ASAHI GLASS COMPANY

MATERIAL SAFETY DATA SHEET

Product Name **Prepared:** 18-Aug-1992 **Revised:** 20-AUG-2002

ASAHIKLIN AK-225

Section I - Company Identification

Manufacturer's Name
ASAHI GLASS Co., Ltd.

Address
1-12 Yurakucho 1-Chome
Chiyoda-ku, Tokyo 100-8405, JAPAN
Chemicals Company, Gas&Solvent

Telephone Number for Information
011-81-3-3218-5479
Facsimile Number for Information
011-81-3-3218-7845

Supplier's Name
AGA Chemicals, Inc.

Address
2201 Water Ridge Parkway Suite 400,
Charlotte, NC 28217, USA
Telephone Number for Information
704-329-7600
Facsimile Number for Information
704-357-6308
Emergency Contact (In USA, Canada)
1-800-424-9300

Section II- Composition/Information on Ingredients

Component: 3,3-Dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca)
CAS No. 422-56-0
40 - 50 **%**

Component: 1,3-Dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb)
CAS No. 507-55-1
60 - 50 **%**
Note: This product does not contain any CFCs.

Section III - Physical/Chemical Characteristics

Boiling Point: 54 deg.C
Specific Gravity: 1.55 @ 25deg.C
Vapor Pressure: 0.038 MPa @ 25 deg.C
Freezing Point: -131 deg.C
Vapor Density (Air = 1): 7.0
Evaporation Rate (Diethyl ether=1): 0.9
Solubility in Water: 0.033g/100g H_2O @ 25 deg.C
Appearance and Odor: Clear, colorless liquid with slight ethereal odor.

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used): None (Tag Closed Cup & Cleveland Open Cup)

Flammable Limits: LEL = None; UEL = None

Extinguishing Media
As appropriate for combustibles in area.

Special Fire Fighting Procedures
Use water spray to cool containers. Self-contained breathing apparatus (SCBA) is required if drums rupture and contents are spilled under fire conditions.

Unusual Fire and Explosion Hazards
Containers may rupture under fire conditions. Decomposition may occur.

NFPA Hazard Code
NFPA codes are designed for use by firefighters, sheriffs, or other emergency response teams who are concerned with the hazards of burning or exploding materials. These NFPA codes are not intended to address the hazards of this product other than in a fire situation.

Decomposition of this product at temperature above 300 degree C can form hydrogen fluoride (HF), but HF will only accumulate with continuous exposure to excess heat in a sealed vessel.

a) Flammability - 0 b) Health - 2 c) Instability- 0

Section V- Reactivity Data

Stability
Stable
Condition to Avoid
Material is stable. However, avoid open flames and high temperature.

Incompatibility (Materials to Avoid)
Incompatible with alkali or alkaline earth metals-powdered Al, Zn, Be, etc.

Hazardous Decomposition or Byproducts
Decomposition products are hazardous. This compound can be decomposed by high temperatures (open flames, glowing metal surfaces, etc.) forming hydrochloric and hydrofluoric acids-possibly carbonyl halides.

Hazardous Polymerization
Will Not Occur

Section VI- Health Hazard Data

Route(s) of Entry
Inhalation: X
Skin: X
Eye: X
Ingestion: X

Animal Data:

3,3-Dichloro-1,1,1,2, 2-pentafluoropropane (HCFC-225ca)

Inhalation : 4-h LC50: 37,300 ppm in rats
Oral : LD50 : >5 g/kg in rats
Dermal : LD50: >2g/kg in rabbit.
Eye : Not irritant up to 0.1ml in rabbit.

1,3-Dichloro-1,1,2,2, 3-pentafluoropropane (HCFC-225cb)

Inhalation : 4-h LC50: 36,800 ppm in rats
Oral : LD50 **:** >5 g/kg in rats
Dermal : LD50: >2g/kg in rabbit.
Eye : Not irritant up to 0.1ml in rabbit.

Data from acute toxicity studies indicate that HCFC-225ca and HCFC-225cb have very low acute toxicity. Neither isomer causes eye irritation nor dermal toxicity in standardized tests; skin application of both isomers at high doses (2,000mg/kg body weight) produces no adverse effects. Therefore, the dermal LD50s are greater than 2,000mg/kg body weight. Oral administration of either isomer at high doses (5,000mg/kg body weight) does not cause any mortality and the oral LD50s are greater than 5,000mg/kg body weight. Both isomers also have very low acute inhalation toxicity as measured by the concentration that cause 50% mortality in experimental animals, the LC50, listed above. Cardiac sensitization response in dogs is observed at approximately 15,000ppm for the mixture of HCFC-225ca/HCFC-225cb (45/55 %) and 20,000ppm for HCFC-225cb.

In 28-day inhalation studies with rat, the activity and responsiveness of the animals was reduced at 5,000ppm or greater for each isomer. Toxicity was otherwise confined to the liver; liver enlargement and induction of peroxisomes was seen following treatment with either of the isomers. HCFC-225ca was more potent than HCFC-225cb in eliciting these liver effects. In 90-day study of HCFC-225ca/HCFC-225cb mixture (45/55 %) with rat, toxic effects were observed in liver; liver enlargement and induction of peroxisomes. In 28-day study with marmoset, exposure to HCFC-225ca at 1,000ppm caused effects on the liver, such as slight fat deposition associated with changes in serum biochemical parameters. In the same study, exposure to HCFC-225cb at 5,000ppm caused somnolence during exposure and an increase of cytochrome P-450, indicative of an adaptive response to HCFC-225cb. However, no liver enlargement was seen and virtually no peroxisome induction was observed in either isomer.

Animal testing with HCFC-225ca/HCFC-225cb(=45/55) mixture indicates that the compounds are not teratogenic.

Health Hazard Data (Continued)

The compounds do not produce genetic damage in bacterial cell cultures (Ames Assay), CHL, and in-vivo unscheduled DNA syntheses assay. In one in-vitro study with mammalian cell cultures (human

lymphocytes) HCFC-225ca caused genetic damage while HCFC- 225cb elicited a marginal response. However, the overall evidence from these studies implies that neither isomer is genotoxic.

Carcinogenicity
All ingredients are not listed by NTP, IARC or OSHA as carcinogens.

Exposure Guidelines:

Asahiklin AK-225
AEL*: 100ppm (8h-TWA)
TLV-TWA(ACGIH): Not established
PEL-TWA(OSHA): Not established
* AEL is the Acceptable Exposure Limit set by Asahi Glass Co., Ltd.

EEL*: 1000 ppm (time limit 15 min.)
2000 ppm (time limit 1 min.)
* EEL is the Emergency Exposure Limit set by Asahi Glass Co., Ltd.

Emergency Exposure Limits (EELs) are to be used for short-term emergency exposure control. They are concentrations of short periods which should not result in permanent adverse health effects or interfere with escape. They should not be confused with ACGIH TLV-TWA or TLV STEL values that are designed for repeated exposure guidelines. For the use of AK-225, daily exposure limits such as AEL as well as EEL are to be followed. The EEL for AK-225 is needed to avoid anaesthetic effects which could prevent self-rescue. If an EEL is exceeded for specified duration, evacuation, sheltering in place or other mitigation steps should be taken.

Remarks
AELs (Asahi Glass Co., Ltd.) of HCFC-225ca and HCFC-225cb are 50 and 400ppm, respectively. Though no ACGIH TLV or OSHA PEL are assigned, Asahi Glass temporarily recommends that workplace exposure level should be maintained at 100 ppm or less for the mixture (ca/cb=45/55) until the authorized control level such as ACGHI TLV or OSHA PEL are assigned.

Signs and Symptoms of Exposure

EYE CONTACT:
The compound may cause eye irritation.

SKIN CONTACT:
The compound may cause skin irritation.

INHALATION:
Inhalation of high concentrations of vapor is harmful and may cause hepatitis, heart irregularities, unconsciousness, or death. Intentional misuse can be fatal. Vapor reduces oxygen available for breathing and is heavier than air.

Health Hazard Data (Continued)
Emergency and First Aid Procedures

INHALATION:
If high concentrations are inhaled, immediately remove to fresh air. Keep persons calm. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT:
In case of skin contact, flush with water. Get medical attention if irritation is present.

EYE CONTACT:
In case of eye contact, immediately flush eyes with plenty of water for 15minutes. Call a physician.

INGESTION:
No specific intervention is indicated as the compound is not likely to be hazardous by ingestion. Consult a physician if necessary. Do not induce vomiting because the hazard of aspirating the material into the lungs is considered greater than swallowing it.

Section VII- Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled
NOTES: Review "Fire and Explosion Hazard Data" and "Precautions to Be Taken in Handling and Storing" before proceeding with clean up. Use appropriate Personal Protective Equipment during clean up.

Dike spill. Prevent liquid from entering sewers, waterways or low areas. Ventilate area. Collect on absorbent material and transfer to steel drums for recovery/disposal. Comply with Federal, State, and local regulations on reporting releases.

Waste Disposal Method
Recover by distillation or remove to permitted waste disposal facility. Comply with Federal, State, and local regulations.

Precautions to Be Taken in Handling and Storing
Use with sufficient ventilation to keep employee exposure below recommended limits. Provide adequate ventilation for storage, handling, and use, especially for enclosed or low spaces. Avoid contact of liquid with eyes and prolonged skin exposure. Do not allow product to contact open flame or electrical heating elements because dangerous decomposition products may form.

Storage Conditions
Store in clean, dry, well-ventilated area. Do not heat above 30 deg.C.

Section VIII- Control Measures

Respiratory Protection
Use respiratory protection approved by NIOSH in USA or other equivalent in each country if exposure limits may be exceeded. Self-contained breathing apparatus (SCBA) is required if a large spill occurs.

Ventilation
Normal ventilation for standard manufacturing procedures is generally adequate. Local exhaust should be used when large amounts are released. Mechanical ventilation should be used in low places.

Control Measures (Continued)

Eye/Skin Protection
Impervious gloves should be used to avoid prolonged or repeated exposure. Chemical splash goggles should be available for use as needed to prevent eye contact.

Other Precautionary Information

NPCA – HMIS (National Paint and Coating Association – Hazardous Materials Identification System) Hazard Rating

HMIS codes are intended for use in everyday workplace setting to provide a rapid indication of the occupational hazards associated with chemicals used in the workplace.

a) Flammability - 1 b) Health - 1 c) Reactivity- 0

Section IX- Regulatory Information

For European Union

EEC Classification: Not classified
Hazard Symbol: Not established
Risk phrases: Not established
Safety phrases: Not established, but recommend 23 (Don't breath gas/fumes/vapor/spray), 24/25 (Toxic in contact with skin and if swallowed), 36/37 (Irritation to eyes and respiratory system)
Council Directive 92/32/EEC Status: These chemicals are listed on the EINECS(HCFC-225ca: 207-016-9, HCFC-225cb: 208-076-9).

For United States of America

SNAP Acceptable: HCFC-225ca and HCFC-225cb are listed as SNAP acceptable substitutes for CFCs in the Solvent Cleaning Sector of the Clean Air Act.
Non-VOC: HCFC-225ca and HCFC-225cb are exempted from VOC regulations in the Clean Air Act.
TSCA Status: These chemicals are listed on the TSCA Inventory.
SARA Section 302: None of the chemicals are Section 302 hazard.
SARA Section 311, 312: Acute = Yes
Chronic = Yes
Fire = No
Reactivity = No
Pressure = No
SARA Section 313 = Yes (HCFC-225ca, HCFC-225cb)

Section X- Transportation Information

UN No.: Not established
ADR / RID Status: Not regulated
IMDG Status: Not regulated
ICAO / IATA Status: Not regulated
US DOT Status: Not regulated

Section XI- Additional Information

This Material Safety Data Sheet is offered only for your information, consideration and investigation. Asahi Glass Co., Ltd. provides no warranties, either express or implied, and assumes no responsibility for the accuracy or completeness of the data contained herein.

WARNINGS
This substance harms public health and environment by destroying ozone in the upper atmosphere.