



Refrigeration: Technology for Survival

By **Ronald P. Vallort, P.E.**, 2004–2005 ASHRAE President

In the United States, food now travels up to 2,500 miles (4025 km) from farm to table. That's 25% farther than two decades ago. And much farther than John Starr would have imagined, when almost 100 years ago, he presented the presidential address at the first annual meeting of the American Society of Refrigerating Engineers (ASRE).

"Refrigeration," Starr observed, "is widening beyond bounds that were only dreamed of two decades ago."

In 1904, the food industry was already dependant on refrigeration, and there were other industries that had also found

the value of refrigeration: the production of oil, textiles, photography, chemicals, mining and health care. They all benefited from controlled temperature and humidity.

The history of The American Society of Refrigerating Engineers is really the history of ASHRAE because in 1959 the American Society of Refrigerating Engineers (ASRE) joined with the American Society of Heating and Air-Conditioning Engineers (ASHAE) to form our very own ASHRAE.

Refrigeration is now commonplace, not only in industry, but in virtually every home in industrialized countries. And, now there are more foods to choose from — foods that are safe, foods that last longer, and foods that can be trans-

About the President

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ported halfway around the world in their limited window of freshness.

Refrigeration continues to be used in other industries and enables science, technology, and medicine to perform the everyday miracles that we have become accustomed to: vaccines provided worldwide; life-giving blood, tissue and organ transplants; computer and chip technology. *Refrigeration is the technology of survival and advancement.*

What the refrigeration industry calls “the cold chain” encompasses the steps used to preserve food and other perishable products from the production stage to the consumption stage.

ASHRAE is intimately related to the cold chain. ASHRAE sponsors research, develops programs, teaches courses and develops technical information in handbooks to support and enhance the cold chain.

Each link in the ASHRAE support chain is representative of a member, a section, a student branch, a chapter, a region, a committee or a council. We must do our part to ensure that ASHRAE is one of the strongest links in the cold chain.

ASHRAE’s background in refrigeration began 100 years ago when the newly formed ASRE sought to make sense out of, and standardize, the confused and chaotic existing refrigeration data. There weren’t two sets of ammonia tables that were identical, wild claims of performance abounded and no one even agreed on testing or measuring instruments.

ASRE went to work setting standards for ammonia. In 1912, ASRE helped convince the U.S. Congress to appropriate money to enable the Bureau of Standards to review the data on physical constants used in refrigeration. When the appropriation wasn’t renewed, ASRE raised the money for the Bureau’s research staff to continue, creating one reliable ammonia table that was used universally. ASRE also helped determine the standard tonnage basis of refrigeration and developed one of the first refrigeration safety codes, which has since evolved into ANSI/ASHRAE Standard 15-2001, *Safety Standard for Refrigeration Systems*.

In 1913, ASRE President Peter Neff made this observation: “What we as an organization have to fear is that others will outstrip us, not alone in the knowledge of the subject, but in placing before the world the facts, and causing us to follow where we should have led.”

ASHRAE must maintain its status as leader. Many feel that less emphasis has been placed on refrigeration in recent years, both in the industry and in the Society. Let us take this year, the 100th anniversary of ASRE, to remind our industry and the

public about the importance of refrigeration and the need to make even greater strides in improving the cold chain’s effectiveness to improve the quality of life for people throughout the world.

As the video showed, we may find ourselves amazed, and perhaps a bit self-congratulatory about how well refrigeration works, and how vital refrigeration is to the world. But, we also find ourselves taken aback by the tasks that still lie ahead of us.

As the world’s population increases, the dynamics of food supply and storage vs. population will be crucial. With the population currently increasing at a rate of 77 million people per year, mostly in areas where food deficits already exist, the burden is on us to be the technological link in the cold chain.

According to the World Health Report of 2002, the number one cause of death for people around the world is undernourishment.

We need to advance refrigeration technology to enable all the people of the world to enjoy the benefits of refrigeration. Refrigeration should be more economical and foolproof both to construct and operate, while still being friendly to the environment.

ASHRAE’s mission will continue to increase in importance. Not only does the population continue to grow, but the average life span continues to increase (and I favor that). Meanwhile, agriculturists fear that food production cannot keep pace with population growth. The world’s crops have reached a “yield plateau” that cannot be overcome without jeopardizing farmlands. Most of the earth’s high quality agricultural land is already in use, and the cost of converting the remaining marginal areas is too high, both in financial and ecological costs to be feasible.

Planet Earth has a long future ahead — ASHRAE can and must contribute

to this future.

Accepting that challenge must begin at our very foundation — the place where our technical information is produced — with our technical committees.

There are nearly 100 technical committees to choose from, covering topics such as oils, pumps, refrigerated warehouses and energy conservation. ASHRAE members working on technical committees can develop programs, Handbook revisions and research projects, or monitor standards that impact the cold chain and energy use. I encourage our technical committee members to ask themselves this question when discussing research, programs or information for the Handbook: “How does this impact our industry and the public?”

We cannot underestimate the value of each individual member’s contribution. This fact was recognized by American Society of Heating and Ventilating Engineers (ASHVE)



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President Paul Gant when he said, “In our profession most of us are so intent on the details of engineering that our analytical minds lose sight of the fact that every time we definitely determine a new coefficient or a critical velocity, we have... shown future generations how to conserve a pound of coal or a pound of steel, and this knowledge is cumulative.”

Let me share some of ASHRAE’s current efforts that serve as examples of what I’d like to see us do more of. This year, through its grants-in-aid program, ASHRAE is funding research for a graduate student to work on developing low-cost, energy-efficient refrigerators for use in tropical climates. Last year, through our general research program, we funded a project that will provide medical personnel and instrument manufacturers with data and tools to improve cryosurgical probe designs. Cryosurgery

has been successfully used to treat various types of cancer with an effectiveness that is comparable to surgical removal.

Two different projects — yet both meet basic human needs — are food and medical care.

There are countries where, right now, up to 50% of the crops fail to make it to the first phase of the after-harvest food chain. ASHRAE must help to find ways to construct energy-efficient, low-cost refrigerated transport and storage facilities in countries ravaged by hunger.

And we must remember that refrigeration has other uses besides food. Refrigeration is a vital part of the infrastructure necessary to deliver vaccines worldwide.

Thousands of lives around the world have been saved by vaccines for diseases such as polio, measles, chicken pox and hepatitis. Yet, as many as 3 million children die every year from diseases that are preventable with available vaccines. That’s as if 30 jumbo jets filled with children crashed every day of the year.

We must not lose sight of the environmental impact of current and future refrigeration facilities. The problems of global warming and ozone depletion must be further addressed. We must continue to phase out refrigerants that destroy both the earth’s ozone layer and contribute to global warming.

But, like any problem, the solution is not clear cut. Even ozone-friendly refrigerants affect global warming, because the global warming potential of refrigerants is minuscule when compared to the CO₂ given off during the production of energy used to power refrigerated facilities. When using any refrigerant, increasing the energy efficiency of refrigeration systems is the most effective way to battle global warming.

The waste heat given off by power production, HVAC&R applications and industrial processes often dissipates as waste heat into the atmosphere. Further research and development, as well as just plain creative thinking can enable the otherwise wasted heat energy to be used.

An example is use of tri-generation, the simultaneous production of electrical power, heating and refrigeration. Another is heat pumps. They reduce CO₂ emissions and can be used to both heat and cool. As the cost of energy rises, and as the technology improves, heat pumps using renewable energy will find more applications. Creative, practical thinking is needed to use all the sources of energy, not just the obvious ones.

This is where I challenge ASHRAE technical committees to strengthen our strong foundation of technical information.

We should examine the Handbooks to see if they address all the needs of the cold chain. The Handbooks already contain information that individuals need to design food storage facilities. But what other topics relating to food cold storage, such as logistics, racking and cross-docking, need to be addressed in the Handbooks?

Standards should be formulated that address the needs of the cold chain with an awareness of energy efficiency and creative energy use. Standards are needed that encourage use of waste heat in any operation; waste heat that can be used for applications such as powering microturbines, heating water, driving absorption refrigeration cycles or merely heating spaces.

ASHRAE’s foundation also can be strengthened by reaching outside of our own Society to take advantage of the capabilities of other related societies and organizations. Cooperation and networking via joint seminars, research, and other activities would enable ASHRAE to greatly enhance its basis of knowledge, while at the same time increasing the capability of other societies to improve the world we live in.

We need to encourage governmental bodies to provide incentives for the use and reuse of waste heat. This seems obvious, but I recently found that the Danish government actually taxes use of recovered waste heat.

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ASHRAE must not lose sight of Presidential Member Don Colliver's initiative to reduce future energy consumption in buildings by 30%, 50% and 70%. Unfortunately, energy-efficient equipment usually means a higher first cost, so there needs to be an incentive, or a mandate, to convince manufacturers and consumers that the efficient equipment is indeed advantageous.

An example of such a mandate is the recent rule by the United States government that residential central air conditioner units must be 30% more energy efficient by January 2006.

Our chapters must look outward, into their communities, to promote the understanding of implementation of new technologies that promote energy efficiency, comfort and environmental preservation. Our new Chapter Technical Transfer Committees will play a tremendous part in this effort. Our Student Activities Committees should use the humanitarian benefits of refrigeration as a means to interest young people in our industry.

ASHRAE members that are active in resource promotion must keep our mission in mind when calling on existing or potential contributors. Donors with global foresight may even stipulate that the funds must be used to address specific needs such as finding the most efficient air conditioners for the most inhospitable climates.

We can participate in worldwide programs to update HVAC&R technology, such as working with engineers in developing or war-torn countries. We should encourage institutions to construct more hands-on technical facilities for the training of technicians and operators of refrigeration systems. We can target research programs that benefit people living in countries with limited funds and technology.

Looking ahead, Planet Earth has a long future. ASHRAE can and must contribute to the vitality of this future. The power of ASHRAE is driven

by you, the members of ASHRAE. Refrigeration needs to be revitalized to better serve the needs of the world. We need to seek the best in refrigerants, efficiency, cost reduction, reliability and energy use for all types of refrigeration: industrial, transport and domestic. Heating and

air conditioning will also have to be enhanced to make inhospitable land inhabitable.

Let us ensure that ASHRAE truly is the strongest link in the cold chain. And, that ASHRAE will continue to strive to improve the quality of life for people throughout the world.●

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