1 PRODUCT AND COMPANY IDENTIFICATION

Fluorochemicals
Arkema Inc.
2000 Market Street
Philadelphia, PA 19103

EMERGENCY PHONE NUMBERS:
Chemtrec: (800) 424-9300 (24hrs) or (703) 527-3887
Medical: Rocky Mountain Poison Control Center
(866) 767-5089 (24Hrs)

Information Telephone Numbers
Product Information
Product Name FORANE (R) 401A
Phone Number 800-245-5858
Available Hrs 8:00 am - 5:30 pm (Eastern)

2 COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>CAS RegistryNumber</th>
<th>Typical %</th>
<th>OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>chlorodifluoromethane (HCFC-22)</td>
<td>75-45-6</td>
<td>53% By Wt.</td>
<td>Y</td>
</tr>
<tr>
<td>1,1-difluoroethane (HFC-152a)</td>
<td>75-37-6</td>
<td>13% By Wt.</td>
<td>Y</td>
</tr>
<tr>
<td>2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124)</td>
<td>2837-89-0</td>
<td>34% By Wt.</td>
<td>Y</td>
</tr>
</tbody>
</table>

The substance(s) marked with a “Y” in the OSHA column, are identified as hazardous chemicals according to the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200)

This material is classified as hazardous under Federal OSHA regulation.

The components of this product are all on the TSCA Inventory list.

3 HAZARDS IDENTIFICATION

Emergency Overview
Colorless liquified gas with faint ether odor.

WARNING!
LIQUID AND GAS UNDER PRESSURE, OVERHEATING AND OVERPRESSURIZING MAY CAUSE GAS RELEASE OR VIOLENT CYLINDER BURSTING. MAY DECOMPOSE ON CONTACT WITH FLAMES OR EXTREMELY HOT METAL SURFACES TO PRODUCE TOXIC AND CORROOSIVE PRODUCTS. VAPOR REDUCES OXYGEN AVAILABLE FOR BREATHING AND IS HEAVIER THAN AIR. HARMFUL IF INHALED AND MAY CAUSE HEART IRREGULARITIES, UNCONSCIOUSNESS OR DEATH. LIQUID CONTACT WITH EYES OR SKIN MAY CAUSE FROSTBITE.

Potential Health Effects

Skin contact and inhalation are expected to be the primary routes of occupational exposure to this material. As with most liquefied gases, contact with the rapidly volatilizing liquid can cause frostbite to any tissue. High vapor concentrations are irritating to the eyes and respiratory tract and may result in central nervous system (CNS) effects such as headache, dizziness, drowsiness and, in severe exposure, loss of consciousness and death. The dense vapor...
of this material may reduce the available oxygen for breathing. Prolonged exposure to an oxygen-deficient atmosphere may be fatal. Inhalation may cause an increase in the sensitivity of the heart to adrenaline, which could result in irregular or rapid heartbeats. Medical conditions aggravated by exposure to this material include heart disease or compromised heart function.

4 FIRST AID MEASURES

IF IN EYES, immediately flush with plenty of water. Get medical attention if irritation persists.

IF ON SKIN, Flush exposed skin with lukewarm water (not hot), or use other means to warm skin slowly. Get medical attention if frostbitten by liquid or if irritation occurs.

IF SWALLOWED, Not applicable - product is a gas at ambient temperatures.

IF INHALED, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. Do not give adrenaline, epinephrin or similar drugs following exposure to this product.

5 FIRE FIGHTING MEASURES

Fire and Explosive Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto-Ignition Temperature</td>
<td>1258 F / 681 C</td>
</tr>
<tr>
<td>Flash Point</td>
<td>NA - Gas</td>
</tr>
<tr>
<td>Flash Point Method</td>
<td></td>
</tr>
<tr>
<td>Flammable Limits - Upper</td>
<td>NA</td>
</tr>
<tr>
<td>Lower</td>
<td>NA</td>
</tr>
</tbody>
</table>

Extinguishing Media

Use extinguishing media appropriate to surrounding fire conditions.

Fire Fighting Instructions

Stop the flow of gas if possible. Use water spray on person making shut-off. Fire fighters and others who may be exposed to products of combustion should wear full fire fighting turn out gear (full Bunker Gear) and self-contained breathing apparatus (pressure demand NIOSH approved or equivalent). Fire fighting equipment should be thoroughly decontaminated after use.

Fire and Explosion Hazards

May decompose on contact with flames or extremely hot metal surfaces to produce toxic and corrosive products. Liquid and gas under pressure, overheating or overpressurizing may cause gas release and/or violent cylinder bursting. Container may explode if heated due to resulting pressure rise. Some mixtures of HCFCs and/or HFCs, and air or oxygen may be combustible if pressurized and exposed to extreme heat or flame.

6 ACCIDENTAL RELEASE MEASURES

In Case of Spill or Leak

Use Halogen leak detector or other suitable means to locate leaks or check atmosphere. Keep upwind. Evacuate enclosed spaces and disperse gas with floor-level forced-air ventilation. Exhaust vapors outdoors. Do not smoke or operate internal combustion engines. Remove flames and heating elements.

7 HANDLING AND STORAGE

Handling

Avoid breathing gas. Avoid contact with eyes, skin and clothing. Keep container closed. Use only with adequate ventilation. Do not enter confined spaces unless adequately ventilated.
7  HANDLING AND STORAGE

Storage
Do not apply direct flame to cylinder. Do not store cylinder in direct sun or expose it to heat above 120 F. Do not drop or refill this cylinder. Keep away from heat, sparks and flames.

8  EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls
Investigate engineering techniques to reduce exposures below airborne exposure limits. Provide ventilation if necessary to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

Eye / Face Protection
Where there is potential for eye contact, wear chemical goggles and have eye flushing equipment available.

Skin Protection
Wear appropriate chemical resistant protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine appropriate type glove material for given application. Rinse contaminated skin promptly. Wash contaminated clothing and clean protective equipment before reuse. Wash skin thoroughly after handling.

Respiratory Protection
Avoid breathing gas. When airborne exposure limits are exceeded (see below), use NIOSH approved respiratory protection equipment appropriate to the material and/or its components (full facepiece recommended). Consult respirator manufacturer to determine appropriate type equipment for a given application. Observe respirator use limitations specified by NIOSH or the manufacturer. For emergency and other conditions where exposure limit may be significantly exceeded, use an approved full face positive-pressure, self-contained breathing apparatus or positive-pressure airline with auxiliary self-contained air supply. Respiratory protection programs must comply with 29 CFR § 1910.134.

Airborne Exposure Guidelines for Ingredients

<table>
<thead>
<tr>
<th>Exposure Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-chloro-1,1,2-tetrafluoroethane (HCFC-124)</td>
<td></td>
</tr>
<tr>
<td>WEEL TWA</td>
<td>1000 ppm</td>
</tr>
<tr>
<td>chlorodifluoromethane (HCFC-22)</td>
<td></td>
</tr>
<tr>
<td>ACGIH TWA</td>
<td>1000 ppm 3540 mg/m3</td>
</tr>
<tr>
<td>1,1-difluoroethane (HFC-152a)</td>
<td></td>
</tr>
<tr>
<td>WEEL TWA</td>
<td>2700 mg/m3 (1000 ppm)</td>
</tr>
</tbody>
</table>

-Only those components with exposure limits are printed in this section.
-Skin contact limits designated with a "Y" above have skin contact effect. Air sampling alone is insufficient to accurately quantitate exposure. Measures to prevent significant cutaneous absorption may be required.
-ACGIH Sensitizer designator with a value of "Y" above means that exposure to this material may cause allergic reactions.
-WEEL-AIHA Sensitizer designator with a value of "Y" above means that exposure to this material may cause allergic skin reactions.
9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance/Odor  Colorless liquified gas with faint ether odor.

pH  NE

Specific Gravity  1.194 g/cm³ @ 25°C (77°F)

Vapor Pressure  112.1 psia @ 77°F

Vapor Density  3.3 @ 25°C / 77°F

Melting Point  NA

Freezing Point  NE

Boiling Point  -27°F / -33°C

Solubility In Water  0.1% @ 25°C (77°F)

Evaporation Rate  >1 (CC14=1.0)

Percent Volatile  100

10 STABILITY AND REACTIVITY

Stability
This material is chemically stable under specified conditions or storage, shipment and/or use. See HANDLING AND STORAGE section of this MSDS for specified conditions.

Incompatibility
Avoid contact with strong alkali or alkaline earth metals, finely powdered metals such as aluminum, magnesium or zinc and strong oxidizers, since they may react or accelerate decomposition.

Hazardous Decomposition Products
Thermal decomposition products include hydrogen fluoride, hydrogen chloride, carbon monoxide, carbon dioxide and chlorine.

11 TOXICOLOGICAL INFORMATION

Toxicological Information
Chlorodifluoromethane
Several accidental deaths have been associated with exposure to this material or mixtures with other fluorocarbons. Death was generally attributed to oxygen deficiency. Microscopic examination of the tissues of some of the victims showed effects on the lungs and fatty deposits in liver cells. An increase in the incidence of heart palpitations has been claimed by individuals occupationally exposed. Monitoring of workers during occupational exposure showed no connection to exposure and cardiac arrhythmia or neurologic disorders. Other epidemiological studies have reported similar results. Repeated skin application of a 10 second spray caused reddening and slight swelling of the skin and a delay in hair growth.

No skin allergy was observed in guinea pigs following repeated exposure. Studies with mice, dogs, rats, rabbits, cats and monkeys have shown that inhalation exposure can cause cardiac arrhythmias. Inhalation causes an initial stimulation and then depression of the central nervous system (CNS). Symptoms in animals include loss of equilibrium, tremors, convulsions and narcosis and death, usually attributed to asphyxiation. At levels that caused anesthesia, dogs exhibited convulsions. Acute exposure by inhalation was fatal to rabbits, also causing hemorrhages and effects on the liver. Following repeated inhalation exposure, no effects were reported in guinea pigs, dogs and cats; mild liver effects were reported in rabbits; and, effects on the lungs, CNS, heart, liver, kidney, spleen were reported in rats, mice and rabbits. An increase in malignant tumors of the salivary glands was reported in male rats but not in female rats or mice of either sex after long-term inhalation exposure. Long-term oral dosing produced no adverse effects in rats. Inhalation exposure produced no adverse effects on male reproductive performance in rats and mice. Eye malformations were reported in the offspring of rats
11 TOXICOLOGICAL INFORMATION

exposed by inhalation during pregnancy. In rabbits, rats and humans, a small portion of inhaled material was distributed into the brain, heart, lungs, liver, kidneys and fat. It was rapidly eliminated from the body in the inhaled air. No significant metabolism occurs in humans or rats. The results of the tests for genetic changes were mixed. Single exposure (acute) studies indicate:
Inhalation - Practically Non-toxic to Rats (2 hr-LC50 300,000 ppm)
Eye Irritation - Slightly Irritating to Rabbits (5-30 sec. exposure to gas spray)
Skin Irritation - Moderately Irritating to Rabbits (liquefied gas with patch applied)

1,1-Difluoroethane (HFC-152a)
Studies of workers exposed in industry operations did not indicate that this material causes heart arrhythmias. Acute inhalation exposure produced signs of sedation and heart arrhythmias in rats, but no adverse effects were observed in mice or monkeys. Rats did not exhibit increased sensitivity to cardiac effects after chemically induced heart injury, but did show an increased sensitivity after chemically induced injury to lung arteries. Inhalation, followed by intravenous injection of epinephrine to simulate stress reactions, resulted in cardiac sensitization in dogs. Following repeated inhalation exposure, respiratory irritation, sedation and an increase in urinary excretion of fluoride were observed in rats. Effects on nasal tissue and reversible kidney changes were observed in rats following long-term inhalation, but no increase in the incidence of tumors was observed. No birth defects were noted in the offspring of rats exposed by inhalation during pregnancy. No genetic changes were observed in a test using bacteria, but were observed in a test using human cells. Single exposure (acute) studies indicate:
Inhalation - Practically Non-toxic to Rats (4-hr LC50 383,000 ppm)

2-Chloro-1,1,1,2-tetrafluoroethane
Acute inhalation of high concentrations has produced a rapid anesthetic effect in mice and dogs. Inhalation, followed by intravenous injection of epinephrine to simulate stress reactions, resulted in cardiac sensitization in dogs. Following repeated inhalation exposure, drowsiness and loss of coordination were observed in rats (at high dose levels) and slight central nervous system effects and minor blood chemistry changes were observed in rats and mice. Long-term inhalation produced no increased incidence of tumors in rats. No birth defects were noted in the offspring of rats or rabbits exposed by inhalation during pregnancy, even at dosages which produced adverse effects in the mother. No genetic changes were observed in tests using bacteria, animal cells or animals. Single exposure (acute) studies indicate:
Inhalation - Practically Non-toxic to Rats (4-hr LC50 230,000 to 300,000 ppm)

12 ECOLOGICAL INFORMATION

Ecotoxicological Information
Chlorodifluromethane
The toxicity threshold for fish is 180 mg/l (24-hrs) and for bacteria under anaerobic conditions is >400 mg/l (24-hrs). No effects were reported on the growth of aerobic and anaerobic microorganisms over a 24 hour period, including gram-positive and gram-negative species, from exposure to a media that contained this material at 5 mg/ml.

Chemical Fate Information
Chlorodifluromethane
This material is not readily biodegradable (0% after 28-days) and is practically not bioaccumulable (log Pow 1.08). In air, it has a half-life in the atmosphere of 8.4 years, an ozone depletion potential (ODP) of 0.055, and a halocarbon global warming potential (HGWP) of 0.33. It is moderately adsorbed in soils and sediments (log Koc 1.8).

2-Chloro-1,1,1,2-tetrafluoroethane
When released into the environment, this material may be expected to partition almost exclusively into the atmosphere. Bioaccumulation is considered unlikely (log Pow 1.9-2.0). This material is not readily
12 ECOLOGICAL INFORMATION

biodegradable (2% after 28-days).

13 DISPOSAL CONSIDERATIONS

Waste Disposal

Recover, reclaim or recycle when practical. Dispose of in accordance with federal, state and local regulations. Note: Chemical additions to, processing of, or otherwise altering this material may make this waste management information incomplete, inaccurate, or otherwise inappropriate. Furthermore, state and local waste disposal requirements may be more restrictive or otherwise different from federal laws and regulations.

14 TRANSPORT INFORMATION

<table>
<thead>
<tr>
<th>DOT Name</th>
<th>Liquefied Gas NOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT Technical Name</td>
<td>(Chlorodifluoromethane, Chlorotetrafluoroethane)</td>
</tr>
<tr>
<td>DOT Hazard Class</td>
<td>2.2</td>
</tr>
<tr>
<td>UN Number</td>
<td>UN 3163</td>
</tr>
<tr>
<td>DOT Packing Group</td>
<td>PG NA</td>
</tr>
<tr>
<td>RQ</td>
<td></td>
</tr>
</tbody>
</table>

15 REGULATORY INFORMATION

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370)

Immediate (Acute) Health  Y  Fire  N
Delayed (Chronic) Health  N  Reactive  N
Sudden Release of Pressure  Y

The components of this product are all on the TSCA Inventory list.

Ingredient Related Regulatory Information:

<table>
<thead>
<tr>
<th>SARA Reportable Quantities</th>
<th>CERCLA RQ</th>
<th>SARA TPQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124)</td>
<td>NE</td>
<td>NE</td>
</tr>
<tr>
<td>chlorodifluoromethane (HCFC-22)</td>
<td>NE</td>
<td>NE</td>
</tr>
<tr>
<td>1,1-difluoroethane (HFC-152a)</td>
<td>NE</td>
<td>NE</td>
</tr>
</tbody>
</table>

SARA Title III, Section 313

This product does contain chemical(s) which are defined as toxic chemicals under and subject to the reporting requirements of, Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372. See Section 2

2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124)
chlorodifluoromethane (HCFC-22)

Massachusetts Right to Know

This product does contain the following chemicals(s), as indicated below, currently on the Massachusetts Right to Know Substance List.

1,1-difluoroethane (HFC-152a)
chlorodifluoromethane (HCFC-22)
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