How to decontaminate

Fluorinated Gases in Insulation Foams

EDI
European
Decontamination
Institute

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1. Presentation

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Dear reader

The first session of the Working Group Hazardous Substances of the EDI in 2025 dealt with the topic of F-gases in insulation foams.

From 1 January 2025, building owners and contractors must ensure emissions are minimised by handling foams and the gases contained within them in a way that ensures their destruction.

This 'Guide on How to decontaminate fluorinated gases in insulation foams' aims to inform the stakeholders in our industry about this obligation. The guide originates from the working group and has been written by Laura Garcia based on the information and know-how of Marianne Hedberg (SEG Umwelt-Service GmbH) on this topic.

I hope this document will help you to comply with the new legislation and to find the proper solutions for the insulation foams that you will encounter in numerous demolishing and/or decontamination projects.

The second session of the Working Group Hazardous Substances of the EDI in 2025 will deal with 'How to decontaminate asbestos'. I hope we can count on you to contribute to the creation of our next guide.

Kind regards,

2. Why are fluorinated gases hazardous?

Fluorinated gases (F-gases) are synthetic gases used in a variety of industrial applications, including insulation foams.

Among the most common F-gases found in insulating foams are chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

These gases were used as blowing agents to produce insulation foams from plastic materials. Due to the dense structure of the resulting materials, the gases remain in the pores even after 30 to 40 years.

CFCs were widely used in the production of insulation foams until it was discovered that they caused **significant damage to the ozone layer.**

As a result, the international community took action to **phase out** the use of CFCs under the Montreal Protocol in 1987, which aimed to protect the ozone layer.

In Europe, EU Regulation 2037/2000 officially banned the production and use of CFCs in most applications, including insulating foams.

This means that, although new production was phased out, CFC gases will still be present in older insulations found during demolition.

Any CFC gas released into the atmosphere will remain there for a long time (50 to 100 years or more) and act as a catalyst in breaking down the ozone layer while also **contributing to global warming.**

To replace CFCs, other fluorinated gases, such as HFCs, were introduced in the 1990s.

These gases were seen as a safer alternative in terms of ozone layer protection, as they do not contribute to ozone depletion.

However, while F-gases that do not contain chlorine do not harm the ozone layer, they are still potent greenhouse gases with a high global warming potential (GWP).

In response to these growing concerns, EU Regulations 2024/573 and 2024/590, adopted in 2024, strengthen efforts to reduce the environmental impact of F-gases.

These updated regulations set **more ambitious targets** for the faster removal of substances harmful to both the ozone layer and the climate.

One example is a 79% reduction in F-gas emissions by 2030 compared to 2014 levels.

The updates also focus on the **safe removal** of construction waste containing F-gases, while encouraging the transition to low-GWP cooling agents.

3. Which European legislation regulates fluorinated gases?

The main legislative framework for handling fluorinated gases in the EU is set out in **Regulations (EU) 2024/573** on fluorinated greenhouse gases and **(EU) 2024/590** on substances that deplete the ozone layer, both from the European Parliament and the Council, from 7 February 2024.

In the following, the use of the phrase F-gases will include CFCs, HCFCs, and HFCs. These regulations establish rules for the use, management, and disposal of F-gases, aiming to reduce their emissions and prevent their release into the atmosphere.

They strengthen the EU's ongoing efforts to mitigate the harmful environmental impact of F-gases and tackle climate change as well as ozone depletion.

Particularly relevant to the construction industry, the regulations outline specific measures for handling insulation foams containing F-gases during renovation, refurbishment, or demolition activities. From 1 January 2025, building owners and contractors must ensure emissions are minimised by handling foams and the gases contained within them in a way that ensures their destruction.

If the gases are recovered, only appropriately qualified personnel are allowed to carry out this task. These measures are essential to ensure that the F-gases are safely removed and do not contribute to environmental damage.

Earlier EU regulations have addressed the use of F-gases in cooling and heating equipment. However, recent scientific work has shown that the so-called 'material banks' of construction insulation contribute more to the problem than was initially expected.

The Kigali Amendment of the Montreal Protocol addresses this, among other things, and is the reason for the updates to the EU regulations.

4. Where can fluorinated gases be found?

There are a large number of products containing fluorinated greenhouse gases:

- Insulation foams
- Refrigeration
- Heat pumps
- Air conditioners
- Electric power transmission
- Aerosol sprays
- Electronics
- Industrial manufacturing processes

When considering the end-of-life of foam insulation products, it is important to remember that foams used in building insulation — particularly in walls, roofs, basements, and foundations — often contained fluorinated gases before stricter regulations were enforced.

Therefore, **foams installed before 2015 in these areas are more likely to contain CFCs, HFCs, or HCFCs.**

Depending on the year of manufacture, the following can be expected:

- **Foam manufactured before 1995:** It is likely that CFCs (chlorofluorocarbons) were used, as they were phased out due to their harmful impact on the ozone layer.

- **Foam manufactured between 1995 and 2004:** HCFCs (hydrochlorofluorocarbons) were likely used during this period, and like CFCs, they are now being phased out because of their environmental effects.

- **Foam manufactured after 2004:** It is more probable that HFCs (hydrofluorocarbons) were used, which, while not harmful to the ozone layer, have a high global warming potential.

- **Since the phase-out of CFCs,** various other blowing agents have been used. Notably, hydrocarbons (HCs) are often used in polyurethane and phenolic insulation. These are flammable and should be handled with care in recovery facilities.

Regarding the types of foam used, the following fluorinated gases can be expected depending on the materials involved:

- **Extruded polystyrene (XPS):** XPS foams, especially those produced before 2015, are very likely to contain CFCs, HFCs, or HCFCs as blowing agents. These gases were used to create pores in the polystyrene, making the insulation highly effective. XPS foam is one of the most common types used in construction and industrial insulation. This foam is flammable, so flame retardants are often added. In older insulation, HBCD (hexabromocyclododecane) was commonly used, but it is now banned as a Persistent Organic Pollutant (POP).

- **Polyurethane (PU) foam:** Another widely used material for thermal insulation, PU foam manufactured before 2015 likely contained some form of F-gas as blowing agents.

- **Expanded polystyrene (EPS) or Styrofoam:** This material was also produced with F-gases, but due to its open structure, most of the gases would have escaped during or shortly after production.

It's important to note that recent insulation products no longer use F-gases as blowing agents; instead, CO_2 or hydrocarbons are now used.

5. What analyses and tests must be carried out to know whether a material contains fluorinated gases?

Determining whether a material contains F-gases can often begin with simple steps, such as consulting the product specifications or checking the year of manufacture.

However, when this information is unavailable or unclear, more sophisticated tests such as GC-MS, FTIR, and headspace analysis can provide definitive results.

By using these tests in conjunction with knowledge about the material's composition and manufacturing history, you can determine whether a material contains harmful fluorinated gases and take appropriate actions for recycling or disposal.

5.1. Preliminary steps to determine fluorinated gases in materials

Before diving into complex analyses and tests, there are several preliminary steps that can be taken to gather useful information about the material in question.

These steps often provide enough data to guide the next steps in the investigation, potentially avoiding unnecessary testing or reducing the scope of required analyses.

Consult the product specifications

One of the simplest ways to determine whether a material contains fluorinated gases is to review the product specifications.

Ideally, most manufacturers would provide detailed information about the components and chemicals used in their products, including whether any fluorinated gases were employed as blowing agents during production.

For insulation foams, particularly those manufactured in the past, manufacturers might disclose the types of blowing agents used, such as HFCs, HCFCs, or even CFCs.

However, in practice, this information is rarely available. Even when product specifications are provided, fluorinated gases are typically not listed as components of the product.

This is because, as blowing agents, their role is to act during the manufacturing

process, so they are often omitted from the product's component lists.

Therefore, if you do have access to the product documentation, such as a datasheet, user manual, or technical specification sheet, it is worth examining these documents to check for mentions of fluorinated gases.

However, it is important to note that such mentions are uncommon.

If this information is not available, you may need to contact the manufacturer directly or explore other sources that may provide the necessary technical details.

Consider the year of manufacture and foam type

When trying to determine whether a foam material contains F-gases (F-GHGs), it is important to consider two key factors: the date of manufacture and the type of foam.

These elements can provide important clues as to whether the foam contains fluorinated gases such as HFCs, HCFCs, or CFCs, which were commonly used as blowing agents in foam production before stricter regulations were put in place.

As outlined in the previous section, foams installed **before 2015,** particularly in building insulation applications (e.g., **walls, roofs, basements and ground)**, are more likely to contain these gases.

The year of manufacture plays a pivotal role in understanding which types of blowing agents were commonly used in foam insulation, as regulations on fluorinated gases were introduced and phased in over time.

For a detailed overview of the relationship between foam type and the associated use of fluorinated gases, please refer to the earlier section, which explains how the year of manufacture and foam type help determine the likely presence of HFCs or HCFCs in the foam.

5.2. Advanced testing and analysis for fluorinated gases

If the above methods do not provide sufficient information to confirm the presence of fluorinated gases in a material, more advanced testing and analyses may be required.

These methods are typically carried out in laboratories or by specialised professionals, and they provide more accurate and definitive results.

The annexes of the EU regulation list over a hundred different substances that require separate treatment. It is not feasible to send samples for analysis of the entire list.

Efforts are underway to establish a specific set of substances to be included in a package designed for the analysis of insulation foams, and to encourage laboratories across Europe to adopt this approach.

IMPORTANT NOTE

If you opt to send samples to a laboratory for fluorinated gas detection, the laboratory must be a specialist in these substances.

The laboratory must be certified for analysis of the substances in question.

However, it is important to understand that, at present, very few laboratories in the world are certified and capable of conducting this type of testing, not only in Europe but globally.

The most common tests that can be performed to identify F-gases are the following:

1

Density and Thermal Property Testing

One of the initial ways to identify the presence of fluorinated gases in foam materials is to perform a density test.

Fluorinated gases like HFCs, HCFCs, and CFCs are often used to create foams with low density, as they are typically more effective in providing insulation.

By measuring the foam's density, it may be possible to determine if it was produced using a fluorinated blowing agent, although this test alone may not provide definitive results.

Additionally, testing the thermal properties of the foam, such as its thermal conductivity or insulation value, may help provide more information.

Some fluorinated gases contribute to the foam's ability to retain heat, so comparing the thermal performance of the material with industry standards for various blowing agents could provide a useful indication.

2 Chemical Analysis Techniques

For more detailed and accurate results, chemical analysis techniques can be used to detect the presence of fluorinated gases. The most common methods for chemical analysis include:

1. **Gas Chromatography-Mass Spectrometry (GC-MS):** GC-MS is a widely used technique for detecting and quantifying chemical compounds in a sample. It works by separating the components of the sample (in this case, the gases) and identifying them based on their mass-to-charge ratio. GC-MS is highly effective for detecting trace amounts of fluorinated gases, such as HFCs, HCFCs, and CFCs, in foam materials.

2. **Fourier Transform Infrared Spectroscopy (FTIR):** FTIR is another powerful tool for identifying the chemical composition of a material. It works by measuring the absorption of infrared light by different molecular bonds within the sample. This technique is useful for identifying specific functional groups, including the C-F bonds found in fluorinated gases.

3. **Headspace Analysis:** In some cases, headspace analysis can be used to detect volatile fluorinated gases that may have been trapped within the foam material. This method involves extracting and analysing the gases present in the space above the material using techniques like GC-MS.

3 Professional Evaluation

If you are unable to conduct these tests on your own, or if you require expert interpretation of the results, you may want to consult a professional in the field of material analysis or environmental chemistry.

These specialists can provide an in-depth evaluation of the foam, using both standard and advanced testing methods to determine the presence of fluorinated greenhouse gases.

6. How should insulating foams containing fluorinated gases be removed and treated?

6.1. Procedures for removing insulating foams containing fluorinated gases

The removal of insulating foams containing fluorinated gases is a critical operation that must be performed following precise procedures to minimise environmental impact and ensure compliance with legal standards. The process involves multiple phases, each of which requires specific technical procedures and equipment to ensure both safety and environmental responsibility.

The key steps in this process include the preparation, physical removal of the foam, recovery of the F-gases and their final disposal. These steps are detailed as follows:

1. Preparation and Prior Investigation

Before beginning any demolition or renovation activities, a thorough investigation must be conducted to determine if insulating foams contain fluorinated gases (F-gases), as required by EU regulations. This responsibility lies with both the project promoter and the contractor. Failure to comply with this requirement may lead to penalties. If F-gases are identified or suspected, a proper procedure must be followed to ensure their safe removal.

NOTE

Failure to properly manage insulating foams containing F-gases during demolition and renovation activities, as stipulated by Regulations (EU) 2024/573 and 2024/590, will result in penalties. These penalties will be determined by individual EU member states, with each country responsible for setting its own enforcement measures. The specific penalties for non-compliance are expected to be established and enforced by the end of 2025.

This investigation should focus on identifying whether the foam contains substances such as HFCs, HCFCs, or CFCs, which are commonly used as blowing agents.

In the event that F-gases are present, the investigation will help plan the safest removal method to prevent the accidental release of these harmful gases during the operation.

2. Physical Removal of the Insulating Foam

Once the investigation confirms the presence of F-gases, the next step is the careful removal of the insulating foam. It is critical that the foam is removed in as large pieces as possible.

Cutting, crushing, or breaking the foam should be avoided, as these actions will cause the gases to be released into the atmosphere.

The foam should be kept intact during the removal and transported whole to a treatment facility, where the proper conditions can be applied for gas removal.

For example, in the case of a sandwich panel containing foam, the panel should be removed intact.

At the treatment facility, the foam will undergo processing in a chamber where the F-gases will be safely extracted and destroyed.

3. Treatment of the Insulating Foam

Disposal

The foam should be transported to an authorised waste treatment facility equipped to handle hazardous materials, where it will be processed in a controlled environment. The facility will ensure that F-gases are safely separated and eliminated.

Reuse

If the foam is removed in whole pieces without crushing or breaking, there may be potential for the material or other construction elements, such as wall panels, to be reused. This should be done with caution to ensure that no F-gases are released during handling.

Recycling

Once the foam has been separated and all F-gases have been removed, materials like wood, metal, or plastic that were adhered to the foam can be sent for recycling. This process should occur in a certified facility where the foam is safely treated, and the fluorinated gases are destroyed before recycling the materials.

4. Recovery of F-Gases through Underpressure Condensation

Once the insulating foam has been removed and transported intact to an authorised facility, the recovery of fluorinated gases (F-gases) is carried out through a process of condensation under reduced pressure.

This method involves placing the foam in a sealed chamber where the internal pressure is lowered, allowing trapped gases within the foam cells to be released in a controlled manner.

To condense the released F-gases, a cryogenic cooling system is used to bring the gases below their condensation point.

The condensed gases are collected in a secure container either in liquid or solid form for subsequent treatment.

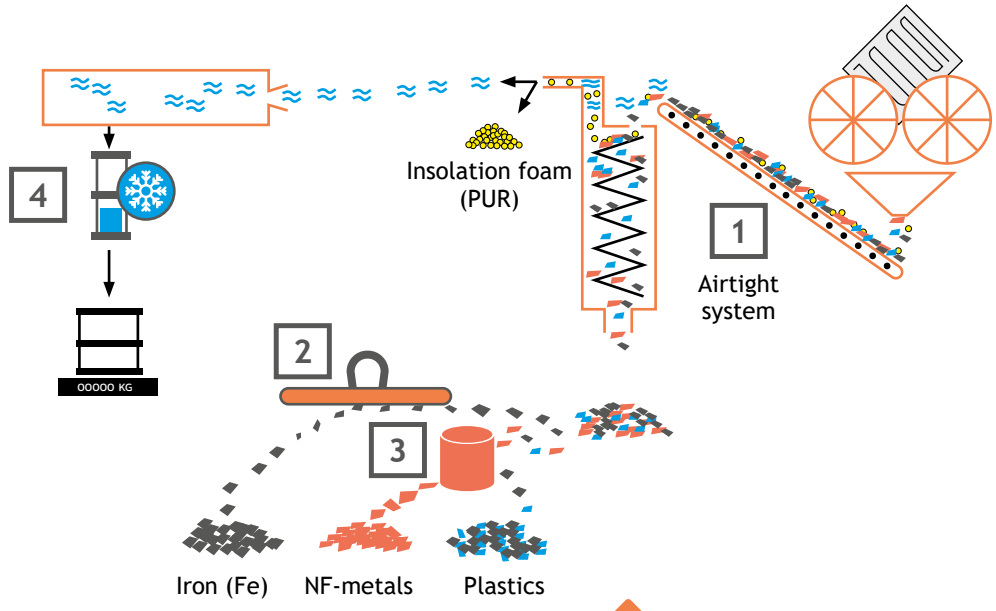
Depending on the composition and purity of the recovered gases, they may be:

Destroyed

In high-temperature thermal destruction units that ensure complete decomposition without generating harmful by-products.

Regenerated

If the gas meets quality standards, it may be purified and reused in industrial applications, reducing the need for producing new F-gases.



1 Separation of the insolation foam from the Fe/ NF-metal/plastics mixture by windsifter

2 Removal of iron by magnetic separator

3 Removal of non-ferrous metal by NFM-separator

4 Capture an liquefaction of the blowing agents from the process air

Did you know?

Releasing the F-gases contained in just 10 kg of insulation foam can have the same climate impact as driving a car all the way around the equator.

6.2. Reporting and documentation

Under Regulation (EU) 2024/573, there is no explicit obligation to report the removal of insulating foams containing F-gases. However, national or local regulations may require such reporting, so contractors should consult the relevant authorities to ensure full compliance.

In any case, it is highly recommended that contractors maintain detailed documentation for traceability and to support compliance efforts. The recommended documentation should include:

The type of fluorinated gases contained in the insulating foams removed.

The identification of the material in which the F-gases were contained.

The name and certification of the waste disposal or recycling facility used.

The dates and details of the disposal process.

While not required for reporting purposes under EU regulation, keeping this documentation is crucial for ensuring proper traceability of F-gases and could be useful in case of audits by environmental authorities. Retaining these records for a minimum of five years is recommended to ensure transparency and accountability.

6.3. Training and certification requirements

Regulation (EU) 2024/573 mandates that personnel involved in the removal of insulating foams containing fluorinated gases must undergo appropriate training and certification to ensure they have the necessary knowledge and skills to handle F-gases safely and in compliance with legal requirements.

However, the regulation does not specify the exact content of this training.

It is expected that EU Member States will decide on the specific training content and inform the European Commission of their national implementation plans within the course of this year.

From the European Demolition Institute (EDI), we recommend that training ideally covers the following areas:

Environmental regulations and the potential risks of releasing F-gases into the atmosphere.

Identification of materials containing F-gases.

Guidelines for the removal of insulating foams containing F-gases.

Safe handling of insulating foams containing F-gases.

About EDI

The **European Decontamination Institute (EDI)** was established in 2013 to advance the proper decontamination of hazardous substances that may occus on construction and demolition sites.

EDI was created in response to several critical issues: the need to protect industry workers, challenges on job sites, difficulties in identifying hazardous substances, and the lack of knowledge among many stakeholders.

The Institute's primary goal is to gather and disseminate knowledge on decontamination, promote the safe removal of hazardous substances, and foster standards and regulations for this field.

With a European focus, **EDI** aims to share best practices across companies, countries, and stakeholders, working towards consistent guidelines across various sectors.

Some of the main objectives of the association are:

- **Protect the interests** of the decontamination industry in Europe
- **Promote European standards** on decontamination techniques
- **Impact on health and safety legislation**
- **Improve legislation** on the removal and depositing of hazardous waste
- **Exchange information** on techniques, working methods, and training
- **Maintain contacts** with similar organizations globally (e.g. Asia, America, and other regions)

More information in:

www.decontaminationinstitute.org

Participate in EDI

EDI is a perfect place for every National Association or Federations, decontamination contractors, engineering companies related to decontamination activities or decontamination suppliers. They are all able to get on board of a mutually rewarding cooperation.

- National Associations
- Engineering or consulting companies
- Contractors
- Suppliers

Participate as a member

Some benefits of **EDI** membership are:

- Access to contents of the private members' area
- Business opportunities and new contacts
- Credibility with clients, suppliers, partners and Public Administrations
- Visibility and promotion of your company on the web, communications and corporate materials.
- Free consultation of all EDI contents: guides, webinars, courses and conference books from forums, events and webinars.
- Participation in governance and Workign Group meetings

If your organization is also involved with demolition activities, you can apply for a combined membership through the European Demolition Association, EDA.

Who can be a member?

- National Decontamination Associations or Federations
- Decontamination contractors, from countries with or without a National Decontamination Association.
- Decontamination suppliers: manufacturers.

Participate as a partner

Some of the benefits of being an **EDI** partner are:

- Participation in the association's public activities and others in which EDI collaborates.
- Your own page in the association's directory, on the website and in all the media in which the list of collaborators is published.
- Access to some private contents

Who can be a partner?

- Entities, associations and other groups related to the decontamination industry, universities and educational centers related to the activity of the association
- Specialized press related to the decontamination industry
- Specialized events related to decontamination

More information in:

www.decontaminationinstitute.org/get-involved

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www.decontaminationinstitute.org/guide-fluorinated-gases

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