

The Fluorocarbon-Free Option for the sake of the planet

Fluorocarbon - Free

Thermal Insulation

~Rigid urethane foam~



Ministry of the Environment



Ministry of the Environment
JAPAN

The Fluorocarbon-Free Option

The Fluorocarbon-Free Option - for the sake of the environment

Climate change has become a serious problem. To help solve this problem, we have the option to purchase products that do not use fluorocarbons, "Fluorocarbon-free products"

What are Fluorocarbons?

Various types of fluorocarbons are used in various applications

Fluorocarbons are composed of Fluorine and Carbon. Fluorocarbons have many advantages such as being hard to burn, chemically stable, easy to liquefy and safe to humans. Because of this, they have become used widely as refrigerants, which carry heat in air-conditioners, mobile air-conditioners, refrigerators, vending machines, drinks coolers, freezer showcases and water coolers. They are also used as foam agents for insulation, cleaning agents for semiconductors and precision components and propellants for aerosols such as air dusters. There are many types of fluorocarbons; the first type was CFCs, followed by HCFCs and then HFCs.

Types of Fluorocarbons

- CFCs (Chlorofluorocarbons)

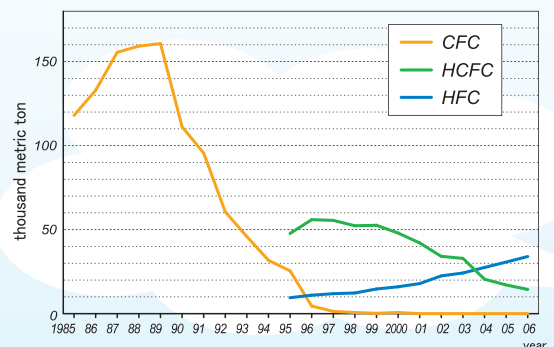
Compounds of Carbon, Fluorine and Chlorine

- HCFCs (Hydrochlorofluorocarbons)

Compounds of Carbon, Fluorine, Chlorine and Hydrogen

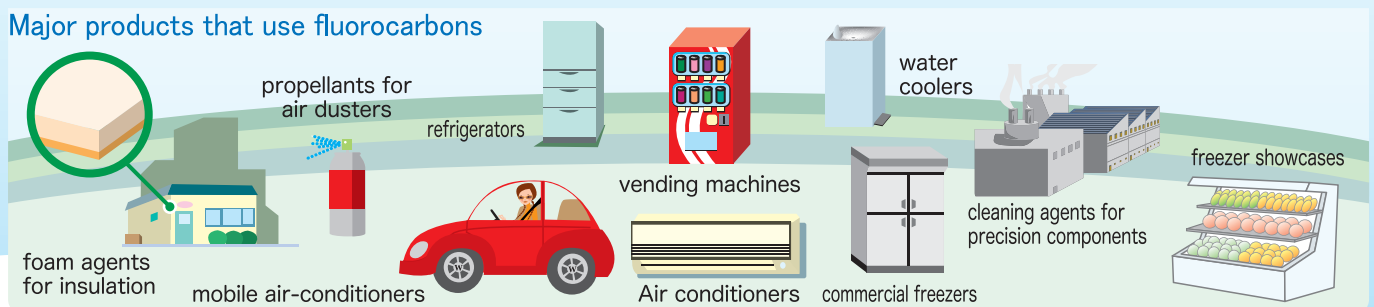
- HFCs (Hydrofluorocarbons)

Compounds of Carbon, Fluorine and Hydrogen



Fluorocarbons shipments in Japan
Based on data of Japan Fluorocarbon Manufacturers Association

Major products that use fluorocarbons

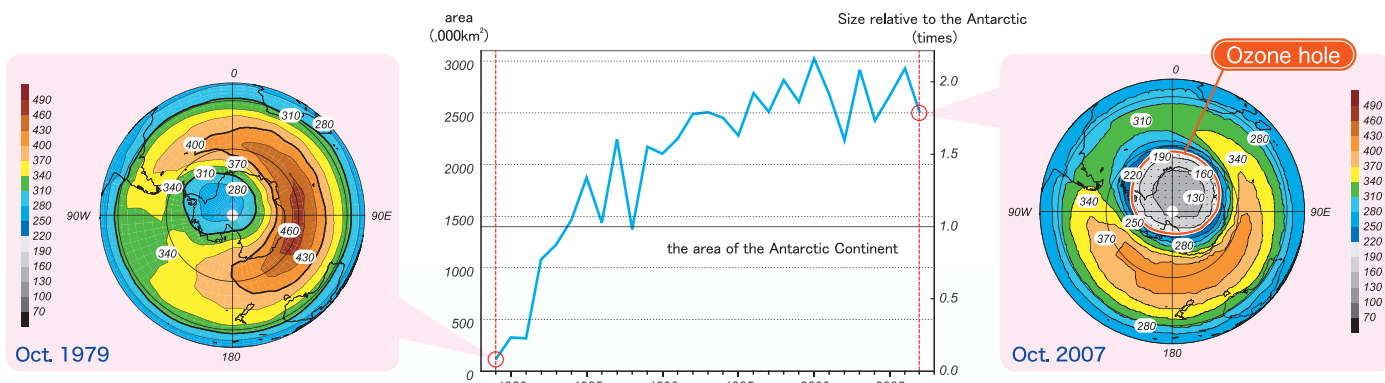


However, Freons are a cause of climate change and ozone layer depletion!!

Ozone Layer Depletion

Ozone layer depletion continues unabated

The Ozone Layer is 10-50km above the Earth's surface and absorbs harmful UV rays from the Sun. However, CFCs and HCFCs which are emitted into the air reach the ozone layer and decompose ozone by chemical reactions. The depletion of ozone above the Antarctic is so serious that in September - October each year the ozone density decreases drastically. This is called "Ozone Hole", because it looks like a hole in the sky. Still now, there is no clear sign of recovery of the Ozone Hole.



Chronological change of the size of the ozone hole and the distribution of the ozone above the Antarctic in October
Source: Japan Meteorological Agency Ozone Layer Observation Report 2007

Impact on Climate Change

Fluorocarbons are about 100-10,000 times stronger greenhouse gases than CO₂

Currently, climate change caused by man-made emissions of CO₂ is becoming more and more serious. Climate change is not only caused by CO₂. Fluorocarbons such as CFCs, HCFCs and HFCs also have strong greenhouse effects. Their impact on climate change is known to be extremely strong – ranging from a hundred times to over ten thousand times stronger than CO₂. For example, fluorocarbons used in air-conditioners and mobile air-conditioners are more than 1,000 times stronger greenhouse gases than CO₂. If 1 kg of fluorocarbons are emitted into the air accidentally, they will have the equivalent impact of more than 1 ton of CO₂.

Geographical pattern of surface warming

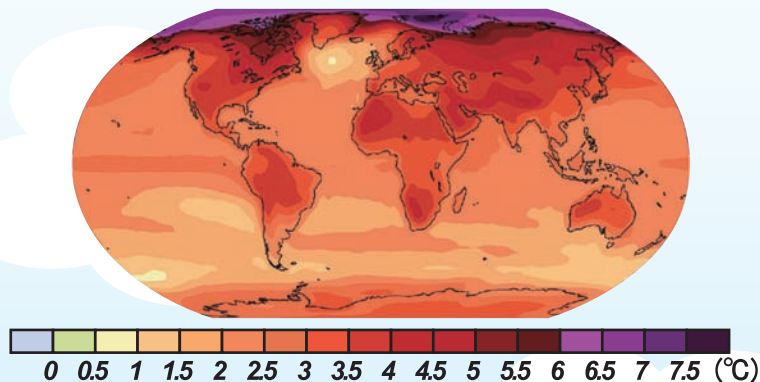


Figure : Projected surface temperature changes for the late 21st century (2090-2099). The map shows the multi-AOGCM average projection for the A1B SRES scenario. Temperatures are relative to the period 1980-1999.

Figures have been taken from IPCC third assessment report (2007)

Global warming potentials of CFC, HCFC and HFC (in comparison with CO₂ at equal weight)

1

CO₂

124

HFC-152a

1430

HFC-134a

1810

HCFC-22

4750

CFC-11

10900

CFC-12

14800

HFC-23

Figures have been taken from IPCC third assessment report (2007)

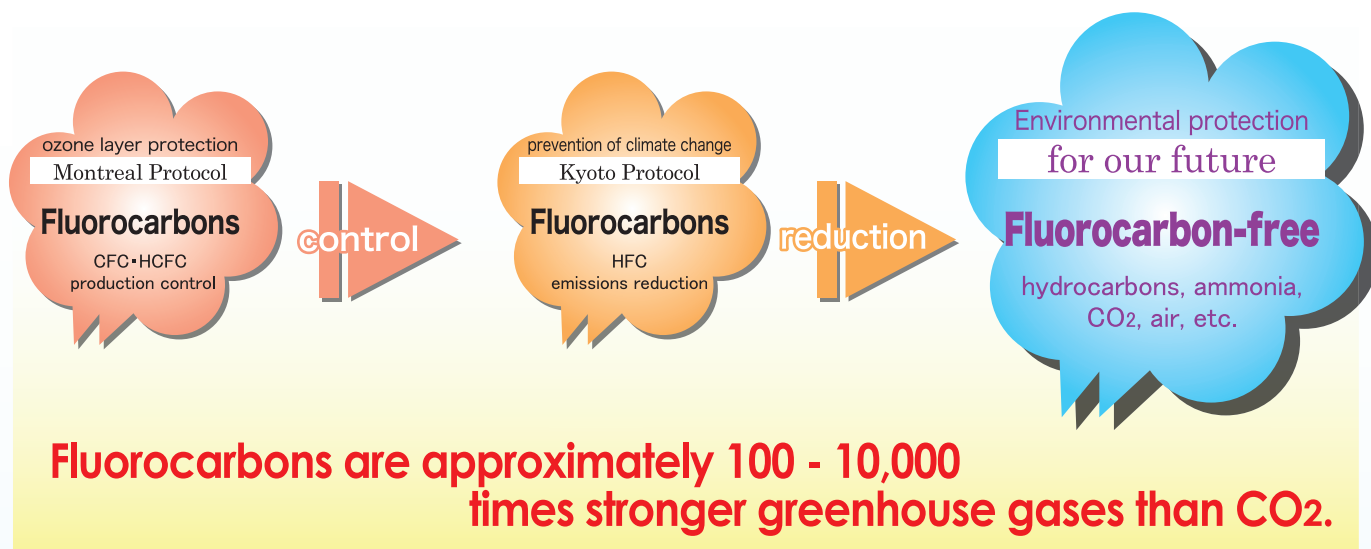
Global Developments in Action on Fluorocarbons

The world is moving forward to prevent climate change and protect the ozone layer

When ozone layer depletion was recognized as a global environmental problem caused by fluorocarbons, the "Montreal Protocol on Substances that Deplete the Ozone Layer" was adopted, under which production of CFCs has been completely phased out in developed countries including Japan. Global actions are also being taken for the phase-out of production of HCFCs, which were introduced as the alternatives to CFCs.

In addition, HFCs, the alternative to CFCs and HCFCs, are controlled under the "Kyoto Protocol" because they have a significant impact on climate change though they don't have any impact on ozone depletion.

In order to protect the ozone layer and prevent climate change, various measures are taken in Japan, including recovery and destruction of a fluorocarbons in equipment such as refrigerators and air-conditioners, and promotion of the use of alternative products.



Choose Fluorocarbon-Free Products

Our choices will change the future

Since fluorocarbons are a cause of climate change and ozone depletion, alternative technologies and products that do not use fluorocarbons are being developed. In Japan, to promote these products, government agencies are obliged to use fluorocarbon-free products in accordance with the "Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing)" and the government provides subsidies to encourage companies to adopt fluorocarbon-free products.

Fluorocarbon-free products are being developed and marketed in many areas. In this pamphlet, we will introduce **Fluorocarbon-Free Thermal Insulation ~ Rigid urethane foam ~**. Please carefully consider whether you can choose a fluorocarbon-free product for the sake of the environment.

Take a step towards combating climate change by choosing fluorocarbon-free products.



Label for
Fluorocarbon-Free
Products



Fluorocarbon-Free Thermal Insulation • •

What is thermal insulation?



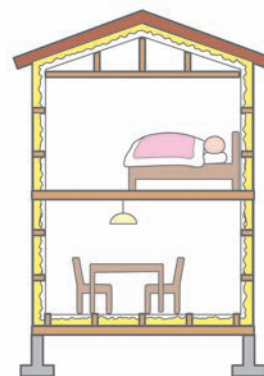
Recently, highly insulated houses that improve the efficiency of heating and cooling are getting popular. Improving the insulation performance of buildings is also desirable as a measure to prevent climate change.

There are many types of thermal insulation, and some foam plastic insulation uses fluorocarbons.

Fluorocarbons are harmless, odorless, and make fine bubbles in plastic, yielding high insulation performance, leading to the use of significant amount of fluorocarbons in this application.

However, fluorocarbons emitted from this insulation deplete the ozone layer and contribute to climate change. For this reason, today foam plastic insulation freeing itself from fluorocarbons and insulation such as extruded polystyrene, high expanded polyethylene and phenolic foam, which historically depend on fluorocarbons, are now almost fluorocarbon-free.

However, in the field of rigid urethane foam insulation, the use of fluorocarbon HCFC141b has been greatly reduced and replaced mainly with HFCs. In 2006, almost 6,000 tons (around 5.6 million tons of CO₂ equivalent) of HFCs were newly used, part of which was emitted during manufacturing and the rest of which will be gradually emitted over a long period of time. Most of the HFCs used are HFC245fa and HFC365mfc. Although these two types of HFCs are not targeted under the Kyoto Protocol, their use must be reduced to prevent climate change as they are still powerful greenhouse gases.



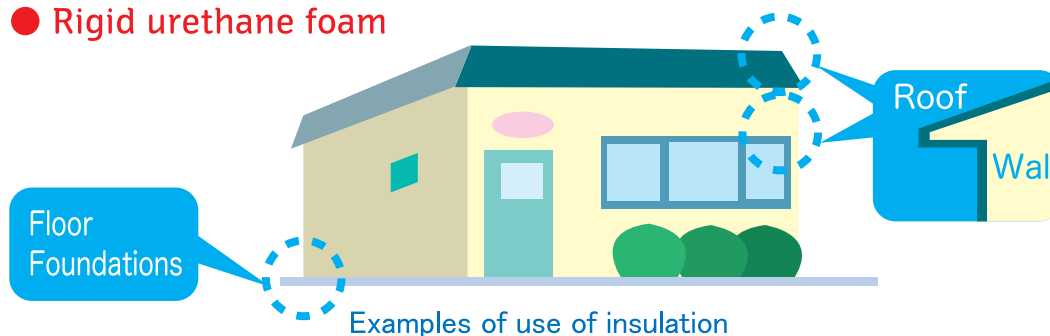
Major insulation types

Completely or almost fluorocarbon-free

- Non-foam-plastic insulation (Glass wool etc.)
- Extruded polystyrene foam
- Phenolic foam
- High expanded polyethylene foam
- Expanded polystyrene foam

Using fluorocarbons

- Rigid urethane foam



The focus of this pamphlet is rigid urethane foam insulation, for which it is particularly desirable to be fluorocarbon-free.

Fluorocarbon-Free Rigid Urethane Foam Insulation • • • • •

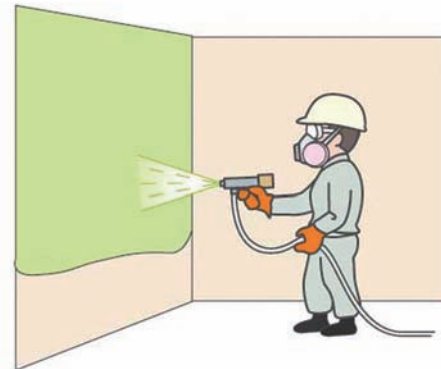
There are two types of rigid urethane foam: sprayed on site (Sprayed-Type) and formed in factories (Pre-formed). Fluorocarbon-free products are commercially available for both types.

Fluorocarbon-free sprayed-type rigid urethane foam

An insulation layer is formed and integrated with the building materials by using a blowing agent on site, taking advantage of the product's self-adherence properties.

Fluorocarbon-free sprayed type rigid urethane foam includes the method of spraying CO₂ directly as a blowing agent and the method of reacting chemical substances with water to produce CO₂ to create foam.

As a sprayed-type, the foam does not have joints, which are a cause of heat loss, and is quick and simple to install, this type represents a major part of rigid urethane foam insulation. However, fluorocarbon-free sprayed-type insulation represents around just 10% of the domestic market.



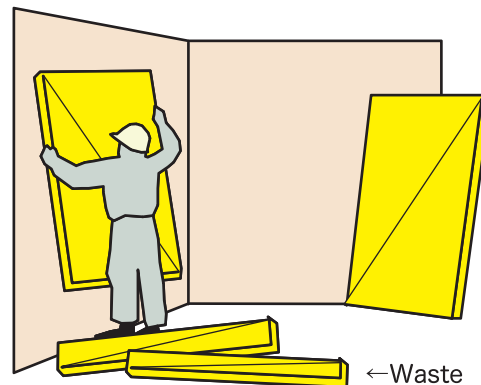
Application on site

< Usage Example >

Housing complexes and factories etc.

Fluorocarbon-free pre-formed rigid urethane foam

At the factory compounds such as cyclopentane are reacted with urethane to create foam. The shipment amount of pre-formed foam is less than that of site-applied foam, most of the factory-made foam has now been replaced with fluorocarbon-free alternatives.



Boards are attached to concrete walls

< Usage Example >

Detached houses and vending machines etc.



※For Sprayed-type rigid urethane foam, since fluorocarbon-free products have a lower insulation performance than fluorocarbon-based products, a thicker layer is required. Also, for both sprayed-type and pre-formed rigid urethane foam, special treatment and equipment is required in some cases, leading to relatively higher cost at present.

Major National Policies • • • • •

Several Policies are Underway to Promote the Use of Fluorocarbon-Free Building Insulations

1) Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing)

In accordance with the Law on Promoting Green Purchasing, evaluation criteria and factors for consideration in procurement of specific products are specified in the "Basic Policy on the Promotion of Procurement of Eco-friendly Goods"

The evaluation criteria and factors for consideration for insulation for public works are shown in the table below. Government entities must fulfill the evaluation criteria and consider the factors for consideration when purchasing thermal insulation.



Evaluation criteria and factors for consideration in the Law on Promoting Green Purchasing

| | |
|---------------------------|--|
| Evaluation criteria | Materials that prevent loss of heat through the outer walls of buildings, and meet the criteria below. |
| | ① May not use materials harmful to the ozone layer. |
| | ② May not use hydro-fluorocarbons (replacement carbon). |
| | ③~④ Omitted |
| Factors for consideration | Insulation materials made of plastic foam must maintain long term insulation performance, and use materials that have a global warming potential that is as small as possible. |

Source: Basic Policy on the Promotion of Procurement of Eco-friendly Goods (Partly revised by the Cabinet on 5th February 2008)

2) Revision of Japanese Industrial Standards (JIS)

In 2006, JISs concerning sprayed-type rigid urethane foam for building insulation (JIS A 9526:2006R) and foam plastic insulation materials (JIS A 9511:2006R) were successively revised. This makes the type of blowing agent used easy to identify and the wider uptake of fluorocarbon-free products can be expected.

Type A: Products that use, as blowing agents, hydrocarbon and carbon dioxide (CO₂) etc., not fluorocarbons*

Type B: Products that use fluorocarbons as blowing agents

* In the case of JIS A 9526, carbon dioxide (CO₂) only

3) Revision of Public Works Standard Specifications

In February 2007, the "Public Works Standard Specifications" and "Public Works Standard Specifications for Repair Works" were revised. In accordance with the revision in JISs, it was clearly specified that, unless there are special circumstances, fluorocarbon-free (JIS Type A) products should be used in methods for placing insulation in reinforced concrete in interior construction and also methods for spraying foams in public works. It is expected that due to this revision the uptake of fluorocarbon-free insulation will be accelerated in public works.

4) CASBEE: Comprehensive Assessment System for Building Environmental Efficiency

The CASBEE system is being developed and promoted by the Ministry of Land, Infrastructure and Transport to improve energy efficiency and reduce the environmental impact of houses and other buildings. CASBEE is a comprehensive system to assess the environmental performance of buildings. One of the assessment items is "avoidance of fluorocarbons and halons", in which fluorocarbon-free insulation is ranked at the highest level 5 for being an environmentally friendly product.

In building a house, while it is important to improve insulation performance, it is also important to choose fluorocarbon-free insulation to gain further climate benefit.



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