Backgrounder
Over 75 Years of Leadership

1930: The Fluorocarbon Boom

Frigidaire's Thomas Midgley ends his talk at the 1930 meeting of the American Chemical Society in Atlanta with a dramatic demonstration of R-12, positioning fluorocarbon refrigerants superior to the toxic alternatives then in use. A year later, R-12 is introduced as a commercial refrigerant. The fluorocarbon industry is born.

DuPont and General Motors combine their resources to form Kinetic Chemicals, Inc. in 1930 at DuPont's Deepwater, New Jersey, plant. Freon® is registered as a trademark for fluorocarbons. A year later, Freon® 12 is being produced in commercial quantities and is broadly accepted throughout the refrigeration industry. A new age of refrigeration is at hand.

In succeeding years, DuPont introduces a series of commercial Freon® products: R-11, R-114, R-113 and R-22, later to become the basic intermediate for Teflon®, which was accidentally discovered by DuPont chemist Roy Plunkett in 1938.

Air-conditioning expands to restaurants, drug stores and larger retail stores. The first practical room air conditioners for home use appear in the early 30s. The first window air conditioner is introduced by the Thorne Co. in 1932 but is never mass-produced.

GM's Cadillac Division starts work on a vapor compression system with R-12 as its refrigerant. By 1939, a prototype self-contained unit is installed in the Cadillac's trunk. Some buses have already been equipped with self-contained air-conditioning units since the mid-30s, though mostly as test vehicles.

1940: The War Years

World War II puts a halt to most civilian construction. A few months before the U.S. goes to war, Willis Carrier installs his first Weathermaster air-conditioning units, an "air and water" induction system utilizing high-velocity air and smaller ducts. The Equitable Building in Portland, Ore., becomes the prototype for the modern fully air-conditioned office building.

The U.S. Department of Agriculture uses R-11 and R-12 to develop new aerosol propellants. With a war-time need for aerosol insecticides, based on Freon® propellants, for U.S. troops in the Pacific, Kinetic Chemicals expands its facilities, opening a wartime fluorocarbon plant in E. Chicago.

40 million units of self-contained, pressurized packs of liquefied Freon® 12, known as "the bug bomb," are prepared for U.S. military forces, primarily for use as propellants for insecticides. In addition, fluorocarbons are used for refrigeration transport, frozen-food production and medical applications, including frozen blood plasma.

In 1945 R-13 is developed and released for use.

Prior to 1940, the only way to keep cool in an automobile is to open a window. What flew into the car was another matter. The gradual acceptance of fresh air heating and the cowl ventilator start a trend toward modern automotive air-conditioning. As the decade begins, Packard and Cadillac begin offering air-conditioning units on their luxury cars, mostly in the Southwest. By 1947, many independent manufacturers created a large aftermarket business by installing air conditioners on all makes of cars.

In 1949, DuPont buys out GM's interest in Kinetic Chemicals and creates its Organic Chemicals Department. The name is soon changed to Freon® Products Division.

Room air-conditioners are now widely accepted throughout the country.

1950: Patents Not Pending

World War II essentially halts automotive air conditioning's growth. It begins anew in 1953 with a practical, affordable system that ironed out the pre-war bugs of smoke-filled back seats and hard-to-reach controls. The number of air-conditioned cars jumps from 3,000 pre-war models to 36,000 by 1954, reaching one million by 1959.

Many of the original organic fluorocarbon patents held by DuPont expire, opening the field to new companies. Within 15 years, five new companies enter the fluorocarbon market.

DuPont releases its registered refrigerant numbering system for general use, to avoid confusion and proliferation of different names for similar products.

Mass production of modern refrigerators begins in earnest after World War II. By 1950, more than 80 percent of American farms and more than 90 percent of urban homes have one.

Carrier's Weathermaster system is incorporated in Dallas housing developments in the early 50s. Units that heat in the winter and cool in the summer are being developed, though early models are bulky and expensive. R-14 is made available for use in 1955.

The use of aerosol-propelled insecticides greatly increases throughout the world.

1960: Lighter, Safer, Better

The wartime "bug bomb" becomes the post-war aerosol container that, by the mid-60s, is consuming more than half the fluorocarbons being produced.

R-502 is introduced as a commercial refrigerant, packed in lightweight "Zephyr" cylinders for greater safety and easier handling. It is quickly installed in over 10,000 supermarkets across the country. Liquid-Vapor Valve cylinders and Freon® Dispo-A-Cans® soon follow.

Freon® 13, used for ultra-low temperature refrigeration of -100 degrees F and lower, is introduced, intended for use with R-13 or R-22 in a cascade system.

Compact cars make their debut in 1960. A big drawback? No air conditioning. Large luxury cars are cooler and more appealing. Within a year, Corvairs and Falcons offer air conditioning and sales soar. By 1967, 40 percent of new cars have factory-installed air conditioning. A year later, it is standard equipment on the more-expensive cars.

European demand for fluorocarbons greatly increases.

1970: The Space Age

The "energy crisis" sends electricity rates soaring, leading to the development of energy-efficient air conditioners. Congress mandates thermostat settings, though compliance with the new law is sporadic.

Still the leading global supplier of refrigerants for the commercial and industrial air conditioning and refrigeration industries, DuPont begins its own studies for alternative refrigerants after questions arise about possible harmful effects of fluorocarbons on the stratospheric ozone.

Moline and Rowland publish ozone depletion theory in 1974.

The theory suggests that continued use of CFCs could eventually deplete the ozone layer. Although the link to ozone depletion is not firmly established for over a decade, the potential for ozone depletion adds another dimension to refrigerant desirability.

As ozone depletion joins toxicity, flammability and corrosion on the list of undesirable traits of refrigerants, DuPont introduces HFC-134a as a CFC replacement.

Automotive air-conditioning units become lighter, more efficient and more compact. However, concerns about ozone-depletion reach the automotive industry. By 1976, R-134a is being considered the heir apparent to R-12 as the standard refrigerant.

In addition, U.S. production of aerosol products declines, the European aerosol market flourishes.

DuPont initiates the direct contact, or fluid bed, freezing of food. Equipment is being developed for its use.

1980: A Changing Environment

In 1980, 72 percent of new cars sold in the U.S. have air conditioning. Within 10 years, it is up to 94 percent. Two-thirds of all cars and light trucks in operation in the U.S. are air-conditioned.

The "ozone hole" is discovered over Antarctica in 1985 but the cause is uncertain.

With evolving scientific evidence suggesting a link between increasing emissions of CFCs and potential future ozone loss, an international agreement is reached in 1987, the Montreal Protocol, requiring a 50% decrease in CFC consumption over a ten year period.

With the ink barely dry on the Montreal Protocol, in March of 1988 the distinguished panel of scientists, the International Ozone Trends Panel, releases its summary report linking the "ozone hole" and, potentially, seasonal ozone losses in the northern hemisphere to CFCs. Ten days later DuPont unilaterally commits to phase out CFC production through an orderly transition to alternatives.

In the interest of accelerating the transition to alternatives, DuPont shares its safety and environmental information and leads in the formation of consortia to complete the testing. The objective: a refrigerant that is safe, environmentally superior and requires only minimal changes to equipment.

Faced with the prospects of an impending phase out of R-12, carmakers put their money on an alternative refrigerant - R-134a. New components like condensers and compressors are developed as well as new materials like lubricants and desiccants.

1990: The Suva® Family

The Clean Air Act Amendments of 1990 established a production phase out schedule and yearly reduction percentage for ozone-depleting chemicals. In 1996, CFCs are phased out in the U.S.

Accelerating a process that normally would take 15-20 years to develop, test and commercialize, DuPont spends over $500 million and takes only four years to introduce the Suva® family of refrigerants. These low- or non ozone-depleting products, called HCFCs and HFCs, help enable an economical, non-disruptive global transition that is still underway in developing countries.

The DuPont™ Suva® family provides safe high-performance alternatives for automotive, residential and commercial air-conditioning systems, home refrigerators, supermarket display cases and other commercial refrigeration uses.

As in the 1930s, when CFCs revolutionized the refrigeration industry, DuPont unveils a string of new products, beginning with Suva® 134a and Suva® 123 in 1991, MP39, MP66, HP80 and HP81 - all in 1992 - and HP62 a year later.

In 1994, Suva® refrigerants become available for all refrigeration applications. Suva® 407C receives UL approval, replacing HCFC-22 DX applications. Suva® 95 is introduced for lower discharge temperatures while offering greater cooling capacity. DuPont extends its product line to include Suva® 408A, 409A and 410A. Most important, the Suva® refrigerants are globally accepted as safe and environmentally superior alternatives to the CFCs that had been the backbone of the refrigeration and air conditioning industry for more than 60 years.

2000 And Beyond: The Future Beckons

A new century means new needs, new research and new innovations. Proud of its pace-setting achievements in 20th Century refrigeration, DuPont is already looking to the future with its Suva® and ISCEON® 9 series families of refrigerants that reach far beyond the home and office, beyond earth-bound limits to the stars themselves. The aerospace and automotive industries, cryogenics and semiconductor are just a few of the fields to conquer with forward-looking concepts, space-age technology and environmentally safer and more superior applications.

DuPont continues to lead the industry in demonstrating its commitment to sustainability. The company receives the 2002 National Medal of Technology, awarded for policy and technology leadership in the phase out and replacement of chlorofluorocarbons.

DuPont Fluorochemicals makes history in 2004 by being first-to-market with HFC refrigerant blends manufactured in China.

Developed countries party to the Montreal Protocol are required to achieve a 35 percent reduction in consumption of HCFCs by year's end, 2004.

In 2005, DuPont acquires a new line of easy-to-use, non-ozone depleting retrofit refrigerant blends as an expansion of its HFC portfolio. DuPont™ ISCEON® 9 Series refrigerants are easy to use, mineral oil compatible and non-ozone depleting retrofit refrigerants for the stationary air conditioning and commercial refrigeration industries. As a result, they quickly become instrumental in meeting the demand from contactors and equipment owners seeking retrofit options for existing equipment, and in accelerating the phase-out of ozone- depleting substances, such as R-22, in a range of air conditioning and refrigeration applications.

DuPont places first on *BusinessWeek*'s 2005 ranking of "The Top Green Companies," based on the company's experience in creating sustainable innovations related to the reduction of greenhouse gases (GHGs), results relative to company revenues, and management's leadership on environmental issues over the past 10 years.

With nine global refrigerant-manufacturing facilities, DuPont, a principle supplier of consistent, high-quality DuPont™ Suva® HFC-134a refrigerant for today's vehicle manufacturers and the automotive aftermarket, continues to meet the increasing demand for HFCs and other products as their use continues to grow.

In June 2006, DuPont announces that it has identified a leading candidate, "DP-1," in its testing of new, low-GWP proprietary refrigerants. "DP-1" shows performance similar to HFC-134a without the need for a complete redesign of automotive air-conditioning systems, as well as significantly lower GWP than current refrigerants and zero ozone depletion potential (ODP).

The first demonstration of "DP-1" at the 2006 European Automotive Air Conditioning (EAAC) Show in Frankfurt, Germany shows that, although no changes are necessary to the vehicle's existing R-134a MAC system in order to run on "DP-1", AC systems will need to be optimized to accommodate the differences between DP-1 and 134a. As a result of its compatibility with existing 134a MAC systems, "DP-1" has the potential to enable a cost-effective transition to low GWP refrigerants across the entire global MAC industry.

Twenty years after international scientists determined that chlorofluorocarbons (CFCs) were impacting the ozone layer, three DuPont scientists receive 2006 The Heroes of Chemistry award, presented by the American Chemical Society (ACS) for their invention of non-ozone-depleting alternatives. DuPont scientists Donald Bivens, a former process engineer and research scientist at DuPont and now a consultant for the company; Mark Shiflett, a research associate; and Akimichi "Michi" Yokozeki, a process engineer and research scientist are honored as "chemical innovators whose work has led to the welfare and progress of humanity" in a significant way in the past decade."

At DuPont, Better Living Through Chemistry has evolved into The Miracles of Science – miracles that open the door to continued progress and innovation.