NOVEMBER 2015

ACCELERATE AMERICA

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Dan Steffen
AAA Refrigeration Service

SPECIAL TRAINING ISSUE

CONTRACTOR GOES TO SCHOOL ON CO_2

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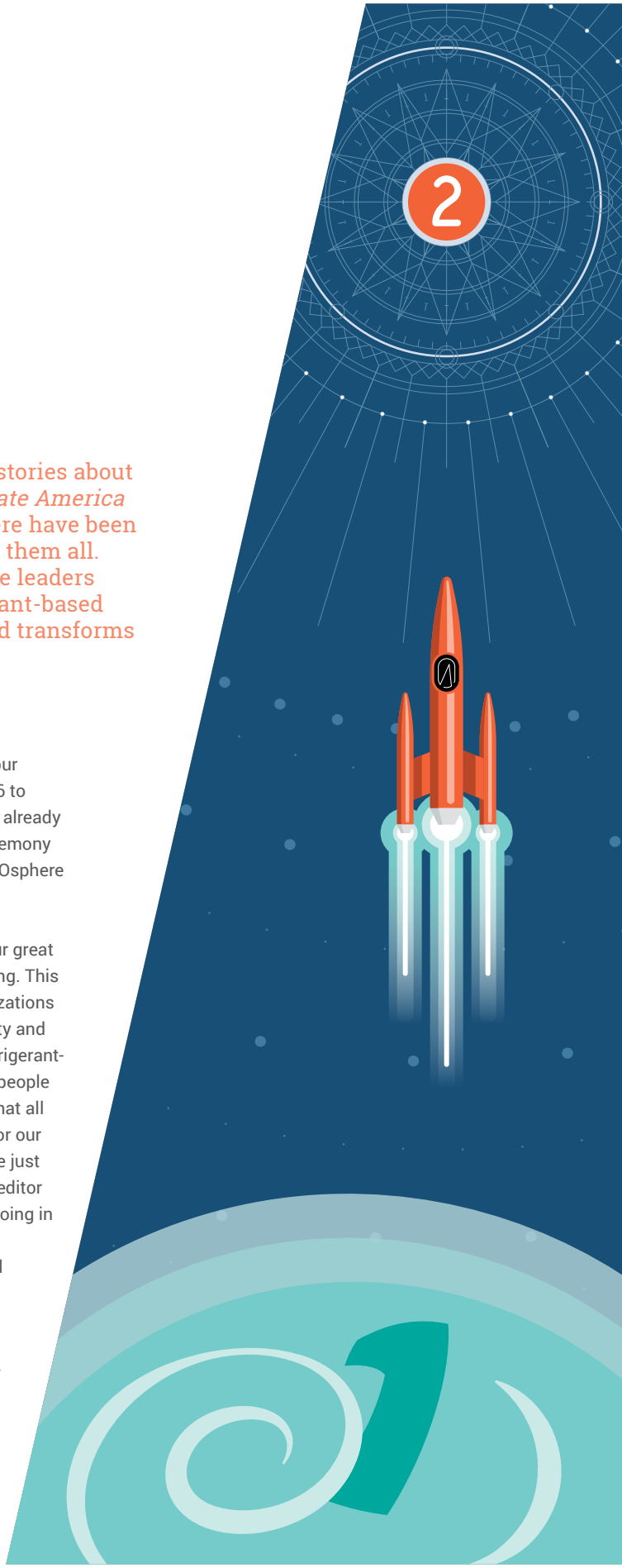
Publisher's note by Marc Chasserot

WHAT'S NEXT IN **YEAR 2**



I can't believe how fast this first year has passed.

I remember asking myself whether we would have enough stories about natural refrigerant leaders and innovators to fill up *Accelerate America* each month. Well, in fact, it's been quite the opposite, as there have been so many advancements that we have not been able to cover them all. And the trend is only accelerating. This is great news for the leaders and innovators that have made the move to natural refrigerant-based technologies, as they will be in the forefront when this trend transforms North America's HVAC&R industry.

So what's next?

First of all, we will have more reporters on the ground engaged in probing and in-depth journalism. We will cover more topics, sectors and companies (especially end users) that deal with natural refrigerant-based technologies. We will attend and report from more trade shows, seminars and conferences all across the continent. And we will provide international stories from our new sister *Accelerate* magazines in Europe and Asia when they are relevant for our North American readership.

We will continue to invest in great design, infographics and photography in order to make the read more enjoyable, relevant and recognizable.

We will expand our industry email list from 20,000 to 50,000 recipients, and double our number of Twitter followers to 50,000. We will boost our presence on LinkedIn and Facebook. And we will continue to print and send free monthly copies to decision-makers within end-user companies to complement our digital edition on AccelerateNA.com. Plus we will announce a new partnership with a leading news-marketing provider (top secret) to further expand the visibility of *Accelerate America*.

Last but not least we will launch our *Accelerate America* Awards in 2016 to recognize industry leadership. I'm already looking forward to the awards ceremony next June in Chicago, during ATMOsphere America.

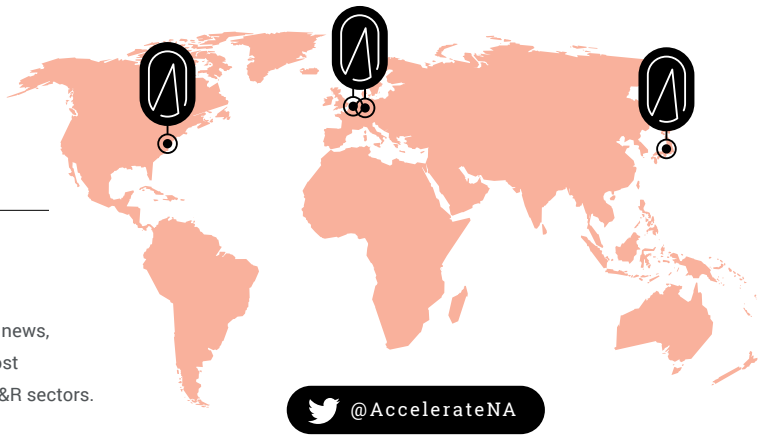
In summary, more eyes will see our great reporting, wherever they are reading. This matters as more and more organizations recognize the business opportunity and environmental value in natural refrigerant-based technologies. Very quickly people will need a trusted authority on what all this means today and tomorrow for our industry. Our clear mission is to be just that authority. Please let me, and editor Michael Garry, know how we are doing in fulfilling our mission at marc.chasserot@shecco.com and michael.garry@shecco.com.

On behalf of the whole *Accelerate America* team, a big Thank You for reading our magazine. The best is yet to come!

VOLUME 2, ISSUE #10, NOVEMBER 2015

ACCELERATE AMERICA

ADVANCING HVAC&R NATURALLY



About Accelerate America

Brought to you by shecco america Inc., the worldwide experts in natural refrigerant news, *Accelerate America* is the first monthly news magazine written for and about the most progressive business leaders working with natural refrigerant solutions in all HVAC&R sectors.
http://acceleratena.com

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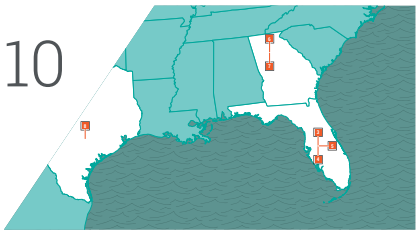

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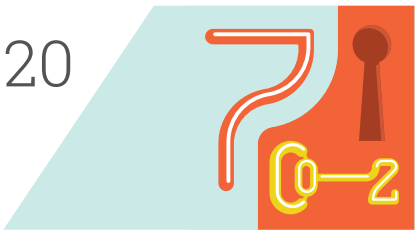

Seven keys to servicing CO_2 systems

Guest column by André Patenaude

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Editor's note by Michael Garry

KNOWLEDGE IS POWER

As a longtime business journalist, I have found that most businesses are reticent about sharing information with the press, lest they tip their hands to their competitors.

But I have discovered that in the HVAC&R industry, people are more open to talking about their activities. One of the most striking examples is the Environmental Protection Agency's GreenChill program, in which food retailers are willing to divulge refrigerant data and best practices with the EPA and other retailers, even competitors.

At conferences like ATMOsphere America and the Food Marketing Institute's Energy & Store Development Conference, retailers and other end users have been forthcoming about their experience with natural refrigerants and other environmental initiatives. *Accelerate America*, now entering its second year of existence, has also benefited from the willingness of many end users to tell us their stories.

In the growing field of natural refrigerants, everyone gains from this free flow of information. Knowledge, as they say, is power.

It's ironic, then, that one of the chief laments one hears is that not enough technicians are adequately trained to handle natural refrigerant systems.

This issue of *Accelerate America* is dedicated to exploring where the HVAC&R industry stands regarding natural refrigerant training and education. And what I'm finding is that the willingness to learn and educate others, demonstrated at conferences and industry groups, is starting to manifest itself in the contractor and technician arenas.

The cover story on AAA Refrigeration Service (page 30) shows how this New York City-based contractor, which prides itself on training, has gone about educating its technicians and customers on cascade and transcritical CO_2 systems.

In the future, any contractors or end users who need to learn about natural refrigerant systems may be heading toward the state of Ohio. For example, Emerson Climate Technologies is about to start operating its Helix innovation center at the University of Dayton. (Page 16) The center will include three learning labs and five research modules, including a model supermarket that will feature a transcritical CO_2 refrigeration system.

In Canton, Ohio, Jim Kalish, adjunct professor of advanced refrigeration at Stark State College, and his colleagues are developing an "Active Lab" training center with a transcritical CO_2 system, a CO_2 heat pump and other equipment that will reside inside of an operating grocery store. (Page 42)

And in Lorain, Ohio, Joseph Kokinda, president and CEO of Professional HVAC/R Services, is establishing a unique trade school that will train students between ages 12 and 18 to become employable technicians in the refrigeration and electrical trades, who are well versed in natural refrigerant systems. (Page 44)

Both Kalish and Kokinda are seeking corporate support and I hope they get it. Their passion for educating people about natural refrigerants points the way toward a more knowledgeable industry MG

Besides of having **no impacts on the environment**, natural refrigerants such as R600a and R290 have an important role on the reduction of the equipment's **energy consumption**, which means that it solves both direct and indirect emissions at once.

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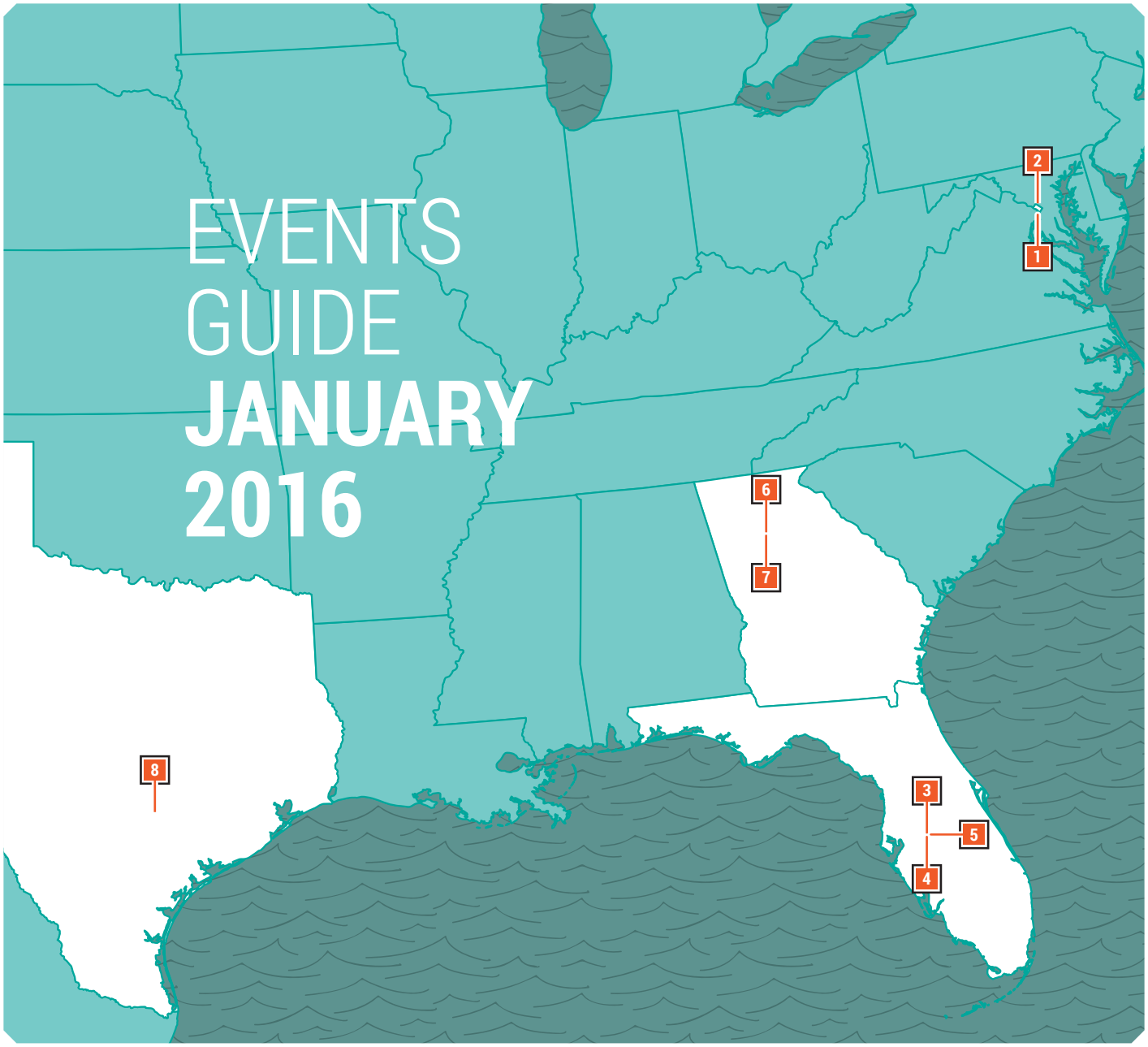
1 December 1, online, 2pm EST
GreenChill Webinar: Using Refrigerant Management Tools to Ensure Compliance with Regulations and Save Costs: Case Study – Stater Bros.
http://epawebconferencing.acms.com/r7i3yfxukta/
twitter: @EPAgreenchill

2 December 1-3, Galveston, TX
Clean Air Through Energy Efficiency Conference (CATEE)
http://catee.tamu.edu/home

3 December 5-8, Orlando, FL
Heating, Air-conditioning & Refrigeration Distributors International (HARDI) Annual Conference
http://www.forward15.com/registration-2/
twitter: @HARDInews



1 January 11-15, Washington, DC
Building Innovation 2016
http://www.nibs.org/?page=conference2016

2 January 20-22, Washington, DC
SAE 2016 Government/Industry Meeting
http://www.sae.org/events/gim/
twitter: #SAEComVEC / @SAEIntl

3 January 23-27, Orlando, FL
2016 ASHRAE Winter Conference
https://www.ashrae.org/membership--conferences/conferences/2016-ashrae-winter-conference
twitter: @ashraenews

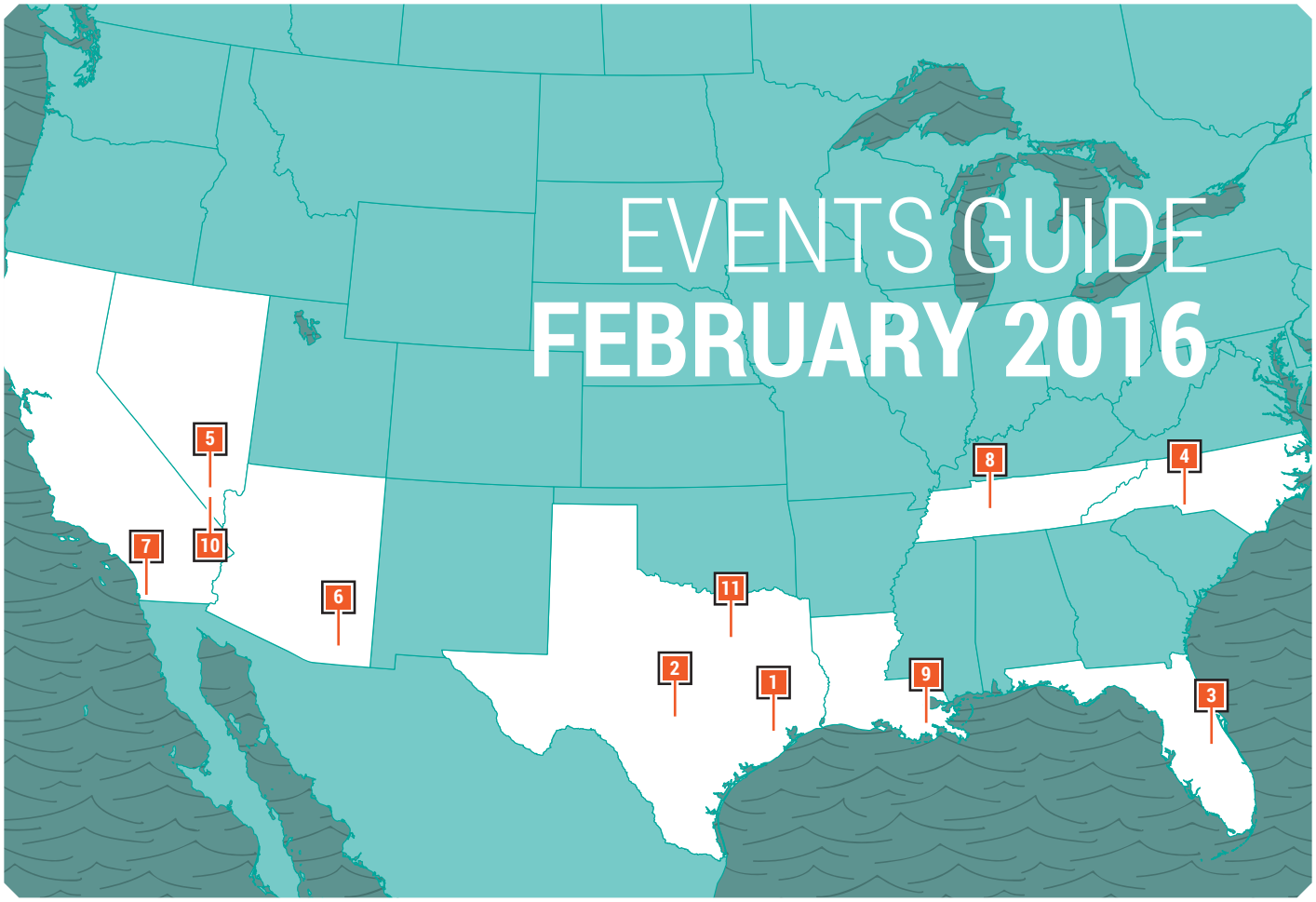
4 January 24-27, Orlando, FL
IAQA 19th Annual Meeting
http://www.iaqa.org/iaqa2016
twitter: @IAQAssociation

5 January 25-27, Orlando, FL
AHR Expo 2016
http://www.ahrexpo.com/
twitter: #HVAC #HVACR / @ahrexpo

6 January 26-28, Atlanta, GA
International Production & Processing Expo
http://www.ippexpo.org

7 January 30-February 3, Atlanta, GA
52nd WFLO Institute
http://www.gcca.org/wflo-institute-cold-chain-education-training/
twitter: @gccaorg / #wflo

8 January 31-February 3, Austin, TX
StorePoint 2016
http://www.storepointevent.com/agenda.aspx
twitter: @StorePointEvent



1
February 7-11, Houston, TX
Cooling Technology Institute (CTI) Annual Conference
http://www.cti.org/meetings.shtml

2
February 8-12, Austin, TX
Campus Energy 2016
http://www.ideacampus2016.org/
twitter : @districtenergy

3
February 11-13, Orlando, FL
Mobile A/C (MACS) Training Event and Trade Show
http://bit.ly/1K6cZbu
twitter: @MACS_Worldwide

4
February 15-19, Charlotte, NC
Industrial Refrigeration Workshop
http://conferences.k-state.edu/industrial-refrig/

5
February 16-18 Las Vegas, NV
Convenience Distribution Marketplace 2016
http://www.cdamarketplace.net/
twitter : @CDA_01

6
February 17-20, Tucson, AZ
Annual Convention National Turkey Federation
http://www.eatturkey.com/meetings
twitter : @TurkeyGal

7
February 20-24, San Diego, CA
AFFI-CON 2016
http://www.affi.org/events/affi-con-2016
twitter : @FriendsofFrozen

8
February 21-23, Nashville, TN
2016 Annual Meat Conference
http://www.meatconference.com/
twitter: @MeatInstitute

9
February 22-24, New Orleans, LA
Supply Chain Conference
http://www.gmaonline.org/forms/meeting/Microsite/SupplyChain16

10
February 28 - March 2, Las Vegas, NV
The NGA Show
http://www.thengashow.com/
twitter: #NGAShow16 @NationalGrocers

11
February 28 - March 2, Dallas, TX
Retail Supply Chain Conference 2016
http://www.rila.org/events/conferences/supplychain/Pages/default.aspx
twitter: #RILAsupplychain @RILAtweets

Shaping Refrigeration Systems for Tomorrow

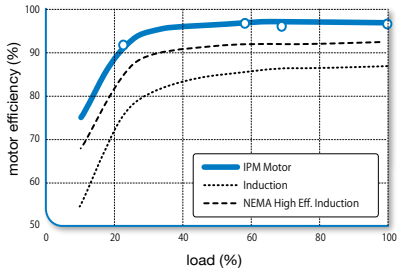
NewTon

Client Testimonial - Yokohama Reito Co., Ltd. (Japan)

The world's first introduction of semi-hermetic IPM motor to be mounted on ammonia screw compressor

Interior Permanent Magnet (IPM) Motor

In order to improve the drive efficiency the system employes IPM motor, achieving higher efficiency by 5 to 10% than conventional induction type.

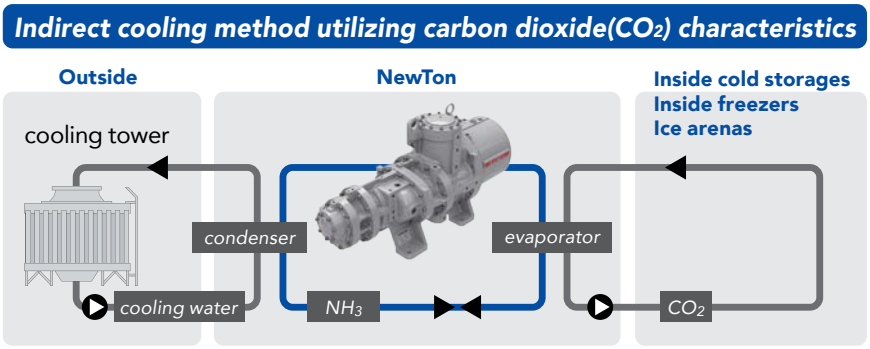


Revolution speed control by Variable Frequency Drive (VFD)

VFDs are used as driver to IPM motor. The rated revolution is set 4,500rpm (partially 5,600rpm) and continuously revolution speed control is equipped as a standard feature to correspond to part load operation. Driving at high speed and controlling revolution speed greatly contribute to energy-saving part load operation as compared to the conventional slide valve type.

Indirect cooling method utilizing carbon dioxide (CO_2) characteristics

NewTon system can contain ammonia completely only in machine room so that it can achieve both energy-saving and safety.



Yokohama Reito Co., Ltd. (Yokorei)

Since its foundation in 1948, Yokorei has been dedicating their business to cold storage facility logistics and food product sales. Yumeshima logistic center was newl built in Osaka's Special Economic Zone, at the crossroads of logistics flow in Osaka's economy. This facility has the function of both international port and distribution center logistics.

Interviewee: Mr. Yukio Sasaki
Deputy General Manager, Cold Storage Headquarters

Advantages of Factory Packaged System

A NewTon package comes as a skid mounted unit that requires no on site assembly. This is an advantage in workmanship and quality over a conventional built-up system. Also, the CO_2 pipe size and material can be change to reduced size and schedule, resulting in lower cost for material and construction. Furthermore, Mr. Sasaki states that he has seen other secondary benefits of a packaged system.

"Factory packaged systems reduce areas for regular maintenance. The usually required oil flushing is one of those that are not required anymore. Also, the longer product life gives us a very long interval between overhauls. On top of these, the ammonia detector is only required in the machine room. All these benefits have given us a dramatic cost in the maintenance cost.

Proven Energy Efficiency

Upon seeking new refrigeration system for Yumeshima Logistics Center, the foremost consideration of all was to have a system with a natural refrigerant. After considering initial capital cost, operating cost (maintenance and utility), and 20-year life cycle cost, Yokorei's clear decision was to use a Mayekawa NewTon system.

"At first I was skeptic, thinking an NH_3/CO_2 refrigeration system that has to employ a secondary refrigerant might not as efficient as the conventional direct Ammonia refrigeration system," Mr. Sasaki from Yokorei's technology department. However, after visited Mayekawa's Moriya factory to inspect NewTon in service and reviewing performance data, Mr. Sasaki's skepticism was gradually melting away.

"To be able to operate and maintain with a very little superheat, due to the flooded-type evaporator on the condenser that is strong against the load variation. Very little gap between the NH_3's evaporating temperature and CO_2's condensing temperature. CO_2's high performance as a refrigerant. These 3 points convinced me of the superiority of NewTon in efficiency and energy-saving. The pair-up between the IPM motor and the inverter on NewTon is arguably the best match in a refrigeration system this size.

With the BEMS (Building Energy Management System) installed, the power consumption of the entire facility, as well as that of NewTon, is closely monitored and it has been showing a very good result."

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SHORT TAKES

by Elke Milner & James Ranson

R290 A/Cs perform well in hot weather

A workshop at the latest Montreal Protocol meeting revealed that R290 (propane) outperforms R22 in high and very high ambient temperatures in mini-split air conditioning systems.

The findings were disclosed at the 27th Meeting of the Parties (MOP) to the Montreal Protocol in Dubai, held November 1-5. They were based on a report titled "Alternative Refrigerant Evaluation for High-Ambient-Temperature Environments: R22 and R-410A Alternatives for Mini-Split Air Conditioners," which was compiled by the Oak Ridge National Laboratory (ORNL).

In the study, R290 achieved COPs of 3.85 and 3.30 at 82°F (27.8°C) and 95°F (35°C), improving on R22's performance by 11% and 7% respectively, the only alternative refrigerant in the test to do so.

Several synthetic blends from chemical producers Honeywell, Chemours and Arkema performed worse than both R22 and R290, in terms of both COP and capacity. Other than the capacity of Arkema's synthetic blend, R290 outstripped the alternative refrigerants in every other category.

Currently, the United States limits the charge for single split units using propane to 114 g, restricting the capacity range of the systems compared to other regions around the world JR

DeCA plans transcritical for 3 U.S. commissaries

The U.S. Department of Defense (DoD) announced last month that its Defense Commissary Agency (DeCA) will install transcritical CO_2 refrigeration systems at three commissaries in 2016, replacing existing F-gas systems.

The commissaries are located at Mountain Home Air Force Base (near Mountain Home, Idaho); Edwards Air Force Base (near Rosamond, Calif.); and Fort Huachuca (Sierra Vista, Ariz.). Each transcritical CO_2 system will use an adiabatic gas cooler, which is designed to lower condensing temperatures and improve efficiency in warm-weather climates.

DeCA installed its first U.S.-based CO_2 transcritical system in a commissary in Newport, R.I. It also has an ammonia/CO_2 cascade system in a commissary at Lackland Air Force Base, San Antonio, Texas. Abroad, DeCA has an NH_3/CO_2 system at a distribution center in Kanto Plain, Japan, and is installing a CO_2 transcritical system at Spangdahlem Air Base in Germany.

The natural refrigerant projects are part of an Obama administration commitment to reducing HFC emissions. The DoD is making up to $3 million available to support R&D alternatives to HFCs EM

Aldi CO_2 system looks familiar

A transcritical CO_2 system installed at a new Aldi Food Store in West Seneca, N.Y., is in many respects not that much of a departure from the retailer's traditional systems.

The Purity system, supplied by Hussmann through its alliance with Systemes LMP, "provides Aldi with an economical outdoor package system that looks and operates much like the HFC refrigeration systems in many of the existing Aldi stores, minimizing changes to current footprint and rooftop curbing," said Quentin Crowe, Hussmann's product manager for refrigeration systems.

The similarities simplify shipping, rigging and installation of the unit, as well as make it more service-friendly. In addition, the system will be supplying supplemental heat reclaim and is expected to reduce the store's energy consumption by 5%-10% EM

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SHORT TAKES

By Robert Davidson and Michael Garry

Emerson's research center to be operational in December

Emerson Climate Technologies' Helix innovation center, which will encompass five research modules and three learning labs supporting innovation in the HVAC&R industry, is scheduled to be operational in December, with a grand opening in the spring.

Helix will occupy a 40,000-square-foot facility on the University of Dayton campus, about 40 miles from Emerson's headquarters in Sidney, Ohio. It will focus on five HVAC&R industry markets: supermarket refrigeration, food service operations, residential connected homes, data center cooling and light commercial buildings. (See "A Place to Dream," *Accelerate America*, Nov. 2014)

The center will incorporate a model supermarket with a transcritical CO_2 booster refrigeration system, which will chill refrigerated cases and a walk-in cooler, and support the HVAC system. The system will provide building heat and hot water, and heat the sidewalk to melt snow.

"We look forward to the opportunity to get into this space with our customers and industry partners to test and evaluate new approaches to the retail experience, from food safety to lighting to HVAC and new refrigerants," said Mitch Knapke, director, food retail marketing and business development for Emerson Climate Technologies' refrigeration business MG

SABMiller joins Refrigerants, Naturally!

SABMiller, a London-based multinational brewing and beverage company, has joined the Refrigerants, Naturally!, initiative, a group of companies dedicated to using natural refrigerants in point-of-sale cooling applications.

The other members of Refrigerants, Naturally! are Coca-Cola, PepsiCo, Red Bull and Unilever.

In joining Refrigerants, Naturally!, which operates out of Koenigstein, Germany, SABMiller is committing to reduce the emissions from its trade refrigeration by 25% by 2020 and, by the same deadline, stop buying new fridges that use F-gas refrigerants. SABMiller markets a number of beer brands, including Fosters and Pilsner, and is a major Coca-Cola bottler.

"Refrigerants, Naturally! is a great example of collaboration between business and civil society to bring about the kind of practical, systemic change needed to reduce the impact of climate change," said Anna Swaithes, director of sustainable development for SABMiller. "Joining Refrigerants, Naturally! will help us accelerate progress on lowering the environmental impact of our fridges — without compromising the customer experience."

Pending regulatory approval, SABMiller is being acquired by brewer Anheuser-Busch InBev MG

Walmart opts for ammonia

Adhering to its plan to avoid HFCs, Walmart is using ammonia refrigeration in its new 452,000-square-foot distribution center in Mankato, Minn.

The system circulates 34,000 pounds of ammonia through 14,000 linear feet of refrigeration piping with the help of five 2,560-hp compressors, serving a variety of temperature requirements.

Walmart's sustainability report states its intention to "begin phasing out HFC refrigerants by 2015 and replacing them with non-HFC refrigerants where these are legally allowed and available for new purchases of point-of-sale units and large refrigeration installations."

The retail giant has installed ammonia systems in other warehouses in its global footprint, including an ammonia system in a distribution center in Balzac, Alberta, and an NH_3/CO_2 cascade system in an Asda facility in the U.K. RD

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James Kalish

IT'S DEMAND, NOT TRAINING, HOLDING BACK CO_2

The issue we face with CO_2 refrigeration training is that not enough people want it today

– By James Kalish

My background in CO_2 refrigeration goes back over 10 years, and in those early years there were a lot of misconceptions about this technology.

More recently, due to the efforts of the Department of Energy, the Environmental Protection Agency, Environmental Investigation Agency, the Food Marketing Institute and shecco (R744.com and *Accelerate America*), an abundance of good and proven information is now available. Case studies can be easily reviewed today directing interested individuals to the energy and environmental benefits of CO_2 refrigeration and the equipment options. Many pioneering end users are open to sharing their performance data and experiences with anyone, including direct competitors.

While the information is available, there has often been talk that there is a void in CO_2 refrigeration training, particularly of technicians and end users, that is an impediment to adding more CO_2 refrigeration sites. I do not subscribe to this hypothesis; rather I hold that anyone wanting CO_2 refrigeration training can access it today from a number of reliable resources.

The issue we face on the training side is first and foremost demand – not enough people want this training today. They have little motivation to want it until they are involved in

an active CO_2 refrigeration project. Though the number of CO_2 projects has been growing in North America, it is still relatively small; the need for training has been more than satisfied by various equipment and controls manufacturers and other industry resources.

Ironically, when adoption of CO_2 systems does expand, the reliability of these systems will mean a reduction in maintenance, hurting traditional contractors and union locals. Any shortages of technicians today will be eliminated as the refrigeration contracting industry shrinks. The requirements for installers and maintenance technicians dealing with CO_2 are also less complex, as they are handling a "natural refrigerant"—even though it involves much-higher-pressure considerations.

What is holding back demand for CO_2 technology? For one, unlike Europe, we do not yet have high-cost energy or environmental laws that would encourage more use of CO_2 refrigeration. Environmental consciousness is, by itself, not enough of a driver.

Also hampering CO_2 system installation in the U.S. and Canada is the slow approval process at UL, ETL (Electrical Testing Lab) and ASHRAE for new pressure directives and equipment, even though the technology has already been proven under CE in Europe. We hear talk of this being resolved but have seen very little progress.

UNBIASED APPROACH

If an independent and unbiased training in CO_2 refrigeration is sought, Stark State College in Canton, Ohio, has a solid curriculum available that is supported by the college and available at a nominal charge. Our CO_2 training can be done on campus or brought to your location anywhere in the U.S. and Canada. Also, if an end user wants/needs an energy and environmental survey of any underperforming HFC store, we can supply that using our full-time students under the supervision of our faculty for only the cost of our travel and software modeling.

We have also provided CO_2 refrigeration project design consulting on both new construction and retrofit situations in the U.S. and Canada, as well as in Europe. We have supported departmental expansion projects where a store with an HFC central rack system is complemented by the addition of a CO_2 system.

While Stark State students cannot presently get hourly college credits for CO_2 refrigeration training, a certification from the college is given on successful completion of the training course. The course is conducted over five consecutive days, depending on the mix of items covered. A modified program course for maintenance and repair personnel can be completed in three days.

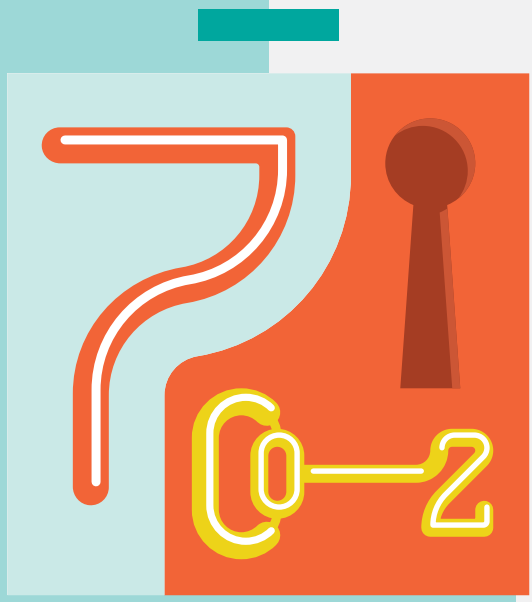
We are also in the process of creating an "Active Lab" with functioning CO_2 equipment and controls, where we plan to have training as well as a center of excellence demonstrating best practices. It is our intention that this facility will help spark more industry interest in CO_2 installations and therefore more interest in CO_2 training. We are seeking a food retail partner to host the lab in a commercially operating grocery store. (For more on this project, see page 42)

Where we feel more education on CO_2 refrigeration should be focused is on engineers, architects and building/store designers. If these people do not include CO_2 systems in their designs, there will be few such projects in the future. I personally perform one- and two-day seminars for this group when they contact us, but again we have not yet seen much demand. We have talked to 10 universities that educate these individuals about including CO_2 refrigeration in their curricula without any success. We have offered to guest lecture at these universities on CO_2 refrigeration and CO_2 HVAC without any takers to this point.

So I return to my earlier position: that the lack of CO_2 training is not an obstacle to achieving more CO_2 refrigerated sites. We need to look elsewhere to find what is slowing the growth of this viable natural refrigerant option JK

James Kalish is an adjunct professor of advanced refrigeration at Stark State College, Canton, Ohio, with more than 40 years of hands-on experience in the HVAC&R industry. He has served in numerous business & technology development and implementation roles and on the board of directors at component, controls and refrigeration contracting companies worldwide. He has supervised a number of transcritical CO_2 installations in the U.S. and Europe.

Jim can be contacted at 1-216-440-0352 or a jkalish@starkstate.edu



SEVEN KEYS TO SERVICING CO_2 SYSTEMS

Even with high pressures and other peculiarities, transcritical CO_2 systems are easy to manage if you're properly trained

By Andre Patenaude

Carbon dioxide (R744) continues to gain momentum as a leading option for refrigeration systems. In recent years it has demonstrated favorable results in a variety of system configurations, particularly in Europe, Australia and Canada. Investment costs are dropping, as innovations in component technology and application methods continue to reveal potential performance gains.

All of these results are ensuring that CO_2 will be a long-term option, making it valuable for service technicians to understand how they differ from HFC systems. Citing seven key strategies, this article will examine R744 transcritical systems from a service technician's perspective to help them effectively prepare for the refrigerant's unique properties.

1 KEEP COOL UNDER PRESSURE

Many technicians new to R744 are concerned about its higher operating pressures compared to HFCs. The good news is R744 is easy to manage if you're properly trained.

It's first important to know where the high-pressure areas are located. In a typical transcritical booster system, the really high pressures will only occur on a hot summer day between the medium-temperature compressors and the pressure-reducing valve, mostly on or near the roof.

Pressures in this area can reach extremes of up to 1,400 psig at 240°F (115.6°C) and typically require stainless steel piping, though high-pressure copper pipes are likely in the near future. The remainder of the system, however, will be in 400–500 psig range — almost the same pressures technicians are accustomed to in 410A high-side systems.

UNDERSTAND R744'S CRITICAL AND TRIPLE POINTS 2

The critical point of R744 is only 87.8 °F (31 °C)/1,055 psig, a relatively low temperature for a refrigerant. At this point, liquid and vapor densities become the same. Above the critical point the pressures and temperatures are independent of each other. R744 systems operating above this point are said to be in "supercritical" mode.

Another important concept to understand is the "triple point." The three phases of CO_2 (i.e., solid, liquid and vapor) coexist at -69.8 °F (-56.6 °C). That may seem low, but the corresponding pressure is 60.4 psig. R744 at that point will turn to dry ice in an instant.

For this reason technicians can't begin charging an R744 system with liquid because the internal pressures will be well below 60.4 psig. To be on the safe side, the system must be vapor-charged until all sections have equalized to around 145 psig before techs can switch to faster-charging liquid bottles.

OPTIMIZE EFFICIENCY IN WARM AMBIENT ENVIRONMENTS 3

Transcritical R744 systems work more efficiently in colder environments. In Toronto, Canada, for example, a system might only operate 200 hours per year in supercritical mode. In Atlanta, Ga., the same system could require 1,020 annual supercritical hours.

Manufacturers and suppliers are working to reduce annual supercritical time in warmer regions to fewer than 100 hours. Five strategies already underway include:

- Spray nozzles cool airflow across the condenser coil by misting water, keeping condensing temperatures lower.
- Adiabatic gas coolers create the same effect by trickling water down adiabatic pads mounted outside condensers. In the Atlanta example, an adiabatic system could reduce supercritical operation to below 100 hours per year.
- Parallel or "flash tank" compression uses an independent compressor to reduce energy consumption at high ambient temperatures.
- Subcooling continues to cool gas exiting the gas cooler, thereby increasing efficiency, even in warm ambient conditions.
- Ejectors allow systems to operate with very low superheat by converting high-pressure gas energy to useful work. This also adds efficiency by increasing saturated suction temperature.

PROACTIVELY MANAGE POWER OUTAGES AND STANDSTILL PRESSURES 4

When an R744 system shuts down, pressures build faster than in HFC systems. It's critical to have a strategy for "power off" conditions ahead of time, whether it's scheduled downtime or unscheduled interruptions like power outages.

One way to avoid losing R744 through pressure relief valves is to install a small standby condensing unit to cool liquid in the flash tank and keep the pressure down. Another option used in some smaller systems is a "fade-out" vessel that can increase system volume when the system is down.

PROVIDE PROPER EQUIPMENT FOR SERVICE TECHNICIANS 5

CO_2 rack manufacturers are making life easier for service technicians by including multiple pressure transducers and temperature sensors in their systems. Techs can call up readings on the controller to get specific information quickly. It's also a good idea to have a good calibrated gauge set with the proper high-pressure hoses in the machine room.

continued on p.22

6 USE BEST PRACTICES FOR R744 CYLINDER STORAGE, CHARGING AND MAINTENANCE

For an R744 system, it's important to have a refrigerant plan that accounts for three key issues:

- Local codes — Where can you store R744 cylinders? Do they have to be inside the building?
- Stock storage — If your system needs 2,000 pounds of CO_2, that's 4,600 pounds of cylinders and refrigerant. A mezzanine might not be the best place to put all that weight in a concentrated area.
- Transferring R744 to the machine room — If the machine room is on the mezzanine, it might be worthwhile to run permanent high-pressure hoses to a charging manifold on a ground-level storage area.

7 KNOW OTHER UNIQUE PROPERTIES OF R744

Understanding R744's peculiarities will significantly reduce maintenance costs and downtime. Here are a few final tips for smartly working with CO_2 systems.

Finding leaks can be challenging, especially if they're in a case. After all, there are already 400 parts per million of CO_2 in the air we breathe. Your detector can also be confused if you're trying to find a leak after hours while a floor buffer is in use.

Preventative maintenance is critical with R744 systems, partly for the business case. End users who install CO_2 systems want a positive return on investment. A proper maintenance plan will help ensure that.

Know the consequences of trapping R744. CO_2 pressure rises faster than HFC, so when techs add valves, they should make sure they're not trapping refrigerant between valves that could potentially close with no escape route. They must provide an escape route through a pressure relief or check valve to another area of the system protected by a pressure-reducing valve.

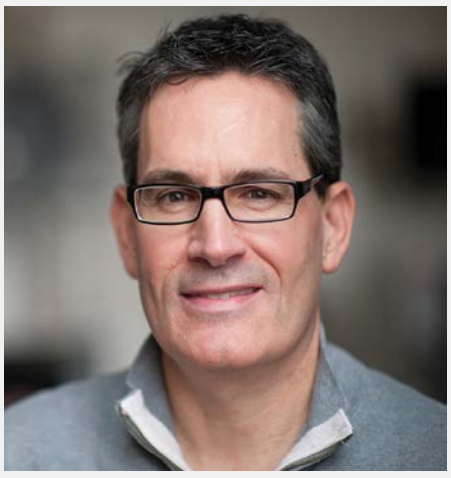
Keep it clean. R744 systems have a lot of joints, and it's important to purge nitrogen to reduce oxidation. Pressure will build up if there's too much metal, particulates or dirt in the system, potentially causing component failures.

Keep it dry. R744 liquid can hold about 20 times more moisture than its vapor form. Wet CO_2 in your liquid line can drop that moisture when it reaches the expansion valve, leaving free water in your evaporators. That's not a good thing because it leads to carbonic acid, which will eat away at the steel components of your system.

Techs can guard against this by making sure they have a moisture indicator in the liquid line that's sensitive enough to measure down to 8 parts per million at 14 °F (-10 °C) liquid.

Grade 4 R744 refrigerant, sometimes called "Coleman" grade, is recommended because it's 99.99 percent pure AP

This article merely scratches the surface, but rack and component manufacturers offer many other resources to make sure service technicians are properly informed when working on CO_2 systems. Watch for these as you pursue your education on R744.



Andre Patenaude is the director, CO_2 business development, at Emerson Climate Technologies.

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Report on Natural Refrigerants Training in **North America**

2016

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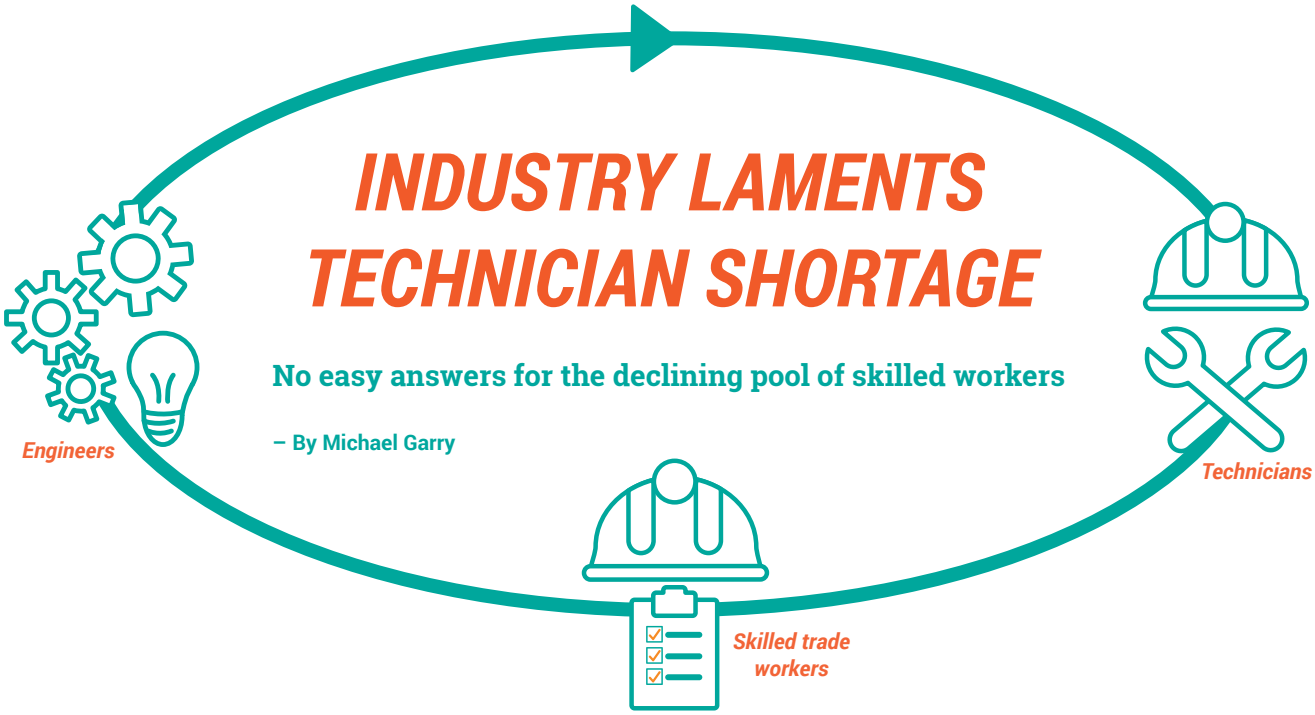

INDUSTRY LAMENTS TECHNICIAN SHORTAGE

No easy answers for the declining pool of skilled workers

– By Michael Garry

Over the past decade or more, the HVAC&R industry has seen a dwindling number of young people interested in trade, mechanic and technician jobs. This trend is unsettling to the industry as a whole as well as to those who favor the transition to natural-refrigerant systems, which require specialized training.

Target, for example, is a retailer that has made hybrid cascade CO_2 its prototype refrigeration system, and is exploring self-contained hydrocarbon units. But the declining pool of technicians "will make all of our jobs much harder," said Paul Anderson, senior group manager of engineering for Minneapolis-based Target, in a presentation at the Food Marketing Institute's 2015 Energy & Store Development (E+SD) Conference in San Diego in September.

Anderson's co-presenter, Keilly Witman, former head of EPA's GreenChill program and currently owner of Boise, Idaho-based KW Refrigerant Management Strategy, referred to data on the shortage of trade workers. For example, only 6% of students consider a career in the trades, she said, while 66% of high school students enroll in higher education. Yet 57% of jobs require skilled labor vs. one-third that call for a college degree.

In 2014, Witman noted, Manpower Group spoke to over 37,000 employers in 42 countries to look at the extent to which they are having difficulty finding the right talent, and what jobs are most difficult to fill. The top three jobs employers are having problems filling: skilled trade workers, engineers, and technicians. "So we can't expect an influx of new recruits into the industry," she said.

One factor that could mitigate the labor shortage is the adoption of self-contained refrigeration units that can be wheeled into position and plugged in, with no installation required. In the event of an equipment problem, a store employee could easily remove a modular "refrigerant cartridge" containing the condensing unit and replace it on the spot with a spare, sending the problem unit off to the factory with no down time. "Imagine a refrigeration system that doesn't require in-store servicing," she noted.

But Anderson cautioned against relying too much on technology. "Smarter devices are not enough to offset the problem of attracting and retaining qualified technicians who know how to fix equipment," he said "Some technicians are so reliant on technology that they forget basic refrigeration principles."

Over the past year, *Accelerate America* has quoted a number of end users and manufacturers of natural refrigerant equipment on the labor shortage. Here are some notable examples:

– Tristam Coffin, energy and maintenance project manager, Whole Foods Market:

"As an industry we need to pull younger folks back to the refrigeration side," he said. "We need to make refrigeration sexy again."

– Rusty Walker, senior corporate trainer, Hillphoenix

"We're a greying, maturing industry and we're not getting young technicians in the field anymore."

Walker believes that refrigeration training has become more of a responsibility of the system manufacturer, because trade schools have moved away from it. That's especially true "if we want to move people to natural refrigerants."

– Gerry von Dohlen, president, Newark Refrigerated Warehouse

In New Jersey, which has relaxed its requirements for ammonia-based refrigeration systems, low-charge ammonia systems are in dire need of trained technicians who can maintain them. "I haven't been able to hire any [operating engineers]," said von Dohlen. "New Jersey has none."

To support the change in the New Jersey law, Essex College in Newark, the IIAR and RETA are developing a two-year associate program to train young people to become operating engineers in ammonia refrigeration plants. MG

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TACKLING THE TRAINING CHALLENGE

End users with natural refrigerant systems are taking a variety of approaches to filling the training void

- By Michael Garry

At the Food Marketing Institute's 2015 Energy & Store Development (E+SD) Conference in San Diego in September, Paul Anderson, senior group manager of engineering for Minneapolis-based Target, related an anecdote about a time when he struggled to keep a refrigeration system operating:

"I called a trusted friend in the industry with a lot of experience. He got on a plane and came to the store. In four hours, he had the refrigeration system up and running; we've had no problems since then. He took the time to work with our technicians to show them what the problems were. It was just about basic refrigeration needs. So do you want one guy with 25 years of experience or 25 guys with one year of experience? We need both. So you have to train people coming in."

The need for trained technicians – both for traditional systems as well as new natural refrigerant-based systems – is something that end users from all sectors continue to face. Over the past year, *Accelerate America* has quoted numerous end users of natural refrigerant systems on this issue, both those that employ in-house technicians and those that rely on refrigeration contractors. Here's a sampling of what they said:

FOOD LION: OEM TRAINING EVENT

The biggest lesson Food Lion learned from its secondary and cascade CO_2 stores was the need for proper training on the new technology. Thus, for its Southport, N.C., store that is using a transcritical CO_2 system, Food Lion did an initial training event at the Conyers, Ga., headquarters of Hillphoenix, supplier of the system. On hand were the installation contractor, in-house service technicians who will be responsible for the system, and the backup service contractor. "We made sure there was training not only for installation but for maintenance," said **Wayne Rosa**, Food Lion's energy and maintenance manager.

HANNAFORD SUPERMARKETS: A SENSE OF OWNERSHIP

The local service technicians who oversee the transcritical system at Hannaford's Turner, Maine, store are Hannaford's in-house employees, making it "easier for us to manage training and ongoing service," said **Harrison Horning**, Hannaford's director of energy and facilities. The in-house technicians have worked on the system since its inception in July 2013, gaining a sense of ownership in it. "It wasn't just foisted on them," he said. "That's important for anybody getting into it."

Store staff also needs to be trained on how the transcritical system's control unit differs from those used at other stores. A lack of familiarity can lead to deviations from standard operating procedures (like lighting schedules), according to a Department of Energy report on Hannaford's Turner, Maine, store: "Case Study: Transcritical Carbon Dioxide Supermarket Refrigeration Systems":

AHOLD USA: LEARNING ON THE FLY

Ahold USA's Springfield, Va., Giant store was the site of its installer's first transcritical installation, though "he had done a CO_2 cascade job for us," said **Ken Welter**, manager of refrigeration and design, Mid-Atlantic for Baltic Trails Engineering, Ahold USA's service company. The installer spent time learning the system with the equipment's manufacturer, Carnot Refrigeration, but most of the training came "on the fly" during the 7-8 day start-up.

WHOLE FOODS MARKET: CONTRACTOR CONCERNS

For Whole Foods, a major concern with natural refrigerant systems remains the expertise of maintenance contractors. For example, at its San Jose, Calif., store with a transcritical system, the retailer's contractor has been found wanting when it comes to troubleshooting problems. "When the contractor doesn't understand the system, it's a big issue," said **Tristam Coffin**, energy and maintenance project manager. "If we don't see the service contractors keeping up, we'll put more pressure on OEMs to give us a full turn-key solution."

Installation and service contractors also have a tendency to boost their costs when dealing with natural refrigerant systems with which they are unfamiliar, noted Kathy Loftus, Whole Foods' global leader of sustainable engineering and energy management. This occurred at Whole Foods' HFC-free Brooklyn store, which uses a transcritical system. To counter that, Whole Foods is training contractors to increase their comfort levels with the systems, and is looking for help from manufacturers as well as government agencies (EPA and the Department of Energy), utilities and industry groups (the Food Marketing Institute).

MCDONALD'S: FOOD SERVICE CHALLENGES

While the HVAC&R market is certainly evolving in the U.S., **Roy Buchert**, former global energy director for McDonald's, cited the lack of training, service infrastructure and available components as among the major challenges to the adoption of natural refrigerants in the food service industry.

"It's the trained service personnel who are going to be a challenge," Buchert said. "If something's wrong, I need to be able to get this thing fixed, and quickly."

RED BULL: PARTNERING WITH SUPPLIERS

Paige Dunn, CSR and sustainability project lead for Red Bull, emphasizes the importance of safety, maintenance and training for its growing fleet of hydrocarbon coolers. "In order to ensure that we're properly managing this program, we have to make sure that our coolers are in good working condition. We're dedicated to fixing these coolers."

To that end, Red Bull has partnered with system suppliers to train technicians. Unlike many end users of natural-refrigerant equipment, the company now regards training to be "a non-issue," said Dunn, pointing out the results that can be achieved when stakeholders work together to improve the market.

COCA-COLA: ADVANTAGE OF CO_2 UNITS

Tomas Ambrosetti, eKOfreshment global program director for Coca-Cola, believes the company's expanding fleet of CO_2 vending machines and coolers are relatively straightforward to service. "We believe that CO_2 is going to be easier and safer to maintain in the field than hydrocarbons. It requires very few additional tools. The training is not unlike being trained to maintain R134a or hydrocarbons or anything else. You can do CO_2 maintenance on site; I don't think I would want to do hydrocarbon maintenance on site."

US COLD STORAGE: KNOWLEDGE TRANSFER AND SELF-EDUCATION

US Cold Storage has developed expertise in managing the ammonia/CO_2 cascade refrigeration systems in many of its cold storage facilities "Knowledge transfer and training was a challenge, but we have been able to overcome that," said **Mike Lynch**, vice president of engineering for US Cold Storage. Self-education has also been important, as the company's engineers conduct a post-mortem following every cascade project to discuss whether the system is operating as designed.

continued on p.28

Manufacturers Doing Their Part

Manufacturers of natural refrigerant systems and components have been at the forefront of technician and end-user training. Here are some observations from key players from the past year.

HILLPHOENIX: PUTTING CO_2 INTO PERSPECTIVE

Rusty Walker, Hillphoenix's senior corporate trainer, identifies a list of training challenges manufacturers commonly find with CO_2 systems: understanding the differences among subcritical, transcritical and supercritical; distinguishing myths from reality; putting the risks of CO_2 in perspective; and knowing how a gas cooler, condenser and adiabatic condenser differ.

"Is CO_2 dangerous?" asked Walker, who is based at Hillphoenix's Learning Center in Conyers. "The answer is, 'Yes, of course it's dangerous,' but we have to explain to contractors that's it's no more dangerous than R22 and R134a – because these are both very dangerous, but it doesn't come across their minds."

One area where CO_2 does differ from other refrigerants is in the higher pressures under which it operates. But Walker pointed out that the higher pressures don't exist in the store, and where it does occur, the system is built to handle it. "So it's not a big deal; it's just another refrigerant."

BITZER: ADAPTING TRAINING PROGRAMS

In assessing the state of training, **Joe Sanchez**, application engineering manager, Bitzer U.S., observed that IIAR and RETA have established the "gold standard" for ammonia training. But he added that training for low-charge ammonia systems "will require some adaptation," especially if their commercial use increases.

With regard to CO_2 training, Sanchez noted that IIAR and RETA are adapting their programs for "industrial use," but OEMs are still required for systems training. He speculated on the need for CO_2 - dedicated certification.

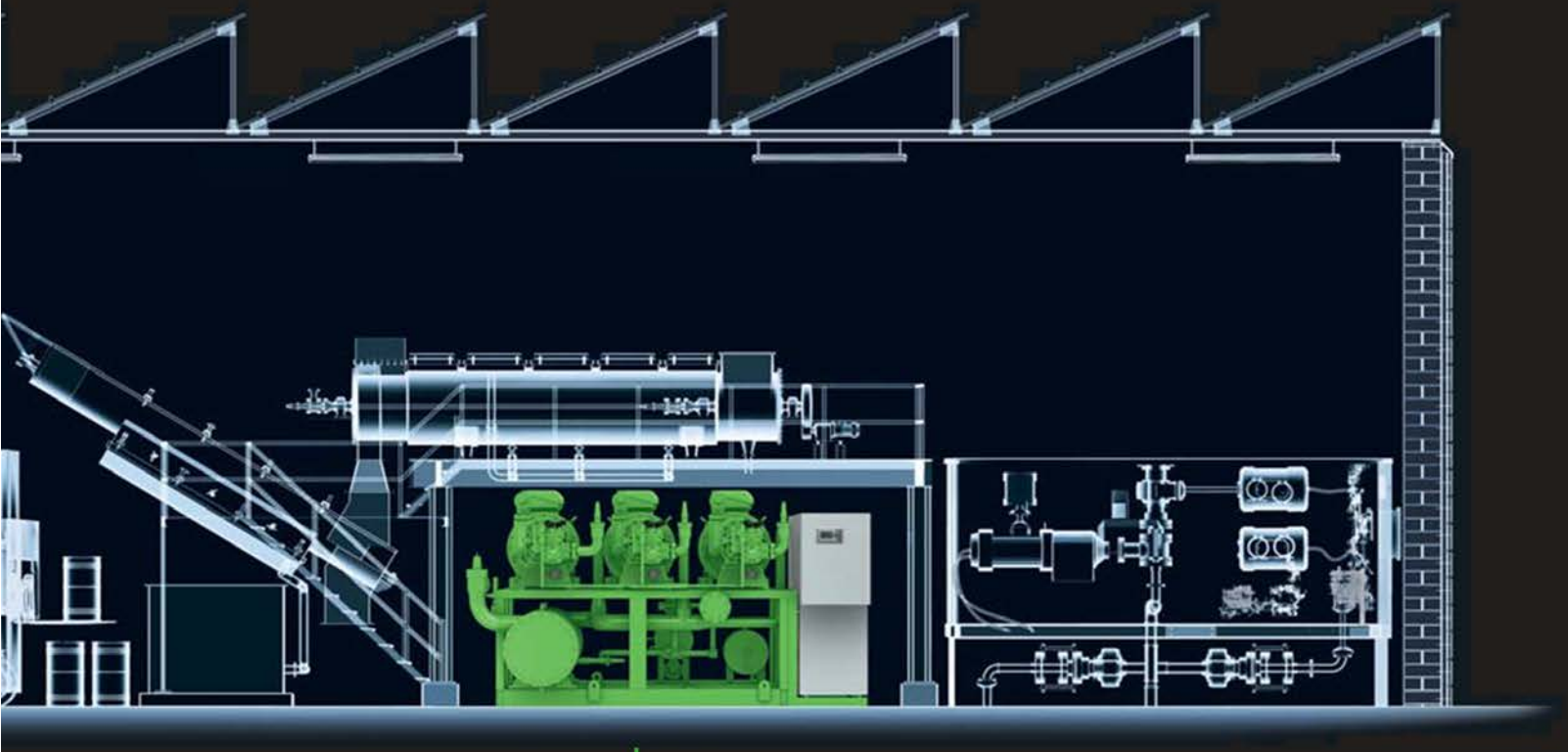
The establishment of better training and certifications on flammable hydrocarbon refrigerants may pave the way for larger charges and applications in the U.S., Sanchez said. "Things that we wouldn't even think about in the U.S. they're already doing in Europe with large flammable systems. This requires the correct knowledge and of course training."

DANFOSS: DISCUSSING THE TOUGH ISSUES

Danfoss is helping to educate the marketplace about natural refrigerants through its EnVisioneering Symposia Series, which brings together policy makers, utilities, equipment manufacturers and contractors to discuss the "tough issues," said **Jon Holloway**, strategic marketing director for Danfoss. "Natural refrigerants have risen to a higher area of the agenda the past couple of years."

SYSTEMES LMP: KEEPING IT SIMPLE

In terms of design, Systemes LMP is working to keep things simple for technicians, said **Xavier Marle**, director of operations for Systemes LMP. For example, CO_2 transcritical systems are designed with nearly the same cases as traditional HFC systems. Granted, there are different components in them, but the cases are similar to those with which end users and technicians are accustomed to working, with the hope of reducing the shock that might come from servicing a new type of system for the first time. MG



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Bitzer

SHIFTING GEARS

To meet the needs of supermarkets installing transcritical and cascade refrigeration systems, AAA Refrigeration Service has stepped up its training program to encompass CO_2 technology

On November 9, 2015, technicians at a still-under-construction DeCicco & Sons supermarket in Larchmont, N.Y., set about turning on a carbon dioxide transcritical refrigeration system – something they had never done before.

On that first day, the technicians, from AAA Refrigeration Service, working with field personnel from equipment suppliers Hillphoenix and Emerson Climate Technologies, programmed the rack and case controllers.

The next day — which included a visit to the store by *Accelerate America* — they filled up the transcritical rack in the engine room in the store's basement with Coleman Grade CO_2 gas (99.99% pure) from several tall tanks, and checked on the rack's compressors. The third day they made sure the refrigerated and frozen cases and walk-ins worked as expected. Then they ran the system for a week to weed out any remaining imperfections, preparing the cases to be stocked with food.

The all- CO_2 transcritical system represents a number of firsts. It's the first such system for DeCicco & Sons, a six-store grocery retailer based in Pelham, N.Y., just north of New York City. (See "DeCicco's Bold Move," Accelerate America, Oct. 2015.) And it's the first transcritical system installed and started up by AAA Refrigeration, based in the Bronx, N.Y. It will be the first to be maintained by AAA once the store opens to the public on December 11.

From left:
Dan Steffen and Kurt Woods,
AAA Refrigeration Service

continued on p.32

> "We wanted to understand CO_2 before our customers did."

Like DeCicco's & Sons, AAA Refrigeration Service is a family-run business, started by two Steffen brothers, Ernest and Ed, in 1937; they were later joined by a third brother, Myron, whose son, Don Steffen, is AAA's current president. Don's son Dan and daughter Jennifer represent the third generation in the business. Bob Isola, vice president of construction, is also a third-generation employee who has been with the company 28 years.

AAA's clients are primarily food retailers, but include cold storage warehouses, including an Amazon facility in New Jersey, and warehouses at New York's famed Hunts Point Market in the Bronx.

For AAA, which for years has worked primarily with traditional direct expansion (DX) refrigeration systems using synthetic refrigerants like R22 and HFCs, taking on the management of a CO_2 transcritical system is a step into the unknown. The system has required intensive training for technicians – a process that will be ongoing. But for transcritical and other natural refrigerant technology to gain a foothold in the U.S. marketplace, contractors like AAA need to make a major commitment to training and education, in partnership with suppliers and end users.

The importance of trained technicians to the adoption of CO_2 systems became apparent when a "large retailer had to stop installing CO_2 in areas of the Midwest outside large cities because the contractors there had not seen it and could not support it," said Dan Steffen, vice president of AAA.

Joel Klabon, field service manager for Hillphoenix's Eastern Region, agreed that OEMs like Hillphoenix will need contractors like AAA to carry the burden of maintaining CO_2 systems. "The future has to involve that or there won't be a future," he said.

Whereas Hillphoenix usually trains one or two people on CO_2 technology, and those people in turn train the rest of the technicians, AAA has tried to expose as many of its technicians as possible to the CO_2 training. "AAA is above average with training," said Klabon. "We don't have to encourage them. Some other contractors need encouragement."

Joel Klabon, Hillphoenix

EDUCATION CULTURE

AAA has long embraced a culture of education and training that should serve it well in the emerging world of natural refrigerants. In addition to the contractor's apprenticeship training program and ongoing training for experienced technicians, AAA has created a "mobile university" trailer that travels between its three divisions —in Plainville, Conn., the Bronx, and North Arlington, N.J.— to demonstrate new equipment to technicians.

In addition, AAA and Hillphoenix hold an annual symposium in April—2015 was its sixth year—for customers and other end users. Hillphoenix and other suppliers talk about new technology and regulatory changes, among other topics. "Our best customer is an educated consumer," said Steffen, paraphrasing the old Sym's clothing store slogan. "By educating our customers, we enable them to make better decisions."

At last April's symposium, before an audience of more than 100, Leigha Joyal, energy analyst for Hillphoenix, explained how supermarkets can get energy incentives for using natural refrigerants like CO_2. (She elaborated on this in "Educating Utilities," *Accelerate America*, June 2015) "Every year we've incorporated some CO_2 in the program," said Steffen.

The symposium is unusual for a contractor to co-sponsor, said Klabon. "It let's customers know what's out there, including CO_2."

"Hillphoenix believes in the importance of education as much as we do and therefore has been very supportive of our training," said Steffen.

Eric Berman of Hillphoenix (at right) with AAA Refrigeration Service technicians.

In addition to CO_2 refrigeration, AAA has begun to encounter AHT self-contained cases containing propane in some ShopRite supermarkets in Westchester County, N.Y. But AAA has not yet begun to service them. The company does handle as many as 50 supermarket refrigeration systems using secondary glycol as a cooling agent.

To teach its technicians about CO_2, AAA held a meeting with Hillphoenix two years ago where the OEM's head corporate trainer, Rusty Walker, explained how the refrigerant works to about 25-30 technicians at a local supply house. (Walker insists CO_2 is "just another refrigerant" see "Hillphoenix: It's Not Rocket Science. It's Just Refrigeration," *Accelerate America*, February 2015) "We wanted to understand CO_2 before our customers did," said Steffen. "So if we did get an opportunity to work with CO_2 —which we have— we wouldn't be scrambling."

In January 2015, Walker returned to focus on cascade CO_2 technology, which is being installed by one of AAA's customers, a ShopRite store in Staten Island, N.Y. He explained the cascade system to 20-25 technicians from across AAA's regions.

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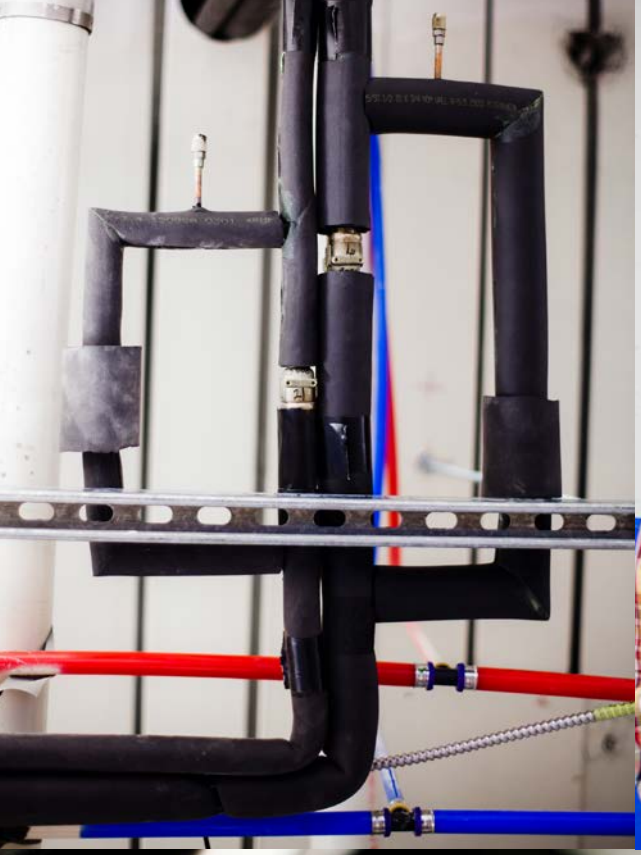

clockwise, from top left:
case isolation valves with relief bypass;
Bob Isola and Kurt Woods,
AAA Refrigeration Service;
CPC rack controllers;
Brent Cheshire, Emerson Climate Technologies;
Danfoss electronic expansion valve

Then this past August, he conducted a full-day training program on transcritical refrigeration for about 30 AAA technicians, including a four-hour classroom session and a two-hour session at the Larchmont store.

John DeCicco, Jr., president of DeCicco & Sons, attended the summer training sessions as well as the 2015 symposium. He also learned about CO_2 at private meetings earlier in the year with Walker, Steffen and others, and in subsequent phone calls.

DeCicco expressed pride at having prompted the training of AAA's technicians on transcritical technology, including many who will not service his store. "They are all learning about it, and will be capable of servicing it," he said. "It's bringing a whole new light to this area."

Out of AAA's 105 technicians and apprentices, between 40 and 50 have experienced CO_2 training, with about 20 ready to service CO_2 systems, said Kurt Woods, a AAA supervisor and a member of its education committee. "Eventually everybody will be trained on CO_2."

With DeCicco's permission, the Larchmont store could serve as a training platform for transcritical technology when it is incorporated into AAA's apprentice curriculum. Already, AAA brought technicians from different areas of the company to the Larchmont store during the startup week to gain exposure to the technology.

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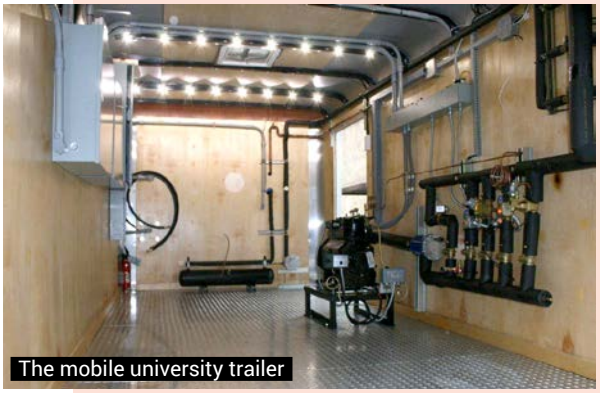
Coleman grade CO_2 cannister

AAA University



The mobile university trailer

At AAA Refrigeration Service, training has for many years been an integral part of the company.

For experienced technicians, AAA puts on an evening seminar once or twice a month from September through May featuring equipment vendors explaining their technology. "It's not a sales pitch," noted Dan Steffen, vice president of AAA.

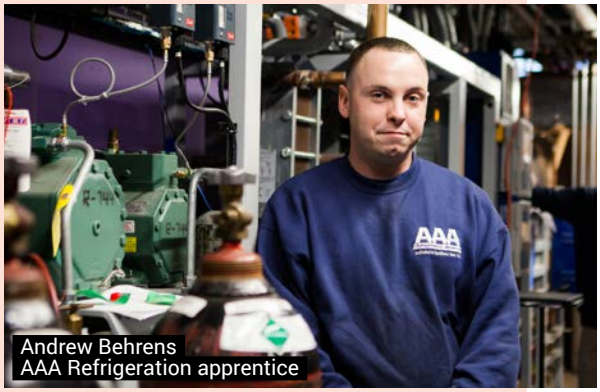
For apprentices, AAA requires a seven-year training program. On two Saturdays per month between September and May, apprentices, split into three levels, attend a four-hour class, usually held at AAA's Bronx office and occasionally in the field. Topics include screw compressors, electrical wiring, advanced controls and store surveys. The year concludes with a final exam in May. After seven or more years, apprentices qualify to become journeymen. All AAA employees belong to a union.

New hires, who generally come from local trade schools, "know the basic refrigeration cycle and components, and we take it from there," said Kurt Woods, a AAA supervisor and a member of its education committee. Minimum requirements include having a clean driver's license, passing the Environmental Protection Agency's certification test and possessing a good work ethic, which Steffen acknowledged is hard to verify.

In 2012, AAA added a hands-on, 14-foot "mobile university" trailer to its apprentice training program. The initial classes called for building and piping the trailer, which now serves as a demonstration lab for controls, valves (including electronic expansion valves), energy management systems, variable frequency drives, leak detectors, compressors and other equipment. Component manufacturers offer new products to AAA for the trailer. "We'll play around with the wires and let the [apprentices] figure out how to fix it," said Bob Isola, AAA's vice president of construction.

In early November, the trailer was on its way to AAA's Connecticut office MG

Wanted:
Qualified Technicians


Andrew Behrens
AAA Refrigeration apprentice

Kurt Woods, a supervisor for AAA Refrigeration Service and a member of its education committee, agrees with the widespread notion that it's hard to find qualified people to work as refrigeration technicians. "Very hard," he said.

This year, AAA, for the first time, brought in trade school students as paid summer interns.

Andrew Behrens, 25, who helped install the transcritical system at DeCicco & Sons' new Larchmont, N.Y., supermarket and will assist in maintaining it, has been an apprentice for AAA for about four years. But he is somewhat unusual.

"There are not a lot of young guys in the industry," said Bob Isola, DeCicco's vice president of construction. "Most of our guys own homes in the suburbs, so pay is not the issue," he said.

AAA hires between 10 and 20 people per year; about half remain after two years. During the first year, beginners tag along with more experienced technicians. In the second year, they are given more independent responsibility. "That's when we see who's built for this or not," said Woods, a 28-year veteran at AAA.

What makes someone built to be a technician? "They have to be mechanically inclined, have a work ethic and a commitment to the hours," said Woods. "They also need to be committed to education. They never stop learning."

Some apprentices are put off by the prospect of night hours after three to four years as an apprentice, noted Woods. Advances in monitoring technology is resulting in more off-hour calls.

Woods is struck by the tendency of many new recruits to not be as tool-oriented as his generation of technicians was. "We fixed our bikes as kids," he said. "You've got to have a love for tools" MG

Fred Perrotta
AAA Refrigeration technician

STILL ADJUSTING

Frank Perrotta, a 16-year veteran AAA technician who attended the transcritical training, will be the primary maintenance technician for DeCicco's transcritical system. Eight other AAA technicians will come into contact with the transcritical system.

At the Larchmont store, Perrotta acknowledged that he's still adjusting to the new technology. "You work one way all these years," he said. "This is similar, but still different — the whole nature of it. It's very challenging."

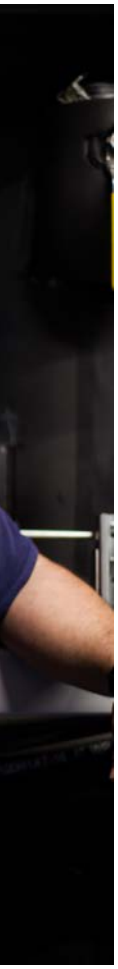
The high pressures in a transcritical system, which can range up to 1,400 psig, worry Perrotta. "It doesn't sound as safe as Freon," he said.

Perrotta also pointed to the greater sophistication of the controllers and valves. "Everything is electronic," he said. "You can't waste time with one store all day because it's so complicated." He expects to be at the Larchmont store frequently until "things settle down."

Programming the transcritical rack's CPC e2e controller is more complex than it is for a traditional DX system, said Brent Cheshire, field service specialist for Emerson Climate Technologies. "You're going from a simple control where you read temperature and open and close valves or handle defrost, to a more in-depth control around the safety of the operation and oil control."

Bob Silvestro, another AAA technician with 16 years of experience, was responsible for the installation of the transcritical system and participated in its startup. He pointed out some differences between the transcritical system and conventional DX systems. "Charging it is a little different. Usually we run compressors to get refrigerant to go in. With this, the pressure it high enough to push the refrigerant in." Piping has a smaller diameter but thicker walls than conventional piping.

Silvestro also mentioned the need to be more "safety conscious" because of the higher pressures. "You don't want the liquid [CO_2]



"Eventually everybody will be trained on CO_2."

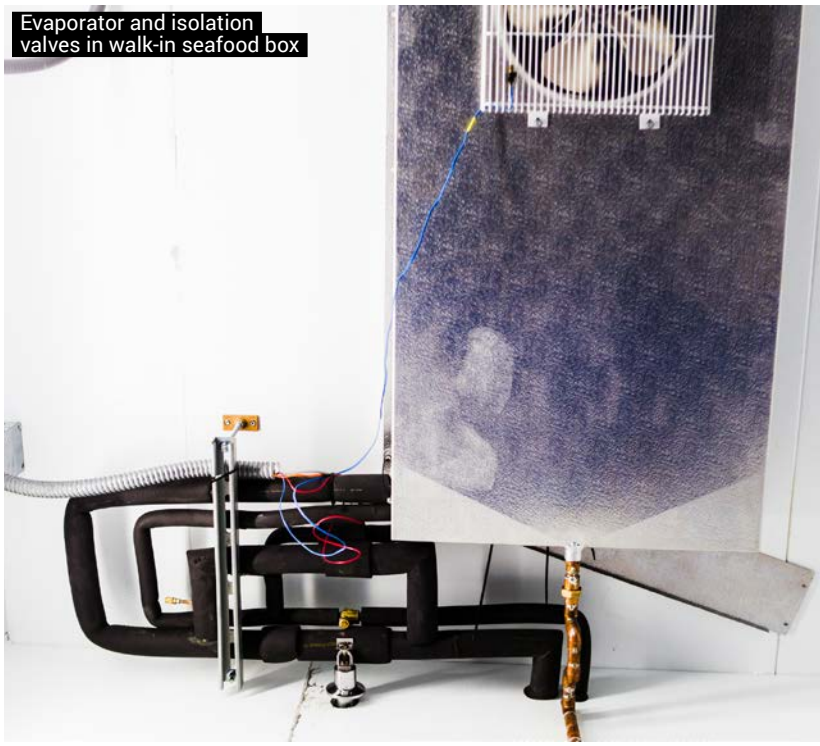
to be caught between two places because it can break pipes and hoses," he said. "But there are bypasses that blow it back to the racks."

There's more to learn, added Silvestro. "But once you learn it, it will be fine."

Isola acknowledged that the technicians' biggest concern about transcritical refrigeration is the safety of the higher operating pressures. But he noted that the transcritical system is designed with bypass and relief valves to relieve excess pressures. "In reality, it's a similar system [to a conventional DX] and should be treated the same," he said. "In a couple of months after working with it, we'll be comfortable with it.

"It's something new," he added. "It's one thing to learn about it in a book or to see videos. Out in the field, it's different. Some people adapt to change better than others."

"When R410A came out, everybody was worried about the pressures," said Steffen. Now there's not as much concern."


Evaporator and isolation valves in walk-in seafood box

Dan Steffen

By monitoring pressure and temperature, the transcritical rack's CPC controller has internal overrides that "will shut things down," said Cheshire. "It has the capability of sending out alarms to our center in Kennesaw, Ga., and we in turn can call the store."

Another key safety feature is the relief bypass on the isolation valves. When those valves are closed to shut down the cases, CO_2 can be vented back to the compressors.

Isola is personally pleased to be learning about the transcritical system. "Now, when a customer asks what I think about it, I can say definitively, 'yes, I like this, I don't like that,'" he said. "If this is the solution, I think it's great being able to go with a natural refrigerant."

Though AAA's supermarket customers regard the cost of retrofitting existing stores with transcritical refrigeration as too high, some are considering transcritical for new stores because of regulatory uncertainty, said Steffen.

"The EPA continually changes their [refrigerant] requirements due to global warming," he said. "Even though [the CO_2 systems] cost a little more up front, it's a long-term solution. You don't have to worry about GWP down the road." MG

PARALLEL TRAINING CONFERENCES FIND SIMILAR CHALLENGES

RETA and RSES events grapple with the need for technician training on natural refrigerants

– By Robert Davidson

At about the same time in late September, about 80 miles apart, two of North America's primary training organizations —the Refrigerating Engineers & Technicians Association (RETA) and the Refrigeration Service Engineers Society (RSES) — held their annual conferences.

At both events, attendees could observe that both the content of training and its method of delivery are changing to keep up with a market that is evolving toward natural refrigerants.

CATCHING UP WITH LOW-CHARGE AMMONIA

The RETA 2015 National Conference, held Sept. 29-Oct. 2 in Milwaukee, Wis., grappled with the impact that higher demand for —and shorter supply of— trained technicians is having on industrial refrigeration.

"There is a greater demand for quality training opportunities," said Jim Price, past president of RETA and South Central regional sales manager, Hansen Technologies. "But because of the expense of travelling to brick-and-mortar sites for training, there is an increase in online-training subscriptions."

As this trend grows stronger, Price said, RETA itself "is in the preliminary stages of updating its online training," in order to give it a more appealing look and to help incorporate interactive learning tools.

In addition to content delivery, the content itself is changing as well. The industry is moving towards new solutions, particularly low-charge ammonia systems, which Price sees as the potential heir to the throne of industrial refrigeration. "These [low charge ammonia] systems address safety, by reducing the charge, and efficiency, by eliminating many of the losses that are inherent in a large central system," he said. But the systems have maintenance challenges. "While they are very compact, their compactness may make them very tight and difficult to service."

As interest grows in new technology, Price acknowledged that RETA is "a little behind the curve" with new training material, but "we are rapidly closing the gap."

There is also a gap with respect to codes and standards, he added. "I do not think the codes have caught up to the progress,

> "There is a greater demand for quality training opportunities."

Jim Price, past president, RETA

especially with regards to CO_2. All refrigerants are potentially dangerous if not understood and respected. We, the industry, must be careful not to become complacent no matter what refrigerant we work with."

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THE NATURAL VOICE

Each Nation and each Industry Sector bears an individual responsibility in the fight against climate change. The refrigeration, heating and cooling industry recognises the role it can play to reduce direct and indirect emissions of greenhouse gases.

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Arthur Miller, RSES

RETA held its first conference in 1909, when the organization was known as the National Association of Practical Refrigerating Engineers. Prior to 2006, the conferences were mostly small gatherings that were sponsored and arranged by local chapters and averaged between 200-400 attendees.

For the 2006 conference, RETA's national staff took a larger role in planning the event, and attendance jumped to more than 700. Each year since, the conference has grown "in both attendance and attendee fulfillment," Price said.

ADDRESSING THE NEED FOR NATURAL REFRIGERANT TRAINING

The 78th Annual RSES Conference and HVAC&R Technology Expo, held Sept. 30-Oct. 3 in Rosemont, Ill., also had plenty to say about training for natural refrigerants, notably CO_2 and hydrocarbons.

While HFOs were discussed during panel sessions, there were "requests for CO_2 training," said Arthur Miller, Region 2 director for RSES and owner of KAM Associates, a training firm. As the demand for CO_2 technician training increases, RSES will be looking at partnering with manufacturers to provide this training, he added.

There was a session on hydrocarbon training. Miller said that he expects the number of trained hydrocarbon technicians to continue to grow. In the EPA's recent proposed changes to Section 608 of the Clean Air Act, the agency is looking at adding some hydrocarbons questions to an updated exam slated for January 1, 2017. "So all of this adds up to a numbers increase" for hydrocarbon technicians, he said.

However, there remains a bias against natural refrigerants that will have to be overcome. "We as an industry have been very complacent with the use of CFCs, HCFCs and HFC refrigerants as well as the reasonable similarity in technologies between these refrigerants in the last number of decades," Miller said. "We have become familiar and comfortable with this arrangement."

The transition to natural refrigerants will remain a concern "until training on this equipment and systems becomes easily accessible by all technicians across the country."

Along with hydrocarbons training, the RSES Conference covered over 30 technical topics, including ice machines, IQA [indoor air quality] basics and troubleshooting techniques. The conference attracted 272 attendees and 19 exhibitors, which Miller said was similar to last year's conference held in Long Beach, CA.

The conference also included a "Students Day," with students coming from several local colleges. Exhibitors answered questions about products, equipment, training and industry opportunities.

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CREATING THE FUTURE IN OHIO

Jim Kalish and Joe Kokinda are pioneering new ways to train the HVAC&R industry and advance understanding of natural refrigerants — the former with a store of the future, the latter with an unconventional trade school. But they need industry support

— By Michael Garry

Dawes Lake, Ohio
photo credits: Mark Spearman

Building a CO_2 Active Lab and the Store of the Future

In an effort to promote understanding and adoption of CO_2-based transcritical refrigeration systems, CO_2 HVAC&R trainer and educator Jim Kalish and his colleagues are developing an industry-supported "Active Lab" with functioning CO_2 equipment and controls.

Most significantly, the lab will be part of an operating grocery store and thereby reflect real-world conditions. Jim will use the store as a best-practices training platform and overall center of excellence for CO_2 refrigeration. He is seeking a food retailer to partner with on this project; interested parties can contact him at 1-216-440-0352.

Here's Jim's description of the project:
Our plan is to have a 35,000-square-foot store designed by our team of CO_2 operating experts. We would prefer it to be located within a 150-mile radius of Canton, Ohio, so we can properly support and maintain HVAC&R systems. It will be set up as a training facility and as a grocery store of the future.

The whole idea of an Active Lab is to have refrigeration loads that are real, so it must be a commercially operating grocery/food business. Doors must be open to the public (which might by osmosis develop environmental awareness of natural refrigerants). Since we know very little about running the front end of a food business, our goal is to attract an experienced and expert retailer that is flexible enough to operate a store with a running lab and training center.

To envision what we are doing, consider a lab wrapped around a grocery store. The equipment will be placed so that customers can see it and service personnel can see the store floor — not hidden away in some mechanical room or on the roof. Equipment placement on the store floor will be designed so that maintenance can be performed without impacting shoppers. Walgreens in its Chicago-area net-zero-energy store did this to a certain extent with equipment up in a mezzanine with a glass partition.

We doubt any grocery store owner would voluntarily design a building in this way, putting refrigeration, air balancing, IAQ and HVAC at the core of the design rather than low on the priority list. In fact, I doubt any store design has ever designated refrigeration as core to its design. A leading grocery operations executive once told me that what his chain offers is refrigerated and frozen food, along with some "other stuff." He added: "Otherwise we would be simply 'dry goods' stores." Yet he and his staff had little impact on optimizing the operating aspects of the store design.

Modern refrigeration is what makes the food business we know possible. So why is it not better considered in the overall store design? How can any grocer in good conscience know that he or she is leaking 15% to 20% of their highly toxic and environmentally nasty chemical refrigerant into their store every year and into their community and finally into the atmosphere? Where do those chemicals go? My guess is they may contact unprotected meat, fish and produce that is exposed to the leaching of the refrigerants. The customers then eat that food!

By contrast, if we leak any CO_2 it only helps preserve the food. In thousands of grocery store installations in Europe operating for a number of years there is virtually no loss of CO_2 in systems with a standby pressure rating of 80 to 120 bar.

Equipment/services rundown

We are taking an "if you build it, they will come" approach to our store of the future when it comes to securing the support of equipment and controls suppliers in an "alliance for the Active Lab." We are also attempting to access government grant monies.

Here is the list of supplies and services we need to launch our Active Lab/transcritical CO_2 training center and store of the future.

- **Transcritical CO2 refrigeration rack and rack controller** are being donated.
- **CO_2 Heat Pump for HVAC**: We are building our own unit, as this technology is still not commercially available to our specifications.
- **CO_2-ready cases and cabinets**: We are seeking the right partners for this part of the Active Lab.
- **Building management control system**: We are looking for a partner that can tie via Modbus into the rack controller and support the Active Lab project.
- **Other HVAC&R equipment**: We are looking for partners for the walk-in units and evaporators, and ancillary equipment.
- **The architectural design of the facility**: We are working with resources at a university in the Cleveland/Akron/Canton area to design the building for the Active Lab.
- **The engineering design and store design**: We are collaborating with resources at another university in the Cleveland/Akron/Canton area to design the workings of the building for the Active Lab. My longtime partner Dr. Frank Monaco is coordinating this effort. We are also talking to two design engineering groups active in the U.S. and Canada to join our alliance and provide their services.
- **Installation, piping, welding and consumables**: We have partnered with Joseph Kokinda's Professional HVAC/R Services.
- **Land**: We are in discussions with economic development officials in three cities to secure a site where there is enough population growth and interest in environmentalism to support the Active Lab. One site is in Canada and two others are in the U.S. and all within a 150-mile radius of Canton, Ohio. The store of the future must be located in a highly motivated "green" community that will support our efforts. The community must also be an interesting destination for individuals who will want to see the store in action and those who will train there. Of course, the retailer that will operate the store must agree to the final location.
- **Building**: We have a Cleveland-based developer that will build the facility to our specifications and rent or lease it to our retail partner. Alternatively, if a store operator wants to fund the building, we are interested in having that discussion.
- **Retailer**: We are just beginning our quest to find the optimal store operator for the Active Lab and store of the future. The building will have all the refrigeration, HVAC and IAQ equipment already installed, and that will be factored into the rent or lease paid by the store operator.

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Joseph Kokinda

A New Kind of Trade School

Joseph Kokinda, president and CEO of Professional HVAC/R Services, Inc., is fed up with the poor skillsets of young people applying for jobs at his refrigeration contracting company, and he wants to do something about it.

Kokinda, who turns 60 next April, has an exceptionally ambitious plan – to create a private and nonprofit trade school in Lorain, Ohio (near his corporate headquarters in Northeastern Ohio) that will train students between ages 12 and 18 to become readily employable technicians in the refrigeration and electrical trades. And he intends to do this in a way that turns conventional educational standards upside down.

Students will attend six days per week, 11 months per year, with the school year beginning in January. Most will spend only four hours per day in class, three days per week; the rest of the time will be devoted to on-the-job training and mentoring. For example, the 545,000-square-foot school will contain a manufacturing center where students will work on assembling CO_2 equipment like racks and heat pumps. Digital and hands-on instruction, rather than lectures, will be emphasized. Students will graduate able to perform many of the tasks of a journeyman.

Kokinda's decade-old, family-run contracting company, which serves retailers like Dollar Tree, Family Dollar and Walgreens, specializes in environmentally friendly and energy-efficient refrigeration rollouts. Thus his school will emphasize natural refrigerants and related technology.

Accelerate America recently asked Joe to elaborate on plans for the school. Here's what he said:

Accelerate America: Why are you doing this?

Joseph Kokinda: Initially, this quest began for selfish reasons. We are concerned about our family business continuing because we can't find young people who pass muster. I'm tired of hiring 50-year-old guys. They give us a great effort but they can't hang; we are old! We need to start young and get into those mindsets, get them off Twitter and Facebook unless they are learning something from it. They need to feel good about what they're doing. This quest has morphed into what you are hearing about today.

AA: What kind of education will your school offer?

JK: The curriculum will be based on the needs of industry in North America. The blueprint will be drawn from multiple sources similar to the Mechanical Systems Qualification Standard, a document published in 2008 by the National Nuclear Security Administration, part of the Department of Energy (DOE). This document covers many topics, one of them being the theory and science of all refrigeration cycles, including those associated with natural refrigerants. It includes links to many videos that explain the science in layman's terms. The DOE has put together many such curricula on all sorts of subject matter, and these standards are gold.

This kind of understanding is woefully short in the U.S. So I believe the way our children are learning now has got to change. Quite frankly the public school system is way short of producing what companies need, namely qualified people that have an understanding of the theory and science before they go to work. Having someone at a young age understand the refrigeration

cycle and how molecules work — it's not going to happen unless we start training them ourselves. It's too late when they're 18 years old.

Financing and debt management will also be taught, as I see a need for all students to understand our fiscal system and be ready for the real world upon graduation. Civic understanding will also be studied, with frequent field trips to venues such as the U.S. Congress, White House, Supreme Court and local government.

AA: The people in the refrigeration trade schools are not being trained in this way?

JK: No. Even in 18-month programs they come out woefully short on being able to step in and do what we're doing nowadays. The technical books being published are already obsolete; that's how fast the technology is changing. That's the conundrum we're faced with. We also need to rebrand HVACR Tech as "Thermodynamic Energy Specialist." And integrity must be a core component of what we offer. The scourge of our trades are the frequent "sting" operations that air nationally, setting up all sorts of unscrupulous trades people who are ripping off the unwary. We must do right by the end user, not the company we may work for.

AA: Natural refrigerants will be part of the curriculum?

JK: No doubt. The curriculum will go hand-in-hand with natural refrigerants and the green movement. Hopefully this model will be copied nationwide and worldwide. If it works, it's a new way of thinking. Making sure that our young are able to pick what interests them is what this program will be all about.

AA: How will the educational process at the school be different from that of conventional trade schools?

JK: In the U.S. kids get a different teacher every year. So the teacher has to relearn their personalities on an annual basis. In our school, teachers of the core curriculum will teach the same group of students for their entire time at the school, from ages 12-18. We will also have specialists in the humanities

> "We are concerned about our family business continuing because we can't find young people who pass muster."

like singing, dancing, acting, art, musical instruments and more, as well as athletics, so that students can develop the parts of their brains required in order to develop the manual dexterity our trades require. To actually excel at the trades, especially refrigeration, you must be able to use the parts of the brain that an organ player uses, making use of both hands and both feet at the same time.

My plan is to make sure everyone has fun on a daily basis. After the second year, students are in class three days per week out of six. The rest is field time — on the floor of the warehouse or in the field with sponsors.

In addition, after being accepted, students will earn a stipend that can be invested. So kids are going to be paid to go to school, which is the exact opposite of what's going on in the U.S. today.

AA: How many students will attend the school?

JK: We'll start with 150-200 and grow by that rate annually until we have about 1,600 after eight years. Getting 150-200 12 year olds should not be that tough. We're definitely going to recruit females. I hope it's a 50/50 mix, male to female. In the U.S., women are looked upon as not able to do this. But during World War II, we had "Rosie the Riveter"; women held 80% of the factory jobs. Why wouldn't that work now?

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AA: Where will the financing for the school come from?

JK: The bulk of the funding will be public initially. It will cover the cost of the building — which is part of a former Ford assembly plant — classrooms and equipment. The City of Lorain, the state of Ohio and the federal government will assist in this financially because the program will produce jobs.

In addition, OEMs and large contractors will become sponsors of the program, providing support for salaries, infrastructure and administration. These key players will offer assistance with curriculum development and mentoring. They will follow not only the progress of individual students, but the school as a whole, and are going to snap these students up immediately upon graduation and place them in very high-paying jobs. These companies will have skin in the game because this is all about jobs.

My intention is to have enough money to relocate qualified families to Northeastern Ohio and find them jobs and housing while their youngsters partake in the program. We will be building housing, roads and other infrastructure (such as supermarkets and the like) in order to support the community. I plan on this thing being bigger than big.

> "Kids are going to be paid to go to school."

AA: What is your timeline for getting this done?

JK: The first step is recruiting the federal government, but local and state also need to become involved heavily for this to succeed. Our initial discussion with Elizabeth Thames, Ohio Senator Sherrod Brown's deputy state director, was in May 2015. This meeting resulted in local contacts that will be developed once our business plan is finalized. Much work still needs to be completed before I ask for an audience with Senator Brown in Washington, D.C. If things progress after my meeting with Senator Brown, following his lead, we could start the school as early as January of 2017.

Once we get the federal funding, the OEMs are going to see the light and become sponsors. It's going to happen. This changing of the paradigm is daunting, and can't be accomplished by one person. Like-minded only need apply! Help is definitely wanted MG

Planned site of Kokinda's trade school, part of a former Ford assembly plant in Lorain, Ohio.

SPECIAL EDITION #2, JANUARY 2016

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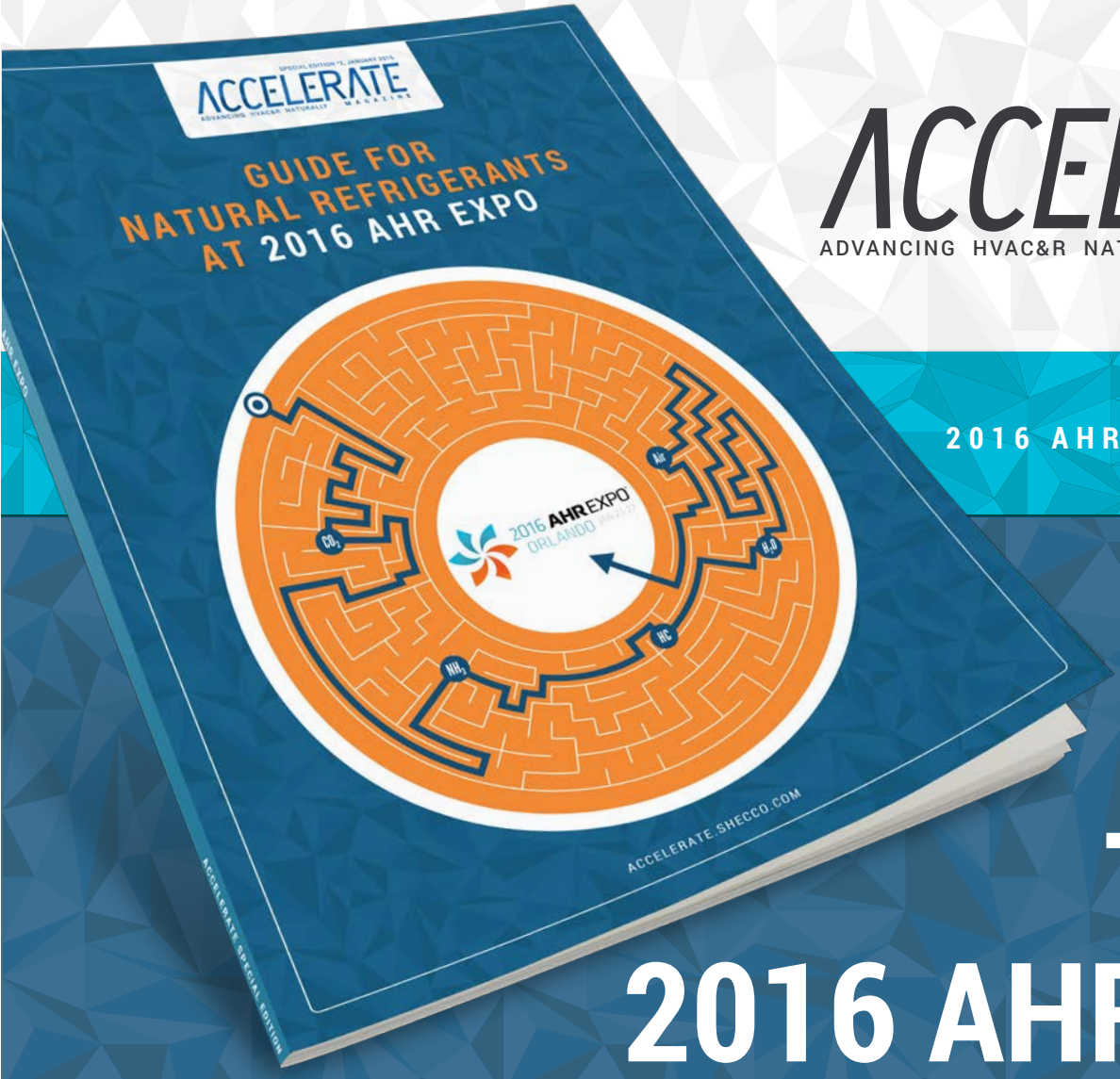

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IT CAN BE DONE

While transcritical CO_2 systems are usually earmarked for new stores, Sobeys is showing that existing stores can be retrofitted with transcritical systems without loss of sales

— By Elke Milner and Michael Garry

Transcritical CO_2 refrigeration systems have been gradually gaining traction in North American supermarkets, particularly in Canada. For retailers seeking to use a low-GWP, energy-efficient refrigerant and future-proof their investment against regulations on synthetic refrigerants, transcritical units are an increasingly viable option.

But it has become an article of faith that these systems only make sense in new stores rather than in existing stores as a replacement for the legacy refrigeration system.

In an existing store, a retailer seeking to remove R22 refrigerant, for example, would simply look for a drop-in substitute refrigerant (typically an HFC) rather than replace an entire DX system, including cases, with a transcritical system. Retailers intent on replacing a high-GWP HFC would go for a lower-GWP HFC as a drop-in. This is certainly true for new or medium-age DX systems and even for aging systems.

Some retailers — such as Whole Foods Market in a store in Sacramento, Calif. — have somewhat deviated from this scenario by retrofitting an existing store with a cascade CO_2 system. But transcritical systems have remained a less attractive option for retrofits because of the work and costs associated with refashioning an existing store to support the high pressures of CO_2.

However, Sobeys, Canada's second largest retailer — and North America's largest retail user of transcritical refrigeration — is rewriting the retrofit script for transcritical systems.

Transcritical refrigeration is Sobeys' standard system. As of September 2015, 78 Sobeys stores in eight provinces (63 in Quebec that operate under the IGA banner) use CO_2 transcritical booster systems with heat reclaim. Each year, another 15 to 20 stores — both new and renovated — are equipped with the systems. Some of these stores are franchised operations.

Of course, "renovated" can mean a total store renovation. But in some cases, Sobeys stores have seen fit to focus a renovation on replacing an existing refrigeration system with a transcritical model.

For example, over the past two years, Systemes LMP, a transcritical OEM based in Laval, Quebec, has retrofit two Sobeys IGA stores in the Montreal area (one a franchisee) with a transcritical system, and is in the process of retrofitting another Sobeys corporate store in Ontario, with one more corporate-store retrofit in Nova Scotia in the planning stages. The retrofits were all prompted by the need to replace aging R22 compressor and dispense with R22.

Changing the refrigerant to a lower-GWP gas would not suffice in these stores. "You would still have a potentially high leak rate because all of the lines and rack fittings are old," said Jeffrey Gingras, president of Systemes LMP. "A leak is a leak even when you have a lower-GWP refrigerant. I think it is important to evaluate the age of the equipment before doing a refrigerant retrofit."

In addition, these changes align with Sobeys' strategy to standardize on transcritical systems as a long-term, future-proof, energy-efficient solution that puts the stores outside the reach of future regulatory measures. Sobeys gave LMP the opportunity to retrofit the stores to further prove the merits of transcritical CO_2 refrigeration, said Gingras.

WORKING AT NIGHT

The Montreal area stores include one in Sainte-Thérèse, a suburb of Montreal, and one in Sherbrooke, about 80 miles east of Montreal. Systemes LMP finished retrofitting the former store in July and the latter about 1.5 years ago, according to Xavier Marle, director of operations for Systemes LMP. The transcritical systems are both running successfully.

In both cases the retrofits were done "with no loss of sales," said Marle. "We converted to CO_2 while the stores were running, slowly transferring the circuits every night." While refrigerated cases have to be changed out at night, when customers are not around,

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piping and overhead work as well as a lot of the work in the compressor rooms can be done during the day.

For these stores, the majority of the original cases were modified with electronic expansion valves and new evaporators to accommodate the CO_2 refrigeration, and re-piped to the new rack. Upon completing the transcritical installation, Systemes LMP decommissioned the existing R22 racks, took them apart and removed them.

The Sainte-Thérèse franchised store opted to use a 60-horsepower subcooling unit to keep the transcritical system operating in more efficient subcritical mode. "The owner wanted to reduce his peak consumption and ensure having the lowest power consumption possible," said Gingras. The Sherbrooke store does not use subcooling.

The original systems did not include monitoring, but the retrofits are being closely monitored to make sure the new systems are making the most of the heat reclaim function. The stores in both Quebec and Ontario feature heat recovery, which is used for space and hot water heating.

The Montreal-area stores wanted to keep their existing compressor rooms, so Systemes LMP team had to move all the equipment in the compressor rooms to make room for the transcritical racks. On the other hand, the store in Ontario built a new compressor room.

In the Ontario store, where work is still in progress, the cases were much older and waning in efficiency. Sobeys decided to replace all the cases (as well as racks) in order to save a significant amount of energy. In this instance, the retrofit to transcritical CO_2 made more sense than opting for a cascade system, as the new cases would be delivered already equipped to work with CO_2 refrigerant. Presently, the compressor racks are nearly completed and the Systemes LMP team has begun overhead work.

The Nova Scotia store will also get new cases and racks. This type of retrofit is "much easier" than one where the cases are modified, noted Gingras.

TIME COMMITMENT

The cost of a transcritical retrofit can be difficult to define, said Gingras. "When you're going to all-CO_2, you have to change everything. All the lines, all the cases, all the racks – everything's got to be changed. Putting a price on the start-up time, organization, and teamwork required to make sure this all works without causing any downtime for the store is pretty difficult."

But he acknowledged the longer time commitment involved. "You have to rip out a whole system to install a new one," he said. "Basically it's two jobs in one. I would say a normal installation would take around three to four months, and this takes eight to nine months."

For Gingras, the major lesson learned throughout these projects is the importance of teamwork. "We have to make sure everybody's on the same page — making sure that all the subs and every contractor knows the timeline and exactly what needs to be up and working and when," he said. "Having a correct schedule is important so all the contractors aren't at the same area at the same time." Systemes LMP manages this by holding regular meetings with the team.

Retrofits are generally trickier than a new store installation; the existing system needs to be replaced while the crew makes sure there is no downtime and thus loss of product. "Once again, it's all about teamwork," said Gingras. "If you're taking out the meat cases, you need to be sure that the new meat cases are working the next morning" MG

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BREAK-THROUGH IN DUBAI

The latest meeting of the Montreal Protocol resulted in the long-awaited formation of a contact group to start negotiations on a global phase down of HFCs

— By Klára Skačanová

Downtown Dubai, featuring Burj Khalifa (Khalifa Tower), the world's tallest artificial structure (2,722 feet).

After seven years of failed efforts on the part of the U.S. and other countries to add an HFC phase down amendment to the Montreal Protocol, significant progress was made at talks held in Dubai in early November.

The key development at the Montreal Protocol gathering — the 27th Meeting of the Parties (MOP27), held November 1-5 — was the formation for the first time of a "contact group," a mechanism in the negotiations process necessary for forming agreements among countries. This makes the goal — an HFC phase-down amendment under the Montreal Protocol in 2016 — a real possibility. Work will intensify with a number of meetings to be held in the coming months, including an extraordinary Meeting of the Parties.

The formation of the contact group required the cooperation of several countries that in the past few years were strictly opposed to regulating HFCs under the Montreal Protocol.

"Reaching agreement on this decision by the Parties will pave the way to help all countries transition to alternatives and away from HFCs," said Gina McCarthy, administrator for the U.S. Environmental Protection Agency, who participated in the Dubai meeting. "It is a significant accomplishment for climate action on the road to the Paris Climate Conference later this month and sends a strong signal that the international community can come together to confront some of the world's greatest environmental challenges and continue progress toward cutting global greenhouse gas emissions."

Added John Kerry, U.S. Secretary of State: "This is a major accomplishment. The Montreal Protocol is among the most successful multilateral environmental treaties in history. Amending it to include HFCs could set a course for actions that would avoid 0.5°C of warming by the end of the century."

Nevertheless, this marks just the beginning of negotiations. There is still a long way to go before an agreement on all issues concerning an HFC phase down can be found.

Waiting for consideration are four proposals that would amend the Montreal Protocol to phase down HFCs. They were submitted by: the North American countries, the EU, a number of small island countries including the Federated States of Micronesia, and India.

The proposals include baselines, reduction schedules, grace periods as well as the level of ambition for both developed and developing countries. But first a series of other issues need to be addressed.

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> John Kerry,
> U.S. Secretary of State

→ FUNDING AND OTHER CHALLENGES

The mandate for a contact group, finalized during a two-day discussion preceding the Meeting of the Parties, represents a compromise that had been negotiated during several earlier meetings in 2015. According to the mandate, countries must first resolve the challenges related to an HFC phase down before a formal negotiations process on an amendment itself can begin.

A key issue on the table is funding for developing countries to be able to comply with an HFC phase down. In addition, countries are requesting flexibility in terms of sectors to be addressed, as well as replacement technologies to be selected. Other challenges include intellectual property rights (IPR), and second and third conversions (facilities that were already converted from CFCs or HCFCs with support of the Multilateral Fund), and linkages between the HCFC phase out and a potential HFC phase down.

Developing countries have requested that early funding be provided even before an amendment is finalized. This would raise awareness of available technologies in their countries, increase the knowledge of technicians, and demonstrate the feasibility and energy efficiency of low-GWP technologies.

Some countries suggested that a definition of low GWP or a GWP threshold would be instrumental in ensuring their future compliance, while guiding them in technology choices. Another proposal was to link the level of funding to the level of CO_2-equivalent emissions.

A group of developing countries indicated that a special exemption for countries with high ambient temperature conditions would be necessary if suitable alternatives in specific sectors are not yet commercialized. Such an exemption would be subject to a time limit and re-evaluation. Countries would still have to define high ambient temperatures as well as which applications would be eligible for an exemption. Some argued that since a certain amount of HFC consumption will be allowed at the end of a phase down period, there might not be need for any country- or sector-specific exemptions.

The Dubai agreement sends a strong message to the COP21 climate conference in Paris in early December. But much remains to be done for a final agreement on an HFC phase down amendment to be reached next year ⓪ KS

NASA Says HFCs Deplete Ozone Layer

According to new research from NASA, hydrofluorocarbons (HFCs), long thought to have no impact on the ozone layer, indirectly contribute to ozone depletion by a small but measureable amount.

A paper published in Geophysical Research Letters on October 22 evaluates the impact of five types of HFCs expected to contribute the most to global warming by 2050. The results show that HFCs will cause a 0.035% decrease in ozone by 2050.

"We're not suggesting HFCs are an existential threat to the ozone layer or to ozone hole recovery, but the impact isn't zero as has been claimed," said Margaret Hurwitz, an atmospheric scientist at NASA's Goddard Space Flight Center in Greenbelt, Md., and lead author of the paper. "HFCs are, in fact, weak ozone-depleting substances."

The research demonstrates that HFC emissions, by contributing to the warming of the stratosphere, accelerate the chemical reactions that destroy ozone molecules. In addition, they reduce ozone levels in the tropics by accelerating the upward movement of ozone-poor air.

Amendments calling for a global HFC phase down under the Montreal Protocol have been stalled for a few years by claims that the Protocol does not have the mandate to regulate non-ozone depleting substances. But scientific evidence that HFCs do in fact impact the ozone layer could help advance the discussions on HFCs.

NASA scientists have begun looking at the effect of HFCs on land and ocean temperature, rainfall and sea ice ⓪ KS

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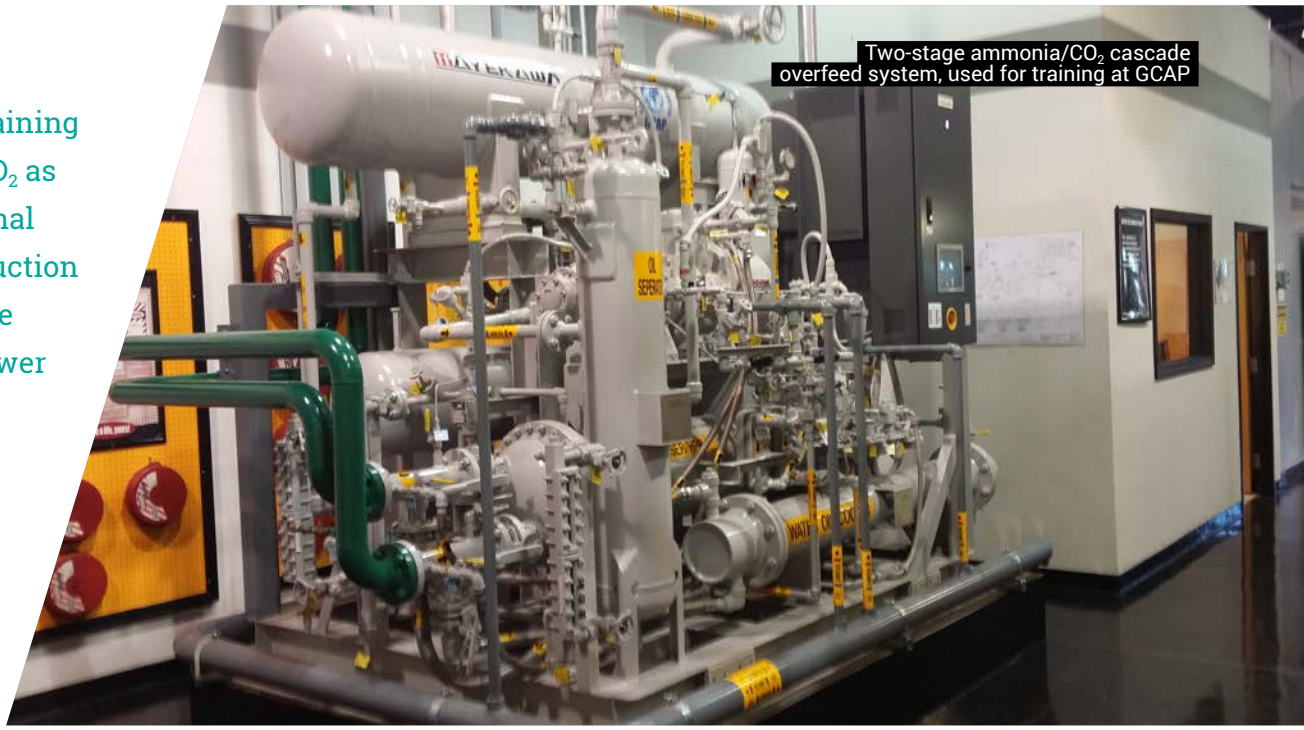
GCAP ADAPTS TO CHANGING INDUSTRY

Industrial refrigeration training school offers CO_2 as well as traditional ammonia instruction to accommodate trend toward lower NH_3 charges

– By Elke Milner



Two-stage ammonia/CO_2 cascade overfeed system, used for training at GCAP

Industrial refrigeration has long leaned toward using large amounts of ammonia as the primary refrigerant. More recently, in an effort to make their facilities safer and get beneath the regulatory radar, many cold-storage facilities are gravitating to lower-charge ammonia systems, such as cascade NH_3/CO_2 configurations.

As a leading training school for industrial refrigeration, the Garden City Ammonia Program (GCAP) is equipped to explain traditional systems as well as the lower-charge variety.

"We try to meet the industry's needs as they arise, and we're able to create our own curricula," said Jeremy Williams, managing director and lead instructor for GCAP. "We find many different trade schools and associations try to mimic our design and philosophies because they've seen the success. We're able to focus what we teach on industry needs rather than an outdated curriculum."

According to Williams, the GCAP curricula are evaluated on a regular basis; even the two books the company has written are revised every year or two.

Situated in Garden City, Kansas in the western part of the state, GCAP is one of the best-known private industrial refrigeration training facilities in the U.S. It started humbly in 2003 in a building that "was basically an empty shell," Williams recalled. Today GCAP has over 35,000 square feet of training facilities in different buildings and "probably more equipment than most average industrial food plants have on site for refrigeration," he said. "Each day we try to add to it, keep building, and try to be the best in the industry."

HANDS-ON LEARNING

GCAP offers four divisions of courses: ammonia refrigeration, CO_2 refrigeration, steam boiler systems and process safety management/risk management programs. The CO_2 courses focus largely on cascade NH_3/CO_2 systems.

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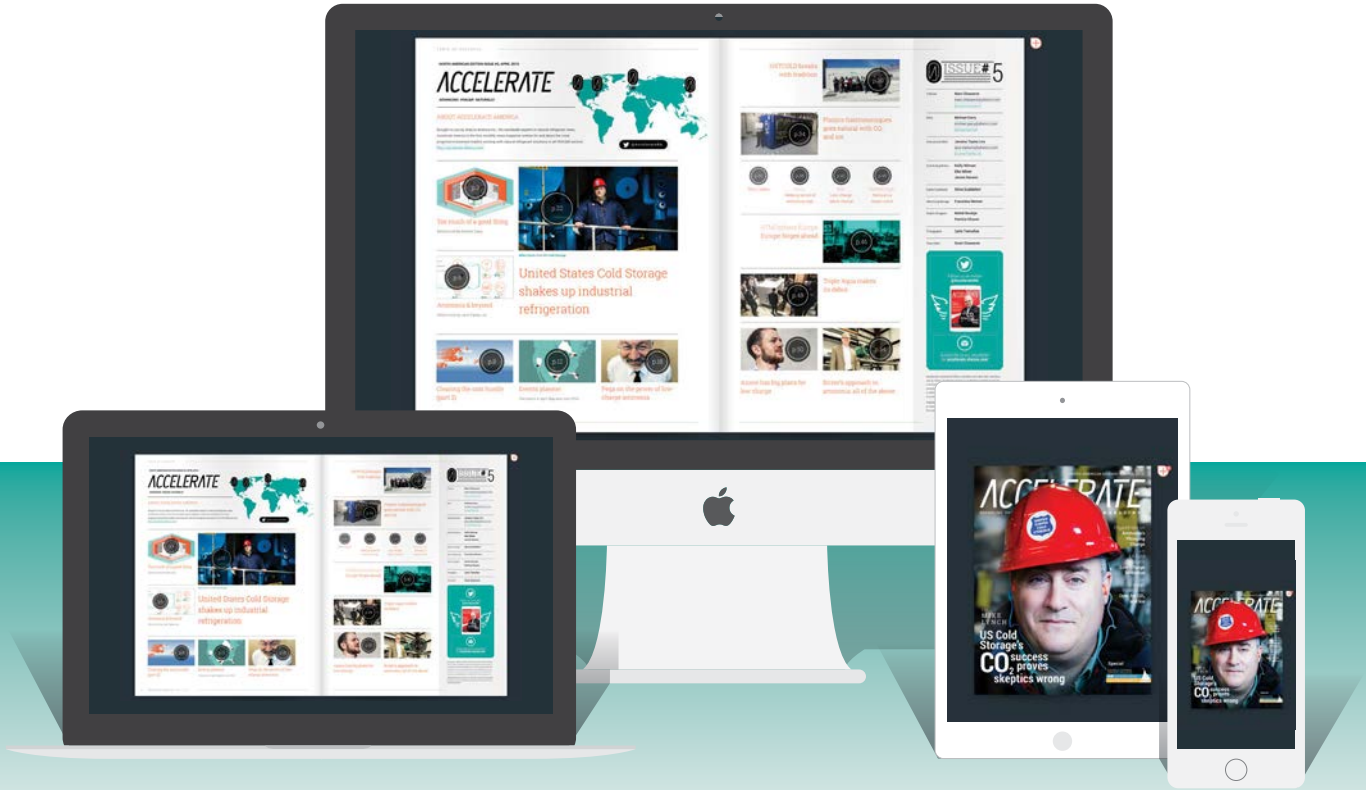

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Jeremy Williams
managing director, GCAP

The courses range from entry-level (how to operate a refrigeration system) all the way to Recognized and Generally Accepted Good Engineering Practices (RAGAGEP). GCAP is developing a new "Technician I" class, which should be available in March 2016. The class will cover "the complete start up of an engine room, from charging it with ammonia to putting it in cruise control and trying to walk away from the system," Williams said. Students will learn to run a 13-screw-compressor engine room with more than 15 different loads and five temperature zones for freezers and coolers.

Each course division has access to on-site systems to offer a hands-on learning experience to GCAP students. According to Williams, the ammonia refrigeration division has the most equipment available, followed by the steam boiler division. GCAP has a live NH_3/CO_2 cascade system as well.

"Operators learn by putting their hands [on a system], taking it apart, seeing the inside, and we think [on-site equipment] is a valuable resource," he said.

The GCAP instructors helped design and build the on-site refrigeration systems. "We try to build each system a bit differently to reflect the variation that exists in the industry," said Williams. "You won't find two that are exactly the same."

Some of the systems are built on what Williams called the "'90s or early 2000s philosophy," while others are built with the future in mind. Williams believes this is imperative because older designs often exist alongside newer technologies.

VARIED STUDENT BODY

The courses are designed for anyone working in the industrial refrigeration industry. Attendees usually are already active in industrial refrigeration and are looking to gain experience as well as add certifications to their résumé.

"I would say that most of the students are operators, technicians, supervisors and engineers at a facility using industrial refrigeration," Williams said. "Contractors that help install and troubleshoot the systems are taking these classes as well. The certification we offer is highly recognized."

In the last few years, GCAP has also been attracting more people who are trying to get jobs in the field. "They are trying to gain some experience and take our classes to get their foot in the door," he said.

Williams agrees with the widespread observation that the HVAC&R industry is seeing a decline in the availability of trained technicians.

"I think it's a significant issue," he said. "There aren't many people wanting to work in blue-collar trades. A lot of what we call the 'retirement' or 'baby-boom' generation is moving out, and there aren't many coming in to fill those shoes." EM

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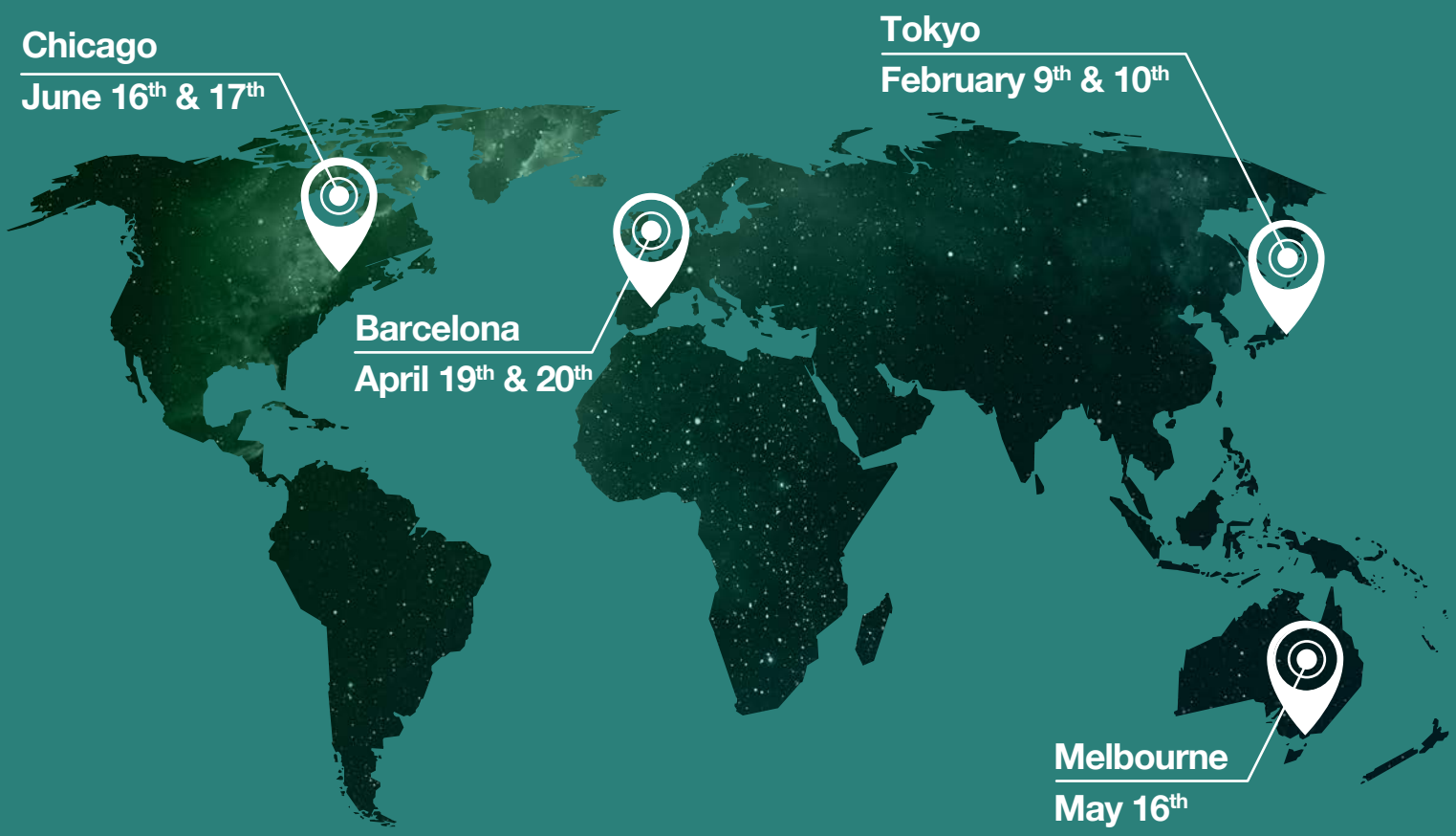

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