



## APPENDIX C

### FM-200® (HFC-227ea) Material Safety Data Sheet

#### SAFETY DATA SHEET



#### FM-200™

Version 7.2      Revision Date: 10/17/2017      SDS Number: 1334268-00038      Date of last issue: 10/03/2017  
Date of first issue: 02/27/2017

#### SECTION 1. IDENTIFICATION

Product name : FM-200™  
SDS-Identcode : 130000036866

##### Manufacturer or supplier's details

Company name of supplier : The Chemours Company FC, LLC  
Address : 1007 Market Street  
Wilmington, DE 19899 United States of America (USA)  
Telephone : 1-844-773-CHEM (outside the U.S. 1-302-773-1000)  
Emergency telephone : Medical emergency: 1-866-595-1473 (outside the U.S. 1-302-773-2000) ; Transport emergency: +1-800-424-9300 (outside the U.S. +1-703-527-3887)

##### Recommended use of the chemical and restrictions on use


Recommended use : Firefighting agent  
Restrictions on use : For professional users only.

#### SECTION 2. HAZARDS IDENTIFICATION

##### GHS classification in accordance with 29 CFR 1910.1200

Gases under pressure : Liquefied gas  
Simple Asphyxiant

##### GHS label elements

Hazard pictograms : 

Signal Word : Warning  
Hazard Statements : H280 Contains gas under pressure; may explode if heated.  
May displace oxygen and cause rapid suffocation.

Precautionary Statements : **Storage:**  
P410 + P403 Protect from sunlight. Store in a well-ventilated place.

##### Other hazards

Vapors are heavier than air and can cause suffocation by reducing oxygen available for breathing. Misuse or intentional inhalation abuse may cause death without warning symptoms, due to



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cardiac effects.  
Rapid evaporation of the product may cause frostbite.

#### SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Substance  
Substance name : 1,1,1,2,3,3,3-Heptafluoropropane  
CAS-No. : 431-89-0

##### Hazardous ingredients

Chemical name	CAS-No.	Concentration (% w/w)
1,1,1,2,3,3,3-Heptafluoropropane*	431-89-0	>= 90 - <= 100

\* Voluntarily-disclosed non-hazardous substance

#### SECTION 4. FIRST AID MEASURES

General advice : In the case of accident or if you feel unwell, seek medical advice immediately.  
When symptoms persist or in all cases of doubt seek medical advice.

If inhaled : If inhaled, remove to fresh air.  
Get medical attention if symptoms occur.

In case of skin contact : Thaw frosted parts with lukewarm water. Do not rub affected area.  
Get medical attention immediately.

In case of eye contact : Get medical attention immediately.

If swallowed : Ingestion is not considered a potential route of exposure.

Most important symptoms and effects, both acute and delayed : May cause cardiac arrhythmia.  
Contact with liquid or refrigerated gas can cause cold burns and frostbite.  
Other symptoms potentially related to misuse or inhalation abuse are  
Cardiac sensitization  
Anaesthetic effects  
Light-headedness  
Dizziness  
confusion  
Lack of coordination  
Drowsiness  
Unconsciousness

Protection of first-aiders : No special precautions are necessary for first aid responders.

Notes to physician : Treat symptomatically and supportively.

#### SECTION 5. FIRE-FIGHTING MEASURES

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- |  |   |  |
|--|---|--|
| Suitable extinguishing media                   | : | Not applicable<br>Will not burn  |
| Unsuitable extinguishing media                 | : | Not applicable<br>Will not burn  |
| Specific hazards during fire fighting          | : | Exposure to combustion products may be a hazard to health. If the temperature rises there is danger of the vessels bursting due to the high vapor pressure.  |
| Hazardous combustion products                  | : | No hazardous combustion products are known   |
| Specific extinguishing methods                 | : | Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Fight fire remotely due to the risk of explosion. Use water spray to cool unopened containers. Remove undamaged containers from fire area if it is safe to do so. Evacuate area. |
| Special protective equipment for fire-fighters | : | Wear self-contained breathing apparatus for firefighting if necessary. Use personal protective equipment.  |

#### SECTION 6. ACCIDENTAL RELEASE MEASURES

- |   |   |  |
|---|---|--|
| Personal precautions, protective equipment and emergency procedures | : | Evacuate personnel to safe areas. Avoid skin contact with leaking liquid (danger of frostbite). Ventilate the area. Follow safe handling advice and personal protective equipment recommendations.   |
| Environmental precautions   | : | Prevent further leakage or spillage if safe to do so. Retain and dispose of contaminated wash water.   |
| Methods and materials for containment and cleaning up               | : | Ventilate the area. Local or national regulations may apply to releases and disposal of this material, as well as those materials and items employed in the cleanup of releases. You will need to determine which regulations are applicable. Sections 13 and 15 of this SDS provide information regarding certain local or national requirements. |

#### SECTION 7. HANDLING AND STORAGE

- |                         |   |   |
|-------------------------|---|---|
| Technical measures      | : | Use equipment rated for cylinder pressure. Use a backflow preventative device in piping. Close valve after each use and when empty. |
| Local/Total ventilation | : | Use only with adequate ventilation.   |
| Advice on safe handling | : | Avoid breathing gas.  |

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Handle in accordance with good industrial hygiene and safety practice, based on the results of the workplace exposure assessment  
Wear cold insulating gloves/ face shield/ eye protection.  
Valve protection caps and valve outlet threaded plugs must remain in place unless container is secured with valve outlet piped to use point.  
Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.  
Prevent backflow into the gas tank.  
Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems.  
Close valve after each use and when empty. Do NOT change or force fit connections.  
Prevent the intrusion of water into the gas tank.  
Never attempt to lift cylinder by its cap.  
Do not drag, slide or roll cylinders.  
Use a suitable hand truck for cylinder movement.  
Keep away from heat and sources of ignition.  
Take precautionary measures against static discharges.  
Take care to prevent spills, waste and minimize release to the environment.

Conditions for safe storage : Cylinders should be stored upright and firmly secured to prevent falling or being knocked over.  
Separate full containers from empty containers.  
Do not store near combustible materials.  
Avoid area where salt or other corrosive materials are present.  
Keep in properly labeled containers.  
Keep in a cool, well-ventilated place.  
Keep away from direct sunlight.  
Store in accordance with the particular national regulations.

Materials to avoid : Do not store with the following product types:  
Self-reactive substances and mixtures  
Organic peroxides  
Oxidizing agents  
Flammable liquids  
Flammable solids  
Pyrophoric liquids  
Pyrophoric solids  
Self-heating substances and mixtures  
Substances and mixtures which in contact with water emit flammable gases  
Explosives  
Acutely toxic substances and mixtures  
Substances and mixtures with chronic toxicity

Recommended storage temperature : < 52 °C

Storage period : > 10 y

Further information on storage stability : The product has an indefinite shelf life when stored properly.



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### SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

#### Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

#### Hazardous components without workplace control parameters

Ingredients	CAS-No.
1,1,1,2,3,3,3-Heptafluoropropane	431-89-0

**Engineering measures** : Ensure adequate ventilation, especially in confined areas. Minimize workplace exposure concentrations.

#### Personal protective equipment

**Respiratory protection** : General and local exhaust ventilation is recommended to maintain vapor exposures below recommended limits. Where concentrations are above recommended limits or are unknown, appropriate respiratory protection should be worn. Follow OSHA respirator regulations (29 CFR 1910.134) and use NIOSH/MSHA approved respirators. Protection provided by air purifying respirators against exposure to any hazardous chemical is limited. Use a positive pressure air supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown, or any other circumstance where air purifying respirators may not provide adequate protection.

**Hand protection**  
**Material** : Low temperature resistant gloves

**Remarks** : Choose gloves to protect hands against chemicals depending on the concentration specific to place of work. For special applications, we recommend clarifying the resistance to chemicals of the aforementioned protective gloves with the glove manufacturer. Wash hands before breaks and at the end of workday. Breakthrough time is not determined for the product. Change gloves often!

**Eye protection** : Wear the following personal protective equipment:  
Chemical resistant goggles must be worn.  
Face-shield

**Skin and body protection** : Skin should be washed after contact.

**Protective measures** : Wear cold insulating gloves/ face shield/ eye protection.

**Hygiene measures** : Ensure that eye flushing systems and safety showers are located close to the working place.  
When using do not eat, drink or smoke.



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Wash contaminated clothing before re-use.

#### SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Liquefied gas
Color	:	colorless
Odor	:	slight, ether-like
Odor Threshold	:	No data available
pH	:	No data available
Melting point/freezing point	:	-129.5 °C
Initial boiling point and boiling range	:	-17 °C (1,013 hPa)
Flash point	:	Not applicable
Evaporation rate	:	Not applicable
Flammability (solid, gas)	:	Will not burn
Upper explosion limit / Upper flammability limit	:	Upper flammability limit Method: ASTM E681 None.
Lower explosion limit / Lower flammability limit	:	Lower flammability limit Method: ASTM E681 None.
Vapor pressure	:	4.547 hPa (25 °C)  540 hPa (-30 °C)  29,360 hPa (123 °C)
Relative vapor density	:	5.87
Density	:	1.388 g/cm <sup>3</sup> (25 °C) (as liquid)
Solubility(ies) Water solubility	:	0.23 g/l (25 °C)
Partition coefficient: n-octanol/water	:	log Pow: 0.36
Autoignition temperature	:	No data available
Decomposition temperature	:	No data available

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Viscosity  
Viscosity, kinematic : Not applicable

Explosive properties : Not explosive

Oxidizing properties : The substance or mixture is not classified as oxidizing.

Particle size : Not applicable

#### SECTION 10. STABILITY AND REACTIVITY

Reactivity : Not classified as a reactivity hazard.

Chemical stability : Stable if used as directed. Follow precautionary advice and avoid incompatible materials and conditions.

Possibility of hazardous reactions : Can react with strong oxidizing agents.

Conditions to avoid : Heat, flames and sparks.

Incompatible materials : Oxidizing agents

Hazardous decomposition products : No hazardous decomposition products are known.

#### SECTION 11. TOXICOLOGICAL INFORMATION

##### Information on likely routes of exposure

Inhalation  
Skin contact  
Eye contact

##### Acute toxicity

Not classified based on available information.

##### Ingredients:

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Acute inhalation toxicity : LC50 (Rat): > 788696 ppm  
Exposure time: 4 h  
Test atmosphere: gas  
Method: OECD Test Guideline 403

No observed adverse effect concentration (Dog): 90000 ppm  
Test atmosphere: gas  
Symptoms: Cardiac sensitization

Lowest observed adverse effect concentration (Dog): 105000 ppm  
Test atmosphere: gas  
Symptoms: Cardiac sensitization

Cardiac sensitisation threshold limit (Dog): 730,190 mg/m<sup>3</sup>

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Test atmosphere: gas  
Symptoms: Cardiac sensitization

#### **Skin corrosion/irritation**

Not classified based on available information.

#### **Serious eye damage/eye irritation**

Not classified based on available information.

#### **Respiratory or skin sensitization**

##### **Skin sensitization**

Not classified based on available information.

##### **Respiratory sensitization**

Not classified based on available information.

#### **Ingredients:**

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Routes of exposure: Skin contact  
Species: Humans  
Result: negative

#### **Germ cell mutagenicity**

Not classified based on available information.

#### **Ingredients:**

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Germ cell mutagenicity - Assessment : Weight of evidence does not support classification as a germ cell mutagen.

#### **Carcinogenicity**

Not classified based on available information.

#### **Ingredients:**

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Carcinogenicity - Assessment : Weight of evidence does not support classification as a carcinogen

#### **IARC**

No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

#### **OSHA**

No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

#### **NTP**

No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.





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#### Reproductive toxicity

Not classified based on available information.

#### Ingredients:

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Reproductive toxicity - Assessment : Weight of evidence does not support classification for reproductive toxicity

#### STOT-single exposure

Not classified based on available information.

#### STOT-repeated exposure

Not classified based on available information.

#### Ingredients:

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Assessment: No significant health effects observed in animals at concentrations of 250 ppm V/6h/d or less.

#### Repeated dose toxicity

#### Ingredients:

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Species: Rat  
NOAEL: 105000 ppm  
LOAEL: >105000 ppm  
Application Route: inhalation (gas)  
Exposure time: 13 Weeks  
Method: OECD Test Guideline 413  
Remarks: No significant adverse effects were reported

#### Aspiration toxicity

Not classified based on available information.

## SECTION 12. ECOLOGICAL INFORMATION

#### Ecotoxicity

#### Ingredients:

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Toxicity to fish : LC50 (Danio rerio (zebra fish)): > 200 mg/l  
Exposure time: 96 h  
Method: OECD Test Guideline 203  
Remarks: Based on data from similar materials

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): > 200 mg/l  
Exposure time: 48 h  
Method: OECD Test Guideline 202  
Remarks: Based on data from similar materials



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#### Reproductive toxicity

Not classified based on available information.

#### Ingredients:

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Reproductive toxicity - Assessment : Weight of evidence does not support classification for reproductive toxicity

#### STOT-single exposure

Not classified based on available information.

#### STOT-repeated exposure

Not classified based on available information.

#### Ingredients:

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Assessment: No significant health effects observed in animals at concentrations of 250 ppm V/6h/d or less.

#### Repeated dose toxicity

#### Ingredients:

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Species: Rat  
NOAEL: 105000 ppm  
LOAEL: >105000 ppm  
Application Route: inhalation (gas)  
Exposure time: 13 Weeks  
Method: OECD Test Guideline 413  
Remarks: No significant adverse effects were reported

#### Aspiration toxicity

Not classified based on available information.

## SECTION 12. ECOLOGICAL INFORMATION

#### Ecotoxicity

#### Ingredients:

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Toxicity to fish : LC50 (Danio rerio (zebra fish)): > 200 mg/l  
Exposure time: 96 h  
Method: OECD Test Guideline 203  
Remarks: Based on data from similar materials

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): > 200 mg/l  
Exposure time: 48 h  
Method: OECD Test Guideline 202  
Remarks: Based on data from similar materials



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Toxicity to algae : ErC50 (Pseudokirchneriella subcapitata (green algae)): > 114 mg/l  
Exposure time: 72 h  
Method: OECD Test Guideline 201  
Remarks: Based on data from similar materials

NOEC (Pseudokirchneriella subcapitata (green algae)): 13.2 mg/l  
Exposure time: 72 h  
Method: OECD Test Guideline 201  
Remarks: Based on data from similar materials

#### Persistence and degradability

##### Ingredients:

##### **1,1,1,2,3,3,3-Heptafluoropropane:**

Biodegradability : Result: Not readily biodegradable.  
Method: OECD Test Guideline 301D

#### Bioaccumulative potential

No data available

#### Mobility in soil

No data available

#### Other adverse effects

##### Product:

Results of PBT and vPvB assessment : This substance is not considered to be persistent, bioaccumulating and toxic (PBT). This substance is not considered to be very persistent and very bioaccumulating (vPvB).

### SECTION 13. DISPOSAL CONSIDERATIONS

#### Disposal methods

Waste from residues : Dispose of in accordance with local regulations.

Contaminated packaging : Empty containers should be taken to an approved waste handling site for recycling or disposal.  
Empty pressure vessels should be returned to the supplier.  
If not otherwise specified: Dispose of as unused product.

### SECTION 14. TRANSPORT INFORMATION

#### International Regulations

##### **UNRTDG**

UN number : UN 3296  
Proper shipping name : HEPTAFLUOROPROPANE  
Class : 2.2  
Packing group : Not assigned by regulation

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Labels : 2.2

#### IATA-DGR

UN/ID No. : UN 3296  
Proper shipping name : Heptafluoropropane  
Class : 2.2  
Packing group : Not assigned by regulation  
Labels : Non-flammable, non-toxic Gas  
Packing instruction (cargo aircraft) : 200  
Packing instruction (passenger aircraft) : 200

#### IMDG-Code

UN number : UN 3296  
Proper shipping name : HEPTAFLUOROPROPANE

Class : 2.2  
Packing group : Not assigned by regulation  
Labels : 2.2  
EmS Code : F-C, S-V  
Marine pollutant : no

#### Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

#### Domestic regulation

##### 49 CFR

UN/ID/NA number : UN 3296  
Proper shipping name : Heptafluoropropane  
Class : 2.2  
Packing group : Not assigned by regulation  
Labels : NON-FLAMMABLE GAS  
ERG Code : 126  
Marine pollutant : no

## SECTION 15. REGULATORY INFORMATION

#### EPCRA - Emergency Planning and Community Right-to-Know

##### CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

##### SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

##### SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

**SARA 311/312 Hazards** : Gases under pressure  
Simple Asphyxiant



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**SARA 313** : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

#### US State Regulations

##### Pennsylvania Right To Know

1,1,1,2,3,3,3-Heptafluoropropane 431-89-0

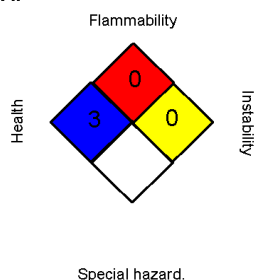
##### California Prop. 65

This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

## SECTION 16. OTHER INFORMATION

#### Further information

##### NFPA:



##### HMIS® IV:

HEALTH	/	0
FLAMMABILITY		0
PHYSICAL HAZARD		3

HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. The "/" represents a chronic hazard, while the "0" represents the absence of a chronic hazard.

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Chemours™ and the Chemours Logo are trademarks of The Chemours Company. Before use read Chemours safety information.

For further information contact the local Chemours office or nominated distributors.

All chemical substances in this material are included on or exempted from listing on the TSCA Inventory of Chemical Substances.

#### Full text of other abbreviations

AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC -



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International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Sources of key data used to compile the Material Safety Data Sheet : Internal technical data, data from raw material SDSs, OECD eChem Portal search results and European Chemicals Agency, <http://echa.europa.eu/>

Revision Date : 10/17/2017

Items where changes have been made to the previous version are highlighted in the body of this document by two vertical lines.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and shall not be considered a warranty or quality specification of any type. The information provided relates only to the specific material identified at the top of this SDS and may not be valid when the SDS material is used in combination with any other materials or in any process, unless specified in the text. Material users should review the information and recommendations in the specific context of their intended manner of handling, use, processing and storage, including an assessment of the appropriateness of the SDS material in the user's end product, if applicable.

US / Z8

