

# The CO<sub>2</sub> freezer story

## Innovation in Industrial Refrigeration

### **Refrigeration: An Essential Technology in the Food Industry**

In line with our environmental policy, Nestlé is committed to minimising the impact of its industrial operations on the environment. This includes the technologies the Company uses in its 500 factories worldwide and, among these, refrigeration. Without refrigeration in manufacturing, storage and distribution, modern food production would not be possible.

Today, Nestlé has four major product sectors where refrigeration is widely used: ice cream, frozen/chilled foods and freeze-dried instant coffee.

### **A Technology in Evolution**

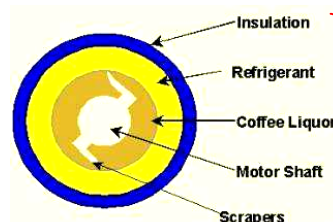
In the 1930s, the synthetic refrigerants CFC's (chlorofluorocarbons) were developed, with remarkable refrigeration properties. They were more convenient than ammonia and were considered safer until, in the 1980s, when scientists began to link them to depletion of the ozone layer and global warming.

In 1986, Nestlé began a program to phase out its industrial refrigeration installations based on CFC's and to replace these with natural refrigerants, ahead of imposed targets fixed by the EU and the Montreal Protocol.

### **Nestlé at the Forefront of Innovation**

Since 1996, Nestlé engineers have taken a leading role to use natural refrigerants and revive carbon dioxide in industrial refrigeration. They have found that, in low temperature food applications, ammonia and carbon dioxide together in a "cascade" refrigeration system can improve manufacturing plant efficiency and safety, thus meeting our goals for the safety of our people, our neighbours and the environment, at the same time as making good economic sense.

In 2000, no commercial CO<sub>2</sub> SSHE freezer (Scraped Surface Heat Exchanger) was available on the markets. In 2001, Nestlé commissioned the biggest CO<sub>2</sub>/NH<sub>3</sub> cascade system built in the past 50 years in the Nescafé factory in Hayes, UK. Nestlé engineers and R&D in collaboration with key suppliers such as Star refrigeration (<http://www.star-ref.co.uk/>) took on the challenge to develop in-house the first such **CO<sub>2</sub> freezer for freezing coffee liquor**.



In 2003, Nestlé opened a Frozen Foods plant in Jonesboro, USA. Nestlé Engineers again installed a CO<sub>2</sub>/NH<sub>3</sub> cascade, the biggest in the world. A further SSHE CO<sub>2</sub> freezer was subsequently developed to cool sauces.



### ***The Challenge of ice Cream Freezers***

Today, Nestlé is a world leader in the ice cream business. Efficient freezing plays such a major role for ice cream quality that Nestlé engineers from the Beauvais Product Technology Centre in France, responsible for ice cream product and process development, along with the corporate engineering team in the Vevey Headquarters, approached ice cream equipment manufacturers to develop a CO<sub>2</sub> freezer specific for ice cream. Ice cream was the last product sector where neither Nestlé nor any other ice cream producer had such a system.

The opportunity to install such CO<sub>2</sub> freezer came in 2005 when Nestlé Thailand needed to extend its Bangchan ice cream factory. Nestlé Engineers installed its first CO<sub>2</sub>/NH<sub>3</sub> package refrigeration unit. Here feeding the cooling coil of the freezing equipment with CO<sub>2</sub> was not really an innovation. This had already been done in the Hayes and Jonesboro Nestlé factories. The novelty was that instead of extending the existing HCFC plant, a dedicated package refrigeration unit using natural refrigerants was installed, well ahead of what was required by the Montreal protocol for a developing country. For the record, HCFC phase out in Thailand is due by 2040.



Here the main challenge was then to manufacture and field test a reliable CO<sub>2</sub> freezer that would operate satisfactorily with a different refrigerant, different pressure,

different settings, different valve sizes, etc... and giving different heat exchange properties with an unknown impact on the product quality.

### ***Working with External Suppliers***

Although Nestlé extensively uses freezing in its factories, developing refrigeration technologies is outside our core business so, when possible, we co-develop technologies with external suppliers as partners, each partner bringing in its specific areas of expertise.

Gram Equipment (<http://www.gram-equipment.com>) and York Refrigeration (<http://www.sabroe.com>) both responded quickly in developing and installing **the world's first commercial ice cream freezer using carbon dioxide** in Nestlé Thailand Bangchan ice cream factory.

Nestlé acknowledges the external suppliers who have worked with us towards a common goal in continuing the commercial revival of carbon dioxide as a natural refrigerant.

### ***Nestlé: Fulfilling its Leadership Role***

Nestlé has a long history of technological excellence. Today, as the world's number one food group, the Company is fulfilling a responsibility to bring to the industry technologies that set new standards for the whole ice cream and food industry.

In a fierce, competitive world of business, the new carbon dioxide freezing technology is a development we have championed, but that we share with our competitors, inviting them to follow our lead in promoting safe technologies that are, environmentally sound and economic in energy.

Vevey, 26 May 2006