

Information of PFAS and PFAS present in mixtures and articles

Identity and quantity

Please fill in the following table in the columns relevant to you with the respective information concerning

Please assign quantities individually to each PFAS and PFAS in mixtures and/or articles.

Please use one line for each individual substance and, if necessary, with multiple entries in one data field.

#	Chemical name	Trade name(s)	CAS No.
1	1,1,1,2-tetrafluoroethane	Norflurane, R-134a, HFC-134a, Klea, Zephex, Genetron, Forane, Freon, Daikin Note that mixtures of HFCs and HFOs may use these trade brand names or those that are used for HFOs	811-97-2

2	difluoromethane	R-32, HFC-32, Klea, Genetron, Forane, Freon, Daikin	75-10-5
3	trifluoromethane	R-23, HFC-23	75-46-7
4	pentafluoroethane	R-125, HFC-125, Klea, Genetron, Forane, Freon, Daikin	354-33-6

5	1,1,1-trifluoroethane	R-143a, HFC-143a,	420-46-2
6	1,1-difluoroethane	R-152a, HFC-152a	75-37-6
7	1,1,1,2,3,3,3-heptafluoropropane	R-227ea, HFC-227ea	431-89-0
8	1,1,1,3,3,3-hexafluoropropane	R-236fa, HFC-236fa	690-39-1
9	1,1,1,3,3-pentafluoropropane	R-245fa, HFC-245fa, Enovate	460-73-1

10	1,1,1,3,3-pentafluorobutane	R-365mfc, HFC-365mfc, Solkane	406-58-6
11	1,1,1,2,2,3,4,5,5,5-decafluoropentane	HFC-43-10mee, Vertrel	138495-42-8
12	2,3,3,3- tetrafluoroprop-1-ene	R-1234yf, HFC-1234yf, Solstice, Opteon	754-12-1
13	Trans-1,3,3,3-tetrafluoroprop-1-ene	R-1234ze(E), HFO-1234ze(E) , Solstice	29118-24-9

14	Cis-1,1,1,4,4,4-hexafluorobut-2-ene	R-1336mzz(Z), HFO-1336mzz(Z), Opteon	692-49-9
15	Trans-1,1,1,4,4,4-hexafluorobut-2-ene	R- 1336mzz(E), HFO- 1336mzz(E), Opteon	66711-86-2
16	Trans 1-Chloro-3,3,3-trifluoroprop-1-ene	R-1233zd(E) ,HCFO-1233zd(E), Solstice, Forane,	2730-43-0

17	chlorodifluoromethane	R-22, HCFC-22	75-45-6
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18	1-chloro-1,1 - difluoro-ethane	R-142b, HCFC-142b	75-68-3
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; your PFAS/precursor/perfluorinated precursor.

If not, use multiple lines for each individual substance, linked with a clear identifica

EC No.	Mixture	Polyfluorinated precursors/polymers
		Please indicate.
212-377-0	Where indicated HFCs and no HFOs may be used in refrigerant mixtures.A spreadsheet attached separately shows all the known mixtures that may be used as refrigerants in the EU subject to restrictions under the F-Gas Regulation 517/2014. The EEA Report EEA Report No 20/2019 Fluorinated Greenhouse Gases 2019 provides data on supply of individual substances. Used in refrigerant mixtures	

200-839-4	Used in refrigerant mixtures	no
200-872-4	Used in refrigerant mixtures	as well as use as refrigerant the substance is used as a feedstock to manufacture bromotrifluoromethane which is currently used as a feedstock for the manufacture of the pesticide fipronil
206-557-8	Used in refrigerant mixtures	no

206-996-5	Used in refrigerant mixtures	no
200-866-1	Proprietary mixtures may be used as blowing agents for insulation foams. Used in refrigerant mixtures	Dehydrofluorination of 1,1-difluoroethane (HFC-152a) is the most broadly used chemical process for the production of vinyl fluoride (used to produce polyvinylfluoride, however the quantity reported in by the EEA would not include any substance used for feedstock
207-079-2	Used in refrigerant mixtures	no
425-320-1	Used in refrigerant mixtures	no
419-170-6	Proprietary mixtures may be used as blowing agents for insulation foams	no

430-250-1	Proprietary mixtures may be used as blowing agents for insulation foams	no
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420-640-8	Proprietary mixtures may be used as solvents	no
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468-710-7	Used in refrigerant mixtures	no
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810-135-4	As well as use as a refrigerant, proprietary mixtures may be used as blowing agents for insulation foams. Used in refrigerant mixtures	no
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700-651-7

As well as use as a working fluid, proprietary mixtures may be used as blowing agents for insulation foams. Used in refrigerant mixtures

811-213-0

As well as use as a working fluid, proprietary mixtures may be used as blowing agents for insulation foams

688-906-8

Proprietary mixtures may be used as blowing agents for insulation foams

200-871-9	no	production of tetrafluoroethylene, a monomer, or hexafluoropropene, a monomer. Hexafluoropropene (HFP) can be used to produce hexafluoropropylene oxide, a monomer. HFP is also used to produce 1,1,1,2,3,3,3-heptafluoropropane
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200-891-8	no	production of vinylidene fluoride, a monomer. Vinylidene fluoride HFO-1132ais also used as a refrigerant
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tion, such as CAS No., etc.

Production process of PFAS, PFAS-containing mixture	Production process of PFAS-containing article
Electrochemically or by other methods	

other methods

REACH definitions of articles used throughout. The only relevant articles would be finished insulation foams for all substances listed. Some substances have never been used in foams, and some are no longer used due to the F-Gas Regulation 517/2014 HFC-134a is unlikely to be used alone or in mixtures in articles.

other methods

no

other methods

no

other methods

no

other methods no

other methods yes

other methods no

other methods no

other methods no

other methods no

other methods no

other methods no

other methods yes

other methods

yes

other methods

yes

other methods

yes

other methods

no

other methods

no

Production process of polymers, fluorescins or other complex perfluorated compounds

NIAS (e.g. oligomers or impurities)

not applicable

Purity is typically > 99.8%. Main Impurity 1,1,2,2-tetrafluoroethane
EC no.: 206-628-3. Very minor impurities are substances of similar boiling points from the production process.

not applicable

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

trifluoromethane is brominated with bromine. According to the REACH Registration Dossier on the ECHA website <https://echa.europa.eu/sv/registration-dossier/-/registered-dossier/10495/1> bromotrifluoromethane is manufactured and/or imported in the European Economic Area for industrial use resulting in the manufacture of another substance (use of intermediates) for fine chemicals production. Fipronil contains a CF₃ group

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process as well as chlorodifluoromethane.

not applicable

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

not applicable

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

dehydrofluorinated to vinyl fluoride, a monomer

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

no

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

no

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

no

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

no

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

may be used as a solvent carrier
for fluorocarbon lubricant or adhesive

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

no

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

no

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

no

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

no

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

no

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

pyrolysis of chlorodifluoromethane at about 650C to give TFE and HCl, followed by polymerisation or copolymerisation. Depending on reaction conditions hexafluoropropene (HFP) can be produced, which can be copolymerised. HFP can be reacted with an oxygen donor to give hexafluoropropylene oxide, a monomer used in oligomerisation and polymerisation.

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

The substance is used as a feedstock to produce vinylidene fluoride (1,1-difluoroethene) which is polymerised to poly-vinylidene fluoride or co-polymers.

Purity is typically > 99.8%. Minor impurities are substances of similar boiling points from the production process.

Expos

Generation and/or use of any relevant fluorinated substance including e.g. volatile substances during production that could be released to environment

Tonnage range production or import of PFAS and/or PFAS containing mixtures **per year**

do we need to add specifics for any substances that are produced in the EU. In the EU all emissions from chemical complexes are required to be reported and are available at the European Pollutant Release and Transfer Register (E-PRTR) Chlorinated substances are feedstocks used for its manufacture. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions. There are several possible processes for its manufacture. The main commercial processes include:
hydro-fluorination of trichloroethylene, via 1-chloro-2,2,2-trifluoroethane;
isomerisation/hydro-fluorination of 1,1,2-trichloro-1,2,2-trifluoroethane to 1,1-dichloro-1,2,2,2 tetrafluoroethane followed by hydro-dechlorination of the latter;
hydro-fluorination of tetrachloroethylene to 1-chloro-1,2,2,2 tetrafluoroethane and subsequent hydro-dechlorination to 1,1,1,2-tetrafluoroethane.

Data for HFCs, HFOs and HCFOs is from 2018 from EEA Report EEA Report No 20/2019 Fluorinated Greenhouse Gases 2019 and is the total EU supply. Data is for 2018 unless stated. The supply total excludes Feedstock use. Information on feedstock use, if available is included. 32543 tonnes

Difluoromethane is produced from dichloromethane by fluorination. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions.

14647 tonnes

Trifluoromethane is produced as a by-product during the production of chlorodifluoromethane. In the EU, any trifluoromethane not required for use as a feedstock or refrigerant is destroyed on site by thermal oxidation.

54 tonnes for use as refrigerant. It is thought that significantly less than 1000 tonnes of trifluoromethane or bromotrifluoromethane are used for the manufacture of fipronil

Difluoromethane is produced from dichloromethane by fluorination. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions.

12938 tonnes

1,1,1-trifluoroethane is produced from 1,1-dichloro-1-fluoro-ethane by fluorination. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions. 1,1-dichloro-1-fluoro-ethane is produced from 1,1,1-trichloroethane

Total EU Supply 2017, 6006 tonnes, the supply in 2018 is listed as confidential

1,1-dichloroethane is fluorinated to produce the substance. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions

3245 tonnes

The substance is produced from hexafluoropropene by reaction with HF. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions.

1387 tonnes

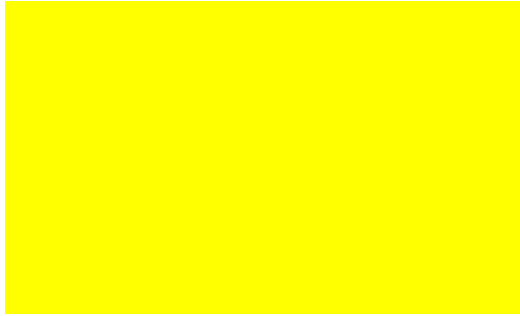
The feedstock is a chlorinated propane, which is fluorinated to produce the substance. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions.

18 tonnes

The feedstock is a chlorinated propane, which is fluorinated to produce the substance. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions.

supply for all years listed as confidential

The feedstock is a chlorinated butane, which supply for all years listed as is fluorinated to produce the substance. As the confidential product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions.



supply for all years listed as confidential except 2009 at 50 tonnes

The feedstock is a chlorinated propene, which 11437 tonnes is fluorinated to produce the substance. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions..

The feedstock is a chlorinated propene, which supply for all years listed as is fluorinated to produce the substance. As the confidential Total HFOs and HCFOs product is a low boiling point substance 17750 tonnes production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions.

tetrachloroethene is used as a feedstock to produce -1,1,1,4,4,4-hexafluorobut-2-ene isomers, with trichlorotrifluoroethane isomers as intermediates. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions.

supply for all years listed as confidential Total HFOs and HCFOs 17750 tonnes

tetrachloroethene is used as a feedstock to produce -1,1,1,4,4,4-hexafluorobut-2-ene isomers, with trichlorotrifluoroethane isomers as intermediates. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions.

supply for all years listed as confidential Total HFOs and HCFOs 17750 tonnes

The feedstock is a chlorinated propene, which is fluorinated to produce the substance. As the product is a low boiling point substance production is in closed systems on chemical plant complexes, with abatement measures to minimise emissions.

supply for all years listed as confidential Total HFOs and HCFOs 17750 tonnes

Chlorodifluoromethane (HCFC-22) is produced by the reaction of chloroform (CHCl_3) and hydrogen fluoride (HF) in the presence of antimony pentachloride (SbCl_5) catalyst. Trifluoromethane is the major by-product and is either destroyed or used as a feedstock of refrigerant. The EU reports its emissions of HFC-23, as part of its Annual greenhouse gas inventory submission to the UNFCCC. From this, in 2017 the EU reported over 98% reduction in emissions compared to 1990, due to the adoption of abatement technology..

Data for HCFCs is from EEA Report 12/2019 Ozone Depleting Substances 2019. Total 2018 production of HCFCs in the EU was 129594 tonnes and imports of 4968 tonnes. EEA does not break down the data further but for production HCFC-22 (chlorodifluoromethane) and HCFC 142b (1-chloro-1,1 - difluoro-ethane) are thought to account for the vast majority of the total, with HCFC-22 being the major substance. Both are used as feedstocks.

1-chloro-1,1 - difluoro-ethane is produced from 1,1,1,-trichloroethane by reaction with HF in the liquid phase. 1,1-dichloro-1-fluoroethane is an intermediate.

see answer for HCFC-22

sure-related questions

Tonnage range of PFAS incorporated in articles per year	Tonnage range production of PFAS containing article per year	Number of workers involved in handling at company or customer sites
REACH definitions of articles used throughout. Expected to be zero. The substance is not incorporated in articles, but is used in articles.	It is assumed that this relates to the use of the substance in eg air-conditioners, refrigeration systems or MDIs and the question is answered throughout on this basis. It is expected that all the reported supply will be used in articles.	Assume the production text only apply to substances produced in the EU. 5 companies reported production of HFCs in the EU-please check. It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on chemical sites for its production and industrial sites used in closed systems to transfer into mixtures, repackaging, refrigeration, air-conditioning and heat pump equipment, MDIs and similar. Handled widely by professional and technical staff for servicing and maintenance of refrigeration, air-conditioning and heat pump equipment. In total of the order of 100,000 workers

Expected to be zero.

It is expected that all the reported supply will be used in articles.

It is used by professional workers (widespread uses), in formulation or re-packing, or destruction at industrial sites and in manufacturing. **Handled on chemical sites for its production** and industrial sites used in closed systems to transfer into mixtures, repackaging, refrigeration, air-conditioning and heat pump equipment and similar. Handled widely by professional and technical staff for servicing and maintenance of refrigeration, air-conditioning and heat pump equipment. **In total of the order of 100,000 workers**

Expected to be zero.

It is expected that all the reported supply will be used in articles.

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. **Handled on chemical sites for its production** and industrial sites used in closed systems as a feedstock, to transfer into mixtures, repackaging, low temperature refrigeration. Handled widely by professional and technical staff for servicing and maintenance of refrigeration. **In total of the order of 5,000 workers**

Expected to be zero.

It is expected that all the reported supply will be used in articles.

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. **Handled on chemical sites for its production** and industrial sites used in closed systems to transfer into mixtures, repackaging, refrigeration, air-conditioning and heat pump equipment and similar, or for destruction. Handled widely by professional and technical staff for servicing and maintenance of refrigeration, air-conditioning and heat pump equipment. **In total of the order of 100,000 workers**

REACH definitions of articles used throughout. Expected to be zero. The substance is not incorporated in articles, but is currently used in articles. However as the major use of 1,1,1-trifluoroethane is for Refrigerant R-404A and this is subject to use restrictions in the EU under the F-Gas Regulation, it is expected that its supply will continue to decrease very quickly in the next few years

It is expected that all the reported supply will be used in articles.

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. **Handled on chemical sites for its production** and industrial sites used in closed systems to transfer into mixtures, repackaging, refrigeration equipment and similar, or for destruction. Handled widely by professional and technical staff for servicing and maintenance of refrigeration, air-conditioning and heat pump equipment. **In total of the order of 100,000 workers**

The F-Gas Regulation 517/2014 bans the use of HFCs or HFC blends with a GWP >150 in the manufacture of all foams by 1 January 2023 and for extruded polystyrene (XPS) from 1 January 2020. **As the substance has a GWP less than 150 it could be used in extruded polystyrene foam production alone or in a mixture. The quantity is not known but would be included in the EEA reported quantity.**

According to the F-gas Regulation, the substance can be used in technical aerosols as it has a GWP less than 150. It may be used alone or in mixtures. It is not widely used in RAC applications.

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on industrial sites used in closed systems to transfer into mixtures, repackaging, technical aerosols, for production of XPS foam and similar, or for destruction. **In total of the order of 5,000 workers**

The F-Gas Regulation 517/2014 bans the use of HFCs or HFC blends with a GWP >150 in the manufacture of all foams by 1 January 2023. Until then the substance can be used as a foam blowing agent

Used in MDIs, fire extinguishers, and some refrigeration equipment

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on industrial sites used in closed systems to transfer into mixtures, repackaging, MDIs, fire extinguishers, for production of PU foams, or for destruction. **In total of the order of 5,000 workers**

expected to be zero

expected to be for fire extinguishers

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on industrial sites used in closed systems to transfer into mixtures, repackaging, fire extinguishers, **In total of the order of less than 1.000 workers**

The F-Gas Regulation 517/2014 bans the use of HFCs or HFC blends with a GWP >150 in the manufacture of all foams by 1 January 2023. Until then the substance can be used as a foam blowing agent. The quantity is not known

The substance is used as a refrigerant and as a working fluid for Organic Rankine Cycle systems

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on chemical site for its production and industrial sites used in closed systems to transfer into mixtures, repackaging, for production of PU foams, or for destruction. **In total of the order of 5,000 workers**

The F-Gas Regulation 517/2014 bans the use of HFCs or HFC blends with a GWP >150 in the manufacture of all foams by 1 January 2023. Until then the substance can be used as a foam blowing agent. The quantity is not known

The substance is used as a working fluid for Organic Rankine Cycle systems

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on industrial sites used in closed systems to transfer into mixtures, repackaging, for production of PU foams, or for destruction. **In total of the order of 5,000 workers**

expected to be zero

expected to be zero

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on industrial sites Used in co-solvent systems and vapor degreasing equipment for cleaning, rinsing, and drying. **In total of the order of 5,000 workers**

expected to be zero

expected to be 11437 tonnes

It is used by professional workers (widespread uses), in formulation or re-packing, or destruction at industrial sites and in manufacturing. Handled on industrial sites used in closed systems to transfer into mixtures, repackaging, refrigeration, air-conditioning and heat pump equipment and similar. Handled widely by professional and technical staff for servicing and maintenance of refrigeration, air-conditioning and heat pump equipment. **In total of the order of 100,000 workers**

Used as a foam blowing agent, mainly for PU foam but can be used for XPS. Quantity not known

Quantity used as a refrigerant is not known.

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on chemical sites for its production and industrial sites used in closed systems to transfer into mixtures, repackaging, refrigeration, air-conditioning and heat pump equipment and similar, production of insulation foams, or for destruction. Handled widely by professional and technical staff for servicing and maintenance of refrigeration, air-conditioning and heat pump equipment. **In total of the order of 100,000 workers**

Used as a foam blowing agent, mainly for PU foam. Quantity not known

quantity used as a refrigerant is not known. Also used as a working fluid for Organic Rankine Cycle systems

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on chemical sites for its production and industrial sites used in closed systems to transfer into mixtures, repackaging, refrigeration, air-conditioning and heat pump equipment and similar, production of insulation foams, or for destruction. Handled widely by professional and technical staff for servicing and maintenance of refrigeration, air-conditioning and heat pump equipment. **In total of the order of 20,000 workers**

Used as a foam blowing agent, mainly for PU foam. Quantity not known

quantity used as a refrigerant is not known. Also used as a working fluid for Organic Rankine Cycle systems

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on chemical sites for its production and industrial sites used in closed systems to transfer into mixtures, repackaging, refrigeration, air-conditioning and heat pump equipment and similar, production of insulation foams, or for destruction. Handled widely by professional and technical staff for servicing and maintenance of refrigeration, air-conditioning and heat pump equipment. **In total of the order of 20,000 workers**

Used as a foam blowing agent, mainly for PU foam but can be used for XPS. Quantity not known

quantity used as a refrigerant is not known. Also used as a working fluid for Organic Rankine Cycle systems

It is used by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing. Handled on chemical sites for its production and industrial sites used in closed systems to transfer into mixtures, repackaging, refrigeration, air-conditioning and heat pump equipment and similar, production of insulation foams, or for destruction. Handled widely by professional and technical staff for servicing and maintenance of refrigeration, air-conditioning and heat pump equipment. **In total of the order of 100,000 workers**

Should be zero due to ban under the Ozone Regulation 1005/2009

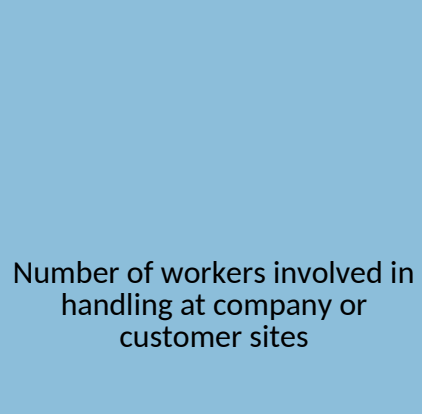
Should be zero due to ban under the Ozone Regulation 1005/2009

It may still be handled to some extent by professional workers (widespread uses) if there are remaining RAC systems in the EU that contain HCFC-22 that requires its removal at the equipment location. However these are expected to be quite relatively few. Handled on chemical sites for its production and use in closed systems as a feedstock. May be handled on industrial sites for its destruction. In total of the order of 5,000 workers.

Should be zero due to ban under the Ozone Regulation 1005/2009

Should be zero due to ban under the Ozone Regulation 1005/2009

Handled on chemical sites for its production and use in closed systems as a feedstock. May be handled on industrial sites for its destruction. In total of the order of 1,000 workers.

A solid blue square.

Number of workers involved in
handling at company or
customer sites