

SAFETY DATA SHEET

ACCORDING TO EC-REGULATION 1272/2008 (CLP/GHS).

1. SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1	Product identifier	
	Product name	Hexafluoropropene
	Chemical name	Hexafluoropropene
	Trade name	Hexafluoropropene
	Alternative names	Monomer-6; 1,1,2,3,3,3-hexafluoroprop-1-ene
	Formula	C ₃ F ₆
	EC No.	204-127-4
	REACH Registration No.	01-2119471981-30-0013
	CAS No.	116-15-4
1.2	Relevant identified uses of the substance or mixture and uses advised against	
	Identified use(s)	Intended for production of various polymers and copolymers, and various fluoroorganic compounds.
	Uses advised against	None when used as intended
1.3	Details of the supplier of the Safety Data Sheet	
1.3.1	Manufacturer	«HaloPolymer Kirovo-Chepetsk», LLC per. Pozharny, 2, 613040, Kirovo-Chepetsk, Kirov Region, The Russian Federation.
	Telephone	+7-83361-9-4281
	Fax	+7-83361-9-3594
	Website	www.halopolymer.com
1.3.2	Only representative of a non-Community manufacturer	URALCHEM Assist GmbH Johannssenstrasse 10 30159, Hannover, Germany
	Telephone	+49-511/45 99 444
	Fax	+49-511/45 99 446
	E-mail	info@uralchem-assist.de
1.4	Emergency telephone number	
	Manufacturer/supplier:	+7-83361-9-4250 [24 hours.]
	European emergency number:	112
		Consult the relevant national official advisory body if necessary.

2. SECTION 2: HAZARDS IDENTIFICATION

Classification and labeling have been performed according to Regulation (EC) No. 1272/2008 (CLP/GHP)

2.1	Classification of the substance	
2.1.1	Classification according to Regulation (EC) No 1272/2008 [CLP/GHS]	Hazard class and category: Liquefied gas Acute Toxicity - Inhalation (Acute Tox. 4) Specific target organ toxicity – single (STOT Single Exp. 2) Specific target organ toxicity – single (STOT Single Exp. 3) Specific target organ toxicity – repeated (STOT Rep. Exp. 2)

2.2	Label elements
	Labeling according to Regulation (EC) No 1272/2008 [CLP/GHS]
	Hazard Pictogram:



GHS04



GHS08



GHS07

Signal word:
Hazard statements:

WARNING
H280: Contains gas under pressure; may explode if heated.
H332: Harmful if inhaled

Precautionary Statements:

H335: May cause respiratory irritation
H371: May cause damage to the kidneys by inhalation.
H373: May cause damage to the kidneys through prolonged or repeated inhalation.

2.3 Other hazards

P260 Do not inhale dust/fume/gas/mist/vapors/spray.
P264 Wash hands thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271: May cause fire or explosion; strong oxidizer
P312: Call a POISON CENTER/doctor/ if you feel unwell.
P308+P311 IF exposed or concerned: Call a POISON CENTER/ doctor/
P304+P340+P312: IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell
P403+P233: Store in a well-ventilated place. Keep container tightly closed.
P405: Store locked up.
P410 + P403: Protect from sunlight. Store in a well-ventilated place. When heated, the product is decomposed with formation of toxic and corrosive vapours.

2.4 Additional Information

See Section 11

3. SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Product identifier type in accordance with Article 18(2) of Regulation (EC) No 1272/2008	Identifier number	Identification name	Weight % content (or range)	EC Number
CAS number	116-15-4	Hexafluoropropene	≤ 100	204-127-4

3.2 Mixtures

Not applicable.

3.3 Additional Information

None.

4. SECTION 4: FIRST AID MEASURES



4.1 Description of first aid measures

Inhalation

Move to fresh air.
Oxygen or artificial respiration if needed.
Victim to lie down in the recovery position, cover and keep him warm.
Call a physician immediately

Skin Contact

Take off contaminated clothing and shoes immediately.
Wash off immediately with plenty of water.
Keep warm and in a quiet place.
Call a physician or poison control centre immediately.
Wash contaminated clothing before re-use.

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Call a physician or poison control centre immediately.
Take victim immediately to hospital.

Ingestion

Due to its physical form, exposure to this chemical is not likely. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth out with water. Get immediate medical advice/attention.

4.2 Most important symptoms and effects, both

May cause drowsiness or dizziness.
Contact with the liquid may cause cold burns/frostbite.

	acute and delayed	Direct contact with the liquefied gas may cause severe and possibly permanent eye injury due to frostbite from rapid liquid evaporation.
4.3	Indication of immediate medical attention and special treatment needed	No specific requirements

5. SECTION 5: FIRE-FIGHTING MEASURES

5.1	Extinguishing Media	
	Suitable Extinguishing Media	Use large volumes of water as fog. Large fires: sprayed water or fog. Small ignitions: dry chemical or CO ₂ .
	Unsuitable Extinguishing Media	All fire-extinguishing means except carbon-dioxide fire extinguishers, inert gases, and sprayed water.
5.2	Special hazards arising from the substance or mixture	The product is a liquefied and hardly combustible gas.
5.3	Advice for fire-fighters	In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment. Wear chemical resistant oversuit. Cool containers / tanks with water spray.

6. SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1	Personal precautions, protective equipment and emergency procedures	Advice for non-emergency personnel: - Prevent further leakage or spillage if safe to do so. - Keep away from Incompatible products (see Section 10). Advice for emergency responders: - Evacuate personnel to safe areas. - Keep people away from and upwind of spill/leak. - Ventilate the area. - Wear suitable protective clothing. Refer to protective measures listed in sections 7 and 8.
6.2	Environmental precautions	Should not be released into the environment.
6.3	Methods and material for containment and cleaning up	Allow small spillages to evaporate provided there is adequate ventilation.
6.4	Reference to other sections	See Sections 7, 8 and 13
6.5	Additional Information	None





7. SECTION 7: HANDLING AND STORAGE

7.1	Precautions for safe handling	Additional hazards when processed: Pressurized container: Do not pierce or burn, even after use. Close valve after each use and when empty. Precautions for safe handling: Do not handle until all safety precautions have been read and understood. Ensure good ventilation of the work station. Do not breathe fumes, gas, mist, spray, vapors. Wear personal protective equipment. Avoid contact with skin and eyes. Safe handling of the gas receptacle: Securely chain cylinders when in use and protect against physical damage. Hygiene measures: Handle in accordance with good industrial hygiene and safety procedures. Do not eat, drink or smoke when using this product. Always wash hands after handling the product.
7.2	Conditions for safe storage, including any incompatibilities	Protect from sunlight. Do not expose to temperatures exceeding 50 °C. Keep container closed when not in use. Store in dry, cool, well-ventilated area. Incompatible materials: Alkali metals. Finely divided metals (Al, Mg, Zn). Strong oxidizing agents.
7.3	Specific end use(s)	Intended for production of various polymers and copolymers, and various fluoroorganic compounds.

8. SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters 8.1.1 Occupational Exposure Limits

Substance	Hexafluoropropene			
CAS No.	116-15-4			
	Limit value - Eight hours		Limit value - Short term	
	ppm	mg/m ³	ppm	mg/m ³
<u>Belgium</u>	0,1	0,6		
<u>Canada - Ontario</u>				0,005 (1)(2)
People's Republic of China		4		
	Remarks			
Canada - Ontario	(1) Ceiling limit value (2) Inhalable aerosol and vapour			

- 8.1.2 Biological limit value** No information available.
- 8.1.3 PNECs and DNELs** Long-term exposure - inhalation - systemic effects
DNEL: 0,62 mg/m³
- 8.2 Exposure controls**
- 8.2.1 Appropriate engineering controls** Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.
- 8.2.2 Personal protection equipment**
- Eye/face protection  Safety glasses and face shield. At work use shock-proof safety glasses without ventilation.
- Skin protection  Protective gloves.
- Respiratory protection  If there is a probability that the exposure level is above 2 ppm, use approved NIOSH with full face-piece and forced air supply or of similar design. To increase the level of protection, use it together with a self-contained breathing apparatus.
- Skin and body protection  Suitable protective clothing, safety shoes, protective headgear which prevent contact of hexafluoropropene with skin. All protective equipment should be clean, available every day, and should be worn before work.
- Hygiene measures Follow the industrial hygiene precautions (in rooms where the product is handled):
- workers whose clothes are become dirty with hexafluoropropene must change into the clean clothes in proper time;
 - eating, smoking, and drinking are not allowed;
 - it is necessary to wash hands before eating, drinking, smoking, or going to the toilet;
 - after working shift it is necessary to take a shower-bath.
- 8.2.3 Environmental Exposure Controls** Control of product content in atmospheric air. Use closed systems, ventilation. To avoid the product release to atmosphere, the workroom air must be cleaned and directed for dispersion to atmosphere. Waste

water of production process must be treated according to the manufacturing instructions.

9. SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1	Information on basic physical and chemical properties	
	Physical state at 20°C and 101.3 kPa	Liquefied gas
	Colour	Colourless.
	Odour	Odourless.
	Melting Point (°C) / Freezing Point (°C)	Not applicable
	Boiling point	Not applicable
	Flash Point (°C)	Not applicable
	Flammability (solid, gas)	non flammable
	Explosive limit ranges at 20°C and 101.3 kPa	Not applicable
	Vapour Pressure (MPa)	0.587
	Surface tension	Not applicable
	Relative density (g/cm ³) @ 25°C	6,14x10 ⁻³
	Solubility (Water) (mg/L) @ 28°C	82
	Stability in organic solvents and identity of relevant degradation products	Not applicable
	Partition Coefficient (n-Octanol/water)	1.95
	Self-ignition temperature (°C)	Not applicable; test substance is a gas with no flammable range in air.
	Viscosity (mPa.s)	Not applicable
	Explosive properties	Non-explosive, based on structural examination.
	Oxidizing properties	Not applicable
9.2	Other information	None

10. SECTION 10: STABILITY AND REACTIVITY

10.1	Reactivity	Halogenates, hydrates, dimerizes, and reacts with ammonia, hydrogen sulfide, alcohols, ethers, inorganic oxides
10.2	Chemical stability	Stable under recommended storage conditions.
10.3	Possibility of hazardous reactions	The possibility of thermodestruction.
10.4	Conditions to avoid	Do not expose to direct solar radiation. Do not overheat in order to avoid thermodestruction.
10.5	Incompatible materials	Alkali metals. Finely divided metals (Al, Mg, Zn). Strong oxidizing agents.
10.6	Hazardous Decomposition Product(s)	When exposed to temperature above 500 °C, the product can decompose to form toxic substances: perfluoroisobutene, tetrafluoroethylene, octafluorocyclobutane. The final products of thermal degradation are carbon oxides, fluorine, hydrofluoride.

11. SECTION 11: TOXICOLOGICAL INFORMATION

11.1	Information on toxicological effects	
11.1.1	Acute toxicity	
	Inhalation / Skin Contact / Eye Contact	Inhalation: LC50 (rat) (4 h): 3060 ppm (male) LC50 (mouse) (4 h): 2000 — 2600 ppm LC50 (guinea pig) (4 h): 2000 — 2600 ppm LC50 (rabbit) (4 h): 2000 — 2600 ppm
11.1.2	Skin corrosion/irritation	not irritating
11.1.3	Serious eye damage/irritation	not irritating
11.1.4	Respiratory or skin sensitization	not sensitizing
11.1.5	Mutagenicity	Negative mutagenicity tests support no classification
11.1.6	Carcinogenicity	Not available
11.1.7	Reproductive toxicity	The test substance did not adversely affect reproductive organs in a 90-day study. The substance does not need to be classified for reproductive toxicity according the EU Classification, Labelling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No.

1272/2008.

11.1.8	Repeated dose toxicity: sub-acute / sub-chronic / chronic	Based on the results of repeated inhalation studies, the substance is classified as Specific Target Organ Toxicity Repeated Exposure Category 2 (Kidney) according to the EU Classification, Labelling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008.
11.2	Other information	None

12. SECTION 12: ECOLOGICAL INFORMATION

12.1	Toxicity	Based on the results of the aquatic toxicity studies and the relevant mammalian toxicity, the substance is not toxic (not T).
12.2	Persistence and degradability	The test substance is not expected to undergo appreciable biodegradation, does not hydrolyze, and is unlikely to degrade via direct photodegradation given no UV absorbance above 290 nm. However, the test substance undergoes atmospheric oxidation with a half-life of 6.2 days and does not contribute to ozone depletion or global warming.
12.3	Bioaccumulative potential	Atmospheric oxidation in laboratory studies resulted in the formation of carbonyl fluoride and trifluoroacetyl fluoride. These degradates are incorporated into raindrops/aerosols in the atmosphere and in the water phase degraded to trifluoroacetic acid, hydrogen fluoride, and carbon dioxide.
12.4	Mobility in soil	The test substance is a gas under all environmental conditions and only slightly soluble in water. It has a high vapour pressure (587952 Pa) and Henry's Law constant (1.08E6 Pa m ³ /mol), and low log Kow (1.95) and Koc (47.5 L/kg). Environmental releases will result in virtually all of the substance compartmentalizing into the atmosphere. Any potential atmospheric deposition to land and water would result in rapid redistribution from soil and water due to its volatility and low sorption to soil.
12.5	Results of PBT and VPVB assessment	Regarding all available data on biotic and abiotic degradation, bioaccumulation and toxicity it can be stated that the substance does not fulfill the PBT criteria (not PBT) nor does it fulfill the vPvB criteria (not vPvB).
12.6	Other adverse effects	No information available.

13. SECTION 13: DISPOSAL CONSIDERATIONS

13.1	Waste treatment methods	Pressurized gas bottle: dispose of only in empty condition! Dispose of contents in accordance with local, state or national legislation.
13.2	Additional Information	
13.2.1	Contaminated packaging:	Where possible recycling is preferred to disposal or incineration. Dispose as unused product according to the local and national standards.

14. SECTION 14: TRANSPORT INFORMATION

14.1	Land transport (ADR/RID):	
	UN-No.:	1858
	Proper shipping name	HEXAFLUOROPROPYLENE (REFRIGERANT GAS R 1216)
	Transport hazard class(es)	2
	Labels	2.2
14.2	Inland water ways transport (ADN):	
	UN-No.:	1858
	Proper Shipping Name:	HEXAFLUOROPROPYLENE (REFRIGERANT GAS R 1216)
	Class:	2
	Hazard Label(s):	2.2

14.3	Marine transport (IMDG)	
	UN-No.:	1858
	Proper Shipping Name:	HEXAFLUOROPROPYLENE (REFRIGERANT GAS R 1216)
	Class:	2
	Hazard Label(s):	2.2
	EmS number	F-C,S-V
14.4	Air transport (ICAO-TI/IATA-DGR):	
	UN-No.:	1858
	Proper Shipping Name:	HEXAFLUOROPROPYLENE
	Class(es)	2.2
14.5	Additional information:	None

15. SECTION 15: REGULATORY INFORMATION

15.1	Safety, health and environmental regulations/legislation specific for the substance or mixture	
15.1.1	EU regulations	
	Authorizations and/or restrictions on use	None known.
15.1.2	National regulations	Hazard classification - In accordance with: State Standard of Russian Federation (GOST 12.1.007). Label elements - In accordance with: State Standard of Russian Federation (GOST 31340-07).
15.2	Chemical Safety Assessment	Available.

16. SECTION 16: OTHER INFORMATION

16.1 Classification of the substance
16.1.1 Classification according to Regulation (EC) No 1272/2008 [CLP/GHS]

Hazard class and category:

Liquefied gas
Acute Toxicity - Inhalation (Acute Tox. 4)
Specific target organ toxicity – single (STOT Single Exp. 2)
Specific target organ toxicity – single (STOT Single Exp. 3)
Specific target organ toxicity – repeated (STOT Rep. Exp. 2)

Label elements

Hazard Pictogram:



GHS04



GHS08



GHS07

Signal word:

Danger

Hazard statements:

H280: Contains gas under pressure; may explode if heated.
H332: Harmful if inhaled
H335: May cause respiratory irritation
H371: May cause damage to the kidneys by inhalation.
H373: May cause damage to the kidneys through prolonged or repeated inhalation.

Precautionary Statements

P260 Do not inhale dust/fume/gas/mist/vapors/spray.
P264 Wash hands thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271: May cause fire or explosion; strong oxidizer
P312: Call a POISON CENTER/doctor/ if you feel unwell.
P308+P311 IF exposed or concerned: Call a POISON CENTER/doctor/
P304+P340+P312: IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell
P403+P233: Store in a well-ventilated place. Keep container tightly closed.

P405: Store locked up.
P410 + P403: Protect from sunlight. Store in a well-ventilated place.

16.2 LEGEND

STOT	Specific Target Organ Toxicity
DNEL	Derived No Effect Level
PNEC	Predicted No Effect Concentration
PBT	PBT: Persistent, Bioaccumulative and Toxic

Additional Information

Occupational sanitary-hygienic standards of Russian Federation:
PDK = 30 mg/m³, 4th dangerous class (low - hazardous substance).
(PDK – Highest non-recurrent concentration in the air of working area).

Information contained in this publication or as otherwise supplied to Users is believed to be accurate and is given in good faith, but it is for the Users to satisfy themselves of the suitability of the product for their own particular purpose. HaloPolymer Kirovo-Chepetsk LLC gives no warranty as to the fitness of the product for any particular purpose and any implied warranty or condition (statutory or otherwise) is excluded except to the extent that exclusion is prevented by law. HaloPolymer Kirovo-Chepetsk LLC accepts no liability for loss or damage (other than that arising from death or personal injury caused by defective product, if proved), resulting from reliance on this information. Freedom under Patents, Copyright and Designs cannot be assumed.

You should not use the product with the purposes other than those specified, without consultation with us.

It is the Customer's responsibility to make an assessment of this product and use it observing safety precautions and requirements of relevant laws and legal norms.

The Buyer of the product intended for a third party's usage is obliged to take all reasonable steps to afford access to all information contained in this SDS for any person making use of this product.

An Employer must inform employees and other persons of the dangers they can be incurred and precautionary measures they should apply.

Annex to the extended Safety Data Sheet (eSDS)

1. EXPOSURE ASSESSMENT

Overview of exposure scenarios for Hexafluoropropene (HFP)

Table 1. Overview on exposure scenarios and coverage of substance life cycle

ES number	Annual Volume per registrant (tonnes)*	Manufacture	Identified uses			Resulting life cycle stage		Linked to Identified Use	Sector of Use (SU)	Preparation Category (PC)	Process Category (PROC)	Article Category (AC)	Environmental Release Category ERC
			Industrial	Professional	Consumer	Service life (for articles)	Waste stage						
ES1	>1000	X						Manufacture and Storage of HFP	SU3, SU8	PC19	PROC1	Not Applicable	ERC1
ES2	>1000		X					Polymerisation of HFP	SU3, SU12	PC19	PROC1,2,3	Not Applicable	ERC6c

***Note:** Only the tonnage band is listed as tonnage is never used in the risk assessment and is considered confidential to consortium members. All assessments are based on emissions. Registrants need to verify they are below daily emission values.

- HFP is also used as a transported isolated intermediate for fluorinating agent compounds, this tonnage and use is not considered in this assessment.
- The monomer is also bound in an imported polymer. There are therefore no identified uses in the EU for the bound monomer in the polymer substance. Exposure scenario development for workers, consumers or the environment is not relevant. The predicted quantitative exposure to the bound monomer for workers, consumers and the environment would be extremely low.

1.1. Manufacture and Storage of Hexafluoropropene (HFP)

1.1.1. Exposure scenario (ES1)

1. Title					
Free short title		Manufacture and storage of Hexafluoropropene (ES1)			
Systematic title based on use descriptor		SU3, SU8, PC19, PROC1, ERC1* *ERC1 not used in environmental assessment			
Processes, tasks activities covered		Used in closed process			
Assessment Method		Worker inhalation: ECETOC TRAM worker Man Via Environment: ECETOC TRAM Environment Environment: ECETOC TRAM Environment			
2. Operational conditions and risk management measures					
Scenario name	Process Category (PROC)	Type of setting	Is substance a solid?	Time of potential exposure [hours/day]	Use of ventilation ?
manufacture	PROC 1	industrial	No	>4 hours (default)	Outdoors
2.1 Control of workers exposure					
Frequency and duration of use					
Daily, >4 hrs					
Product characteristic (including package design affecting exposure)					
Physical state: gas/liquefied gas Concentration: max. 100%					
Amounts used					
n/a for worker exposure					
Human factors not influenced by risk management					
none					
Other given operational conditions affecting workers exposure					
none					
Technical conditions and measures at process level (source) to prevent release					
Closed process system, closed sample systems					
Conditions and measures to control dispersion from source towards the worker					
LEV or vapour recovery systems for truck loading/unloading operations.					
Organisational measures to prevent /limit releases, dispersion and exposure					
Containment in closed process					
Conditions and measures related to personal protection, hygiene and health evaluation					
No PPE required, administrative controls such as area monitoring to keep workers out of areas where exposure potential exists					
2.2 Control of environmental exposure					
Frequency and duration of use					
Release days 320 days/yr (365 days are allowed, lower number used in assessment for conservatism, as emissions are reported on an annual basis)					
Product characteristics					
Physical state: gas/liquefied gas Concentration: max. 100%					
Amounts used					
Assessment based on emissions not on amount used. HFP air emissions per site not to exceed 40 kg/day.					
Environment factors not influenced by risk management					
Dilution factor river: 10 [TRA/EUSES default] Dilution factor marine: 100 [TRA/EUSES default]					
Other given operational conditions affecting environmental exposure					
none					
Technical conditions and measures at process level (source) to prevent release					
LEV or vapour recovery systems for truck loading/unloading operations.					
Onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil					
Closed process system, air emission abatement					

Additional good practice advice beyond the REACH CSA
 Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

As the substance as a liquefied gas may cause frost bite, the following Personal Protection Equipment is recommended as good industrial practice advice beyond those considered in the risk assessment:
 Protective clothing, gloves, Face and Eye protection where contact with liquefied may occur.
 Training of personnel

1.2. HFP Polymerisation

1.2.1. Exposure scenario (ES2)

1. Title				
Free short title	HFP Polymerisation (ES2)			
Systematic title based on use descriptor	SU3, SU12, PC19, PROC 1, PROC2, PROC3, ERC6c* *ERC6 not used for environmental assessment			
Processes, tasks activities covered	Storage of HFP, polymerisation (PROC1), post polymerisation (PROC2,3)			
Assessment Method	Worker inhalation: ECETOC TRAM worker Man Via Environment: ECETOC TRAM Environment Environment: ECETOC TRAM Environment			
2. Operational conditions and risk management measures				
Scenario name*	Process Category (PROC)*	Type of setting	Duration of exposure potential [hours/day]	Use of ventilation
storage, transfer, polymerisation of HFP	PROC 1	industrial	1 to 4 hours	Outdoors
storage, transfer polymerisation of HFP	PROC 1	industrial	15 mins to 1 hour	Outdoors
indoors with LEV	PROC 1	industrial	15 mins to 1 hour	Indoors with LEV
post polymerisation (residual HFP)	PROC 2	Industrial	1 to 4 hours	Indoors with LEV
post polymerisation (residual HFP)	PROC 3	industrial	1 to 4 hours	Indoors with LEV
2.1 Control of workers exposure				
Frequency and duration of use				
Daily, >4 hrs				
Product characteristic (including package design affecting exposure)				
Physical state: gas/liquefied gas Concentration: max. 100%				
Amounts used				
n/a for worker exposure				
Human factors not influenced by risk management				
none				
Other given operational conditions affecting workers exposure				
none				
Technical conditions and measures at process level (source) to prevent release				
Closed process system until post polymerisation				
Conditions and measures to control dispersion from source towards the worker				
LEV or vapour recovery systems for truck loading/unloading operations.				
Organisational measures to prevent /limit releases, dispersion and exposure				
Containment in closed process				
Conditions and measures related to personal protection, hygiene and health evaluation				
No PPE required, administrative controls such as area monitoring to keep workers out of areas where exposure potential exists				
2.2 Control of environmental exposure				
Frequency and duration of use				
Release days 320 days/yr (365 days are allowed, lower number used in assessment for conservatism, as emissions are reported on an annual basis)				
Product characteristics				

Physical state: gas/liquefied gas Concentration: max. 100%
Amounts used
<i>Assessment based on emissions not mamount used. HFP air emissions per site not to exceed 40 kg/day</i>
Environment factors not influenced by risk management
Dilution factor river: 10 [TRA/EUSES default] Dilution factor marine: 100 [TRA/EUSES default]
Other given operational conditions affecting environmental exposure
<i>none</i>
Technical conditions and measures at process level (source) to prevent release
LEV or vapour recovery systems for truck loading/unloading operations.
Onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
<i>Closed process system, air emission abatement</i>
Additional good practice advice beyond the REACH CSA Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.
As the substance as a liquefied gas may cause frost bite, the following Personal Protection Equipment is recommended as good industrial practice advice beyond those considered in the risk assessment: Protective clothing, gloves, Face and Eye protection where contact with liquefied may occur. Training of personnel

1.3. Combined Environmental Exposure (ES1 and ES2) for HFP

1.3.1. Environmental exposure

Releases to the environment

Compartments	Predicted releases (kg/d)	Measured release (kg/d)	Explanation / source of measured data
Aquatic (without STP*)	No releases		There is no known release to aquatic. All process water goes through WWTP but HFP is removed via depressurization prior to WWTP.
Aquatic (after STP)	No releases		There is no known release to aquatic. All process water goes through WWTP but HFP is removed via depressurization prior to WWTP.
Air (direct + STP)		40	Maximum emission for single site based on permit reporting
Soil (direct only)	No releases		No direct pathway for release to soil.

*STP = sewage treatment plant (called waste water treatment plants (WWTP) when industrial)

Summary of the releases taken into account for the exposure estimation.

Summary of the releases to the environment

Compartments	Release from point source (kg/d) (local exposure estimation)	Total release for regional exposure estimation (kg/d)	Justification
Aquatic (without STP*)	0	0	No release to water, processes provide for removal of HFP gas so that it will not remain in the process water.
Aquatic (after STP)	0	0	No release to STP, processes provide for removal of HFP gas so that it will not remain in the process water.
Air (direct + STP)	40	35	Based on reported local air emissions and ECETOC Regional air releases
Soil (direct releases only)	0	0	

*STP = sewage treatment plant (also called waste water treatment plants (WWTP) when industrial)

1.4. Regional exposure concentrations

Regional concentrations in the environment

	Predicted regional Exposure Concentrations		Measured regional exposure concentrations		Explanation / source of measured data
	value	unit	value	unit	
Freshwater	2.3E-11	mg/L			ECETOC TRAM 1.1
Marine water	2.2E-11	mg/L			ECETOC TRAM 1.1
Freshwater sediments	1.9E-10	mg/kg dwt)			ECETOC TRAM 1.1
Marine sediments	1.8E-10	mg/kg dwt)			ECETOC TRAM 1.1
Agricultural soil	7.3E-10	mg/kg dwt)			ECETOC TRAM 1.1
Grassland (natural)	7.3E-10	mg/kg dwt)			ECETOC TRAM 1.1
Air	5.0E-03	µg/m3			ECETOC TRAM 1.1

Regional concentrations in food and drinking water

	Predicted regional Exposure Concentrations		Measured regional exposure concentrations		Explanation / source of measured data
	value	unit	value	Unit	
Wet fish	3.4E-19	kg/kg bw			ECETOC TRAM 1.1 from EUTGDsheet-TRAM.xls under Exposure rows 68- 73
Drinking water	6.9E-19	kg/kg bw			ECETOC TRAM 1.1 from EUTGDsheet-TRAM.xls under Exposure rows 68- 73
Meat	5.9E-18	kg/kg bw			ECETOC TRAM 1.1 from EUTGDsheet- TRAM.xls under Exposure rows 68- 73
Milk	3.9E-17	kg/kg bw			ECETOC TRAM 1.1 from EUTGDsheet- TRAM.xls under Exposure rows 68- 73

2. Risk characterisation

The risk characterisation ratio (RCR) can be expressed as the quantitative exposure estimate divided by the DNEL (Derived No Effect Level) in case of Human Health endpoints, or the PNEC (Predicted No Exposure Concentration) in case of environmental endpoints.

As shown in Chapter 1 there is zero exposure to the bound monomer in the imported polymer for workers, consumers and the environment. Hence, for bound monomer in the imported polymer, all RCRs for Human Health and Environmental endpoints are approximating zero.

2.1. Manufacture and Storage of Hexafluoropropene (HFP)

2.1.1. Human health

2.1.1.1. Workers

(Semi) Quantitative risk characterisation for workers

	Route	ES 1- exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio
Acute - systemic effects	Dermal	Not relevant		
	Inhalation	0.088	46	0.002
Acute - local effects	Dermal	Not relevant		
	Inhalation	Not relevant		
	Combined routes			RCR Inhalation- systemic + RCR Dermal- systemic
Long-term - systemic effects	Dermal (mg/kg bw/d)	No Exposure		
	Inhalation (mg/m ³)	0.044	0.6	0.07
	Combined routes			RCR Inhalation- systemic + RCR Dermal- systemic
Long-term – local effects	Dermal (mg/cm ² /d)	Not relevant		
	Inhalation (mg/m ³)	Not relevant		

2.1.1.2. Consumers

No Exposure to Consumers.

2.1.1.3. Indirect exposure of humans via the environment

(Semi) Quantitative risk characterisation for humans exposed via the environment

Route	ES 1 and ES 2 combined exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio
Dermal- systemic (acute or long term) (mg/kg bw/d)	No Exposure to man via the environment		
Local Inhalation daily dose- systemic (long term) (mg/kgbw/d) (based on local PEC air)	2.8E-03	0.05*	0.06
Oral- systemic (long term) (mg/kg bw/d)	No Exposure to man via the environment		
Combined routes			0.06

*the 0.15 mg/m³ general population DNEL was converted to a total inhalation intake DNEL so that comparison could be made by the following conversion:

$$(0.15 \text{ mg/m}^3 \times 20 \text{ m}^3/\text{day})/60\text{kg} = 0.05 \text{ mg/kg bw/day}$$

where 20 m³/day is the breathing rate for 24hrs and 60 kg is the average weight of the adult general population.

All risk characterization ratios for humans via the environment were less than or equal to 0.1 indicating safe use and confirm negligible exposure for exposure based waiving.

2.2. Polymerisation

2.2.1. Human health

2.2.1.1. Workers

(Semi) Quantitative risk characterisation for workers

	Route	ES 2- exposure concentrations (EC)	DN(M)EL	Risk characterisation ratio
Acute - systemic effects	Dermal	Not relevant		
	Inhalation	0.13	46	0.003
Acute - local effects	Dermal	Not relevant		
	Inhalation	Not relevant		
	Combined routes			RCR Inhalation- systemic + RCR Dermal- systemic
Long-term - systemic effects	Dermal (mg/kg bw/d)	No Exposure		
	Inhalation (mg/m ³)	0.065	0.6	0.1
	Combined routes			RCR Inhalation- systemic + RCR Dermal- systemic
Long-term – local effects	Dermal (mg/cm ² /d)	Not relevant		
	Inhalation (mg/m ³)	Not relevant		

2.2.1.2. Consumers

No Exposure to Consumers.

2.3. Environmental Risk Characterization for manufacturing and polymerisation of HFP (ES 1, 2)

2.3.1. Environment

2.3.1.1. Aquatic compartment (including sediment)

Risk characterisation for the aquatic compartment

Compartments	PEC	PNEC	RCR	Discussion
Freshwater (mg/L)	2.3E-11	0.033	7E-10	
Marine water (mg/L)	2.2E-11	0.003	7E-09	
Fresh Water Sediment (mg/kg dwt)	1.9E-10	0.279	7E-10	
Marine Sediment (mg/kg dwt)	1.9E-10	0.028	7E-09	

2.3.1.2. Terrestrial compartment (including secondary poisoning)

Risk characterisation for the terrestrial compartment

Compartments	PEC	PNEC	RCR	Discussion
Agricultural soil (mg/kg dwt)	1.4E-02	0.254	0.06	The PEC is extremely conservative since it includes a high deposition of HFP to soil from air which seems unlikely. RCR extremely conservative
Grassland (mg/kg dwt)	1.4E-02	0.254	0.06	The PEC is extremely conservative since it includes a high deposition of HFP to soil from air which seems unlikely. RCR extremely conservative
Terrestrial food chain	not needed	not needed	not needed	Not needed as substance does not bioaccumulate per section 8.0 of CSR

2.3.1.3. Atmospheric compartment

Section R2.7.1 from the ECHA Guidance R.2, Characterization of dose concentration response for the environment, indicates that the methods to develop a PNEC air is not yet fully developed (ECHA 2008b). Section 2.1.1.3 of the CSR demonstrated that the risk characterization for inhalation for humans via the environment (PEC air/DNEL general population) was low, 6E-02. The regional PEC air and PEC soil for the all the combined uses was 5.0E-06 mg/m³ and 1.4E-02 mg/kg dwt respectively indicating low impact on the environment. Based on the low level of hazard and that low levels expected in the air there is minimal risk to organisms from the atmospheric compartment.

2.3.1.4. Microbiological activity in sewage treatment systems

Microbiological activity in sewage treatment systems

Compartments	PEC	PNEC	RCR	Discussion
STP (mg/L)	No exposure			Substance is a gas and does not go through STP treatment.

2.4. Exposure Based Waiving Summary

Based on the risk characterization ratios reported the consortium asserts that there are no significant exposures to HFP based on the uses identified. All RCRs are less than or equal to 0.1 which is well below the required RCR =1.0 to show safe use. The exposure assessments are Tier 1 with some refinement but still they are extremely conservative so there is minimal uncertainty in the assessment. The site operates with the intent to have no exposures and negligible releases. The risk assessment supports that there is no significant exposure to workers, man via the environment or the environment.