns that voluntary efforts don't have similar binding power to legal regulations for companies, but there are advantages related to costs and applicability to individual circumstances.

	Legal regulations	Economic instruments	Voluntary efforts
Overview	Restrictions and regulations	Taxes, Surcharges, Subsidies, Emissions trading	Voluntary approach, Negotiated agreements etc.
Pros	<ul style="list-style-type: none"> • Penalties for not following restrictions • Less margin for injustice • Predictable effects 	<ul style="list-style-type: none"> • Economic efficiency and ecological effectiveness • Decision making limited only by budgetary constrains • Motivation for continuous efforts 	<ul style="list-style-type: none"> • Lower operation and monitoring costs • Better fit to individual circumstances • Increased awareness of employees
Cons	<ul style="list-style-type: none"> • High costs of legal action • inflexibility • Possible economic damage 	<ul style="list-style-type: none"> • Decrease in economic competitiveness with increased production costs • Taxes can be a heavy burden for low-income households • Less public acceptance and understanding 	<ul style="list-style-type: none"> • Companies independently set their goals, which results in different goals for companies with different levels of commitment.

Efforts to reduce VOCs emissions have had a great impact in Japan ! !

In Japan's approach to decreasing VOCs emissions, the VOCs Voluntary Emissions-Reduction Programs plays a significant role. It started in 2005 with 22 organizations participating. In 2014 the program included 40 organizations with 7,300 participating companies.

■ CONTACT ■

METI Industrial Science and Technology Policy and Environment Bureau, Environmental Protection Guidance Office

1-3-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8901
 TEL 03-3501-4665 URL <http://www.meti.go.jp/>

Japan Environmental Management Association for Industry

Mitsui-Sumitomo Bldg. 6F/7F 2-2-1 Kaji-cho, Chiyoda-ku, Tokyo 101-0044
 TEL 03-5209-7707 URL <http://www.jemai.or.jp/>