NATIONAL REFRIGERANTS, INC.
MATERIAL SAFETY DATA SHEET

PRODUCT IDENTIFICATION

PRODUCT NAME: REFRIGERANT 134a (HFC-134a)
CHEMICAL NAME: 1,1,1,2-TETRAFLUOROETHANE
GENERAL USE: REFRIGERANT

PRODUCT INFORMATION
(800) 262-0012
TRANSPORTATION EMERGENCY
CHEMTREC (800) 424-9300

MEDICAL EMERGENCY
(856) 455-4555
DISTRIBUTOR / MANUFACTURER
NATIONAL REFRIGERANTS, INC.
661 KENYON AVE. ROSENHAYN, NJ

INGREDIENTS-----HAZARD CLASSIFICATIONS

COMPONENTS-HAZARDOUS:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>CAS #</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>1,1,1,2-TETRAFLUOROETHANE</td>
<td>811-97-2</td>
<td>100.0</td>
</tr>
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NFPA 2-0-0

HEALTH HAZARD INFORMATION

PERMISSIBLE EXPOSURE LIMITS:
NO TLV OR PEL HAS BEEN ESTABLISHED FOR THIS CHEMICAL.
RECOMMENDED WORKPLACE ENVIRONMENTAL EXPOSURE LEVEL (WEEL) (8-HR TWA):
1,000 PPM; ESTABLISHED BY AMERICAN INDUSTRIAL HYGIENE ASSN.

EMERGENCY FIRST AID

INGESTION:
N/A - PRODUCT IS A GAS AT AMBIENT CONDITIONS

EYE CONTACT:
IF IN EYES, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. GET MEDICAL ATTENTION.

DERMAL:
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.
INHALATION:
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, EPINEPHRINE OR SIMILAR DRUGS FOLLOWING EXPOSURE TO THIS PRODUCT.

FIRE AND EXPLOSION DATA

FLASH POINT: FLAMMABLE LIMITS: AUTOIGNITION TEMP:
GAS: NA PER DOT REGS. LOWER: NA UPPER: NA NE

EXTINGUISHING MEDIA:
USE EXTINGUISHING MEDIA APPROPRIATE TO SURROUNDING FIRE CONDITIONS

SPECIAL FIREFIGHTING PROCEDURES:
WEAR SELF-CONTAINED BREATHING APPARATUS IF FIGHTING FIRES NEAR THIS PRODUCT DUE TO TOXICITY OF THERMAL DECOMPOSITION PRODUCTS. KEEP CONTAINERS COOL.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
HFC 134a IS NOT FLAMMABLE AT AMBIENT TEMPERATURES AND ATMOSPHERIC PRESSURE. HOWEVER, THIS MATERIAL WILL BECOME COMBUSTIBLE WHEN MIXED WITH AIR UNDER PRESSURE AND EXPOSED TO STRONG IGNITION SOURCES. LIQUID AND GAS UNDER PRESSURE, OVERHEATING OR OVERPRESSURIZING MAY CAUSE GAS RELEASE OR VIOLENT CYLINDER BURSTING. MAY DECOMPOSE ON CONTACT WITH FLAMES OR EXTREMELY HOT METAL SURFACES TO PRODUCE TOXIC AND CORROSIVE PRODUCTS.

SPILL MANAGEMENT

REMOVE OR EXTINGUISH IGNITION OR COMBUSTION SOURCES. EVACUATE ENCLOSED SPACES UNTIL GAS IS DISPERSED. KEEP UPWIND. STOP LEAK IF POSSIBLE WITHOUT RISK. DISPERSE GAS WITH FLOOR-LEVEL FORCED-AIR VENTILATION. EXHAUST VAPOURS OUTDOORS. REMOVE ALL FLAMES, HEATING ELEMENTS AND GAS ENGINES. WASH CONTAMINATED CLOTHES BEFORE USE. DESTROY CONTAMINATED SHOES.

SPECIAL HANDLING AND STORAGE CONDITIONS

DO NOT GET IN EYES, ON SKIN OR CLOTHING. DO NOT BREATHE VAPOR, MIST OR GAS. KEEP CONTAINER CLOSED. KEEP AWAY FROM HEAT, SPARKS AND FLAMES. STORE IN TIGHTLY CLOSED CONTAINERS. EMPTY CONTAINER MAY CONTAIN HAZARDOUS RESIDUE. DO NOT DROP, RUSE OR REFILL CONTAINER. DO NOT SMOK. READ LABEL BEFORE USE. DO NOT CUT, GRIND OR WELD ON OR NEAR CONTAINER DUE TO POSSIBLE TOXIC FUME GENERATION. HFC 134a SHOULD NOT BE MIXED WITH AIR ABOVE ATMOSPHERIC PRESSURE FOR LEAK TESTING OR ANY OTHER PURPOSE.
VENTILATION REQUIREMENTS:
INVESTIGATE ENGINEERING TECHNIQUES TO REDUCE EXPOSURES BELOW AIRBORNE EXPOSURE LIMITS. PROVIDE VENTILATION IF NECESSARY TO CONTROL EXPOSURE LEVELS BELOW AIRBORNE EXPOSURE LIMITS (SEE INGREDIENTS SECTION). DILUTION VENTILATION ACCEPTABLE, BUT LOCAL MECHANICAL EXHAUST VENTILATION PREFERRED, IF PRACTICAL, AT SOURCES OF AIR CONTAMINATION SUCH AS OPEN PROCESS EQUIPMENT.

EYE: WHERE THERE IS POTENTIAL FOR EYE CONTACT, WEAR CHEMICAL GOGGLES AND HAVE EYE FLUSHING EQUIPMENT IMMEDIATELY AVAILABLE.

HAND (GLOVE TYPE):
USE SYNTHETIC RUBBER GLOVES SUCH AS NEOPRENE. LINED GLOVES ARE RECOMMENDED FOR PROTECTION FROM COLD.

RESPIRATOR TYPE:
AVOID BREATHING VAPOR, MIST, OR FUME. USE NIOSH/MSHA APPROVED FULL FACE (TC-19C) SUPPLIED AIR RESPIRATOR OR SELF CONTAINED BREATHING APPARATUS WHERE AIRBORNE EXPOSURE IS LIKELY. IF USED, FULL FACEPIECE REPLACES NEED FOR CHEMICAL GOGGLES AND /OR FACESHEILD. IF EXPOSURES CANNOT BE KEPT AT A MINIMUM WITH ENGINEERING CONTROLS, USE NIOSH/MSHA APPROVED RESPIRATORY EQUIPMENT AS NOTED ABOVE. OBSERVE RESPIRATOR USE LIMITATIONS SPECIFIED BY NIOSH/MSHA OR THE MANUFACTURER. FOR EMERGENCY AND OTHER CONDITIONS WHERE THERE MAY BE A POTENTIAL FOR SIGNIFICANT EXPOSURE, USE AN APPROVED FULL FACE POSITIVE-PRESSURE AIRLINE WITH AUXILIARY SELF-CONTAINED BREATHING APPARATUS OR POSITIVE PRESSURE AIRLINE WITH AUXILIARY SELF-CONTAINED AIR SUPPLY. RESPIRATORY PROTECTION PROGRAMS MUST COMPLY WITH 29 CFR SECTION 1910.134.

OTHER PROTECTIVE EQUIPMENT:
WEAR APPROPRIATE CHEMICAL RESISTANT PROTECTIVE CLOTHING TO PREVENT SKIN CONTACT.

PHYSICAL PROPERTIES

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<tr>
<th>BOILING POINT/RANGE:</th>
<th>MELTING POINT:</th>
<th>FREEZING POINT:</th>
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<tbody>
<tr>
<td>-26.4 C (-15.5 F)</td>
<td>NA</td>
<td>-101 C (-149.8 F)</td>
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<tr>
<td>MOLECULAR WEIGHT:</td>
<td>SPECIFIC GRAVITY (H2O=1):</td>
<td>VAPOR PRESSURE (MM HG):</td>
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<tr>
<td>102.0</td>
<td>1.21 @ 25 C (77 F)</td>
<td>96.16 PSIA @ 77 F</td>
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<tr>
<td>VAPOR DENSITY (AIR=1):</td>
<td>SOLUBILITY IN H2O:</td>
<td>% VOLATILES BY VOLUME:</td>
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<tr>
<td>3.52</td>
<td>NEGLIGIBLE</td>
<td>100.0</td>
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APPEARANCE AND ODOR:
CLEAR, COLORLESS, LIQUEFIED GAS WITH FAINT ETHEREAL (EITHER-LIKE) ODOR.
REACTIVITY DATA

STABILITY: CONDITIONS CONTRIBUTING TO INSTABILITY:
STABLE

THERMAL DECOMPOSITION DUE TO EXPOSURE TO HEAT (>800 F) OR FIRE.

INCOMPATIBILITY-AVOID CONTACT WITH:
STRONG STRONG
ALKALIS OXIDIZERS

AVOID CONTACT WITH STRONG ALKALI OR ALKALINE EARTH METALS, FINELY POWERED METALS SUCH AS ALUMINUM, MAGNESIUM OR ZINC AND STRONG OXIDIZERS SINCE THEY MAY REACT WITH OR ACCELERATE DECOMPOSITION OF THIS MATERIAL. DO NOT MIX WITH OXYGEN OR AIR ABOVE ATMOSPHERIC PRESSURE.

HAZARDOUS DECOMPOSITION THERMAL AND OTHER:
THERMAL DECOMPOSITION PRODUCTS INCLUDE HYDROGEN FLUORIDE, CARBON MONOXIDE AND CARBON DIOXIDE.

CONDITIONS TO AVOID:
FLAMES, EXTREMELY HOT METAL SURFACES, HEATING ELEMENTS, COMBUSTION ENGINES, ETC.

TOXICITY

ROUTE: ANIMAL: DATA:
ORAL ANIMAL: SEE COMMENTS.
DERMAL SEE COMMENTS.
INHALATION RAT 4 HR LC50 > 500,000PPM

TOXIC EFFECTS/Routes of Entry

EYE EFFECTS:
RAPID VOLATILIZATION OF LIQUID MAY CAUSE FROSTBITE IF LIQUID IS APPLIED TO THE EYES

SKIN EFFECTS:
SLIGHT IRRITANT. CONTACT WITH LIQUID MAY CAUSE FROSTBITE.

OTHER TOXIC EFFECTS:
SKIN CONTACT AND INHALATION ARE EXPECTED TO BE THE PRIMARY ROUTES OF OCCUPATIONAL EXPOSURE TO HFC 134a. AS WITH MOST LIQUEFIED GASES, CONTACT WITH THE RAPIDLY VOLATILIZING LIQUID OR COLD VAPORS CAN CAUSE FROSTBITE OR FREEZE BURNS TO ANY TISSUE DUE TO THE CRYOGENIC (EXTREME LOW TEMPERATURE) EFFECT OF THIS MATERIAL. STUDIES WITH LABORATORY ANIMALS INDICATE THAT HFC 134a IS PRACTICALLY NON-TOXIC BY THE INHALATION ROUTE. HOWEVER, EXPOSURE TO HFC 134a GAS AT HIGH CONCENTRATIONS MAY AFFECT THE NERVOUS SYSTEM AND PRODUCE A RAPID ANESTHETIC EFFECT. THE DENSE VAPOR OR HFC 134a IS HEAVIER THAN AIR AND DISPLACES AIR IN CONFINED SPACES, THEREBY REDUCING OXYGEN AVAILABLE FOR BREATHING.
UPON EXPOSURE TO AN OXYGEN DEFICIENT ATMOSPHERE, A PERSON MAY EXPERIENCE
SYMPTOMS OF OXYGEN DEFICIENCY, INCLUDING HEADACHE, DIZZINESS, DROWSINESS,
CYANOSIS, LACK OF MUSCLE CONTROL FOLLOWED BY COLLAPSE. PROLONGED EXPOSURE TO
AN OXYGEN-DEFICIENT ATMOSPHERE MAY BE FATAL. AS WITH MANY OTHER HALOGENATED
HYDROCARBONS, INHALATION OF HFC 134a MAY CAUSE AN INCREASE IN THE SENSITIVITY OF
THE HEART TO ADRENALINE, WHICH COULD RESULT IN IRREGULAR HEARTBEATS (CARDIAC
ARRHYTHMIAS), RAPID HEARTBEATS (TACHYCARDIA) AND REDUCED HEART FUNCTION. DUE
TO THE POTENTIAL FOR THIS EFFECT, WORKERS WITH HEART DISEASE OR COMPROMISED
HEART FUNCTION SHOULD ONLY HAVE LIMITED EXPOSURE TO THIS MATERIAL.

TARGET ORGAN TOXIN:
CENTRAL NERVOUS SYSTEM, RESPIRATORY SYSTEM, HEART.

TOXICITY COMMENTS:
DATA FROM LABORATORY STUDIES CONDUCTED BY ELF ATOCHEM NORTH AMERICA, INC. AND
FROM THE SCIENTIFIC LITERATURE ON HFC 134a ARE SUMMARIZED BELOW.
SINGLE EXPOSURE (ACUTE) STUDIES INDICATE:
INHALATION-PRACTICALLY NON-TOXIC TO RATS (4-HR LC50> 500,000PPM;
30-MIN. LC50 APPROX. 750,000PPM)
EYE IRRITATION-SLIGHTLY IRRITATING TO RABBITS
SKIN IRRITATION-SLIGHTLY IRRITATION TO RABBITS (24HR EXPOSURE)
NO ALLERGIC SKIN RESPONSE WAS OBSERVED IN GUINEA PIGS FOLLOWING REPEATED SKIN
EXPOSURE TO HFC134a. INHALATION OF VERY HIGH CONCENTRATIONS OF THIS MATERIAL
(GENERALLY EXCEEDING 50,000 PPM) PRODUCES A RAPID ANESTHETIC EFFECT IN MICE, DOGS
CATS AND MONKEYS. AS WITH MANY OTHER HALOGENATED HYDROCARBONS, INHALATION
OF HFC 134a FOLLOWED BY INTRAVENOUS INJECTION OF EPINEPHRINE TO STIMULATE HUMAN
STRESS REACTIONS. RESULTED IN HEART SENSITIZATIONS AT LEVELS ABOVE OR ABOUT 750,000
PPM IN DOGS. NO TOXIC EFFECTS AND NO TUMORS WERE OBSERVED IN AN ORAL DOE STUDY
OF RATS GIVEN CORN OIL SOLUTIONS OF HFC 134a AT 300 MG/KG/DAY FOR 1 YEAR FOLLOWED BY
LIFETIME OBSERVATION. LONG-TERM INHALATION (2-YEARS) OF HIGH CONCENTRATIONS OF
HFC134a (50,000PPM) CAUSED AN INCREASED INCIDENCE OF BENIGN, NOT LIFE-THREATENING
TUMORS OF THE TESTES IN RATS. NO EXPOSURE-RELATED EFFECTS OR TUMORS WERE
OBSERVED AT 10,000 PPM IN THIS STUDY. HFC 134a WAS NEGATIVE IN THE MOUSE DOMINANT
LETHAL ASSAY. NO BIRTH DEFECTS WERE NOTED IN RATS AND RABBITS EXPOSED TO HFC 134a
BY INHALATION DURING PREGNANCY, EVEN AT LEVELS (300,000 PPM AND 50,000PPM,
RESPECTIVELY) WHICH PRODUCED TOXIC EFFECTS IN THE MOTHERS AND THEIR OFFSPRING.
HFC 134a PRODUCED NO GENETIC CHANGES IN STANDARD TEST USING ANIMALS (VIVO TEST)
AND ANIMAL OR BACTERIAL CELLS. METABOLISM STUDIES IN RATS EXPOSED BY THE ORAL
AND INHALATION ROUTES SHOW THAT HFC134a IS NOT METABOLIZED OR ACCUMULATED IN
THE BODY TO ANY SIGNIFICANT EXTENT AND IS RAPIDLY ELIMINATED IN THE EXHALED AIR.

DISPOSAL PROCEDURES
RECYCLE OR RECLAIM IF POSSIBLE. RECLAIMED MATERIAL MAY BE INCINERATED BUT TOXIC
AND CORROSIVE COMBUSTION PRODUCTS (HF AND HCL) MUST BE HANDLED APPROPRIATELY.
CONSULT FEDERAL, STATE, OR LOCAL AUTHORITIES FOR PROPER DISPOSAL PROCEDURES.
PROPER SHIPPING NAME: 1,1,1,2-TETRAFLUOROETHANE

UN NUMBER: 3159

HAZARD CLASS: 2.2 (NON-FLAMMABLE GAS)

DOT LABELS: 2.2 (NON-FLAMMABLE GAS)

DOT PLACARD: NON-FLAMMABLE GAS

PROPER SHIPPING DESCRIPTION: 1,1,1,2-TETRAFLUOROETHANE, 2.2, UN3159

ADDITIONAL INFORMATION

ECOTOXICOLOGICAL INFORMATION: 
THE LOG OF THE OCTANOL/WATER PARTITION COEFFICIENT (LOG POW) FOR HFC 134A IS 1.06. HFC 134a DOES NOT DISSOCIATE IN WATER.

CHEMICAL FATE INFORMATION:
A 28-DAY BIODEGRADATION STUDY WITH HFC 134a USING AN ACTIVATED SLUDGE INOCULUM PRODUCED 3% BIODEGRADATION.

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DATE OF LATEST REVISION/REVIEW: 9/01
PERSON RESPONSIBLE FOR MSDS: Ray Madariaga

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