The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

FM-200
6402FR Revised 28-FEB-2008

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

FM-200 is a registered trademark of DuPont.

CAS Number	: 431-89-0
Formula	: CF3 CHF CF3
Molecular Weight	: 170.03
CAS Name	: Propane, 1,1,1,2,3,3,3-Heptafluoro-

Tradenames and Synonyms

FM200
FE-227
2-Hydroperfluoropropane
Propane, 1,1,1,2,3,3,3-Heptafluoro-
HFC-227eaHP
2-Hydroheptafluoropropane
Heptafluoropropane
2-H-heptafluoropropane
1,1,1,2,3,3,3-Heptafluoropropane
R-227
R227
HFC-227ea

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont Fluoroproducts
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS

Product Information	: 1-800-441-7515 (outside the U.S. 302-774-1000)
Transport Emergency	: CHEMTREC 1-800-424-9300(outside U.S. 703-527-3887)
Medical Emergency	: 1-800-441-3637 (outside the U.S. 302-774-1000)

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
1,1,1,2,3,3,3-Heptafluoropropane	431-89-0	99.95

HAZARDS IDENTIFICATION

Potential Health Effects

Based on animal data, overexposure to FM-200 by inhalation may cause suffocation, if air is displaced by vapors, and irregular heart beat with a strange sensation in the chest, "heart thumping," apprehension, lightheadedness, feeling of fainting, dizziness, weakness, sometimes progressing to loss of consciousness and death.

FM-200 may cause frostbite if liquid or escaping vapor contacts the skin.

FM-200 may cause "frostbite-like" effects if the liquid or escaping vapors contact the eyes.

In one study, human volunteers were selected to inhale FM-200 at a concentration of 6000 ppm but the study was terminated due to a rise in pulse rate that was believed to be unrelated to the chemical. In a subsequent study with human volunteers inhaling concentrations up to 8000 ppm no clinically significant effects were observed for any of the measured laboratory parameters.

Individuals with preexisting diseases of the cardiovascular system or nervous system may have increased susceptibility from excessive exposures.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

INHALATION

If inhaled, immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT

Treat for frostbite if necessary by gently warming affected area.

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

(FIRST AID MEASURES - Continued)

INGESTION

Ingestion is not considered a potential route of exposure.

FIRE FIGHTING MEASURES

Flammable Properties

1,1,1,2,3,3,3-Heptafluoropropane is not flammable, however in the presence of a flame or ignition source it may decompose to form toxic hydrogen fluoride or carbonyl fluoride.

Non-flammable.

Extinguishing Media

Use media appropriate for surrounding material.

Fire Fighting Instructions

Self-contained breathing apparatus (SCBA) may be required if cylinders rupture or release under fire conditions.

Keep cylinders cool with water spray applied from a safe distance.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Evacuate personnel, thoroughly ventilate area, use self-contained breathing apparatus. Keep upwind of leak - evacuate until gas has dispersed.

Initial Containment

Use forced ventilation to disperse vapors.

HANDLING AND STORAGE

Handling (Personnel)

Do not breathe gas. Avoid contact with eyes, skin, or clothing. Wash thoroughly after handling. Wash clothing after use.

Storage

Store in a clean, dry place. Store below 52 C (126 F).

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use only with adequate ventilation. Keep container tightly closed.

Personal Protective Equipment

EYE/FACE PROTECTION

Wear safety glasses or coverall chemical splash goggles.

RESPIRATORS

Wear NIOSH approved respiratory protection, as appropriate.

PROTECTIVE CLOTHING

Where there is potential for skin contact have available and wear as appropriate impervious gloves, apron, pants, and jacket.

Exposure Guidelines

Exposure Limits
FM-200
AEL * (DuPont) : 1000 ppm, 8 & 12 Hr. TWA

* AEL is DuPont’s Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Boiling Point	: -16.4 C (2.5 F)
Melting Point	: -131 C (-204 F)
Vapor Pressure	: 65.7 psia @ 25 C (77 F) (453.3 kPa)
Liquid Density	: 1.386 g/cm3 @ 25 C (77 F) (86.53 lb/ft3)
Critical temperature	: 101.6 C (214.9 F)
Critical pressure	: 424.7 psia (2930 kPa)
Odor	: None.

(PHYSICAL AND CHEMICAL PROPERTIES - Continued)

Form : Liquified Gas

STABILITY AND REACTIVITY

Chemical Stability

Stable at normal temperatures and storage conditions.

Avoid sources of heat or open flame.

Incompatibility with Other Materials

Incompatible with strong reducing agents such as alkali metals (e.g., sodium, potassium), alkali-earth metals (e.g., magnesium, calcium), and powdered aluminum or zinc.

Decomposition

Decomposes by reaction with high temperature (open flames, glowing metal surfaces, etc.) forming hydrofluoric acid, carbonyl fluorides, carbon monoxide and carbon dioxide.

Polymerization

Polymerization will not occur.

TOXICOLOGICAL INFORMATION

Animal Data

FM-200:

Inhalation 4 hour LC50: > 788,698 ppm in rats

Repeated exposure of rats by inhalation for 4 weeks at concentrations up to 50,000 ppm revealed no toxicologically significants effects. The NOEL for this study was 50,000 ppm. A 90-day inhalation study in rats did not find any exposure related effects at 105,000 ppm. The NOEL for this study was 105,000 ppm.

Cardiac sensitization, a potentially fatal disturbance of heart rhythm associated with a heightened sensitivity to the action of epinephrine, occurred in dogs at 105,000 ppm. The NOAEL for cardiac sensitization was 90,000 ppm. In a different study to evaluate cardiac sensitization in dogs, concentrations of 90,000, 105,000, and 140,000 ppm caused a dose-related increase in incidence and severity; at 90,000 ppm efffects were minimal or mild in nature.

Inhalation studies in rabbits and rats do not suggest developmental toxicity at concentrations up to

(TOXICOLOGICAL INFORMATION - Continued)

105,000 ppm. Tests have shown that FM-200 does not cause genetic damage in bacterial or mammalian cell cultures. Tests in animals for carcinogenicity or reproductive toxicity have not been conducted.

DISPOSAL CONSIDERATIONS

Waste Disposal

Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. Incinerate material in accordance with Federal, State/Provincial and Local requirements.

TRANSPORTATION INFORMATION

Shipping Information

DOT

Proper Shipping Name	: Heptafluoropropane
Hazard Class	: 2.2
I.D. No. (UN/NA)	: UN 3296
DOT Label(s)	: Nonflammable Gas

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status : Listed.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute	: Yes
Chronic	: No
Fire	: No
Reactivity	: No
Pressure	: No

OTHER INFORMATION

NFPA, NPCA-HMIS

NFPA Rating

Health	: 1
Flammability	: 0
Reactivity	: 1

NPCA-HMIS Rating

Health	: 1
Flammability	: 0

(Continued)

Reactivity : 0

Personal Protection rating to be supplied by user depending on use conditions.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : MSDS Coordinator
> : DuPont Fluoroproducts
Address : Wilmington, DE 19898
Telephone : (800) 441-7515

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS

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Praxair™ Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name:	Nitrogen, Compressed (MSDS No. P-4631-E)		**Trade Name:**	Nitrogen
Chemical Name:	Nitrogen		**Synonyms:**	Not applicable
Formula:	N_2		**Chemical Family:**	Considered as an inert gas.
Telephone:	**Emergencies:**	1-800-645-4633*	**Company Name:**	Praxair, Inc.
	CHEMTREC	1-800-424-9300*		39 Old Ridgebury Road
	Routine:	1-800-PRAXAIR		Danbury CT 06810-5113

**Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).*

2. Composition / Information on Ingredients

For custom mixtures of this product request a Material Safety Data Sheet for each component. See Section 16 for important information about mixtures.

INGREDIENT NAME	CAS NUMBER	PERCENTAGE	OSHA PEL	ACGIH TLV-TWA
Nitrogen	7727-37-9	>99%	None currently established	Simple asphyxiant

**The symbol ">" means "greater than."*

3. Hazards Identification

EMERGENCY OVERVIEW

CAUTION! High-pressure gas.
Can cause rapid suffocation.
May cause dizziness and drowsiness.
Self-contained breathing apparatus may be required by rescue workers.
Odor: None

THRESHOLD LIMIT VALUE: Simple asphyxiant (ACGIH 1997)

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION–Asphyxiant. Effects are due to lack of oxygen. Moderate concentrations may cause headache, drowsiness, dizziness, excitation, excess salivation, vomiting, and unconsciousness. Lack of oxygen can kill.
SKIN CONTACT–No harm expected.
SWALLOWING–This product is a gas at normal temperature and pressure.
EYE CONTACT–No harm expected.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: No harm expected.

OTHER EFFECTS OF OVEREXPOSURE: Nitrogen is an asphyxiant. Lack of oxygen can kill.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: The toxicology and the physical and chemical properties of nitrogen suggest that overexposure is unlikely to aggravate existing medical conditions.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: None known.

CARCINOGENICITY: Nitrogen is not listed by NTP, OSHA, or IARC.

4. First Aid Measures

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

SKIN CONTACT: Flush with water.

SWALLOWING: This product is a gas at normal temperature and pressure.

EYE CONTACT: Flush eyes with warm water. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly.

NOTES TO PHYSICIAN: *There is no specific antidote. This product is nearly inert. Treatment of over-exposure should be directed at the control of symptoms and the clinical condition. Refer to section 16.*

5. Fire Fighting Measures

FLASH POINT (test method)	Not applicable		**AUTOIGNITION TEMPERATURE**	Not applicable	
FLAMMABLE LIMITS IN AIR, % by volume	**LOWER**	Not applicable	**UPPER**	Not applicable	

EXTINGUISHING MEDIA: Nitrogen cannot catch fire. Use media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES:
CAUTION! High-pressure gas. Evacuate all personnel from danger area. Immediately deluge cylinders with water from maximum distance until cool, then move them away from fire area if without risk. Self-contained breathing apparatus may be required by rescue workers. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Nitrogen cannot catch fire. Heat of fire can build pressure in cylinder and cause it to rupture. No part of cylinder should be subjected to a temperature

higher than 125°F (52°C). Nitrogen cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.)

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
CAUTION! High-pressure gas. Immediately evacuate all personnel from danger area. Nitrogen is an asphyxiant. Lack of oxygen can kill. Use self-contained breathing apparatus where needed. Shut off flow if you can do so without risk. Ventilate area or move cylinder to a well-ventilated area. Test for sufficient oxygen, especially in confined spaces, before allowing reentry.

WASTE DISPOSAL METHOD: Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F (52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

PRECAUTIONS TO BE TAKEN IN HANDLING: Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using nitrogen, see section 16.

For additional information on storage and handling, refer to Compressed Gas Association (CGA) pamphlet P-1, "Safe Handling of Compressed Gases in Containers," available from the CGA. Refer to section 16 for the address and phone number along with a list of other available publications.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST–Use a local exhaust system, if necessary, to prevent oxygen deficiency.

MECHANICAL (general)–General exhaust ventilation may be acceptable if it can maintain an adequate supply of air.
SPECIAL–None
OTHER–None

RESPIRATORY PROTECTION: None required under normal use. However, air supplied respirators are required while working in confined spaces with this product. Respiratory protection must conform to OSHA rules as specified in 29 CFR 1910.134.

SKIN PROTECTION: Wear work gloves when handling cylinders.

EYE PROTECTION: Wear safety glasses when handling cylinders.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

MOLECULAR WEIGHT: 28.01	**EXPANSION RATIO:** Not applicable
SPECIFIC GRAVITY (air=1): At 70°F (21.1°C) and 1 atm: 0.967	**SOLUBILITY IN WATER**: % by wt:, vol/vol at 32°F (0°C): 0.023
GAS DENSITY: At 70°F (21.1°C) and 1 atm: 0.072 lbs/ft^3 (1.153 kg/m^3)	**VAPOR PRESSURE:** AT 68°F (20°C)**:** Not applicable
PERCENT VOLATILES BY VOLUME: 100	**EVAPORATION RATE (Butyl Acetate=1):** Gas, not applicable
BOILING POINT (1 atm): -320.4°F (-195.8°C)	**pH:** Not applicable
MELTING POINT (1 atm): -345.8°F (-209.9°C)	
APPEARANCE, ODOR, AND STATE: Colorless, odorless, tasteless gas at normal temperature and pressure.	

10. Stability and Reactivity

STABILITY:	**Unstable**		**Stable**	**X**
INCOMPATIBILITY (materials to avoid): None currently known. Nitrogen is chemically inert.				
HAZARDOUS DECOMPOSITION PRODUCTS: None				
HAZARDOUS POLYMERIZATION:	**May Occur**		**Will Not Occur**	**X**

CONDITIONS TO AVOID: Under certain conditions, nitrogen can react violently with lithium, neodymium, titanium, and magnesium to form nitrides. At high temperature it can also combine with oxygen and hydrogen.

11. Toxicological Information

Nitrogen is a simple asphyxiant.

12. Ecological Information

No adverse ecological effects expected. Nitrogen does not contain any Class I or Class II ozone-depleting chemicals. Nitrogen is not listed as a marine pollutant by DOT.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return

cylinder to supplier. For emergency disposal, secure cylinder in a well-ventilated area or outdoors, then slowly discharge gas to the atmosphere.

14. Transport Information

DOT/IMO SHIPPING NAME: Nitrogen, compressed	**HAZARD CLASS:** 2.2
IDENTIFICATION NUMBER: UN 1066	**PRODUCT RQ:** Not applicable
SHIPPING LABEL(s): NONFLAMMABLE GAS	**PLACARD (When required):** NONFLAMMABLE GAS

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (Environmental Protection Agency)

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: Superfund Amendment and Reauthorization Act:

- **SECTIONS 302/304:** Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of extremely hazardous substances (40 CFR Part 355):

  Threshold Planning Quantity (TPQ): None.
  Extremely Hazardous Substances (40 CFR 355): None.

- **SECTIONS 311/312:** Require submission of Material Safety Data Sheets (MSDSs) and chemical inventory reporting with identification of EPA hazard categories. The hazard categories for this products are as follows:

  IMMEDIATE: No
  DELAYED: No
  PRESSURE: Yes
  REACTIVITY: No
  FIRE: No

- **SECTION 313:** Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

  Nitrogen does not require reporting under Section 313.

40 CFR 68: Risk Management Program for Chemical Accidental Release Prevention**:** Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Nitrogen is not listed as a regulated substance.

TSCA: Toxic Substances Control Act: Nitrogen is listed on the TSCA inventory.

OSHA (OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION):

29 CFR 1910.119 : Process Safety Management of Highly Hazardous Chemicals: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Nitrogen is not listed in Appendix A as a highly hazardous chemical.

STATE REGULATIONS:

CALIFORNIA: This product is not listed by California under the Safe Drinking Water Toxic Enforcement Act of 1986 (Proposition 65).

PENNSYLVANIA: This product is subject to the Pennsylvania Worker and Community Right-To-Know Act (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: ***High-pressure gas.*** Use piping and equipment adequately designed to withstand pressures to be encountered. Never work on a pressurized system. ***Gas can cause rapid suffocation due to oxygen deficiency.*** Store and use with adequate ventilation. Close valve after each use; keep closed even when empty. ***Prevent reverse flow.*** Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. ***Never work on a pressurized system.*** If there is a leak, close the cylinder valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state and local laws; then repair the leak***. Never ground a compressed gas cylinder or allow it to become part of an electrical circuit.***

MIXTURES: When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist, or other trained person when you evaluate the end product.

HAZARD RATING SYSTEMS:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH	= 0	HEALTH	= 0
FLAMMABILITY	= 0	FLAMMABILITY	= 0
REACTIVITY	= 0	REACTIVITY	= 0
SPECIAL	SA (CGA recommends this rating to designate Simple Asphyxiant.)		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	0-3000 psig	CGA-580
	3001-5500 psig	CGA-680
	5001-7500 psig	CGA-677
PIN-INDEXED YOKE:	0-3000 psig	CGA-960 (Medical Use)
ULTRA-HIGH-INTEGRITY CONNECTION:	0-3000 psig	CGA-718

Use the proper CGA connections. **DO NOT USE ADAPTERS.**

Ask your supplier about free Praxair safety literature as referenced on the label for this product; you may also obtain copies by calling 1-800-PRAXAIR. Further information about nitrogen can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 1725 Jefferson Davis Highway, Arlington, VA 22202-4102, Telephone (703) 412-0900.

G-10.1 *Commodity Specification for Nitrogen*
P-1 *Safe Handling of Compressed Gases in Containers*
P-9 *Inert Gases—Argon, Nitrogen, and Helium*
P-14 *Accident Prevention in Oxygen-Rich, Oxygen-Deficient Atmospheres*
SB-2 *Oxygen-Deficient Atmospheres*
AV-1 *Safe Handling and Storage of Compressed Gases*
V-1 *Compressed Gas Cylinder Valve Inlet and Outlet Connections*
Handbook of Compressed Gases, Third Edition

Praxair asks users of this product to study this Material Safety Data Sheet (MSDS) and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents and contractors of the information on this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

Praxair MSDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current Praxair MSDSs for these products, contact your Praxair sales representative or local distributor or supplier. If you have questions regarding Praxair MSDSs, would like the form number and date of the latest MSDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (**Phone:** 1-800-PRAXAIR; **Address:** Praxair Call Center, Praxair, Inc., PO Box 44, Tonawanda, NY 14150-7891).

Praxair, Inc.
39 Old Ridgebury Road
Danbury CT 06810-5113