Säkerhetsdatablad
enligt förordning (EG) nr 1907/2006, bilaga II

AVSNITT 1: Namnet på ämnet/blandningen och bolaget/företaget

1.1 Produktbeteckning

Kylmedel R1234yf
8887100019/8887100016

2,3,3,3-Tetrafluoropropene
Registreringsnummer (ECHA): 01-0000019665-61-XXXX
Index: ---
EINECS, ELINCS, NLP: 468-710-7
CAS: 754-12-1

1.2 Relevanta identifierade användningar av ämnet eller blandningen och användningar som det avråds från

Relevanta identifierade användningar av ämnet eller blandningen:
Köldmedel

Användningar som det avråds från:
För närvarande finns ingen information om detta.

1.3 Närmare upplysningar om den som tillhandahåller säkerhetsdatablad

Dometic WAECO International GmbH, Hollefeldstr. 63, 48282 Emsdetten, Tyskland
Telefon:+49 (0) 2572 879 0, Telefax:+49 (0) 2572 879 300

Dometic Scandinavia AB, Gustaf Melins Gata 7, 42131 Västra Frölunda, Sverige
Telefon:+46 31 734 11 00, Telefax:+46 31 734 11 01
www.waeco.de

Den sakkunniga personens e-postadress: info@chemical-check.de, k.schnurbusch@chemical-check.de - använd dessa adresser INTE för att beställa säkerhetsdatablad.

1.4 Telefonnummer för nödsituationer

Informationstjänster vid nödsituationer / officiellt rådgivande organ:

Giftinformationscentralen, 171 76 STOCKHOLM. Ring 112 vid inträffade förgiftningstillbud och begär giftinformation - dygnet runt. Ring 010-456 67 00 i mindre akuta fall - dygnet runt.

Bolagets/Företagets telefonnummer för nödsituationer:
+49 (0) 700 / 24 112 112 (CCWA)

AVSNITT 2: Farliga egenskaper

2.1 Klassificering av ämnet eller blandningen

Klassificering i enlighet med Förordning (EG) 1272/2008 (CLP)

Faroklass	Farokategori	Faroangivelse
Flam. Gas	1	H220-Extremt brandfarlig gas.
Press. Gas	(Liq.)	H280-Innehåller gas under tryck. Kan explodera vid uppvärmning.

2.2 Märkningsuppgifter

Märkning i enlighet med Förordning (EG) 1272/2008 (CLP)

2,3,3,3-Tetrafluoropropene
CAS: 754-12-1, Index:--- EC: 468-710-7

Fara

H220-Extremt brandfarlig gas. H280-Innehåller gas under tryck. Kan explodera vid uppvärmning.

P210-Får inte utsättas för värme, heta ytor, gnistor, öppen låga eller andra antändningskällor. Rökning förbjuden. P281-Använd föreskriven personlig skyddsutrustning.
P377-Läckande gas som brinner: Försök inte släcka branden om inte läckan kan stoppas på ett säkert sätt. P381-Vid läckage, avlägsna alla antändningskällor.
P410+P403-Skyddas från solljus. Förvaras på väl ventilerad plats.

2.3 Andra faror
Inget vPvB-ämne
Inget PBT-ämne
Vätskestänk eller spraydimma kan orsaka förfrysningar.
Explosivt vid uppvärmning

AVSNITT 3: Sammansättning/information om beståndsdelar

3.1 Ämne

2,3,3,3-Tetrafluoropropene	
Registreringsnummer (REACH)	01-0000019665-61-XXXX
Index	---
EINECS, ELINCS, NLP	468-710-7
CAS	754-12-1
% intervall	
Klassificering i enlighet med Förordning (EG) 1272/2008 (CLP)	Flam. Gas 1, H220 Press. Gas (Liq.), H280

3.2 Blandning
e.t.

Text i H-fraserna samt klassificeringsförkortning (GHS/CLP) se avsnitt 16.
De ämnen som anges i detta avsnitt, anges med sin verkliga och korrekta klassificering!
För ämnen som listas i tabell 3.1 i bilaga VI till förordning (EG) nr 1272/2008 (CLP-förordningen) innebär det att det i den här angivna klassificeringen har tagits hänsyn till alla eventuella anmärkningar som anges där.

AVSNITT 4: Åtgärder vid första hjälpen

4.1 Beskrivning av åtgärder vid första hjälpen
Personer som ger första hjälpen ska se till att skydda sig själva!
Ge aldrig en avsvimmad person något att dricka!

Inandning
Avlägsna personen från riskområdet.
Tillför drabbad person frisk luft, uppsök genast läkare.
Vid medvetslöshet, lägg i stabilt sidoläge och inhämta råd av läkare.
Andningsstillestånd - utrustning för konstgjord andning erfordras.

Hudkontakt
Tvätta ordentligt med mycket vatten och ta genast av alla nedstänkta kläder, kontakta läkare vid hudirritation (rodnader etc.).
Förfrysningar ska täckas sterilt.

Kontakt med ögonen
Ta av kontaktlinser.
Spola noga med mycket vatten i flera minuter (ev med flaska för ögonsköljning), kontakta genast läkare, ta fram databladet.

Förtäring
Vanligtvis inget upptagningssätt.

4.2 De viktigaste symptomen och effekterna, både akuta och fördröjda
I tillämpliga fall hittas uppgifter om fördröjda symptom och effekter i avsnitt 11 resp. i samband med exponeringsvägarna som anges i avsnitt 4.1.
I vissa fall kan det förekomma att förgiftningssymtomen inte uppträder förrän efter en längre tid/efter flera timmar.
dåsighet
Huvudvärk
berusning
Vid höga koncentrationer:
Kvävande verkan.
Offret märker inte kvävningen.

4.3 Angivande av omedelbar medicinsk behandling och särskild behandling som eventuellt krävs
Symptomatisk behandling.
Ge inte preparat som innehåller adrenalin-efedrin.

AVSNITT 5: Brandbekämpningsåtgärder

5.1 Släckmedel
Lämpliga släckmedel
Spridd vattenstråle/alkoholbeständigt skum/CO2/torrt släckmedel
Olämpliga släckmedel
Sluten vattenstråle
5.2 Särskilda faror som ämnet eller blandningen kan medföra
Vid brand kan följande bildas:
Fluorväte
Koloxider
Giftiga gaser
Explosivt vid uppvärmning
5.3 Råd till brandbekämpningspersonal
Undvik inandning av rök vid brand eller explosion.
Andningsskydd som inte är beroende av cirkulationsluften.
Komplett skydd
Kyl behållare i riskzonen med vatten.
Kontaminerat släckvatten avfallshanteras enligt myndgheternas föreskrifter.

AVSNITT 6: Åtgärder vid oavsiktliga utsläpp

6.1 Personliga skyddsåtgärder, skyddsutrustning och åtgärder vid nödsituationer
Håll onödig personal på avstånd.
Avlägsna antändningsskällor, rökning förbjuden.
Sörj för god ventilation.
Undvik kontakt med ögon och hud samt inhalering.
6.2 Miljöskyddsåtgärder
Undvik nedtränganden i marken samt i yt- och grundvattnet.

Förhindra inträngning i avlopp, källare, arbetsgropar och andra platser, där ansamlingen skulle kunna vara farlig.
Om produkten har hamnat i avloppet av misstag ska ansvarig myndighet informeras.

6.3 Metoder och material för inneslutning och sanering

Vädra ordentligt om aerosol/gas släpps ut.
Låt förånga.

6.4 Hänvisning till andra avsnitt

Personlig skyddsutrustning: se avsnitt 8. Anvisningar om avfallshantering: se avsnitt 13.

AVSNITT 7: Hantering och lagring

Utöver informationen i detta avsnitt finns det också relevant information i avsnitt 8 och 6.1.

7.1 Skyddsåtgärder för säker hantering

7.1.1 Allmänna rekommendationer

Sörj för god ventilation i lokalen.
Rumsventilering även i närheten av golvet.
Undvik inandning av ångorna.
Undvik kontakt med ögon och hud.
Förvaras åtskilt från antändningskällor - rökning förbjuden.
Vidta åtgärder mot statisk elektricitet.
Använd explosionsskyddad utrustning.
Använd inte på heta ytor.
Det är förbjudet att äta, dricka, röka samt förvara livsmedel i arbetslokalen.
Följ anvisningarna på etiketten och bruksanvisningen.
Använd endast arbetsmetoder som framgår av bruksanvisningen.

7.1.2 Information om allmänna hygienåtgärder på arbetsplatsen

Vidta allmänna hygieniska åtgärder vid hantering av kemikalier.
Tvätta händerna före pauserna och vid arbetets slut.
Förvaras åtskilt från livsmedel och djurfoder.
Kassera kontaminerade kläder och skyddsutrustningar innan du går in i en matsal.

7.2 Förhållanden för säker lagring, inklusive eventuell oförenlighet

Förvaras oåtkomligt för obehöriga.
Förvara produkten i originalförpackningar i låsta utrymmen.
Förvara inte produkten i korridorer och trappuppgångar.
Förvara inte tillsammans med brandfrämjande och självantändliga ämnen.
Skydda mot solljus och temperaturer över 50 °C.
Förvara svalt.
Förvara på väl ventilerad plats.
Observera specialförskrifter för gaser.

7.3 Specifik slutanvändning

För närvarande finns ingen information om detta.

AVSNITT 8: Begränsning av exponeringen/personligt skydd

8.1 Kontrollparametrar

8.2 Begränsning av exponeringen

8.2.1 Lämpliga tekniska kontrollåtgärder

Sörj för god ventilation. Det kan åstadkommas genom lokalt utsug eller allmän frånluft.
Bär ett lämpligt andningsskydd, om detta inte räcker för att få ner koncentrationen under NGV eller AGW-värdena.
Gäller endast, om explosionsgränsvärden är uppförda här.

8.2.2 Individuella skyddsåtgärder, t.ex. personlig skyddsutrustning

Vidta allmänna hygieniska åtgärder vid hantering av kemikalier.
Tvätta händerna före pauserna och vid arbetets slut.

Förvaras åtskilt från livsmedel och djurfoder.
Kassera kontaminerade kläder och skyddsutrustningar innan du går in i en matsal.

Ögonskydd/ansiktsskydd:
Skyddsglasögon, tättslutande med sidoskydd (EN 166).

Hudskydd - Handskydd:
Läderhandskar
Eventuellt
Isoleringshandskar EN 511 (kyla)
De förmedlade genombrottstiderna enligt EN 374 del 3 genomfördes inte i praktiken.
En maximal bärtid rekommenderas som motsvarar 50% av genombrottstiden.

Hudskydd - Annatskydd:
Arbetarskyddsklädsel (t ex säkerhetsskor EN ISO 20345, arbetskyddsklädsel med lång ärm).

Andningsskydd:
Använd andningsskydd vid otillräcklig ventilation.
Andningsskydd som inte är beroende av cirkulationsluften.
Följ föreskriven användningstid för andningsskydd.

Termisk fara:
Vid förekommande fall står denna vid de enskilda skyddsåtgärderna (ögon-/ansiktsskydd, hudskydd, andningsskydd).

Tilläggsinformation för handskydd - Inga tester har utförts.
Urvalet av blandningar gjordes efter bästa förmåga och med hjälp av information om substanserna.
Avseende ämnena har urvalet gjorts utgående från handsktillverkarnans uppgifter.
Det slutliga valet av handskmaterial måste ske med hänsyn till utnötningstid, permeationskvot och degradering.
Valet av en väl anpassad handske är inte bara beroende av materialet, utan också av andra kvalitetskännetecken och varierar från tillverkare till tillverkare.
Vad gäller blandningar går det inte att på förhand beräkna hur beständiga handskmaterialen är. De måste därför kontrolleras före användning.
Information om den exakta utnötningstiden för handskmaterialet kan inhämtas hos tillverkaren för skyddshandskar.

8.2.3 Begränsning av miljöexponeringen
För närvarande finns ingen information om detta.

AVSNITT 9: Fysikaliska och kemiska egenskaper

9.1 Information om grundläggande fysikaliska och kemiska egenskaper

Aggregationstillstånd:	Kondenserad gas
Färg:	Färglös
Lukt:	Svag
Lukttröskel:	Ej bestämd
pH-värde:	e.t.
Smältpunkt/fryspunkt:	Ej bestämd
Initial kokpunkt och kokpunktsintervall:	-29,4 °C
Flampunkt:	e.t.
Avdunstningshastighet:	Ej bestämd
Brandfarlighet (fast form, gas):	Extremt brandfarligt
Undre explosionsgräns:	6,2 Vol-%
Övre explosionsgräns:	12,3 Vol-%
Ångtryck:	6067 hPa (21°C)
Ångtryck:	14203 hPa (54°C)
Ångdensitet (luft = 1):	4
Densitet:	1,1 g/cm3 (25°C)
Skrymdensitet:	Ej bestämd
Löslighet:	Ej bestämd
Löslighet i vatten:	198,2 mg/l (24°C, Regulation (EC) 440/2008 A.6. (WATER SOLUBILITY))

Fördelningskoefficient (n-oktanol/vatten):	2,15 (Regulation (EC) 440/2008 A.8. (PARTITION COEFFICIENT))
Självantändningstemperatur:	405 °C
Sönderfallstemperatur:	Ej bestämd
Viskositet:	Ej bestämd
Explosiva egenskaper:	Produkten är inte explosionsiv. Vid användning kan explosiv/-a ånga/luftblandningar bildas.
Oxiderande egenskaper:	Ej bestämd

9.2 Annan information

Blandbarhet:	Ej bestämd
Löslighet i fett / lösningsmedel:	Ej bestämd
Konduktivitet:	Ej bestämd
Ytspänning:	Ej bestämd
Lösningsmedelshalt:	Ej bestämd
Molmassa:	114 g/mol

AVSNITT 10: Stabilitet och reaktivitet

10.1 Reaktivitet
Produkten har inte kontrollerats.

10.2 Kemisk stabilitet
Stabil vid korrekt lagring och hantering.

10.3 Risken för farliga reaktioner
Inga farliga reaktioner är kända.

10.4 Förhållanden som ska undvikas
Se även avsnitt 7.
Uppvärmning, öppna lågor, antändningskällor

10.5 Oförenliga material
Se även avsnitt 7.
Alkalimetaller
Magnesium
Zink
Lättmetaller

10.6 Farliga sönderdelningsprodukter
Se även avsnitt 5.2.
Ingen nedbrytning vid avsedd användning.

AVSNITT 11: Toxikologisk information

11.1 Information om de toxikologiska effekterna
För eventuell ytterligare information om hälsoeffekter se avsnitt 2.1 (klassificering).

Toxicitet / effekt	Resultat	Värde	Enhet	Organism	Kontrollmetod	Anmärkning
Akut toxicitet, oralt:						u.s.
Akut toxicitet, dermalt:						u.s.
Akut toxicitet, genom inandning:						u.s.
Frätande/irriterande på huden:						u.s.
Allvarlig ögonskada/ögonirritation:						u.s.
Luftvägs-/hudsensibilisering:						u.s.
Mutagenitet i könsceller:						u.s.
Cancerogenitet:						u.s.
Reproduktionstoxicitet:						u.s.

Specifik organtoxicitet - enstaka exponering (STOT-SE):						u.s.
Specifik organtoxicitet - upprepad exponering (STOT-RE):						u.s.
Fara vid aspiration:						u.s.
Symptom:						u.s.

AVSNITT 12: Ekologisk information

För eventuell ytterligare information om miljöeffekter se avsnitt 2.1 (klassificering).

Toxicitet / effekt	Resultat	Tid	Värde	Enhet	Organism	Kontrollmetod	Anmärkning
12.1. Toxicitet för fisk:							u.s.
12.1. Toxicitet för Daphnia:							u.s.
12.1. Toxicitet för alger:							u.s.
12.2. Persistens och nedbrytbarhet:							u.s.
12.3. Bioackumuleringsförmåga:							u.s.
12.4. Rörlighet i jord							u.s.
12.5. Resultat av PBT- och vPvB-bedömningen:							u.s.
12.6. Andra skadliga effekter:							u.s.

AVSNITT 13: Avfallshantering

13.1 Avfallsbehandlingsmetoder
För ämnet / blandningen / restmängderna
Avfallskod för EG:
De nämnda avfallsnycklarna är rekommendationer på grundval av den här produktens tänkta användningsområde.
På grund av det speciella användningsområdet och användarens tillvägagångssätt vid omhändertagandet kan eventuellt även andra avfallsnycklar tilldelas. (2014/955/EU)
14 06 01 Klorfluorkarboner, HCFC, HFC
Råd och anvisningar:
Man ska avråda från avledning av avloppsvatten.
Observera för landet gällande miljöförskrifter.
Till exempel lämplig förbränningsanläggning.
Förorenade förpackningar
Observera i landet gällande miljöföreskrifter.
Råd och anvisningar:
Retur till tillverkaren med resttryck.
15 01 04 Metallförpackningar

AVSNITT 14: Transportinformation

Allmänt
14.1. UN-nummer: 3161
Väg- / järnvägstransport (ADR/RID)
14.2. Officiell transportbenämning:

UN 3161 LIQUEFIED GAS, FLAMMABLE, N.O.S. (R-1234YF)

14.3. Faroklass för transport:	2.1
14.4. Förpackningsgrupp:	-
Klassificeringskod:	2F
LQ:	0
14.5. Miljöfaror:	Ej tillämpligt
Tunnel restriction code:	B/D

Sjötransport (IMDG-kod)

14.2. Officiell transportbenämning:
LIQUEFIED GAS, FLAMMABLE, N.O.S. (R-1234YF)

14.3. Faroklass för transport:	2.1
14.4. Förpackningsgrupp:	-
EmS:	F-D, S-U
Vattenförorenande ämne (Marine Pollutant):	e.t.
14.5. Miljöfaror:	Ej tillämpligt

Flygtransport (IATA)

14.2. Officiell transportbenämning:
Liquefied gas, flammable, n.o.s. (R-1234YF)

14.3. Faroklass för transport:	2.1
14.4. Förpackningsgrupp:	-
14.5. Miljöfaror:	Ej tillämpligt

14.6. Särskilda skyddsåtgärder

Personer som transporterar farligt gods måste vara skolad inom området.
Säkerhetsföreskrifterna ska beaktas av alla personer som är delaktiga i transporten.
Förebyggande åtgärder ska vidtas för att undvika skador.

14.7. Bulktransport enligt bilaga II till MARPOL och IBC-koden

Frakten sker inte som bulk utan som styckegods, därför ej tillämplig.
Hänsyn tas inte här till bestämmelser om minimikvantitet.
Farakod och förpackningskoder kan erhållas på förfrågan.
Följ (special provisions) särskilda bestämmelser.

AVSNITT 15: Gällande föreskrifter

15.1 Föreskrifter/lagstiftning om ämnet eller blandningen när det gäller säkerhet, hälsa och miljö

Observera begränsningar:
Följ branschorganisationernas/arbetsmedicinska föreskrifter.

Direktiv 2012/18/EU ("Seveso III"), bilaga I, del 1 - Följande kategorier stämmer in på den här produkten (eventuellt ska det tas hänsyn till ytterligare beroende på lagring, hantering osv.):

Farokategorier	Noter till Bilaga I	Tröskelvärden (i ton) för de farliga ämnen som avses i artikel 3.10 för tillämpning av - Krav för lägre nivå	Tröskelvärden (i ton) för de farliga ämnen som avses i artikel 3.10 för tillämpning av - Krav för högre nivå
P2		10	50

För tilldelningen av kategorierna och tröskelvärdena ska alltid noterna till bilaga I i direktiv 2012/18/EU följas, i synnerhet de som anges här i tabellerna och noterna 1-6.

Direktiv 2010/75/EU (VOC): 100 %

15.2 Kemikaliesäkerhetsbedömning

En kemikaliesäkerhetsbedömning har genomförts.

AVSNITT 16: Annan information

Bearbetade avsnitt: 2,16
Utbildning av de anställda i hanteringen av farligt gods krävs.

Denna information gäller för produkten när den levereras.
Instruktion/utbildning av de anställda i hanteringen av farliga ämnen krävs.
Nedanstående fraser utgör produktens och innehållsämnenas (angivna i avsnitt 2 och 3) fullständiga H-fraser samt koder för faroklass och kategori (GHS/CLP).
H280 Innehåller gas under tryck. Kan explodera vid uppvärmning.
H220 Extremt brandfarlig gas.

Flam. Gas — Brandfarliga gaser (inklusive kemiskt instabila gaser)
Press. Gas (Liq.) — Gaser under tryck-Kondenserad gas

Förkortningar och akronymer som eventuellt används i det här dokumentet:

AC Article Categories (= Varukategorier)
ACGIH American Conference of Governmental Industrial Hygienists
ADR Accord européen relatif au transport international des marchandises Dangereuses par Route
allm. allmänna
Anm. Anmärkning
AOEL Acceptable Operator Exposure Level
AOX Adsorberbara organiska halogenföreningar
ATE Acute Toxicity Estimate (= Den uppskattade akuta toxiciteten) i enlighet med Förordning (EG) 1272/2008 (CLP)
BAM Bundesanstalt für Materialforschung und -prüfung (Tyskland)
BAuA Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (= federalt organ för hälsa och säkerhet i arbetet, Tyskland)
BCF Bioconcentration factor (= biokoncentrationsfaktorn)
BGV Biologiskt gränsvärde.
BHT Butylhydroxytoluol (= 2,6-Di-t-butyl-4-metyl-fenol)
BOD Biochemical oxygen demand (= Biokemisk syreförbrukning)
BSEF Bromine Science and Environmental Forum
bw body weight (= kroppsvikt)
ca. cirka
CAS Chemical Abstracts Service
CEC Coordinating European Council for the Development of Performance Tests for Fuels, Lubricants and Other Fluids
CESIO Comité Européen des Agents de Surface et de leurs Intermédiaires Organiques
CIPAC Collaborative International Pesticides Analytical Council
CLP Classification, Labelling and Packaging (FÖRORDNING (EG) nr 1272/2008 om klassificering, märkning och förpackning av ämnen och blandningar)
CMR cancerframkallande, mutagent och reproduktionsstörande
COD Chemical oxygen demand (= Kemisk syreförbrukning)
CTFA Cosmetic, Toiletry, and Fragrance Association
DMEL Derived Minimum Effect Level
DNEL Derived No Effect Level (= härledd nolleffektnivå)
DOC Dissolved organic carbon (= Upplöst organiskt kol)
DT50 Dwell Time - 50% reduction of start concentration
dw dry weight (= torrvikt)
e.k. ej kontrollerad
e.t. ej tillämplig
ECHA European Chemicals Agency (= Europeiska kemikaliemyndigheten)
EEG Europeiska Ekonomiska Gemenskapen
EES Europeiska Ekonomiska Samarbetsområdet
EG Europeiska Gemenskapen
EINECS European Inventory of Existing Commercial Chemical Substances
ELINCS European List of Notified Chemical Substances
EPA United States Environmental Protection Agency (United States of America)
ERC Environmental Release Categories (= Miljöavgivningskategori)
etc., m.m., osv. etcetera, med mera, och så vidare
EU Europeiska Unionen
Fax. Faxnummer
GHS Globally Harmonized System of Classification and Labelling of Chemicals (= Globalt Harmoniserade Systemet för klassificering och märkning av kemikalier)
GWP Global warming potential (= Potential att bidra till växthuseffekten)

HET-CAM Hen's Egg Test - Chorionallantoic Membrane
HGWP Halocarbon Global Warming Potential
IARC International Agency for Research on Cancer (= Internationella centrumet för cancerforskning)
IATA International Air Transport Association
IBC Intermediate Bulk Container
IBC (Code) International Bulk Chemical (Code)
IMDG-kod International Maritime Code for Dangerous Goods (IMDG-code)
inkl. inklusive
IUCLID International Uniform ChemicaL Information Database
LQ Limited Quantities
NGV, KTV, TGV NGV = Nivågränsvärde, KTV = Korttidsgränsvärde, TGV = Takgränsvärde (Arbetsmiljöverkets föreskrifter om hygieniska gränsvärden och åtgärder mot luftföroreningar (AFS 2007:2, AFS 2005:17).
NIOSH National Institute of Occupational Safety and Health (United States of America)
ODP Ozone Depletion Potential (= Ozonnedbrytande potential)
OECD Organisation for Economic Co-operation and Development
org. organisk
PAK polycykliska aromatiska kolväten
PBT persistent, bioaccumulative and toxic (= långlivade, bioackumulerande, toxiska)
PC Chemical product category (= Kemisk produktkategori)
PE Polyetylen
PNEC Predicted No Effect Concentration (= uppskattad nolleffektkoncentration)
PROC Process category (= Processkategori)
PTFE Polytetrafluoretylen
REACH Registration, Evaluation, Authorisation and Restriction of Chemicals (FÖRORDNING (EG) nr 1907/2006 om registrering, utvärdering, godkännande och begränsning av kemikalier)
REACH-IT List-No. 9xx-xxx-x No. is automatically assigned, e.g. to pre-registrations without a CAS No. or other numerical identifier. List Numbers do not have any legal significance, rather they are purely technical identifiers for processing a submission via REACH-IT.
resp. respektive
RID Règlement concernant le transport International ferroviaire de marchandises Dangereuses
SADT Self-Accelerating Decomposition Temperature (= självaccelererande sönderfallstemperatur)
SU Sector of use (= Användningssektor)
SVHC Substances of Very High Concern (= ämne som inger mycket stora betänkligheter)
t.ex., t ex till exempel
Tfn. Telefon
ThOD Theoretical oxygen demand (= Teoretisk syreförbrukning)
TOC Total organic carbon (= totalt organiskt kol)
u.s. uppgifter saknas
UN RTDG United Nations Recommendations on the Transport of Dangerous Goods (FN:s rekommendationer om transport av farligt gods)
VbF Verordnung über brennbare Flüssigkeiten (= Förordning om brandfarliga vätskor (Österrike))
VOC Volatile organic compounds (= flyktiga organiska föreningar (FOF))
vPvB very persistent and very bioaccumulative (= mycket långlivad och mycket bioackumulerande)
wwt wet weight

Dessa uppgifter syftar endast till att beskriva produkten med avseende på erforderliga skyddsåtgärder.
De utgör ingen garanti för att produkten har vissa egenskaper. Uppgifterna bygger på senaste kunskapsrön.
Ansvar kan ej göras gällande.
Utfärdat av:

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Annex of Safety data sheet

Identified use: **ES and title**	**Sector of Use (SU)**	**Product Category (PC)** **Article Category (AC)**	**Process category (PROC)**	**Environmental Release Category (ERC)**
ES 1 : Industrial Use, Heat Transfer Fluids – Refrigerants, Coolants	SU 3, 10, 17	PC 16 AC 1, 2	PROC 8b, 9	ERC 7
ES 2 : Professional Use, Heat Transfer Fluids – Refrigerants, Coolants	SU 22	PC 16 AC 1, 2	PROC 8a	ERC 9b
ES 3 : Formulation of preparations	SU 3, 10, 17	PC 16 AC 1, 2	PROC 3	ERC 2
ES 4 : Use, service life, and waste stage environmental exposure	SU 3, 10, 17, 21, 22	Only environmental releases evaluated	Only environmental releases evaluated	ERC 2, 7, 9a, and 9b

Overview of Uses and Exposure Scenarios

HFO-1234yf is used as a heat transfer fluid in mobile air conditioning (MAC) equipment and in stationary air conditioning and refrigeration equipment. It is imported into the European Union (EU) and used by workers at Original Equipment Manufacturers (OEMs) to charge MAC and stationary equipment. Workers also use HFO-1234yf when servicing charged equipment during its service life or when dismantling charged equipment at the end of its service life. In addition, workers use the substance during blending and repackaging activities. Worker exposure may potentially occur during the activities associated with these uses, but exclusively when disconnecting and/or connecting the tight seal shut-off valve coupler hoses during transfer operations. Therefore, the exposure potential is limited in time and minimalized in amount due to the coupler system employed. Environmental exposure is also a possibility when conducting these transfer operations. Minimal releases to the ambient air may potentially occur during activities such as blending and repackaging of the substance, charging and servicing of equipment, dismantling of equipment, and if leakages occur from the charged equipment during its service life. Releases to other environmental compartments beside the ambient air are not possible because HFO-1234yf is a liquefied gas.
Potential consumer exposure is limited to those extremely rare occasions when all of the following conditions are met: the MAC is leaking, HFO-1234yf vents directly into the passenger compartment of the automobile, the passenger compartment remains totally closed, and passengers are present in the car.

1.1 Exposure Scenario ES1
Industrial Use, Heat Transfer Fluids – Refrigerants, Coolants
Industrial uses : Uses of substances as such or in preparations at industrial sites (SU3) ; Formulation [mixing] or preparations and/or re-packaging (excluding alloys) (SU10) : General manufacturing, e.g., machinery, equipment, vehicles, other transport equipment (SU17) excluding buses
Contributing environmental scenario CS1: Industrial use of substances in closed systems (ERC7). Quantified in ES4
Contributing worker scenario CS2: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) (PROC9) Contributing worker scenario CS3: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (PROC8b)
Exposure Scenario 1 (ES 1) describes the activities and processes covered when workers charge various types of packaging, A/C and refrigeration equipment in an industrial setting. It includes: • Refrigerant packaging workers, • Automobile original equipment manufacturer (OEM) assembly workers, and • Stationary equipment OEM assembly workers.
1.2.1 Contributing scenario CS1 controlling environmental exposure for ERC 7
Industrial use of substances in closed systems
Assessed and quantified in ES4
Product characteristics
Low global warming potential (GWP) liquefied gas with a concentration of 100%; Not biodegradable
Amounts used
9000 tonnes per annum (tpa) – EU
Frequency and duration of use
Continuous use/8-hour shift, 200 operating days/year; Intermittent release
Environmental factors not influenced by risk management
None
Other given operational conditions affecting environmental exposure
Under normal conditions of use, exposure would primarily occur when workers disconnect the couplings. Conservatively assumed that approximately 1% (5 grams/mobile A/C) released to air (Henne et al., 2012; Reimann & Shallcross et al., 2011) (release fraction of 0.01).
Technical conditions and measures at process level (source) to prevent release
Process designed to minimize releases to wastewater; Process designed to minimize releases to soil; Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
None
Organizational measures to prevent/limit release from site

Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Regular inspection and maintenance of equipment and machines.
Conditions and measures related to municipal sewage treatment plant
No STP
Conditions and measures related to external treatment of waste for disposal
Not applicable
Conditions and measures related to external recovery of waste
Not applicable
1.2.2 Contributing scenario CS2 controlling worker exposure for PROC 9
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
Product characteristic
Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Assumes activities are at room temperature.
Amounts used
120 kg/8-hour shift – worker; ~50 000 kg/y for plant site producing 100 000 vehicles per year
Frequency and duration of use/exposure
Duration of use/exposure: Intermittent; 20 min/8-hour shift (Under normal operation exposure occurs only at ending of filling process (disconnection), estimated at 0.083 min (5 sec) per disconnecting process x1 processes/fill x 30 fills/hr x 8 hr/shift) Frequency: 200 days/year
Human factors not influenced by risk management
Light work, respiration volume = 10 m^3/8-hour shift
Other given operational conditions affecting workers exposure
Indoor use; Under normal conditions of use, exposure would primarily occur when workers disconnect the couplings.
Technical conditions and measures at process level (source) to prevent release
Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.
Technical conditions and measures to control dispersion from source towards the worker
Mechanical ventilation giving at least [ACH]: 3; Room volume: >50 m^3.; Local exhaust ventilation (Effectiveness: < 10 ppm)
Organizational measures to prevent/limit releases, dispersion and exposure
Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems) and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise

exposures.
Conditions and measures related to personal protection, hygiene and health evaluation
Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines.
1.2.3 Contributing scenario CS3 controlling worker exposure for PROC 8b.
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
Product characteristic
Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Assumes activities are at room temperature.
Amounts used
Not applicable
Frequency and duration of use/exposure
Duration of use/exposure: Intermittent; Conservatively assumed less than 15 minutes/day Frequency: 200 days/year
Human factors not influenced by risk management
Light work, respiration volume = 10 m^3/8-hour shift
Other given operational conditions affecting workers exposure
Outdoor use; Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings.
Technical conditions and measures at process level (source) to prevent release
Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.
Technical conditions and measures to control dispersion from source towards the worker
None
Organizational measures to prevent/limit releases, dispersion and exposure
Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems) and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures.
Conditions and measures related to personal protection, hygiene and health evaluation
Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines.
1.3. Exposure estimation and reference to its source
ASSESSMENT METHOD: CS1: ECETOC TRA v.3. ; CS2 and CS3: Available measured data for HFC-134a were used to evaluate the worker exposure to HFO-1234yf. For comparison purposes only, ECETOC TRA v.3 was also used to estimate inhalation exposure for workers.

Information for CS1: Local releases to the environment

Release	Release factor estimation method	Explanation / Justification
Water	Process and substance knowledge	**Initial release factor:** ERC7 assumes 5% **Final release factor:** 0% **Local release rate:** 0 kg/day **Explanation / Justification:** Substance is a liquefied gas.
Air	Henne et al., 2012; Reimann & Shallcross et al., 2011	**Initial release factor:** ERC7 assumes 5% **Final release factor:** ~1% **Local release rate:** ~350 kg/day across entire 27 EU countries plus Croatia, Norway, Switzerland, and Turkey (EU-27+) after 90% of fleet is converted and at a steady state. **Explanation / Justification:** 5 grams/charging event, which is approximately 1% of the total charge volume (500+ or – grams); Henne et al, 2012; Reimann & Shallcross et al., 2011.
Soil	Process and substance knowledge	**Initial release factor:** ERC7 assumes 5% **Final release factor:** 0% **Local release rate:** 0 kg/day **Explanation / Justification:** Substance is a liquefied gas.

The exposure concentrations and RCRs for both HFO-1234yf and its potential degradation product TFA are reported in ES4.

Information for CS2: Exposure concentrations and risks for worker

Route of exposure and type of effects	Exposure concentration	Source for exposure concentration	Exposure concentration and DNEL (or DMEL) units	DNEL (or DMEL)	Risk characterisation
Inhalation, systemic, long-term	37	Bureau Veritas North America, 2008; data generated on HFC-134a	mg/m^3	950	0.039
	190	TRA v.3 tool used to estimate exposure concentration for comparison purposes only			0.2
Inhalation, systemic, acute	Not needed	Not needed			Not needed
Inhalation, local, long-term	Not needed	Not needed			Not needed
Inhalation, local, acute	Not needed	Not needed			Not needed

Dermal, systemic, long-term	Not needed	Not needed			Not needed
Dermal, systemic, acute	Not needed	Not needed			Not needed
Dermal, local, long-term	Not needed	Not needed			Not needed
Dermal, local, acute	Not needed	Not needed			Not needed
Combined routes, systemic, long-term					0.039
Combined routes, systemic, acute					Not needed

The RCR for inhalation exposure was <1. This indicates that adverse impact to workers is not expected.

Information for CS3: Exposure concentrations and risks for worker

Route of exposure and type of effects	Exposure concentration	Source for exposure concentration	Exposure concentration and DNEL (or DMEL) units	DNEL (or DMEL)	Risk characterisation
Inhalation, systemic, long-term	37	Bureau Veritas North America, 2008; data generated on HFC-134a	mg/m^3	950	0.039
	50	TRA v.3 tool used to estimate exposure concentration for comparison purposes only			0.05
Inhalation, systemic, acute	Not needed	Not needed			Not needed
Inhalation, local, long-term	Not needed	Not needed			Not needed
Inhalation, local, acute	Not needed	Not needed			Not needed
Dermal, systemic, long-term	Not needed	Not needed			Not needed
Dermal, systemic, acute	Not needed	Not needed			Not needed
Dermal, local, long-term	Not needed	Not needed			Not needed
Dermal, local, acute	Not needed	Not needed			Not needed

Combined routes, systemic, long-term					0.039
Combined routes, systemic, acute					Not needed

The RCR for inhalation exposure was <1. This indicates that adverse impact to workers is not expected.

2.1. Exposure Scenario ES2
Professional Use, Heat Transfer Fluids – Refrigerants, Coolants
Professional uses: Public domain (administration, education, entertainment, services, craftsmen) (SU22)
Contributing environmental scenario CS1: Wide dispersive outdoor use of substances in closed systems (ERC9b). Quantified in ES4.
Contributing worker scenario CS2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities (PROC8a)
Exposure Scenario 2 (ES 2) describes the activities and processes covered when professional workers service mobile or stationary A/C or refrigeration equipment. Although each of these workers may use different charge quantities of HFO-1234yf at different frequencies and in different professional settings, they all use equipment during the servicing procedure that is similar to the equipment used during industrial refrigerant charging or packaging. Therefore, professional workers have a similar potential for exposure as do industrial workers, except professional users process fewer units during the work shift and they are more likely to perform the work outdoors. If working indoors, however, their work space would likely be smaller than for industrial users. Therefore, a separate exposure scenario was deemed warranted. In general, the potential release to the environment is also the same between the various servicing workers (mobile and stationary) and industrial workers, de minimus release to only air as described in detail in ES1.
2.2.1 Contributing scenario CS1 controlling environmental exposure for ERC9b
Wide dispersive outdoor use of substances in closed systems
Assessed and quantified in ES4
Product characteristics
Low global warming potential (GWP) liquefied gas with a concentration of 100%; Not biodegradable
Amounts used
4000 tonnes per annum (tpa) – EU
Frequency and duration of use
Continuous use/release, 365 operating days/year; Intermittent release
Environmental factors not influenced by risk management
None
Other given operational conditions affecting environmental exposure
Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings. Conservatively assumed that approximately 6.4% of charge would be released if servicing completed by a skilled worker and that approximately 64% of charge would be

released if servicing completed by an unskilled worker (Henne et al, 2012) despite the fact that servicing is only allowed at professional service centers and completed by skilled workers.
Technical conditions and measures at process level (source) to prevent release
Process designed to minimize releases to wastewater; Process designed to minimize releases to soil; Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
None
Organizational measures to prevent/limit release from site
None
Conditions and measures related to municipal sewage treatment plant
No STP
Conditions and measures related to external treatment of waste for disposal
Not applicable
Conditions and measures related to external recovery of waste
Not applicable
2.2.2 Contributing scenario CS2 controlling worker exposure for PROC 8a
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities
Product characteristic
Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Assumes activities are at room temperature.
Amounts used
Mobile A/C: 0.5 kg/service event; Stationary Equipment: 0.05 – 300 kg/service event
Frequency and duration of use/exposure
Duration of use/exposure: Intermittent; Mobile A/C: ~1 minute/ 8-hour shift (0.083 minutes (5 seconds) per connecting process x 2 connecting processes per vacuuming/re-charging procedure x 1 servicing event per hour x 8 hours per shift) Stationary Equipment: ~< 1 minute/8-hour shift (0.083 minutes (5 seconds) per connecting process x2 connecting processes per vacuuming/ re-charging procedure x up to 4 servicing events per 8-hour shift) Frequency: 200 days/year
Human factors not influenced by risk management
Light work, respiration volume = 10 m^3/8-hour shift
Other given operational conditions affecting workers exposure
Indoor use; Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings.
Technical conditions and measures at process level (source) to prevent release
Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a

closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

Technical conditions and measures to control dispersion from source towards the worker

None

Organizational measures to prevent/limit releases, dispersion and exposure

Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems)and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); EN 378 (Refrigerating systems and heat pumps – Safety and environmental requirements); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures.

Conditions and measures related to personal protection, hygiene and health evaluation

Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines.

2.3. Exposure estimation and reference to its source

ASSESSMENT METHOD: **CS1:** TRA v.3. **CS2:** Available measured data on HFC-134a were used to evaluate the professional worker exposure to HFO-1234yf. For comparison purposes only, TRA v.3 was also used to estimate inhalation exposure for workers.

Information for CS1: Local releases to the environment

Release	Release factor estimation method	Explanation / Justification
Water	Activity and substance knowledge	**Initial release factor:** ERC9b assumes 5% **Final release factor:** 0% **Local release rate:** 0 kg/day **Explanation / Justification:** Substance is a liquefied gas.
Air	Henne et al., 2012	**Initial release factor:** ERC9b assumes 5% **Final release factor:** ~6.4% of initial charge if servicing by skilled workers; ~64% of initial charge if servicing by unskilled workers **Local release rate:** 4 580 kg/day across entire EU-27+. **Explanation / Justification:** Release estimates made by Henne et al., 2012 under the assumption that 90% of entire EU-27+ fleet is converted and at a steady state.
Soil	Activity and substance knowledge	**Initial release factor:** ERC9b assumes 5% **Final release factor:** 0% **Local release rate:** 0 kg/day **Explanation / Justification:** Substance is a liquefied gas.

The exposure concentrations and RCRs for both HFO-1234yf and its potential degradation product TFA are reported in ES4.

Information for CS2: Exposure concentrations and risks for worker

Route of exposure and type of effects	Exposure concentration	Source for exposure concentration	Exposure concentration and DNEL (or DMEL) units	DNEL (or DMEL)	Risk characterisation
Inhalation, systemic, long-term	85.6	Gjolstad et al., 2003; refrigeration repair workers' data generated on HFC-134a	mg/m^3	950	0.09
	5.1	Bureau Veritas North America, 2007; mobile A/C workers; data generated on HFC-134a			0.005
	240	TRA v.3 tool used to estimate exposure concentration for comparison purposes only			0.25
Inhalation, systemic, acute	Not needed	Not needed			Not needed
Inhalation, local, long-term	Not needed	Not needed			Not needed
Inhalation, local, acute	Not needed	Not needed			Not needed
Dermal, systemic, long-term	Not needed	Not needed			Not needed
Dermal, systemic, acute	Not needed	Not needed			Not needed
Dermal, local, long-term	Not needed	Not needed			Not needed
Dermal, local, acute	Not needed	Not needed			Not needed
Combined routes, systemic, long-term					0.09
Combined routes, systemic, acute					Not needed

The RCR for inhalation exposure was <1. This indicates that adverse impact to workers is not expected.

3.1. Exposure Scenario ES3
Formulation of preparations
Industrial uses : Uses of substances as such or in preparations at industrial sites (SU3) ; Formulation [mixing] or preparations and/or re-packaging (excluding alloys) (SU10) : General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment (SU17) excluding buses
Contributing environmental scenario CS1: Formulation of preparations (ERC2) (Covered by ES4)
Contributing worker scenario CS2: Use in closed batch process (synthesis or formulation) (PROC3)
Exposure Scenario 3 (ES 3) describes the activities and processes covered when workers blend various types of refrigeration substances and load the products into ISO containers or tanks. The blended products may contain up to nearly 100% of HFO-1234yf. Activities are expected to occur outdoors, but with the same equipment used during the charging and/or packaging procedures described in ES 1. In this process, however, yield rates are set at 99.75%. Therefore, potential releases to ambient air are expected to be < 0.25% and releases to wastewater and soil are expected to be at 0%. The equipment used for refrigerant blending and loading employs shut-off valve couplers that do not permit release of refrigerant unless a tight seal is made between the blending/filling equipment and the unit. In addition, blending/filling hoses are designed to be connected with the system prior to opening the valve(s) of the containers holding the substances. After blending operations are finished or the containers are filled, the valve(s) are closed prior to decoupling the hoses.
3.2.1 Contributing scenario CS1 controlling environmental exposure for ERC2
Formulation of preparations
Assessed and quantified in ES4
Product characteristics
Low global warming potential (GWP) liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Not biodegradable
Amounts used
5000 tonnes per annum (tpa) – EU; Daily amount: 25 000 kg/day – EU
Frequency and duration of use
Continuous use/8-hour shift, 200 operating days/year; Intermittent release
Environmental factors not influenced by risk management
None
Other given operational conditions affecting environmental exposure
Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings. Assumed 0.25% released to air (12.5 tpa), 0% released to wastewater and 0% released to soil.
Technical conditions and measures at process level (source) to prevent release
Process designed to minimize releases to wastewater; Process designed to minimize releases to soil; Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
None

Organizational measures to prevent/limit release from site
Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Regular inspection and maintenance of equipment and machines.
Conditions and measures related to municipal sewage treatment plant
No STP
Conditions and measures related to external treatment of waste for disposal
Not applicable
Conditions and measures related to external recovery of waste
Not applicable
3.2.2 Contributing scenario CS2 controlling worker exposure for PROC 3
Use in closed batch process (synthesis or formulation)
Product characteristic
Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Assumes activities are at ambient temperature (unless stated differently).
Amounts used
Up to 2 500 kg/shift – worker, based on conservative yearly volume estimate and two shifts/day with five workers/shift
Frequency and duration of use/exposure
Intermittent; 8-hour shift; 200 days/year; Conservatively assumed less than 15 minutes exposure duration/worker, which is based on 70 to 100 connections per day with two shifts/day, five workers/shift, and 30 seconds potential exposure/connection.
Human factors not influenced by risk management
Light work, respiration volume = 10 m^3/8-hour shift
Other given operational conditions affecting workers exposure
Outdoor use; Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings.
Technical conditions and measures at process level (source) to prevent release
Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.
Technical conditions and measures to control dispersion from source towards the worker
None
Organizational measures to prevent/limit releases, dispersion and exposure
Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); EN 378 (Refrigerating systems and heat pumps – Safety and environmental requirements); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures.
Conditions and measures related to personal protection, hygiene and health evaluation
Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines.
3.3. Exposure estimation and reference to its source

ASSESSMENT METHOD: CS1 and CS2: ECETOC TRA v.3

Information for CS1: Local releases to the environment

Release	Release factor estimation method	Explanation / Justification
Water	Process and substance knowledge	Initial release factor: ERC2 assumes 2% Final release factor: 0% Local release rate: 0 kg/day Explanation / Justification: Substance is a liquefied gas.
Air	Process and substance knowledge	Initial release factor: ERC2 assumes 2.5% Final release factor: ~0.25% Local release rate: 62.5 kg/day across EU-27+. Explanation / Justification: Based on process knowledge.
Soil	Process and substance knowledge	Initial release factor: ERC2 assumes 0.01% Final release factor: 0% Local release rate: 0 kg/day Explanation / Justification: Substance is a liquefied gas.

The exposure concentrations and RCRs for both HFO-1234yf and its potential degradation product TFA are covered and reported in ES4.

Information for CS2: Exposure concentrations and risks for worker

Route of exposure and type of effects	Exposure concentration	Source for exposure concentration	Exposure concentration and DNEL (or DMEL) units	DNEL (or DMEL)	Risk characterisation
Inhalation, systemic, long-term	17	TRA v.3 tool used to estimate exposure concentration	mg/m^3	950	0.018
Inhalation, systemic, acute	Not needed	Not needed			Not needed
Inhalation, local, long-term	Not needed	Not needed			Not needed
Inhalation, local, acute	Not needed	Not needed			Not needed
Dermal, systemic, long-term	Not needed	Not needed			Not needed
Dermal, systemic, acute	Not needed	Not needed			Not needed
Dermal, local, long-term	Not needed	Not needed			Not needed
Dermal, local, acute	Not needed	Not needed			Not needed
Combined routes, systemic, long-term					0.018

Combined routes, systemic, acute					Not needed

The RCR for inhalation exposure was <1. This indicates that adverse impact to workers is not expected.

4.1 Exposure Scenario ES4

Use, Service Life, and Waste Stage Environmental Exposure

Industrial uses : Uses of substances as such or in preparations at industrial sites (SU3) ; Formulation [mixing] or preparations and/or re-packaging (excluding alloys) (SU10) : General manufacturing, e.g.. machinery, equipment, vehicles, other transport equipment (SU17) excluding buses; Consumer uses : Private households (=general public = consumers) (SU21) ; and Professional uses : Public domain (administration, education, entertainment, services, craftsmen) (SU22).

Contributing environmental scenario CS1: HFO-1234yf: Wide dispersive outdoor use in closed systems (ERC9b); TFA: Wide dispersive outdoor use of long-life articles, high or intended release (ERC 10b).

Contributing worker scenarios: CS2: HFO-1234yf: Use and Service life (PROC 8a, 9) related to physico-chemical properties

According to Henne et al., 2012, an estimated 19.2 Gg/yr (19 200 tonnes per annum (tpa)) of HFO-1234yf may be emitted to the air from MACs once the conversion to HFO-1234yf in the automobile fleet is complete and at a steady-state (estimated to occur in the year 2020). This value represents the high emission scenario (95% confidence band) for the EU-27+. The 19 200 tonnes estimated to be released per year was based on a predicted car fleet of about 335 million, approximately 90% of which have the substance in the MAC, and on all the lifecycle activities for the HFO-1234yf, except for chemical manufacturing, which does not presently occur in the EU-27+.

4.2.1 Contributing scenario CS1 controlling environmental exposure for ERC9b, 10b

Wide dispersive use in closed systems (ERC9b); TFA: Wide dispersive outdoor use of long-life articles, high or intended release (ERC10b)

See ES1, 2, 3 above, respectively for conditions of use covered by ES4.

Predicted yearly emissions based on Henne et al 2012 and ES3 estimated releases

Activity	Potential amount released (g/MAC)	Percentage of original fill amount potentially released (%)	Fraction of automobiles with release	Henne et al emission factor (g/yr/MAC)	How Henne et al emission factor and/or fraction of automobiles with release determined	Predicted emissions for activity (tpa)
MAC filling at Original Equipment Manufacturers	5	0.9	0.9	0.42	5 g/MAC divided by 12 years (average MAC lifetime)	127
MAC refilling by skilled personnel	35	6.4	0.81	2.92	35 g/MAC divided by 12 years	792
MAC refilling by unskilled personnel	350	64	0.09	29.2	350 g/MAC divided by 12 years	880
Regular automobile usage	35.8	6.5	0.9	35.8	In-use car data for 2002/2003 with no loss rate improvement	10 794
Irregular usage (sudden leaks from accidents, stone impacts, and component defects)	550	100	0.017	550	All or original fill released; 1.9% cars/year times 90% of cars with HFO-1234yf in MAC	3 132
MAC dismantling by skilled personnel	100	18	0.25	8.33	100 g/MAC divided by 12 years	698
MAC dismantling by unskilled personnel	400	73	0.25	33.3	400 g/MAC divided by 12 years	2 789
					Total estimated emissions for ES1 and ES2	**~19 212**
Formulation of preparations (ES3)	Not applicable	Not applicable	Not applicable	Not applicable	0.25% of 5 000 tpa	12.5
					Total estimated emissions for ES1, ES2, and ES3	**~19 225**

4.2.2 Contributing scenario CS2 controlling worker exposure for Use and Service life (PROC 8a, 9) related to physico-chemical properties
Transfer of substance at non-dedicated facilities
Product characteristic
Extremely flammable liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Assumes activities are at ambient temperature (unless stated differently).
Amounts used
Mobile A/C: 0.5 kg/service event; Stationary Equipment: 0.05 – 300 kg/service event
Frequency and duration of use/exposure
Duration of use/exposure: Intermittent; Mobile A/C: ~1 minute/ 8-hour shift (0.083 minutes (5 seconds) per connecting process x 2 connecting processes per vacuuming/re-charging procedure x 1 servicing event per hour x 8 hours per shift) Stationary Equipment: ~< 1 minute/8-hour shift (0.083 minutes (5 seconds) per connecting process x2 connecting processes per vacuuming/ re-charging procedure x up to 4 servicing events per 8-hour shift) Frequency: 200 days/year
Human factors not influenced by risk management
None
Other given operational conditions affecting workers exposure
Indoor use; Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings.
Technical conditions and measures at process level (source) to prevent release
Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.
Technical conditions and measures to control dispersion from source towards the worker
None
Organizational measures to prevent/limit releases, dispersion and exposure
Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems)and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); EN 378 (Refrigerating systems and heat pumps – Safety and environmental requirements); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures.
4.3. Exposure estimation and reference to its source
ASSESSMENT METHOD: CS1: ECETOC TRA v.3

Information for CS1:
Predicted exposure concentrations and risk characterisation ratios for HFO-1234yf:

Protection target	Exposure concentration	Exposure concentration and PNEC units	PNEC	Risk characterisation
Sewage treatment plant (STP)	Not released to STP	mg/L	Not applicable	Not applicable
Freshwater	1.11E-10	mg/L	0.1	1E-09
Sediment (freshwater)	1.67E-09	mg/kg dry weight (dwt)	1.77	9E-10
Agricultural soil	1.97E-09	mg/kg dwt	1.54	1E-09
Marine water	3.19E-11	mg/L	0.01	3E-09
Sediment (marine water)	4.81E-10	mg/kg dwt	0.178	3E-09
Man via the environment (local)	3.28E-06	mg/kg body weight/day	271 (DNEL)†	1.21E-08

† The DNEL was derived by taking the worker inhalation, long-term, systemic DNEL of 950 mg/m^3 and converting it to a dose by multiplying by a presumed daily inhalation rate of 20 m^3/day and dividing by an adult body weight of 70 kg.

The RCRs for HFO-1234yf for all protection targets were all much less than 1. This indicates that adverse impact to the environment and environmental receptors is not expected from potential releases of HFO-1234yf during original filling, refilling, regular usage, irregular usage, and dismantling.

Predicted exposure concentrations and risk characterisation ratios for TFA if instantaneous conversion after HFO-1234yf vented to air:

Protection target	Exposure concentration	Exposure concentration and PNEC units	PNEC (ECHA, 2014)	Risk characterisation
Sewage treatment plant (STP)	Not released to STP	mg/L	Not applicable	Not applicable
Freshwater	1.06E-05	mg/L	1	1E-05
Sediment (freshwater)	5.86E-05	mg/kg dry weight (dwt)	4.22	1E-05
Agricultural soil	9.23E-06	mg/kg dwt	0.0083	1E-03
Marine water	9.14E-05	mg/L	0.1	9E-05
Sediment (marine water)	5.03E-05	mg/kg dwt	0.422	1E-04
Man via the environment (local)	1.12E-04	mg/kg body weight/day	0.25 (DNEL)	4E-04

The RCRs for TFA for all protection targets were all much less than 1. This indicates that adverse impact to the environment and environmental receptors is not expected from the potential conversion of HFO-1234yf to TFA during original filling, refilling, regular usage, irregular usage, and dismantling.

Assessment method for CS2: SAE International Cooperative Research Program 1234

Information for CS2:
Predicted exposure concentrations and physicochemical risk characterisation evaluation

HFO-1234yf is classified as an extremely flammable gas. This classification is based solely on the existence of a lower and upper flammability limit in air at 20°C. The flammability limits in air are 6.2%(V) and 12.3%(V) (method: ASTM E681-04). HFO-1234yf has a boiling point of -29,4 °C
and an autoignition temperature of 405°C. The auto-ignition temperature is very high and is of no concern during normal handling and use.

As HFO-1234yf is not classified as dangerous on the basis of (eco) toxicological properties, only the risk due to its flammable properties is required to be characterized. Exposure to HFO-1234yf within the confines of an automobile as a consequence of leaks due to random collisions is the worst-case situation as higher concentrations are more easily attained because HFO-1234 may escape in a shorter period of time than during a corrosion-type leak. Again, following a collision situation, a Micro automobile with effective volume of 1.25 m^3 was used to determine if the refrigerant's lower flammability level would be attained. In the most severe situation, 70% of the refrigerant is potentially leaked into the passenger cabin after a side impact collision. According to SAE J2772, breakage of other components would more likely lead to a significant release of refrigerant to the ambient air rather than to the passenger cabin. Results from this evaluation suggest that the refrigerant reaches a maximum concentration of 127 000 mg/m^3 (27 200 ppm), well below the lower flammability level of 62 000 ppm.

Exposure to HFO-1234yf due to worst-case corrosion-type leaks (slower gradual leaks) has been shown to reach a maximum concentration of below 2% in the luxury vehicle (maximum was 1.8% as tested); typical commuter vehicles have higher body air leakage and thereby lower maximum refrigerant concentrations (maximum was 1.2% as tested) than luxury vehicles due to the reduced road noise requirement for the higher end vehicles.