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COVER STORY

As hydrofluorocarbons and hydrochlorofluorocarbons are being increasingly phased out to meet government and regulatory requirements, natural refrigerants are candidates to fill the void, getting a closer look from many types of businesses installing smaller refrigeration systems, such as supermarkets and convenience stores.

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chairman's

THOMAS LEIGHTY

MESSAGE

It's time again for IAR's Conference and Exhibition, and that means my term as Chairman is almost over.

Although the past year has flown by, we've reached many of our biggest objectives, and we expect to continue building on that success in 2016.

The primary focus entering the last membership year was the completion and re-release of the updated IAR-2 standard.

You may have heard about this major milestone. The re-release of IAR-2 – the first comprehensive benchmark

association has completed in recent years because it has shifted the focus of our organization, orienting it towards code writing and adoption.

For the first time, the code-writing bodies around the country have a comprehensive single standard that specifically addresses safety for ammonia refrigeration.

IAR-2, and other standards within the newly developed IAR suite of standards – are already being adopted by code-setting authorities. This is an important step that will open new possibilities for the use of ammonia, provide

on display in many ways, large and small across all of our committees.

We're expanding this organization's advocacy on behalf of the industry through the work of the government relations committee . . . increasing our focus on safety under the leadership of the safety committee . . . and making a significant impact on code development through the effort of our code committee.

Meanwhile all of our other IAR committees continue to play a major role in the development of the products that serve our members every day.

That development takes a substantial leadership effort, so I'd like to use this space to recognize the people who have worked in the last year to accomplish many of IAR's objectives: the IAR committee members.

As I conclude my term as chairman, I'd like to urge all our members to become actively involved in the committees and leadership of IAR. The demands on our organization are greater than ever, and we need more and more committed people to help shoulder the load.

There has been tremendous growth over the past year, and my term, working with our staff and the many committed volunteers has been incredibly rewarding.

IAR's work on behalf of the industry is essential, and none of it can be completed without the focus and fortitude of you, our volunteer membership, and our headquarters staff.

I offer a heart-felt thanks to everyone who played a part in IAR's success this year.

To all of our members, friends and colleagues, it has truly been an honor to serve as your Chairman.

I am looking forward to seeing many of you at the conference. And beyond that, I'm looking forward to seeing where the achievements of the past few years take us as we move towards the future of our industry.

For the first time, the code-writing bodies around the country have a comprehensive single standard that specifically addresses safety for ammonia refrigeration.

standard for the safe and efficient design of ammonia refrigeration systems – took an industry-wide effort and years of dedication from our members. I'm pleased to report that it was well worth the work and time it took to produce.

The updated IAR-2 standard covers all aspects of the safe design of ammonia closed circuit refrigeration systems. The new standard addresses significant issues such as machinery room design and location, equipment located outside the machinery room, controls, packaged systems and many other design safety issues that our industry must consider today.

It is a single authoritative source document that provides a path forward for the industry. But the unique feature of IAR-2 is that . . . it is also the first IAR standard to be written entirely in language meant for code adoption.

That makes IAR-2 one of the most important, long reaching projects our

appropriate guidance for the regulatory agencies, and lay the foundation for the growth of this industry for years.

Meanwhile, IAR is already putting the tremendous volunteer effort represented by IAR-2 - to work in the real world.

IAR recently met with OSHA to discuss the ways in which our industry analyses existing design and compares older construction to new standards like IAR-2.

As a result of that discussion, IAR has embarked on a new effort to produce the industry's first RAGEGAP standard for existing facilities.

This new standard will eventually provide invaluable guidance to our members, and the effort is already receiving a positive response from our regulatory community.

And it's not just our standards committee that has worked hard this year. Our organization's volunteer work is

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president's

BY DAVE RULE

MESSAGE

The 2015 – 2016 membership year has been an exciting time for our industry. As regulations and technologies evolve at a rapid pace, we're seeing new opportunities and applications for refrigeration grow like never before.

And nowhere is this innovation more visible than at IAR's Annual Industrial Refrigeration Conference and Exhibition.

This issue of the Condenser coincides with our 2016 annual conference – a time we set aside to come together from all corners of our industry to talk about the trends and technology shaping our business.

Whether you're a longtime IAR member, a first time attendee or a committee member dedicating your time and attention to one of our many projects, your contribution to this industry, and at this conference is vital.

While all corners of our business world are expanding, one central theme is shaping our business environment this year . . . the regulatory approach to HFC's and other synthetic refrigerants.

Working through the rulemaking process, OSHA, EPA and the Department of Homeland Security have started to shape policy that may ultimately place synthetics and natural refrigerants on a more level playing field.

As the R-22 phase-out approaches the later stages of completion, regulatory agencies are more closely considering the safety and environmental impact of HFC and HFO refrigerants and proposing new rules that may significantly impact their use in our industry.

These changes . . . coupled with the introduction of new ammonia system technology . . . opens an opportunity for a broader range of end users in

both the industrial and commercial markets to start considering natural refrigerants.

Given this important development, IAR's advocacy remains a top priority. We've been actively involved in making comments that promote the interests of our members.

Our staff and IAR member volunteers have stepped up our advocacy programs, meeting with OSHA and EPA on a periodic basis in Washington D.C., at regional meetings across the country and on scheduled conference calls.

Several months ago the IAR Staff and a coalition of member volunteers met with the Illinois Boiler Code Division and successfully stopped a pending requirement for end users to conduct periodic inspections on the interior of ammonia pressure vessels.

And, with the support of Jeff Shapiro and the Code Committee we have developed one of the most robust code agencies programs we have seen, designed to adopt IAR Standards into building codes around the country.

IAR has also used the last year to improve many of the IAR member tools and services, beginning with the release of a new member app.

If you've downloaded the app, you'll notice that it delivers a fantastic conference guide, with the ability to follow the technical program in detail, obtain your education credits and rate tech papers, panels and workshops.

But the capabilities of this app reach beyond an improved conference experience.

IAR members will now have easier, password-free access to the member website as well as access to standards, bulletins and technical papers – all formatted for mobile devices. And, over the next year we'll be expanding its functionality to provide additional access to

IAR publications and other services.

We're also expanding our outreach this year by continuing to develop publications like the Condenser, the IAR Connect member newsletter and our very popular webinar education series.

Meanwhile, IAR committees are hard at work following the re-release of the IAR-2 standard at the end of last year. IAR-2 was a monumental effort, but far from slowing us down, its completion has energized our volunteer members, who are already taking the first steps towards new standards, code and advocacy projects.

In 2016, IAR will begin work on a new RAGAGEP standard and a CO2 standard.

I'm pleased to announce that our organization is also launching its first ever certification effort – beginning with a certification program focused on the IAR-2 standard.

This new curriculum will train all sectors of our membership in the use and application of the IAR-2 standard, and eventually the entire suite of IAR standards.

I've mentioned some big goals that IAR is moving forward to meet. We've set the bar high, and all of these exciting projects take a significant effort from your staff to realize.

These projects also depend on the hard work of our volunteer committee members and board leaders, who often put their dedication to this organization before their own professional and personal obligations.

That dedication has put us in a stronger position than ever to pursue the new opportunities, more global mindset and important transitions that are setting the stage to make this new member year more exciting than ever.

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chairman's

MARCOS BRAZ

MESSAGE

During a recent high school fundraising dinner in my small town of Azle, Texas, I looked around in amazement at the nearly 200 people who came out to support this event.

As we sat and visited with people around the tables, I noted how the variety of business backgrounds, ages and experiences created interesting topics of conversation. And I began to

and strength when seen from a distance, or with the perspective of time. And in this future, the ones who have benefitted from this philanthropy will be giving back to the organizations that *they* believe will do the same for future generations.

Within the IAR and at the Ammonia Refrigeration Foundation (ARF), these same principles apply. We all have different roles in our industry, we are associated with different companies, and we often have different

contributions into lasting benefits for our industry.

Two important ARF-funded research projects will be completed later this year, and work statements for three more are in full development as we speak. The outcomes of these projects are enhancing the safety and efficiency of ammonia refrigeration systems.

The Research Panel Discussion on Wednesday, March 23 at the IAR annual conference is a great place to get fully up to speed on the work being done. We have also significantly expanded the scope of the ARF-funded scholarship program to bring a selection of award recipients in-house to the Education Committee, to increase the number of annual scholarship awards, and to increase the size and duration of the scholarships. These activities are further enhancing our efforts to attract the brightest young talent to our industry.

At the same time that we are expanding the reach of IAR and ARF's through research and educational initiatives, we are also devoting significant resources toward building the structure within ARF to meet the needs of our industry well into the future.

We are most proud to announce that ARF recently hired a full-time Executive Director with direct experience in fundraising and non-profit organization leadership. This investment in our future will enable ARF to grow its funding of initiatives which will benefit the industrial refrigeration industry for generations to come.

Like the mosaic, each and every one of you, of *us* collectively, has the power to make this canvas hold a meaningful vision for our industry that will be clearly visible in both the short and long term future of our organization.

We are bound together by our common desire to grow and protect this industry for the benefit of future generations.

wonder just what it was that “glued” such different people (including myself) together that night.

Then I realized that, in fact, what I was witnessing and experiencing was a “mosaic.” With a mosaic, it can be difficult to make much sense of what you are seeing unless you have a perspective view of the whole.

It became clear that what brought all of us together that night was a common spirit of selflessness, cooperation and contribution to the cause; in this case, giving for the benefit of the high school we had all attended.

On a personal level, each of us gives to what we believe holds a better future for the organization, for the community and/or for all of our society. It may be mostly intangible at a specific moment or event; but just like a mosaic, it holds its true significance

daily priorities; but we are bound together by our common desire to grow and protect this industry for the benefit of future generations.

With that in mind, I am very excited to use the space in this column to draw your attention to the next ARF fundraising event, the 2016 William E. Kahlert Memorial Golf Tournament which is being held in Orlando, FL on Friday, March 18 at 1 pm; where our collective spirit and passion for our industry will be present in full force.

Your personal contributions to IAR and the ARF, whether at our annual golf tournament or through a financial donation, are some of the most important steps that can be taken towards our collective future.

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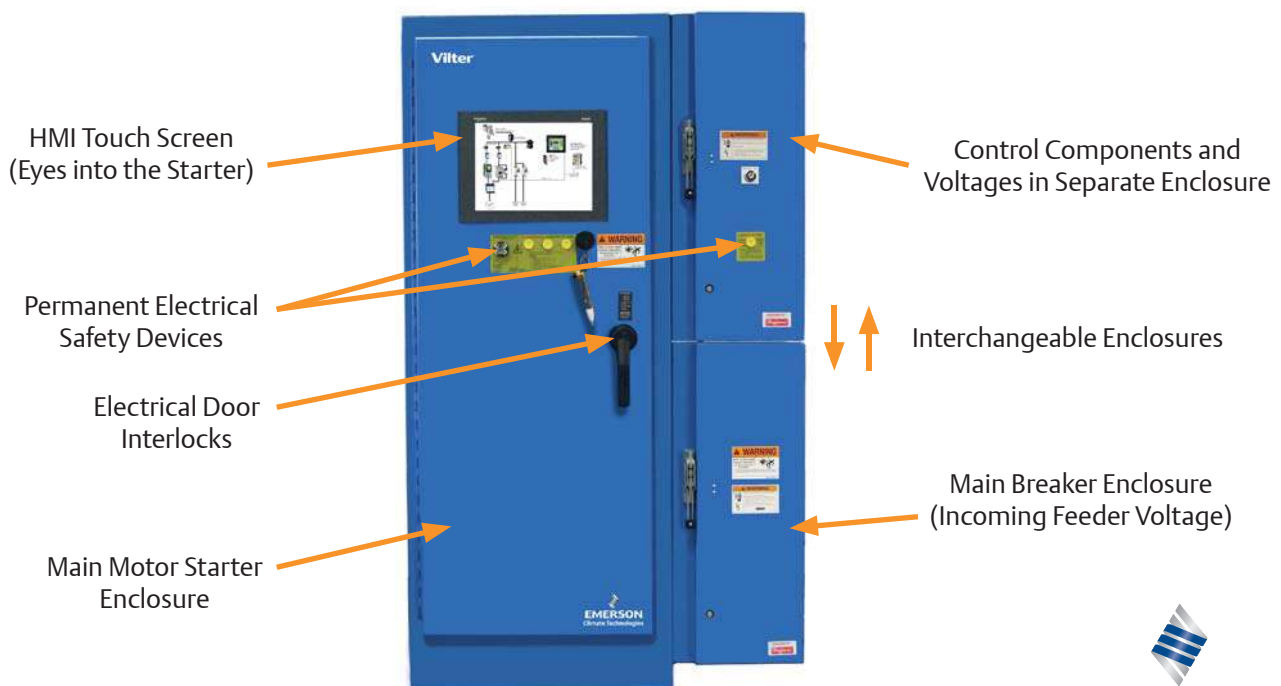
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NATURALS EXPAND TO MEET COMMERCIAL DEMAND

As hydrofluorocarbons and hydrochlorofluorocarbons are being increasingly phased out to meet government and regulatory requirements, natural refrigerants are candidates to fill the void, getting a closer look from many types of businesses installing smaller refrigeration systems, such as supermarkets and convenience stores.

However, natural refrigerants do face challenges. Not only are there pros and cons for each natural refrigerant, but there are also regulatory gaps

that stand in the way of some systems and not many technicians are trained to work with natural refrigerants.

Natural refrigerants — ammonia, propane, butane and CO₂ — were all among the original refrigerants used at the genesis of the mechanical refrigeration industry, but they fell out of favor in the 1930s as synthetic refrigerants were introduced, said William Greulich, principal at Kensington Consulting.

Vincent Grass, global refrigeration leader, corporate operations, engineering services, Nestlé Ltd., said, “Natural refrigerants, including CO₂,

ammonia, water and air and hydrocarbons, such as propane and iso-butane, do not harm the ozone layer and have negligible or no global warming effects. They occur in nature’s biochemical processes and have been used since the 19th century and are not subject to phase-out controls.”

Now that HFCs and HCFCs are being phased out, Grass said moving straight to safe and efficient natural refrigerant solutions wherever legally feasible has been seen as being the most sustainable and responsible alternative for Nestlé in the long term.

Meanwhile, codes, in some areas, are lagging behind.

“Code has been written more or less around the [synthetic] refrigerants,” Greulich said. He added that use of natural refrigerants in large industrial systems has always been possible with the existing code, but there have been certain issues no one wanted to tackle with smaller systems because the other refrigerants were easier and considered safer. “You had boundar-

“The wrinkle is UL doesn’t have a lot of listing standards for small packaged natural refrigerant systems,” Greulich said.

Another challenge in the United States is that a lot of CO₂ equipment was developed in Europe, and in order to be used in North America, the products have to be UL approved. “That is very different than European standards. A lot of parts cannot be approved because they don’t meet the

Greulich said everyone is interested in smaller systems and the first one to get through the UL process will have a large market.

CURRENT USES

Natural refrigerants are being used in a number of places, Patenaude said. “Coca-Cola uses CO₂ as their refrigerant of choice in their dispensing machines. Unilever uses propane in a lot of their small, spot-contained merchandisers. Propane is also being used in self-contained cases to a gram limit of 150 grams,” he explained.

Meanwhile, there are approximately 52 supermarkets in the U.S. that use CO₂ transcritical booster systems, Patenaude said.

Beginning in January 2015, every new horizontal chest freezer Nestlé buys to store ice cream uses natural refrigerants rather than synthetic refrigerants. “These freezers represent 70 percent of Nestlé’s total spend on freezers. They also consume 50 percent less energy than earlier models and are more efficient for customers to run,” Grass said. “New ambitious targets for 2016 and onwards will be communicated in our 2015 Nestlé in Society annual report.”

Port said he is seeing a blurring of the line between what commercial food distributors and industrial food producers are doing. “You’re starting to see commercial guys employ things that are more industrial. In the commercial world, they’re looking to use more CO₂ and secondary refrigerant applications and limit their charge,” Port said.

Ammonia has been used for decades as a refrigerant, but has been relegated to large systems in food processing plants and warehouses. “It has been a specialty refrigerant on the jumbo end of the scale,” Port said, adding that years ago, if he were looking at installing a big freezer, he would have gone down the ammonia path. “The ability to do anything else didn’t exist ten years ago. Now I have the technology available in CO₂, and the CO₂ is much more efficient for the low temperature applications.”

For more than five years, Nestlé has installed refrigeration systems using hydrocarbons and CO₂ for various cooling applications in factories, small distribution centers, research and development centers, office, Nestlé shops and data centers, Grass said.

“Code has been written more or less around the unnatural refrigerants ... use of natural refrigerants in large industrial systems has always been possible with the existing code, but there have been certain issues no one wanted to tackle with smaller systems because the other refrigerants were easier. You had boundaries and had to make the facility robust from a safety standpoint.”

William Greulich, principal at Kensington Consulting

ies and had to make the facility robust from a safety standpoint.”

Bob Port, director of technical services, supply chain engineering, with ConAgra Foods, said the gaps in codes and standards make it more difficult than necessary to install and design hydrocarbon and ammonia systems. “There are a lot of legal roadblocks which have to be worked through,” Port said.

Greulich said in many cases, regulation has been replaced by “the idea there would be so-called listed pieces of equipment.” Regulators look for equipment that is UL listed and some states, such as Ohio, write directly into code which UL listings are compliant.

UL standards,” said Andre Patenaude, director of CO₂ business development for Emerson Climate Technologies.

Greulich said getting equipment UL listed, is a costly and complicated process. “This has created an awkward situation,” he said. “We go to the code official and say, ‘We want to put in this propane chiller.’ The code official says, ‘Great, is there a listing?’”

Patenaude said that could shift as the International Electrotechnical Commission, which the UL follows, alters its testing procedures to be closer to Europe’s. “That is going to make it easier for American companies to adopt European designed products,” he said.



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Port said the industry is still working to figure out low-charge ammonia systems. “We’re finding out they’re more limited and less flexible in a lot of places than we want,” he said. He added that he plans to employ some of these types of systems as he replaces medium sized halocarbon (R-22), refrigeration systems in ConAgra’s plants.

“I have a lot and it presents a challenge to replace some of those smaller

“Instead of operating at a high pressure of 250 pounds, you could be operating at 1,500 pounds. That is very different,” Patenaude said.

The critical point of CO₂ — the highest pressure and temperature where the refrigerant can still condense — is very low relative to other refrigerants and the triple point — the pressure at which CO₂ turns to dry ice. And that can be a challenge. “If

make those systems more efficient in warm ambients:

Patenaude said CO₂ systems are loaded with electronics to optimize performance relative the HFC systems.

Port said a benefit of CO₂ is that it is a much denser refrigerant than ammonia. “The vessel sizes, pipe sizes and coil sizes get smaller and the horsepower per ton to run CO₂ in these lower ranges is much better than with ammonia,” Port said. “If I had the opportunity to go build a new frozen food plant today, I would go CO₂-ammonia cascade.”

In large cascade systems, ammonia is generally used as the primary refrigerant chiller, cooling the CO₂, Patenaude explained. “Generally supermarkets won’t use ammonia because of safety concerns, however they are trying to find inventive ways of taking advantage of both ammonia and CO₂. There are a few stores in the US that have small ammonia chiller / CO₂ cascade system on the roof. They chill the CO₂ and send it into the store,” he explained.

Mark Stencil, IIAR chair-elect and director of strategic accounts at Bassett Mechanical, said there is a growing breadth of applications that are using two-refrigerant systems, combining ammonia with another refrigerant.

When it comes to propane, the challenge is flammability, but the benefit is that it is very close to R-22, and can work with the similar components. “Going to propane is very close to HCFC/HFC, from an applied costs point of view, Patenaude said, adding that modifications / product certifications have to be made due to its flammability.

When it comes to natural refrigerants, Port said companies want to ensure that they’ll have qualified technicians to work on equipment that uses them. “If I deploy a refrigerant, do we have the people, the knowledge base and the skill sets out there to work on it and take care of it? I think that is a bigger challenge,” Port said.

Another challenge is that while newer systems are becoming more complex, fewer technicians are entering the field, Patenaude explained. “From an electronics point of view, our industry is trying to figure out how to dumb-down something that is becoming a lot more complex,” Patenaude said.

“The biggest drawback for CO₂ is in warm ambiance — it is that the basic system is less efficient than a traditional HFC system ... There is a tremendous amount of research and development going on right now to make those systems more efficient in warm ambient temperatures.”

Andre Patenaude, director of CO₂ business development for Emerson Climate Technologies

systems. Trying to do it with an industrial ammonia system is not cost effective,” Port said. “In small systems the cost to operate doesn’t necessarily add up to significant amounts of dollars. In the bigger systems I deal with, it’s a no brainer because of the complex system demands and operating cost, it’s a much bigger animal.”

NAVIGATING THE PROS AND CONS OF NATURAL REFRIGERANTS

All natural refrigerants face certain limitations and have their pros and cons. For example, CO₂ has zero ozone depletion and a global warming potential of one, which is extremely low when compared to the HFC R-404A that has a global warming potential of 3,922. However, CO₂ operates at higher pressures.

someone makes a mistake and allows the pressure to drop to 61 pounds, the CO₂ turns to dry ice and locks up. The only thing they can do is wait for the ice to sublime, or go to vapor. That is critical from a service and design point of view,” he said.

“The biggest drawback for CO₂ is in warm ambiance – it is that the basic system is less efficient than a traditional HFC system,” Patenaude said. “There is a tremendous amount of research and development going on right now to make those systems more efficient in warm ambient temperatures.”

“The biggest challenge facing the CO₂ refrigeration industry is improving efficiency in warm ambient operation, Patenaude said. “There is a tremendous amount of research and development going on right now to

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Welcome to Orlando and the 2016 IIAR Industrial Refrigeration Conference & Exhibition!

Special thanks to every company who provided important financial support for IIAR through their conference participation

The annual conference is an exciting time for all sectors of our industry to come together and catch up with friends and business partners at one of the largest conference and expo events dedicated to the use of natural refrigerants.

There is a lot going on this year, both in our business environment and within our organization, and this will be one of the best and most informative programs we've ever produced. I'd like to take this opportunity to welcome all attendees to the 2016 IIAR Industrial Refrigeration Conference & Exhibition.

If this is your first conference we are so glad to have you with us. If you are a long-time IIAR member who has attended before, welcome back! Orlando is an ideal place to learn about the latest equipment, products, services and technologies that our industry has to offer.

As always, the IIAR Technical Program is the core of the conference. The series of presentations will include rigorously peer reviewed technical paper presentations, experiential workshops, and interactive panels on topics ranging from global refrigerant trends to low charge ammonia systems.

The IIAR conference draws refrigeration professionals from all across the United States and increasingly from around the world.

And this international gathering of the key decision-makers in our industry is the perfect opportunity to network and learn from colleagues from all corners of the globe.

This year, IIAR is celebrating the re-release of IIAR-2, the first comprehensive benchmark standard for the safe and efficient design of ammonia refrigeration systems.

Written specifically for code adoption, IIAR-2 is already influencing code formation. This is an important step that will open new possibilities for the use of ammonia, provide appropriate guidance for the regulatory agencies, and lay the foundation for the growth of this industry for years.

To prepare our membership for the big changes that IIAR-2 is sure to bring, we are introducing a special IIAR-2 educational program this year.

This one-of-a-kind condensed learning experience is designed to instruct attendees on the basic changes and issues that IIAR-2 now addresses for our industry. We're fortunate to have our code experts and the creators of IIAR-2 share an overview of this landmark standard with our attendees during a special afternoon class.

I would like to thank each and every company who provided the important financial support for IIAR through their participation at this conference and to send a special thank you to all the companies that encourage and support the essential volunteer work of our members.

And of course, thanks also go out to our members whose participation and collaboration in exchanging information, experience and expertise make this conference such an incredible learning event – paper authors, workshop presenters and panel participants who develop the presentations are all an integral part of making this such a great conference.

Welcome to Orlando, and enjoy the conference!

Best Regards,

Walter Teeter
2016 Conference Chair

2016 CONFERENCE SPONSORS

Caribe Royale All-Suite Hotel & Convention Center • Orlando, FL • March 20-23



Morning Coffee Break – Wednesday, March 23



BALTIMORE AIRCOIL COMPANY

Luggage Tags



DELTA TEE

Exhibit Hall Lunch – Monday, March 21



Afternoon Coffee Break – Tuesday, March 22

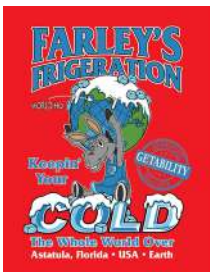


Ammonia, Halocarbon & CO2 Refrigeration Design/Build Services

Conference Wi-Fi



Convention Center Column Wrap



Rising Star Venue CityWalk Event – Monday, March 21
Continental Breakfast – Tuesday, March 22



CityWalk Promenade – Monday, March 21



INDUSTRIAL REFRIGERATION

Meeting Bags



IAR 2 Education Program – Sunday, March 20



Sunny Orlando Sunglasses



Convention Center Column Wrap



Committee Meeting Coffee Breaks

Sunday, March 20



Continental Breakfast – Wednesday, March 23



Registration Map



Pocket Program



Badge Lanyards



Morning Coffee Break
Tuesday, March 22



Conference App



Continental Breakfast – Monday, March 21



Morning Coffee Break – Monday, March 21



ENGINEERING TOMORROW

Water Bottles



Chairman's Reception – Sunday, March 20
Pat O'Brien's Venue CityWalk Event – Monday, March 21



Charging Stations



Afternoon Coffee Break – Monday, March 21



First Timer's Reception – Sunday, March 20



Hotel Room Keys



Bob Marley Venue
Monday Night CityWalk Event

IIAR Annual Conference to Provide Technical Knowledge, Industry Insight to Members

The International Institute of Ammonia Refrigeration 2016 annual conference in Orlando, Florida, will provide three days of technical knowledge, networking and industry-sponsored events for those involved in the ammonia refrigeration industry.

The program begins on Sunday, and this year's Sunday Educational Program will focus on the IIAR-2 standard. The four-hour session will provide an opportunity for people to get insight on the standard and how it will affect plant design and operations, said Mark Stencil, IIAR chair-elect and director of strategic accounts at Bassett Mechanical.

"It will create an understanding of the changes that have taken place and how IIAR-2 has been expanded," Stencil said, adding that the speakers presenting during the session include a mix of end users, manufacturers, process safety experts and design-build contractors.

Dave Rule, president of IIAR, said, "The intent is to provide the members with an overview of the major issues addressed in the rewrite of the standard, which was a three-and-a-half-year process."

IIAR-2 is going to have a major impact on the industry because it is a fully revised safety design standard for how systems are constructed and it will affect the development of the RAGAGEP standard that's also under development. "The membership is aware they need to understand this new standard," Rule said.

The session will also provide a detailed review of the specific sections of the document, the high points operators should be aware of, the major issues IIAR addressed and the factors

behind the decisions the association made, Rule said.

Eric Smith, technical director at IIAR, said the conference will include a full array of committee meetings, which are where a lot of the association's in-depth work gets done. Committee meetings are open to committee members as well as those who would like to sit in as visitors.

Rule said attending the meetings allows members to see what kind of topics are being addressed and the important issues that are going on in the industry.

The conference will feature international committee meetings that bring people together from all parts of the world. There will also be a separate meeting focused on South and Central America to discuss issues from their regions. Delegations from China, India, Chile, Columbia, Costa Rica, Brazil, Australia and Europe will also attend the conference.

Seven workshops will take place during the convention. "One of them is a double-length workshop by Gary Smith from Ammonia Safety Training Institute. He and several industry leaders will be explaining the latest technologies and guidelines addressing what to do immediately after a release is discovered," Eric Smith said.

During another workshop, the American Society for Asset Management will delve into what every manufacturer and contractor needs to know about asset protection, tax reduction and estate planning. "We thought this would be an interesting session for our members that are small business operators," Smith said.

A core feature of the conference is the presentation of technical papers, Stencil said. "The technical papers are presented in an unbiased and generic manner to share new technologies and

case studies for the effective use of ammonia," he said.

To give speakers and presenters the opportunity to share more about their businesses, the conference includes a technomercial program, which takes a slightly more commercial aspect than other sessions. "There is a keen focus on the technical papers being as fair and unbiased as possible, but with the technomercials we allow our valued sponsors and exhibitors to be specific about their offerings and the contributions of their business to our industry," Stencil said.

There are 12 half-hours of technomercials. "Generally they are focused on technological developments, but they allow the speaker to acknowledge their part in those developments," Stencil said.

Meanwhile, attendees will have an opportunity to connect with their peers through a number of networking opportunities, including the chairman's event, in which members from all sectors of the industry come together to socialize and exchange ideas on what is going on throughout the industry.

"It is a great educational experience, but it is also an opportunity to meet and socialize with the best minds in the industry and to get their opinions," Rule said.

IIAR will launch several new member tools and services during the conference, including a member mobile app designed to facilitate easy access to technical publications and other services.

Rule said the app will provide conference information, including maps and how to identify which tracks to attend. "There will be methods to rate technical papers and workshops and it will make it easier to utilize social

media during the meeting to connect with other attendees,” Rule said.

The app will also allow for easier access to IAR’s website. “Members will no longer have to log in. They can go directly to the member site,” Rule said, adding that IAR is continuing to build out its end-user website and will be providing more information on safety, efficiency and regulatory issues. “We’ll be providing more electronic access to videos for end users and we’re expanding that service to include more products.”

Rule said all of IAR’s standards have been formatted for viewing on electronic devices and that the association’s DVDs are being reformatted for electronic access.

As part of its future offerings, IAR is developing a training curriculum and certificate education program for members related to the new IAR-2 safety

design standard. “It will provide our members with training on the new IAR safety design standard and will have test questions developed and monitored according to ASTM standards. Members will have the opportunity to take an exam and show they are proficient in that standard,” Rule said.

IAR will eventually roll out the certification program for its other standards. “One of the things OSHA and EPA always asks me is how are we training our people. That is why we’re developing the curriculum for a certification education program,” Rule said. “Members will have a certificate from IAR and the documentation to show they’ve had proper training.”

IAR will also continue its outreach to the Occupational Safety and Health Administration, Environmental Protection Agency and the Department of Homeland Security to review their

programs and any new rulemaking process they’re going through. “We have started opening up discussions to address how new low-charge ammonia unitary packages could impact existing regulatory programs,” Rule said. “The idea is to move towards establishing new guidelines for how the small unitary packages could be addressed.”

Rule said IAR is continuing to explore methods to increase communications between end users and first responders. “Our end users are required to reach out and coordinate plans with first responders. A lot of times those first responders are volunteer agencies and they are undertrained and underfunded. Too often they are afraid to get involved because they don’t understand the ammonia systems,” he said.

Rule said the new programs and priorities for the year ahead will be discussed throughout the conference.

IAR Conference Technical Paper Presentations to Cover Releases, Small Package Systems

During the annual IAR Conference technical program, a number of presenters will discuss their findings from peer reviewed technical papers. Topics range from global refrigerant trends to determining the effectiveness of vapor retarders on insulation systems.

“A common theme will be small-charge ammonia systems applied to commercial and light industrial applications,” said Eric Smith, IAR’s vice president and technical director.

Additional themes include dealing with releases, how to comply with regulations and the benefits of compliance.

Smith said he expects a good reception for the paper *Quantitative Risk Analyses of Untreated, Vertical Pressure Relief Venting Using a Compu-*

tational Fluid Dynamics Simulation written by William Greulich and Olav Roald Hansen.

“It examines what happens to ammonia when it is released and what the potential downwind effects could be,” Smith said. “The analysis takes a look at weather patterns, air temperature and how ammonia disperses under different scenarios and circumstances and whether or not people nearby might be harmed by a release.”

Smith said the paper is an example of the type of analysis that could be done to figure out whether or not an ammonia system could be used in any particular setting. “Where I think it has great potential are applications for commercial properties that are considering using an ammonia system instead of a synthetic refrigerant,” he

said.

As part of Greulich and Hansen’s research, ammonia dispersion was modeled using computational fluid dynamics software with varied discharge height, wind speed and wind direction. “We’re not using the Gaussian model, which solves one simple equation. It works fairly well if you have nothing in the way. If you have obstructions, like buildings in the way, the model fails quickly,” Greulich said.

Greulich, one of the paper’s authors, said IAR has heard papers on ammonia dispersion for a number of years, but that this one is different. “All of the previous authors have been stuck using similar methods that are inexpensive and easy to use but that comes with a price. This is the first paper to step up to using computational fluid dynam-

ics,” he said, adding that CFD is technically more robust but is expensive, slow and difficult to use.

The paper digs deep into the effects of a release within an urban area, which is filled with buildings that would alter the flow of ammonia once it is released. “Ammonia is a buoyant gas when in equilibrium with the atmosphere. It should rise and go straight to the Moon, but everyone knows that the ammonia comes back because the winds and buildings bring it back,” Greulich said.

Greulich said the work is aimed at assisting the refrigeration community, including regulators, in quantifying public health risks, improving relief placement and assessing the need for relief vent discharge treatment. “We’re really trying to do this so owners and operators of systems and their regulators understand that this is a technical issue and is not something that is easily written in broad brush standards,” he said. “We want code officials to work in an informed way.”

Greulich said natural refrigerants are coming, and ammonia is one of the originals. He said he would like the paper to show that the risks associated with ammonia are calculable and that it is safe. “Up until now, no paper has told you what the risk actually means in useful quantifiable terms,” he said.

Also presenting during the conference is Doug Scott, who will discuss his most recent paper, *Comparing Evaporative and Air Cooled Condensing for Ammonia and HFC-507 Refrigeration Systems*, which is an encore paper to one he presented several years ago.

“It is expanding the case for air-cooled condensers,” Smith said, adding that Scott’s research examines the potential advantage for air-cooled condensers in areas where water is scarce and, therefore, expensive.

Scott said that his paper includes additional citations and compares halocarbon-cooled systems, both air and evaporative, and used the synthetic refrigerant R-507 in the analysis.

“It is a four-way comparison of energy use and operating costs for a typical medium-sized refrigerated warehouse in 11 cities,” Scott said. “In general terms, when water is considered along with electric utility costs, the air-cooled systems are equal or less expensive in nearly all locations of the country.”

The findings surprised Scott, he said. “The prevailing logic would be that evaporative systems would use less energy,” he said. “They do during the peak hours of the year, but peak weather only occurs for a relatively small number of hours in the year. When you look at the year and operation over time, you get a different view and a different picture of the comparison.”

Smith said, “What I like about this paper is that there is not always a one-size-fits-all solution. It also demonstrates very clearly that ammonia has some very good operating efficiencies over R-507.”

Among Scott’s findings is that ammonia is more efficient even in very hot climates.

“The main takeaway from this is there is an opportunity for ammonia to be used where it hasn’t been used much before,” Scott said. “Historically if an owner wanted or needed to use air-cooled, the prevailing conclusion was you needed to use a halocarbon system. You didn’t automatically think of ammonia.”

Meanwhile, a paper presented by John Collins, *Expanding the Use of Ammonia Refrigeration*, looks at the regulatory factors affecting refrigerant selection and the development of new technology that offers new capabilities and options for refrigeration system design.

“Today’s world is putting new demands on our refrigeration systems. Regulatory changes driven by environmental concerns are creating uncertainty around the use of synthetic refrigerants. There is also a higher level of public awareness of the environmental impact of refrigeration,” Collins said.

Collins’ paper shows how ammonia has the potential to become a sig-

nificant refrigerant in new markets, including the commercial arena, and outlines steps the industry can take to support these new applications.

Collins said that there have been significant developments in the design, fabrication and application of heat exchangers and controls for ammonia refrigeration. “This is enabling manufacturers to offer low-charge and small-capacity ammonia systems for commercial and retail applications,” he said. “This shift will require a change in thinking related to how we use the refrigerant and how we design our systems. In taking this step, the industrial sector can learn some lessons from the commercial sector in how to make refrigeration systems user friendly and cost effective.”

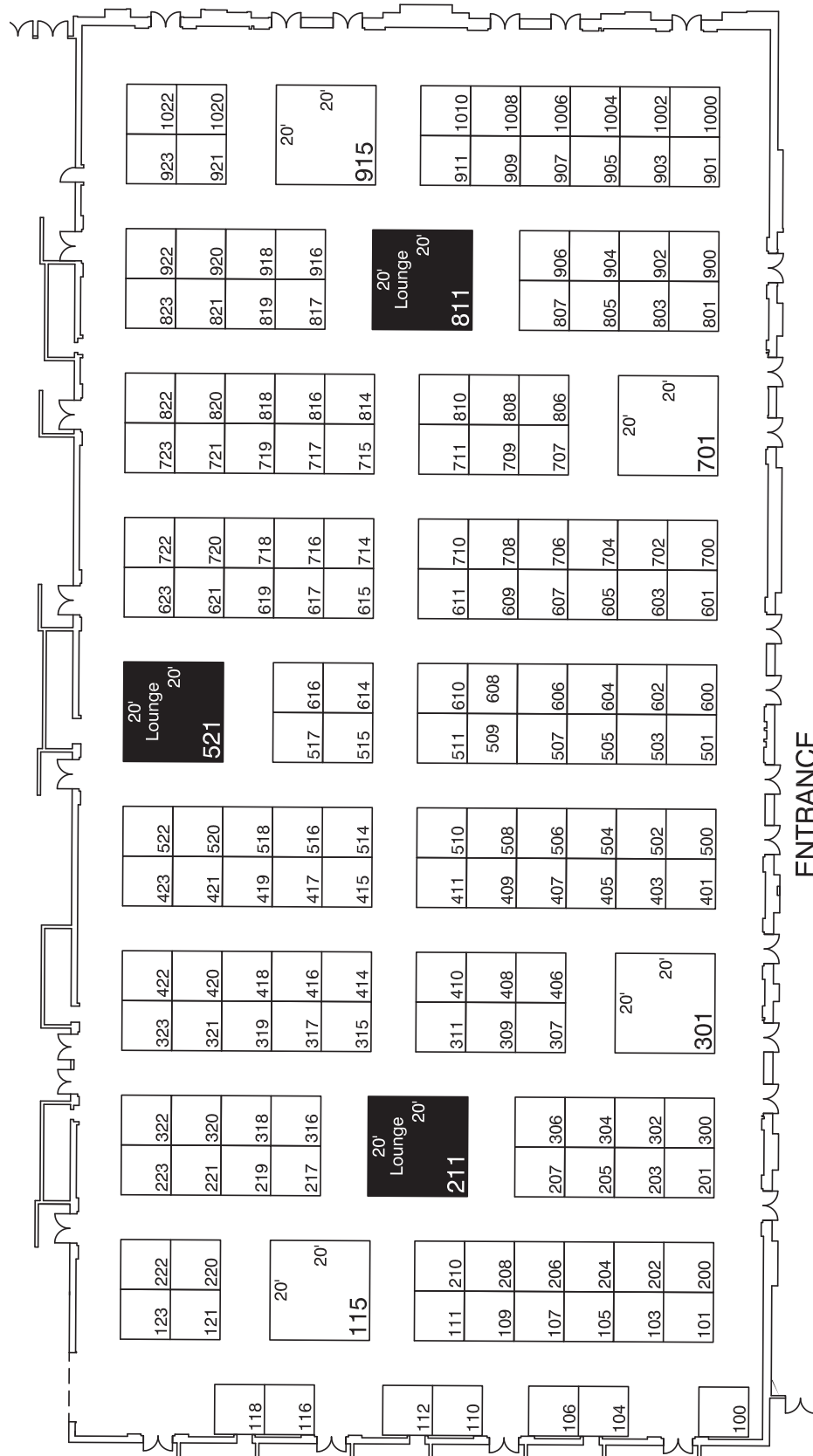
Collins’ paper includes a case study of a recent ammonia/CO₂ cascade system installed at a retail grocery market, which demonstrates how ammonia can be used in a commercial setting. Collins said the ammonia industry needs to invest the money and effort to develop products and materials for small-capacity, low charge-applications to increase the use of natural refrigerants.

“Technology is part of the answer, but it will also take our industry to collectively build on our experience and to bring that knowledge to a broader market,” Collins said. “The infrastructure and institutions to develop and support trained and qualified designers, installers and operators is a major concern that cannot be overlooked. This will take the concerted effort of industry groups including end users, systems designers, manufacturers, contractors and also government agencies. Organizations like IIAR have an opportunity and an obligation to support the commercial sector of the refrigeration industry in addressing its need for natural refrigerant alternatives.”

A total of eight papers will be presented in English during the conference. In addition, there will be an International Program with six paper presentations in Spanish. All papers will have Spanish to English and English to Spanish translation.

EXHIBIT HALL FLOOR PLAN

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IIAR 2016 INDUSTRIAL REFRIGERATION CONFERENCE & EXHIBITION

A. Blasquez E. Refrigeracion Industrial S.A. de C.V.**Booth #207**

A. Blasquez E. Refrigeracion (ABE) is the largest ammonia refrigeration contractor company in Latin America, specializing in refrigeration systems for breweries, beverages food and cold storage industries. ABE – your refrigeration partner in Mexico.

AAIM Controls**Booth #205**

From starters to drives to PLC systems and microprocessor designs, AAIM Controls has the expertise for all your industrial refrigeration requirements with over a century of combined industrial refrigeration controls experience.

Acuren**Booth #801**

Acuren's industry-leading mechanical integrity services for ammonia refrigeration systems include; Corrosion under Insulation Scanning (CUI), Computerized Radiography (CR), API Tank and Vessel Inspections, and our exclusive inspection data management systems, DMAPS.

Advanced Energy Control**Booth #806**

Advance Energy Control (AEC) is an automation controls company that specializes in the latest technology for industrial refrigeration control with an emphasis on energy management.

Airfoil Impellers**Booth #316**

Cast Aluminum fan blades, machine room exhaust fans, product cooler fans, blast freeze fans, and general ventilation fans.

Airgas*Booth #508/510**

Airgas Specialty Products offers anhydrous ammonia, pump-outs, field service, safety video, safety training, and Cold Flow Sampler (for determining water in ammonia).

Alfa Laval**Booth #710**

Alfa Laval manufactures energy-efficient semi welded, gasketed, brazed and AlfaNova 100% Stainless Steel plate exchangers as well as shell and tube heat exchangers.

Alfa Laval Kathabar**Booth #708**

Alfa Laval Kathabar delivers liquid desiccant dehumidification systems with precise, reliable, energy-efficient temperature and humidity control which have low refrigeration charge, eliminate defrost, and provide reliable dehumidification and air decontamination.

Analytical Technology, Inc.**Booth #902**

ATI designs and manufactures a complete line of ammonia gas detectors both fixed and portable and additionally gas detectors for 32 other toxic and combustible gases.

APR Plastic Fabrication**Booth # 416**

APR Plastic Fabrication is leading manufacturer and distributor of custom designed and fabricated plastic tanks, liners, secondary containment systems, and process tanks for the metal finishing and waste treatment industries.

APSM**Booth #406**

APSM provides PSM software and services for effective compliance management.

APTech Group, Inc.**Booth #1018**

APTech Group manufactures Solid-Concentrated Water Treatment used in commercial, institutional, and industrial systems to maintain equipment efficiency. APTech products provide this protection in a safer, more sustainable way than liquids.

Armstrong International**Booth #903/905**

Armstrong provides intelligent system solutions that improve utility performance, lower energy consumption, and reduce environmental emissions while providing an "enjoyable experience."

ASTI**Booth #1016**

ASTI forged strong ties with Industry, EPA, OSHA, DOT, DHS, TSA and many state and local environmental and emergency services leaders earning support for ASTI's highly respected training classes, reaching thousands of emergency response personnel annually.

Azane Inc.**Booth #321**

Azane is a world-leading manufacturer of low charge ammonia cooling solutions. Their range of low charge ammonia packages are suitable for temperature controlled storage, process cooling and HVAC applications.

EXHIBITOR LISTING

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Bacharach, Inc.

Booth #200

Fixed continuous monitors for the detection of gases including ammonia, CO, CO₂, CFCs, HFCs, CH₄ and more featuring multiple alarm, sensor and relay configurations. From one to 64 points, the units are ideal for chillers, walk-in freezers, public spaces, physical plants in commercial and industrial applications.

***Baltimore Aircoil Company (BAC)**

Booth #600/602

BAC is a worldwide manufacturer of heat transfer and ice thermal storage products. BAC's products include evaporative condensers, cooling towers, closed circuit cooling towers, ice thermal storage systems and equipment controls.

***Bassett Mechanical, Inc.**

Booth #315/317

Bassett Mechanical provides expertise in industrial refrigeration, HVAC, piping/plumbing, PLC controls, ASME pressure vessels, sheet metal fabrication and customized service agreements. Bassett is your single supplier for Mechanical Contracting, Metal Fabricating, Maintenance Service and PSM requirements.

***Bitzer US, Inc.**

Booth # 401/403

BITZER is a leading manufacturer of Ammonia Screw Compressors and semi-hermetic reciprocating CO₂ Compressors for both subcritical and trans critical applications. BITZER also manufactures high efficiency, low charge Ammonia Compressor Packages at its Oakwood, Georgia factory.

Bombadur SRL

Booth #421

Bombadur, designs and develops pumps for refrigeration gas recirculation. Inventor of a new centrifugal pump, it could eliminate cavitation problems. We are permanently in touch with our Customers through the engineering department.

Bonar Engineering and Construction

Booth #319

BONAR has provided refrigerated facility design and construction since 1975, varying from large 1.4M SF distribution facilities to smaller freezers, coolers, and process areas. Including ammonia, CO₂ and freon refrigeration.

Cal-Therm Insulations

Booth #706

Cal-Therm Insulation is a full service mechanical insulation contractor based in Southern California. For the past 40 years our company has serviced clients in the Refrigeration Food and Beverage production, and Chemical segments. We continually strive to exceed the clients expectations while delivering optimum energy efficiency, and quality at a competitive price.

Calibration Technologies

Booth #511

Calibration Technologies is a manufacturer of gas detection equipment, specializing in Ammonia. CTI's engineers and technicians have over 30 years of experience in system design, sales and field service. Calibration Technologies provides detection for NH₃, CO₂, CO, H₂S, H₂, O₂, CH₄, R22 and more in a variety of industries including cold storage, food processing, sea vessels, chemical plants and many others.

California Controlled Atmosphere

Booth #819

We will have the all new Tattle relief vent indicator. This product aids in the determination of where a release has occurred.

CAMCO Lubricants

Booth #715

Nationally known leader for our CAMCO 717 HT ammonia refrigeration oils and for all industrial refrigeration applications. CAMCO also has high quality food grade synthetic/semi-synthetic lubricants for all industry applications.

Carnot Refrigeration Inc.

Booth # 923

Pioneer in the development of CO₂ refrigeration technologies, Carnot Refrigeration designs and manufactures innovative solutions based on environmental sustainability and energy efficiency.

IIAR 2016 INDUSTRIAL REFRIGERATION CONFERENCE & EXHIBITION

***Century Refrigeration**

Booth #306

Century Refrigeration is the leader in Comdustrial™ Refrigeration Systems: The ideal balance of commercial and industrial refrigeration markets. We offer flexibility in design surrounded by durability in construction.

Chester-Jensen

Booth #607

Chester-Jensen manufactures air agitated ice builders, instant chillers, plate heat exchangers and other heat transfer equipment.

CIMCO Refrigeration Inc.

Booth #514/516

CIMCO Refrigeration Inc. specializes in engineering, design, installation and service of industrial refrigeration systems. For over 100 years, CIMCO's research and development have led the industry in technological breakthroughs.

***Colmac Coil Manufacturing, Inc.**

Booth #907/909/911

Since 1971 Colmac Coil has provided customers worldwide with innovative heat exchangers and heat transfer solutions for industrial refrigeration, HVAC, power generation, and gas compression applications.

Concepts and Designs, Inc.

Booth #900

Concepts and Designs is a premier supplier of dehumidification systems for humidity and condensation control. Dehumidification provides a permanent solution to avoid contamination hazards in compliance with the USDA zero tolerance.

Cool Air Incorporated

Booth #714

For over 35 years, Cool Air Incorporated has been manufacturing ammonia leak detectors and accessories. Check out our new detector, the LBW-WATCHMAN, on our website @ www.coolairinc.com. Also, on our website, we have enhanced it to include such field support items as installation electrical schematics, operation & maintenance manuals, and calibration videos.

Cornell Pump Company

Booth #704

Cornell Pump presents the latest innovations in refrigerant pumps including their new high-pressure, low-speed 2.5 CBH. Cornell also manufactures high quality glycol and chiller pumps.

CTS

Booth #922

CTS (Creative Thermal Solutions, Inc.) is a dynamic, world-leading company for technology development, prototype manufacturing and evaluation/testing. CTS low charge ammonia cooling systems (like air cooled ammonia chillers with 18 g/kW or 2.3 oz/Ton) are in exploitation for over 15 years.

Cyrus Shank

Booth #716/718

The Cyrus Shank Company manufactures and sells industry-leading relief valves and other products for the refrigeration industry such as relief valves, shut-off valves, flanged valves, expansion valves, manifolds, brass valves, etc.

***Danfoss**

Booth #821/823

Danfoss' complete line of refrigeration valves and electronic controllers includes assembled valve stations in one shared housing and weld-in motorized, solenoid and control valves designed to 754 psig.

***DEEM, LLC**

Booth #805/807

Based in Indianapolis, Indiana - DEEM has over 1,200 employees in nine (9) states serving clients with industrial/commercial refrigeration requirements for the pharmaceutical, food and beverage and cold storage marketplace. Mechanical and electrical services are also part of our skill set along with design engineering and process piping.

***Delta Tee International, Inc**

Booth #814

Delta Tee manufactures heat exchangers, pressure vessels and systems, complete capabilities in designing and manufacturing shell and tube heat exchangers for refrigeration, air conditioning, chem-process, food and other applications.

Draeger Safety Inc.

Booth #915

Draeger offers a full line of fire and gas detection equipment for the ammonia industry. The Draeger Sensor is the foundation for success in the ammonia industry market. With our new advanced product line, Draeger is ready for your gas detection needs.

EXHIBITOR LISTING

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DualTemp Companies, Inc.

Booth #700

DualTemp in partnership with Clauger North America, designs, installs services and maintains your refrigeration & process air systems. Also specializing in parts equipment, safety training supplies and OSHA compliancy.

Dyplast Products, LLC

Booth #302

Dyplast manufactures ISO-C1 polyiso rigid bunstock in Miami, FL for mechanical and refrigeration pipe insulation meeting ASTM C591-15 and CINI 2014 (cryogenic) applications.

EcoClear

Booth #918

EcoClear is a professional coil cleaning and energy saving company that specializes in cleaning chillers, cooling towers, and evaporators/condensers. EcoClear has serviced a wide variety of clients, helping them save up to 20% on their energy cost. As a final step in the clearing process, EcoClear applies a coating that ensures that equipment runs at a higher rate of efficiency between cleanings.

eurammon

Booth #1004

eurammon is a joint initiative by leading global companies, institutions, and individuals committed to increasing the use of natural refrigeration. eurammon has an excellent global network of co-operation agreement with international associations.

***EVAPCO, Inc.**

Booth #208/210

EVAPCO is a worldwide leader in the design and manufacture of industrial refrigeration systems and components. A broad line of AHRI certified air unit evaporators, evaporative condenser, critical process air systems, low charge packaged refrigeration systems, water treatment, pressure vessels, circulators, hydro-cooling coils and ice builders can ship from one of 17 facilities in 9 countries around the world. With an ongoing commitment to research and development, EVAPCO provides the most advanced products in the industry - Tomorrow's Technology....Available Today!

Extol of Ohio Inc.

Booth # 419

Extol offers closed-cellular insulation materials for refrigeration chilled water, steam and process systems. We fabricate and distribute extruded polystyrene (xps), polyisocyanurate, 25/50 polyisocyanurate, cellular glass, phenolic, perlite and mineral wool insulation for piping and equipment. Contoured vessel/tank heads, valve system, fittings, PVC, aluminum, stainless steel, GRP, vapor and weather barrier caulks, sealants and coatings complete the project. Extol also provides specification assistance.

***Farley's Frigeration**

Booth #110/112

Farley's S.R.P. Inc. — AKA / DBA Farley's Frigeration: Family owned and operated, industrial refrigeration contractor/parts supplier. Our Mission: To support and provide the highest quality of parts, equipment and service while offering very competitive prices. All delivered efficiently by friendly, qualified personnel with "Farley's personal touch service guarantee" Providing "Getability" Since 1978

Freije-RSC Engineered Solutions

Booth #217

Freije Engineered Solutions, is an organization with 50 plus years of experience in the industry. RSC has been providing services in the industry 50 plus years, also. The combination of the two companies through a merger has dramatically strengthened and enhanced the services to the Food Process, Food Distribution and Pharmaceutical Industries. We offer key strengths to the industry for Refrigeration, Insulated Panels, HVAC, Mechanical, Plumbing, Electrical, Engineering and Service. The result is a comprehensive offering of professional services to our clients. The merger of freije and RSC creates expanded capability and improves our ability to enhance delivery of products and services nationwide.

***Frick Industrial Refrigeration**

Booth #701

Full line of refrigerant equipment for most applications. Rotary Screw Compressor Packages and Packaged Chillers with VSD, Condensers, Evaporators, AcuAir Hygienic Air Handlers, Vessels, Heat Exchangers, Controls, and Replacement Parts.

IIAR 2016 INDUSTRIAL REFRIGERATION CONFERENCE & EXHIBITION

FriconUSA

Booth #917/919

FriconUSA specializes in manufacturing a variety of high quality and efficient equipment for industrial and commercial refrigeration and air conditioning. Our screw compressor package is ideal for industrial refrigeration

Fujian Snowman Co., Ltd.

Booth #222

Fujian Snowman Co., Ltd. takes the first priority for the Ammonia refrigerant application, including the open type and semi-hermetic screw compressors. The rack and package unit extending from the traditional big scale to smaller one.

Gamma Graphics Services

Booth #722

Gamma Graphics provides non-destructive testing (NDT) services on ammonia refrigeration piping. We are able to identify corrosion on wet or saturated insulation without having to cut holes or breach the vapor barrier on piping in any way. We also provide conventional ultrasonic inspection services on ammonia vessels.

***Garden City Community College**

Booth #407

Ammonia Refrigeration, Boiler, PSM/RMP, Adv RETA Prep, "Hand-On" Ammonia Refrigeration training since 1996, 4 ½ Day Format-Earn College Credit-Degree Opportunities Conforms to OSHA & EPA regulations.

***Gartner Refrigeration**

Booth #820

Gartner Refrigeration has been supplying solutions to the industrial refrigeration and process cooling industries for over 70 years. We provide parts, service, engineering, and installation across North America.

GCAP, LLC (Garden City Ammonia Program)

Booth #522

Garden City Ammonia Program is the world's largest industrial technical school involved in training over 2,000 operators, technicians, engineers, and managers yearly. We have the largest hands-on labs in the industry. GCAP specializes in industrial ammonia refrigeration, industrial CO₂ refrigeration, steam boilers, and PSM/RMP compliance training and services.

***GEA**

Booth #515/517

Screw and piston compressors, refrigeration system controls, packages & process systems, chillers, freezing systems, ice systems. Parts, service, preventive & predictive maintenance, compressor rebuilds, and training.

Gf Piping System

Booth #104/106

COOL-FIT ABS Plus is complete pre-industrial plastic piping system for glycol and secondary cooling piping systems. It is UV resistant, vapor-tight, and 100% water-tight and requires minimum installation time.

Global Cold Chain**Alliance (GCCA)**

Booth #1006

The Global Cold Chain Expo, June 20-22 in Chicago, is the one-stop-shop for cold chain innovation, education and business-to-business networking for the global food industry—from producer to consumer. Learn more at www.globalcoldchainexpo.org.

Grundfos Pumps Corporation

Booth #318/320

Pumping Solutions for today- Innovative thinking for tomorrow. Grundfos offers the industry's broadest line of Refrigerant/CO₂ Pump, Energy Efficient Pumps, Pumping Systems and Controls.

H.A. Phillips & Co.

Booth #711

Phillips manufactures liquid level controls, valves, Level Eye sight glasses, injectors, ASME pressure vessels, gas-powered and pumped recirculation systems, PHE chillers, the Anhydrator system cleaner and PUR air purger. Phillips is the distributor for Danfoss IR products for the US and Canada.

***Hansen Technologies**

Booth #501/503

Hansen Technologies is a worldwide leader in components for industrial and large commercial refrigeration Systems. Offering an extensive line of components for more information visit our website www.hantech.com

Hantemp Controls

Booth #202

Stainless Steel long-neck, two and three way ball valves with optional control motors and lock-out tag-out features. Also stainless steel level controls for ammonia and other liquids.

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Hench Control Energy Management Systems

Booth #408

Hench Control is a manufacturer and service provider of modular energy management systems for industrial refrigeration which quantifiably cut energy cost, improve profitability and significantly reduce the CO₂ footprint for the environment.

HT Industrial

Booth #507

Heat Exchangers, Condensers, Chillers, Pressure Vessels & HVAC/Refrigeration Components. HT Industrial takes pride in providing high quality HEX/PV to our global partners from our facilities in the USA and Canada. Customer Satisfaction, Quality Designs, Product Quality and On Time Deliveries are our primary goals. Let HT Industrial be a partner to your future success.

Hermetic Pumps

Booth #520

Hermetic has been dedicated to the development and production of hermetically sealed pumps. Based on our experience in chemical, petrochemical and process industry we designed canned motor pumps specifically for refrigerant services.

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Booth #405

Hillphoenix specializes in the design and manufacturing of halocarbon, carbon dioxide transcritical and secondary refrigeration systems for cold storage, industrial refrigeration, and ice rink applications.

Honeywell Analytics

Booth #219/221

Honeywell Analytics manufactures the industry's most complete range of monitoring instrumentation for ammonia and other refrigerant gases. We offer fixed-installed units (Manning), portable services, controllers, services/support second to none.

Houghton Chemical

Booth #304

Houghton Chemical is a fourth generation inhibited glycol manufacturer and service company. Our products include: propylene (SAFE-TTHERM), ethylene (WINTREX), biobased, renewable, and aluminum-safe glycols. Our service is unmatched.

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Booth #601/603

Howden Compressors offers the most complete range of screw compressors available in the world for virtually any compressor application-refrigeration to gas reliquification, gas compression or cryogenics, and more.

Industrial Construction & Engineering IC&E

Booth #423

IC&E is a national, full service mechanical insulation contractor and offers other services including: Industrial Wall and Roof installation, Scaffolding, Heat Trace, IMP Duct Work, painting & coating as well as pipe marking.

Industrial Consultants, LLC

Booth #504

Industrial Consultants - your compliance connection for OSHA and EPA related training and services including HAZMAT, refrigeration, PSM/RMP, lockout/tagout, confined space and incident command.

Industrial Refrigeration Technical College

Booth #916

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Industrial Service & Fabricators, Inc.

Booth #505

Industrial Service and Fabricators custom designs and fabricates pressure vessels, tanks, and liquid recirculator assemblies. Products include recirculators, receivers intercoolers, accumulators, surge drums and oil pots.

***Innovative Refrigeration Systems Inc.**

Booth #817

Innovative Refrigeration Systems specialize in customized turnkey industrial refrigeration systems. We design and build computer-controlled ammonia refrigeration, large tonnage Freon systems and large CO₂ systems for the cold storage and food process markets.

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Booth #608

Insul-Therm International is a leader in the fabrication and distribution of insulation products for refrigeration and process systems. Our product offerings include TRYMER™, STYROFOAM™, SARAN™, foamglas, Mylar and many other lines.

Integrated Circuit Systems, Inc.

Booth #610

We design and build custom-made UL control panels and systems for new and existing industrial refrigeration facilities. What sets us apart from the competition; our control systems work. No Exceptions.

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Booth #720

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Isel is a manufacturer of synthetic lubricants with an expertise in industrial refrigeration applications. When you become a distributor of Isel's NXT Refrigeration Lubricants, you receive the full backing of our customer support team and a powerful toolset to help you generate more sales, reduce operational costs and make the right lubricant recommendations.

ISN

Booth #107

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ITW Insulation Systems

Booth #506

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Jamison Door Company

Booth #101/103

HCR/Jamison Door will feature HCR Air Door Technology and BMP RollUp Door.

JAX Refrigeration, Inc.

Booth #707

JAX Refrigeration, Inc. provides Refrigeration Design, Engineering, and Construction for Refrigeration Systems alongside Divisions: JAX Mechanical - HVAC/Mechanical Systems; MEAS - Engineering & Design; JAXCamp Industrial - Food Process and Industrial Equipment; and JAXCool - Thermal/Panel Construction.

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Booth #717

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Booth #216

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Booth #118

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Lanham Insulation, Inc.

Booth #611

For more than 30 years, Lanham Insulation has provided unparalleled quality and reliability in mechanical insulation services. From inception, our expertise and pursuit of excellence have earned us the trust and confidence of our customers. The Lanham team of industry-leading insulation professionals focuses exclusively on the complete success of each project, to ensure the highest levels of safety, quality, and efficiency. Our fundamental mission is to deliver complete satisfaction with superior quality and value.

Lanier Technical College

Booth #119

The Ammonia Refrigeration Program at Lanier College in Oakwood Georgia is dedicated to providing the ammonia refrigeration industry with the best, state-of-the-art, hands-on, live system training in ammonia refrigeration system operation, maintenance, and support.

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Booth #100

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***MRBraz & Associates**

Booth #615

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Multi-Wing America

Booth #906

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North Star Ice Equipment is a world leader in ice technology. We provide cooling solutions based on large volumes of high quality flake ice by designing and manufacturing a full range of reliable and durable ice equipment.

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Paul Mueller will feature their falling film chiller, semi-welded plate and frame heat exchanger, brazed plate heat exchanger and heat recovery equipment.

Paulsen Pipe**Booth #921**

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Premium Inspection and Testing, Inc.**Booth #223**

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Process Compliance (Protex Inc.)**Booth #420**

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Booth #123

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Booth #920

PRUFTECHNIK focuses on the development, production and service of high-tech systems that provide solutions for Shaft Alignment, Conditions Monitoring and Non Destructive testing in the areas of Industrial maintenance.

PSRG, Inc.

Booth #121

PSRG is a full service, integrated HSSE consulting and training firm, specializing in process safety and risk management for ammonia refrigeration (PHA/LOPA, B109, relief system, SOPs, everything PSM/RMP).

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R.E. Lewis Refrigeration Inc.

Booth 1010

RE Lewis' mission: Earn long-term relationships built on trust by delivering construction services with reliability and integrity. Our goal is simple – improve financial and strategic outcomes for our clients.

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Regal is a leading manufacturer of electric motors, mechanical and electrical motion controls and power generation products. For 30+ years, its leesport, PA facility (formerly RAM Motors) has served the refrigeration industry with purpose built designs.

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Booth #206

RVS is a preferred supplier of innovative industrial refrigeration products including factory assembled, packaged recirculation systems and ASME pressure vessels of all types and sizes. RVS, a subsidiary of EVAPCO, is committed to providing superior technical support and the highest quality products with fast, on-time shipment to meet your construction schedule.

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Booth #1008

RETA exists to embrace the professional development of industrial refrigeration system operators and technicians through training and education events focused on safe and efficient operations.

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Booth #220

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SCS Tracer Environmental

Booth #111

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SGS Refrigeration, Inc.

Booth # 619/621

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***Shambaugh & Son L.P.**

Booth #702

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Stellar*Booth # 409/411**

Stellar is a fully integrated design, engineering, construction and mechanical services firm that provides a comprehensive range of self-performed services. Stellar creates food processing plants, refrigerated warehouses, and distribution centers.

Summit**Booth # 116**

Summit Industrial Products is a manufacturer of synthetic lubricants which include several ammonia refrigeration and food grade lubricants. Our ammonia refrigeration and food grade lubricant are NSF H1 certified. Summit also manufactures descalers/degreasers and oil/water separators.

Summit Refrigeration Group**Booth #105**

Summit Refrigeration Group is a full service, customer oriented, designed/build industrial refrigeration contracting company specializing in food processing plants, multi-temperature distribution centers, and specialized process cooling. Services include complete refrigeration design and installation, screw compressor rebuilding, shop fabrication, parts sales, customized preventive maintenance programs, 24 hour emergency service and OSHA PSM compliance for customers nationwide.

Tanner Industries, Inc.**Booth #605**

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Teikoku USA, Inc.**Booth #901**

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A family owned company dedicated to industrial refrigeration since 1896. We offer refrigeration contractors the reliable partnership with system solutions using high quality components such as refrigeration pumps (with couple hermetic canned motor) high side float regulators and automatic oil return systems. For the European market we also produce entire pressure vessel units. Our components are produced in Aachen, Germany and exported all over the world.

Therma Seal Duct Systems**Booth #218**

Refrigeration Duct work.

Therma-Stor, LLC**Booth # 721**

Therma-Stor manufactures heat reclaim (desuperheating) water heaters that harness waste heat from refrigeration systems and use it to heat potable water. Units contain an integrated heat exchanger and storage tank.

Thermofin GmbH**Booth #617**

thermofin produces finned heat exchangers for an application in refrigeration and air conditioning industry in commercial and industrial projects that fit for all kinds of refrigerants (HFC, NH₃, CO₂, glycol etc.).

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Vahterus

Booth #518

As the investors of Plate & Shell Heat Exchanger (PSHE) technology, with an installed base of >40,000 exchangers, Vahterus PSHE have many benefits for advanced refrigeration applications.

*Vilter Manufacturing, LLC

Booth #309/311

Vilter manufactures energy efficient and reliable compressors for use with multiple refrigerants including CO₂. The Vilter compressor's low life-cycle cost and high reliability are backed by the industry's best warranties.

Vogt Ice LLC

Booth #816

For over 75 years Vogt Ice LLC has been your trusted Ice and Chilled Water authority. Visit us today at our booth or our website, vogtice.com.

Wagner-Meinert, LLC

Booth #719

Wagner-Meinert, LLC is committed to exceeding expectations by providing complete customer satisfaction through uncompromised integrity and excellence in engineering, installation, services and training in refrigeration, food process and mechanical integrity.

Warrender, Ltd.

Booth #709

Warrender, Ltd. specializes in seal-less magnetic pump technology, seal-less high head, low NPSH transfer pumps meet zero emissions compliance, while offering any U.S. or International industrial motor specification.

WEG Electric Corp.

Booth #604/606

WEG Electric Corp. is a leading global supplier of motors, drives, controls, generators, and transformers with a focus on quality, technology, R&D, performance, and customer service.

Westermeyer Industries Inc.

Booth #609

Manufactures components for the industrial and commercial refrigeration industry. Supplying products such as: Oil Separators, Accumulators, receivers, oil pots, Shell and tube heat exchangers, and level detection devices.

Wingfan

Booth# 323

Modular axial fans

Zero Zone, Inc.

Booth #300

Zero Zone designs and manufactures custom engineered halocarbon, CO₂, and low charge ammonia refrigeration systems for cold storage/distribution, ice rinks, pharmaceutical, food processing, and other industrial applications.

Zhejiang Wanxiang Technology Corp.

Booth #822

WXR specializes in designing and manufacturing evaporative condensers (both coil and plate), closed circuit cooling tower, evaporator, frequency converter and other types of refrigeration equipment.

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Work Continues on Existing Facilities Standard

COMMITTEE update

IIAR is moving forward on its recognized and generally accepted good engineering practice (RAGAGEP) standard for existing facilities, which is intended to provide guidance for end users and compare their older designs to the new and updated safety standards.

“New and updated standards are applicable for new construction, so the idea is to give them a guideline to compare what is in the new standards and give them a method or procedure to evaluate their existing systems, and implement the practices that need to be

There is often a grey area on what is grandfathered in. “This effort will try to identify those grandfathered questions and add clarity on how to go about updating and documenting your new RAGAGEP for your plant without totally redesigning and rebuilding your facility,” Rule said.

Eric Johnston, chairman of IIAR’s RAGAGEP Standard sub-committee and director of process safety management at American Foods Group, said the proposed IIAR standard for evaluating RAGAGEP scope will provide

It is up to each facility to confirm this for each system.”

Smith said the RAGAGEP standard isn’t necessarily confined to existing facilities. “It could be a new facility which operates under a code that is somewhat outdated. Sometimes states and jurisdictions by legislation are not caught up to the latest codes. It is incumbent on the owner and designer to establish with the code official and within their documents how their facility is being built,” Smith said.

Lundell said the Federal Occupational Safety and Health Administration and Environmental Protection Administration regulations require that each ammonia refrigeration system have its own RAGAGEP, which should be found in the facilities process safety information element of the site’s refrigeration management program, or PSM program if over 10,000 lbs. threshold quantity.

“Depending on the year a system was designed and installed, a site with more than one ammonia refrigeration system more than likely will have different RAGAGEP for each system,” Lundell said. He added that the employer, who may be the owner or an assigned designee, is required to document that the refrigeration equipment complies with RAGAGEP. Determining and documenting the RAGAGEP for each refrigeration system is required for regulatory compliance.

Lundell said if the system is audited, it should only be audited to its RAGAGEP. It should not be audited to codes, standards, and guidelines that were not used in its design, installation, or for its operations and maintenance.

Johnston said OSHA published its interpretive memo, ‘RAGAGEP in Process Safety Management Enforcement’ in June 2015, which means it is imperative that IIAR provide guidance for end users on identifying the RAGAGEP that is applicable to the ammonia refrigeration industry.

The whole idea is to give people something they can lean on to determine what they have to bring up to code.”

Bob Czarnecki, chairman of the IIAR standards committee

updated in their worker-safety programs,” said IIAR President Dave Rule.

Bob Czarnecki, chairman of the IIAR standards committee and recently retired refrigeration program manager at Campbell Soup Co., said, “Basically they are going to spell out, based on the latest standards that are out there, things you must comply with whether you have an old system or not. The whole idea is to give people something they can lean on to determine what they need to bring up to code.”

Eric Smith, vice president and technical director at IIAR said, “Older facilities were built under different codes and standards. As such, they aren’t really expected to have to comply with new standards as they get published or updated. However, there are clearly some technologies and issues that arise which should be addressed by everyone regardless of system age.”

minimum general safety and system-design requirements for all systems no matter when they were built.

It will also provide a method to document adherence to RAGAGEP for new installations of ammonia refrigeration systems, and provide a method for operators of existing ammonia refrigeration systems to evaluate new and revised codes, standards and practices to determine which practices to adopt.

Tony Lundell, director of standards and safety at IIAR, said, “The RAGAGEP standard will also provide a method for existing ammonia refrigeration systems to determine and document that existing equipment that was designed and constructed in accordance with codes, standards or practices that are no longer in general use is designed, maintained, inspected, tested, and operated in a safe manner.

“If the ammonia refrigeration industry does not identify the applicable RAGAGEP for our industry, then we are potentially leaving our industry open to having other industries, regulatory agencies, etc. define the applicable RAGAGEP for us,” Johnston said.

The initial idea for IIAR’s current RAGAGEP project was conceived well over a year ago when OSHA invited the association to discuss RAGAGEP with them. “As far as industries go, our industry has done a lot to write our own RAGAGEP and not depend on other industries,” Smith said. “OSHA has recognized our efforts and we perceive that citations of other industry standards against ammonia refrigeration systems have waned.”

At the initial meeting, OSHA and IIAR discussed the concept of how older facilities could examine newer standards against their existing facilities and determine which standard practices should be mandatory, which ones should be considered, and which ones could be ignored, Smith said.

“I think OSHA viewed the meeting positively and I think our members will as well, since our members will provide specific guidance on the procedures they need to follow,” Rule said.

Within IIAR, the standard is being developed as a cooperative effort between the Standards Committee and the Compliance Guidelines Committee as well as sub-committees within each.

Johnston said the committee is continuing to work on the draft and will create several versions before one is released for public review, which is expected in June 2017.

“Essentially the next step is that the standards committee provides input, modifies the document, and then generally we submit the draft to other members for additional feedback,” Czarnecki said. “We consider and incorporate their comments before we put it out for public review.”

Czarnecki expects to receive a good amount of feedback on the drafts. “Everybody is probably going to have a whole lot to say about it, particularly the end users. The whole idea is to put something out there that is clear and that everyone can follow,” he said.

New Association Spotlights Sustainable Refrigerants

The North American Sustainable Refrigeration Council — a newly formed 501(c)(3) nonprofit organization — is working to advance natural refrigerants such as ammonia or carbon dioxide and create a more sustainable future for supermarket refrigeration.

“Our focus is supermarkets because we see so much potential there,” said Liz Whiteley, executive director of NASRC, which is based in Santa Cruz, California. “The supermarket industry faces unique challenges — e.g. very small profit margins, huge opportunity cost if a store has to close for work on the refrigeration systems — so it’s a great subset of commercial refrigeration to focus on where we could see meaningful benefits for the climate.”

An appealing aspect of natural refrigerants is that they are not going to be subject to future phasedowns or restrictions like HFC refrigerants, so they offer a solution to the seemingly endless cycle of refrigerant transitions: chlorofluorocarbons (CFCs) to hydrochlorofluorocarbons (HCFCs) to hydrofluorocarbons (HFCs) to lower-global-warming-potential (GWP) HFCs, Whiteley said.

Whether you’re talking about standalone units using hydrocarbon

refrigerants or transcritical CO₂, there’s an opportunity to install systems with substantially smaller climate footprints through lower GWP refrigerants, energy efficiency improvements and decreased system maintenance,” Whiteley said.

The technology, best practices and manpower exist to reduce the impact that supermarket refrigeration has on the environment, but Whiteley said there are hurdles in the way. “Right now in the U.S., when supermarkets look at natural refrigerant options, for the most part they see systems that are expensive, that are different than the rest of their installed base, and that require service technicians who are trained in natural refrigerants,” she explained.

Whiteley said it is important to note that NASRC is a 501(c)(3) nonprofit, which means it exists to advance natural refrigerants specifically because natural refrigerants are better for the environment. “If we can create a world where natural refrigerants are the affordable, logical choice for new store construction, we can lock in technology that’s best for the planet, and that offers a lot of security and

cost savings to supermarkets in the long run,” she added.

Dave Rule, president of IIAR, said there may be several ways the two groups can work together, given that both support the use of natural refrigerants such as ammonia or carbon dioxide. “With R-22 being phased out, a lot of people are turning to natural refrigerants. That is drawing more commercial refrigeration people to IIAR,” Rule said, adding that IIAR has platforms in place to communicate with those in the industry, such as its website, magazine and annual conference.

“We’ve extended the offer for their board members and their members in general to participate in the programs and networking events at the conference,” Rule said. “I’d like to invite them in next year to develop papers and add a second track of papers more focused on the commercial market. We could do the same thing on the workshops and panels.”

Rule said including NASRC members in IIAR workshops and committees could increase the focus on commercial issues. “We can develop new committees to be more specifically focused on the issues for the commercial market.”

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Domestic, Global Policies Serve as a Catalyst for Growth of Natural Refrigerants

The regulatory burden on synthetic refrigerants is much stiffer than it ever has been before, which is opening more opportunities for natural refrigerants in the U.S.

Lowell Randel, vice president, government and legal affairs for the Global Cold Chain Alliance, said a number of factors are contributing to the growth of natural refrigerants, including the Significant New Alternatives Policy (SNAP) Program, which is authorized under the Clean Air Act and administered by U.S. Environmental Protection Agency, as well as the Montreal Protocol, a multilateral agreement under the United Nations

Randel said HFCs with various levels of global warming potential have a higher potential to be phased out of SNAP first. “Then potentially you’ll see that expand to HFCs with lower global warming potentials. I think it is a matter of when – and not if – you’re going to see those global warming HFCs be phased out,” he explained.

R-22 is already among the chemicals being phased out and the EPA has called for an end to R-22 production by 2020. “Because R-22 is on its way out, this would say, ‘Here are alternatives that are appropriate,’” Randel said, adding that ammonia will be an acceptable alternative. “We know that

The EPA has called for an end to R-22 production by 2020.

designed to phase out the production of certain substances.

The SNAP program continues the EPA’s phase-out of certain hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs) and looks at substitute chemicals for those currently being used that impact the environment. SNAP is a dynamic program, so the list of alternative chemicals it provides can change.

“It can evolve as policies evolve. Things that were acceptable in the past may not be [acceptable now],” Randel said. “There is a list but that list will change as new chemicals and substances are developed.”

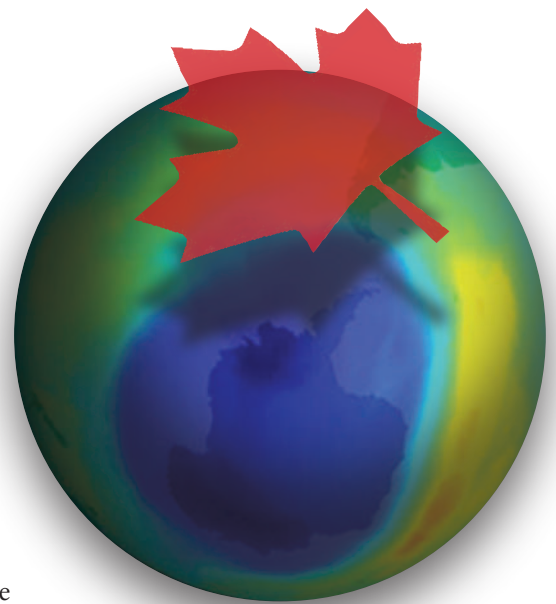
Currently, SNAP is moving its focus to global warming from ozone depletion, including HFCs. “With that transition you’re going to see more changes to the list where they’re going to be removing HFCs due to higher global warming potentials,” Randel said.

ammonia does not deplete the ozone and it doesn’t cause global warming. It will be one of those options that will not be taken off of the list because of global warming.”

The Montreal Protocol is also contributing to the growth of natural refrigerants. “You’ve got all of these countries that have come together and agreed to the Montreal Protocol and said things like R-22 has to go away,” Randel said. “Now there are efforts to expand the Montreal Protocol to include HFCs.”

During recent meetings to lay out a plan on how to incorporate HFCs into the Montreal Protocol, there was consensus that 2016 is an important year for outlining how that would occur. “There will be meetings this year to put together this framework of incorporating HFCs into the Montreal Protocol. Their goal is to have that plan in place by the end of the year,” Randel said.

However, things tend to move slowly with multilateral agreements,



Randel said. “Some [countries] are more hesitant to limit HFCs because they feel they wouldn’t be able to transition as efficiently as some other countries,” he said.

Within the Montreal Protocol, the United States has been one of the chief proponents of phasing out HFCs, and there is a North American Amendment, with the U.S. and Canada leading the charge.

Regardless of the speed with which the Montreal Protocol moves, Randel said President Obama could try to accelerate the United States’ move away from HFCs during his last year in office. “That could bring more changes to SNAP or other policies that would move in that direction,” he said.

In November, EPA published a Notice of Proposed Rulemaking entitled “Protection of Stratospheric Ozone: Update to the Refrigerant Management Requirements under Section 608 of the Clean Air Act.” That proposal is another step towards implementing the Obama administration’s Climate Action Plan. The proposed rule is designed to cut carbon pollution and reduce the use and emissions of substances that deplete Earth’s ozone and contribute to global warming.

Randel said that overall, the industry is recognizing the policy shift on HFCs and is looking at how that transition can be done in a way that causes the minimum number of disruptions.

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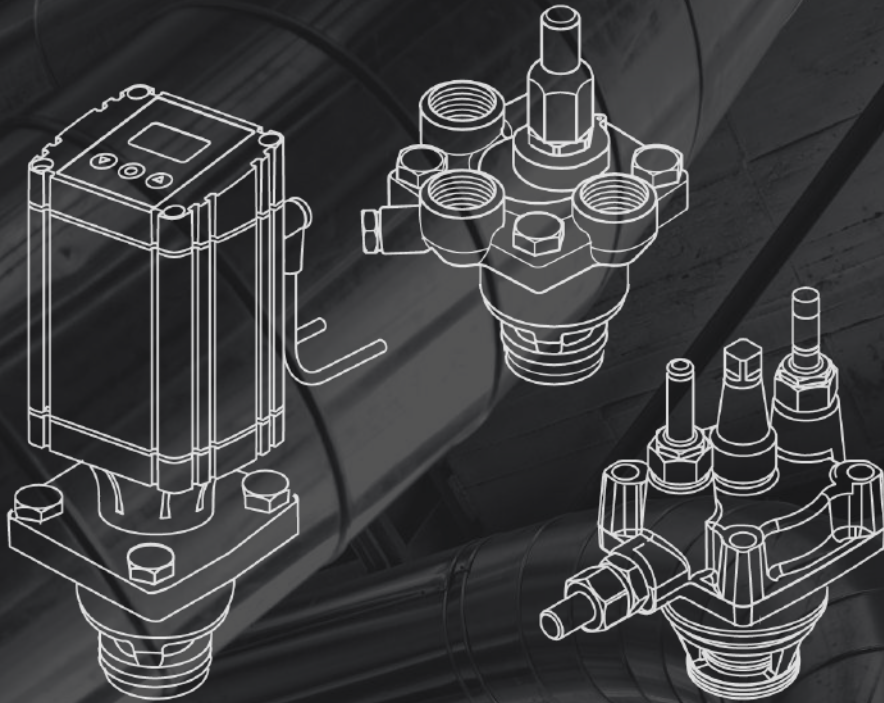
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Remembering Bob Appleton

Bob Appleton never flaunted his expertise in the ammonia refrigeration industry, but those who worked with him during his five-decade career knew that he was the man to see whenever they had a riddle they could not solve.

“He was an encyclopedia of how to get things done,” said Tom Leighty, his long-time business partner at Refrigeration Systems Company in Columbus, Ohio, and current chairman of the IIAR board of directors. “In my opinion, he was probably the best construction engineer I’ve ever come across. Bob was a very practical engineer. He knew how to make things work. There are a lot of engineers who can draw. Bob was one of those people who knew how to do it. If anybody had any problem whatsoever, they went to Bob.”

Robert Arthur Appleton, 73, died December 18, 2015, at his home in Centerburg, Ohio.

Rich Merrill, former director of advanced engineering at Evapco, Inc., had praise similar to Leighty’s, stemming from his experience while chairman of ASME B31.5. Appleton served as vice-chairman on the project, which developed the code for refrigeration piping and heat transfer elements.

“Bob was always my conscience when I needed information on the contracting and engineering business of refrigeration systems,” Merrill said. “I’d run into some strange rules and wonder why they did it that way. I could call up Bob and he’d have the answer.

“He also had a great deal of insight into regulatory and inspection issues,” Merrill said, adding, “Ohio is a really tough state on ammonia system inspections, so he knew a lot about that. He knew the answer beyond saying, ‘well, it depends.’”

Appleton worked at Refrigeration Systems Company from 1962 until his retirement as president in 2015. “Bob

never had an enemy, that’s for sure,” said Leighty, who has been company CEO since 1992. “Everybody respected him.”

Appleton’s impact on the industry included his involvement with the writing of the original IIAR piping manual. “If it had anything to do with concrete, steel or refrigeration, he was really the go-to guy,” Leighty said. “He brought all his talents to the creation of the piping manual.”

Appleton was born in Baltimore, Maryland. He graduated from Franklin University with a degree in engineering. He had many interests outside the industry, including collecting knives and riding his Harley Davidson motorcycle. He also had a pilot’s license and was an avid fan of Ohio State football. He leaves his wife of 46 years, Karen, daughters Anne Edwards and Robin Lockwood and stepson Michael Marshall.

Remembering Bob Armstrong

In an industry that relies on complex data, Bob Armstrong packaged technical information with an inventive elegance and a critical eye as the driving force behind the International Institute of Ammonia Refrigeration’s annual conference for many years and the first editor of the Condenser magazine.

“I worked closely with Bob for many years as the chairman of the IIAR International and Marketing committees and found him to be a tremendous help in all of our work,” said David Rule, IIAR president. “He was a talented and resourceful individual and a great friend.”

Born in Canada, the 6-foot-3 Armstrong combined an out-sized personality with a sense of purpose in his position as vice-president of marketing at IIAR from 1990 to 2012, where his principal responsibilities were in sales and marketing, organizing the annual IIAR conference, producing the Condenser and creating video presentations. He passed away in Calgary, Alberta, on December 7, 2015.

“He could do things with video programs that were just spectacular. He

was a lot of fun to work with,” said Bruce Badger, former IIAR president.

“That’s the kind of touch he had,” Badger said. “It was very similar with the conferences. He was able to mix in the technical information in a com-



fortable environment.

Current Condenser editor Andrea Collins remembers Armstrong as a mentor, eager to pass on a love of all things refrigeration. “Bob was a resource for me, a great boss and a friend,” said Collins.

Badger remembered Armstrong as, “a man with a presence” who loved politics, hockey, wine, cycling and

playing the drums. Armstrong worked on a number of election campaigns. He was also known to sit in on drums with bands that performed at IIAR banquets. Early in his career he dabbled in broadcasting and worked as a disc jockey in North Carolina. He provided narration on many of IIAR’s video productions.

Joe Mandato, a member of the IIAR board of trustees and a former IIAR conference chairman, worked closely with Armstrong for many years. “Bob was instrumental in developing the marketing programs for IIAR. He was also very involved in the planning and execution of board meetings at the annual conference and exhibition,” Mandato said. “I was impressed by his attention to detail and his commitment to making the conferences a success.”

Armstrong was also instrumental in creating programs that led to a significant increase in IIAR membership. Among his many contributions was the first IIAR newsletter, NH3 News, the creation of the IIAR web site, the conversion of all historical technical papers to electronic files and the development of the ammonia video training series.

Is a Vortex to Blame for Your Poorly Functioning Thermosyphon System?



Thermosyphon systems have a solid reputation in the industrial refrigeration industry, and are a popular choice for many . . . as long as they work. But when a thermosyphon system has problems, those problems are sometimes not easy to identify or correct. Gary Gneiting, director of engineering at Mericle Mechanical, Inc., said a vortex could be one reason at the bottom of a poorly performing system.

“I wonder how many thermosyphon systems had design errors due to a vortex that were never resolved,” Gneiting said. “Now there is one more item to review in all thermosyphon systems to prevent vortices and costly field repairs.”

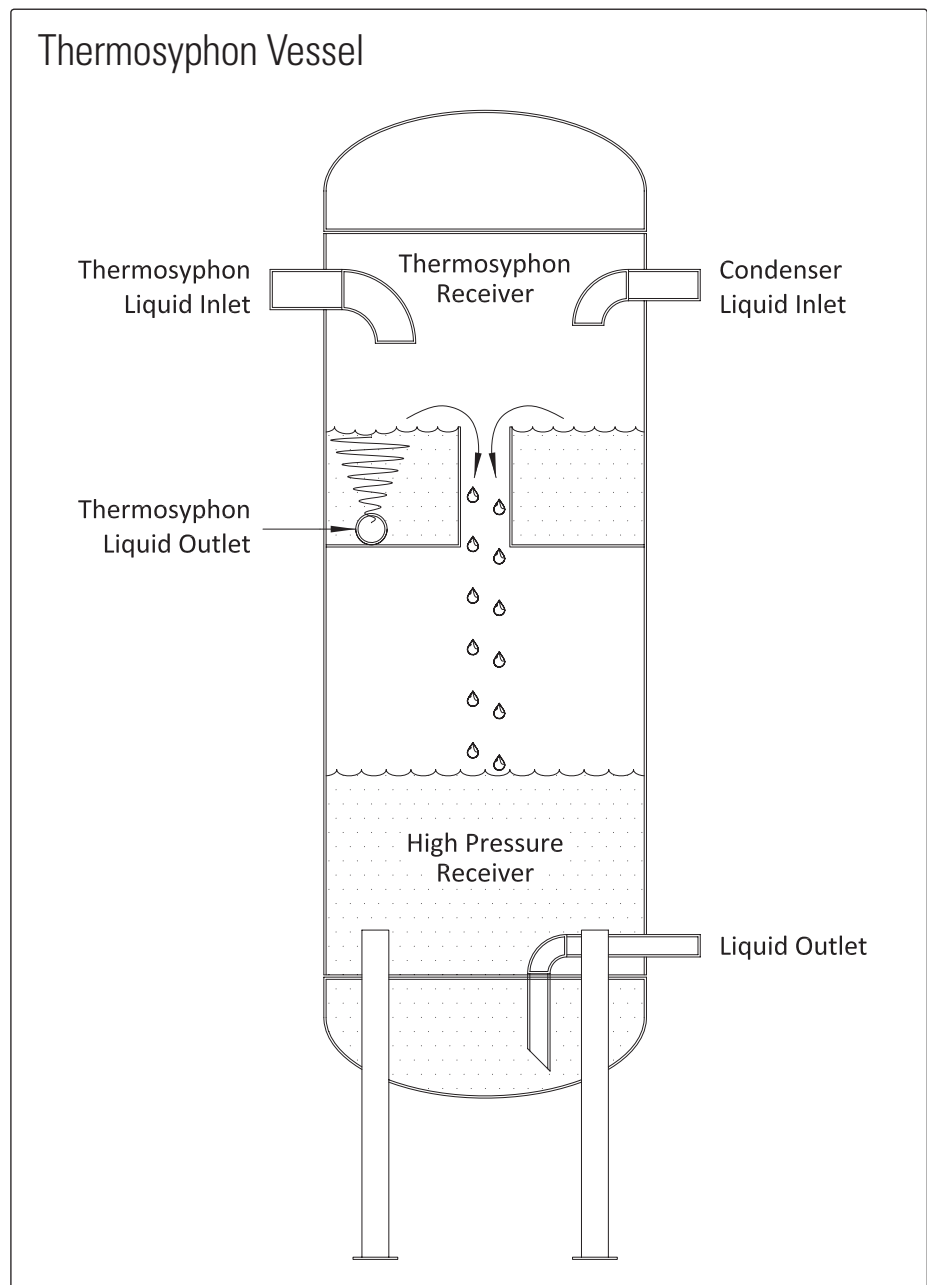
A vortex is a conical, rotating liquid void that forms in a fluid body as a result of a low pressure area. When a vortex occurs, the opening allows gas from the surface to be drawn down through the center of the vortex into the pipes. A vortex can occur in the refrigeration industry in five ways:

1. When oil is drained from oil pots;
2. When liquid enters the high pressure receiver dip tube;
3. When liquid leaves the thermosyphon receiver through the thermosyphon supply line;
4. With pump suction for ammonia recirculators;
5. In water pumps for evaporative condensers.

In the case of a typical pump system, a vortex provides an opening for vapor to enter the liquid stream. Air is then drawn into the system, which inhibits water flow. “The pump is not designed to draw air; it’s made to pump a solid column of water,” Gneiting said. “So instead of 150 gallons per minute of flow, you might only get

10 because you’re moving nothing but air through the system.”

Gneiting said he uncovered the issue with vortices when he reverse-engineered a thermosyphon system at a large ammonia cold storage facility to determine the cause of high discharge temperatures for five ammonia screw compressors. He observed vapor in the thermosyphon supply pipes that



increased significantly when the last screw compressor was operating.

“When four of the screw compressors in the system were running, you could see with sight glasses that it was just liquid, but when five compressors were operating it became overwhelmed with gas. You want to feed liquid, not gas, into your oil cooler. Liquid has a lot of heat transfer capability. When vapor is sent to the oil cooler, the needed heat exchange can’t be accomplished,” he said.

“There was no other explanation for where the gas was coming from than through a vortex,” Gneiting concluded. “It was happening because the liquid level in the thermosyphon vessel was too low.”

To illustrate the issue, Gneiting compared it to watching water flow down the drain in a bathtub. “When the water is high there isn’t a vortex,” he said. “It shows up as the last few inches are going down the drain.”

In researching the issue, Gneiting found a calculation for submergence issued by the Hydraulic Institute that

predicts when vortices will occur. The calculation showed that 11.3 inches liquid height or submergence is necessary to prevent vortices; the thermosyphon system he was studying had only 9.5 inches. Using that discovery, Gneiting calculated that by reducing the thermosyphon ammonia flow by 33 percent, he could reduce the required submergence to 9.4 inches, thus preventing a vortex.

“The more flow you have the more height you need,” he said. “I reduced the flow by de-energizing one of the screw compressors. That was enough to prevent the vortex.”

At that point, the thermosyphon vessel could be replaced, repaired or the 1,000-horsepower screw could be converted to liquid injection. The de-energized screw compressor was operated only three months a year during blast freezing season, so it was decided to add liquid injection instead of replacing the vessel.

“I turned off the oil cooler and injected liquid directly into the screw compressor to perform the oil

cooling,” Gneiting said. “The liquid injection came from a source other than the thermosyphon receiver, so it turned off part of the flow.”

Facility owners can now determine height levels in their thermosyphon system by plugging the appropriate numbers into the formula $S=D + 0.574 * Q * 1/D^{1.5}$, with S equaling submergence inches, D equaling bell diameter inches and Q representing flow rate gallons per minute.

“I’ve been in this business for 35 years and nobody had ever asked me to check for a vortex in a thermosyphon system,” Gneiting said. “This calculation will provide guidance on whether you have a vortex and how best to deal with it. This will become a new item to consider when designing a system. If you have an old system you can check to see if a vortex is the problem.

“The end result is, the industry will have more reliable thermosyphon systems because people can utilize this information to prevent a vortex from forming,” Gneiting said.

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Managing the First 30 Minutes

The ammonia refrigeration industry has long understood that the most critical time during a potential ammonia emergency is the first 30 minutes. The quickness and effectiveness of first responders can mean the difference between a minor, manageable incident, and a chaotic catastrophe.

Once the clock starts ticking, every minute is critical. To successfully control the situation, facilities must prepare in advance, leadership roles must be clearly defined and first responders must be able to take action without waiting for Hazmat teams to arrive on the scene.

Once the clock starts ticking, every minute is critical. To successfully control the situation, facilities must prepare in advance, leadership roles must be clearly defined and first responders must be able to take action without waiting for Hazmat teams to arrive on the scene.

In 2013, the Ammonia Safety and Training Institute worked with IAR to develop a training video and workbook called “Module 5 – Making the First 30 Minutes of Emergency Response Count” that was designed to address this issue – that training is now available at the IAR bookstore.

And module 5 went beyond providing training recommendations around existing federal rules that limited the ability of on-site facility “non-technician responders” from working in the danger area. The training video and workbook went on to show how cer-

tified emergency response technicians were allowed to take action with levels of ammonia vapor (5,000 parts per million) without having to wear a fully encapsulated entry suit. As a result, much-needed shutdown and rescue procedures were not delayed.

But now, ASTI and the International Institute of Ammonia Refrigeration are working with the Occupational Safety and Health Administration and the Environmental Protection Administration on a best management practices standard of operation that simplifies and focuses on-site and public safety first responders to safely engage in the first 30 minutes when

working in less than 5,000 to 10,000 ppm ammonia vapor. Gary Smith, ASTI president, calls this new plan “a game-changer.”

“Our best management practice recommendations will legitimize the 30-minute plan. Time will no longer be wasted as the Emergency Action Plan is being implemented. It’s a new day for a better way,” Smith said. “Plant operators and first responders must be trained and equipped to do more during the first 30 minutes to shut down the threat without losing their “non-responder” protection



afforded under the Emergency Action Plan standard.

“The operators and first responders must act quickly to gauge what is happening so that the Incident Commander can properly set an action plan that contains the problem and moves quickly to protect lives, just as is the case for fire and any other emergency event that they face on a day-to-day basis,” he said. “We want to eliminate the chaos and stop problems when they are small – to prevent injury and minimize the damages of what could otherwise develop into a devastating emergency event.”

Federal guidelines stipulate that trained and equipped refrigeration operators can engage critical operations during an emergency event when they are following a pre-arranged procedure that has been documented as standard operating procedure. An example of this is implementing a hazard zone emergency shutdown procedure. “If you’re working in under 5,000 parts-per-million ammonia vapor and you’re wearing protective clothing that covers all skin, and a self-contained breathing apparatus, there is minimal risk to the responder,” Smith said. “With that in mind, we went back and set a new limit where it is viable for a trained operator working under the scope of an Emergency Action Plan (non-certified emergency responder) to safely initiate the implementation of a SOP that you have already determined will shut down the hazard zone,” he said. “Furthermore, a trained operator may make a rescue if conditions are within the scope of the PPE as defined within the standard of operation.”

ASTI and IIAR are working with OSHA and EPA so that these changes become recognized and generally accepted good engineering practices. The RAGAGEP could then be used by private and public safety responders to demonstrate how they can address emergencies without being fully certified emergency response technicians.

“OSHA and EPA understand the need for our facilities to respond early to prevent a minor situation from turning into something major,” said David Rule, IIAR president. “They understand that our intent is to protect the safety of the workers and prevent any neighbors from being put at risk.”

ASTI has been communicating with fire departments and other first responders to educate them on how the new plan will work. ASTI will hold 15 safety days across the county this year highlighting its best plan for managing the first 30 minutes. ASTI plans live releases of less than 10,000 parts-per-million in four states that will demonstrate to lead responders how to get in and get out, and do what they need in 10 minutes without any ammonia safety issues.

“It’s really important for our facilities to train and prepare their people,” Rule said. “They need to know the right steps so they can take action to prevent a minor situation from developing into a critical situation.

“We also want to reach out to first responders to ensure we have good communication and that they are properly trained to address an ammonia release,” he said.

ASTI is developing a command-team presence that works with public safety response, so that a first responder is immediately met by an Incident Commander who provides a “Conditions-Actions-Needs” (C-A-N) report that clearly sets the stage for joint operations. The public safety first responders should work in sync with the facility response team to complete the initial response of the emergency shutdown or rescue.

Finally, the plan recommends that facilities adopt a pre-emergency readiness procedure. If an event is taking place that poses an increased level of risk, such as opening up the system to change a valve, the appropriate emergency personnel should be informed in advance.

“It only takes 5 to 10 minutes to set up the pre-emergency readiness checklist (assuring that safety measures, PPE, and control points are reviewed, and that the facility IC is notified). So if something goes wrong, the lead responder contacts the plant incident commander, who notifies the evacuation group supervisor and the notification leader and the action plan begins without delay. Every time you do that the team has a chance to set up pre-emergency readiness they exercise their skills and get a better understanding of how to engage their positions,” he said.

Smith concluded, “With this plan we now have a methodology. We have playbooks for life safety and emergency shutdown procedures that are engaging and easy to follow. If the emergency event continues to grow beyond the first 30 minutes (discovery and initial response phases), the first responder team will be ready to transition command and control to the in-coming hazmat technician responders. A sustained response will occur that will eventually lead to the termination phase, and the emergency event will have a much less costly ending than has often been the case in the past.”

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Are You a Creature of Habit?

BY KEM RUSSELL

The lessons we learn come from many places, some from experiences within our work environment and many outside of that environment. Consider this question, “Are you or a co-worker properly prepared to safely perform your assigned responsibilities?” “Have your past training and experiences formed a solid base that will help you complete your activity not only safely, but in an effective and efficient manner?” Or are you more a creature of habit, and do the same thing time and again because, “Well, it

until you add another task and start talking on your cell phone. Then, that long learned driving skill can suddenly turn very dangerous.

Whether you are a refrigeration operator, a supervisor, a department manager or a CEO . . . think about what you do. Consider all your daily activities. Are you in the 87 percent group or the 13 percent group? Some of the activities you complete that have become more of a habit than an activity you stop and think about could have consequences. Here are some examples:

This example is from personal experience,

Are we all creatures of habit? Statistics have shown that 87 percent of people automatically go right when they enter a store. (Probably because they're right-handed.) We shop in the same stores, eat the same food, follow the same routine and use the same sources for information.

worked in the past”, or “That’s the way the old guy taught me.”

Are we all creatures of habit? Statistics have shown that 87 percent of people automatically go right when they enter a store. (Probably because they’re right-handed.) We shop in the same stores, eat the same food, follow the same routine and use the same sources for information.

You may be in the group - 13 percent of people - that act differently, but chances are you perform more of your activities during your day out of habit than through a conscious, thought driven process. We find comfort in our habits, possibly because we don’t have to think about what we are doing. It’s easy. It’s automatic. It’s kind of like driving a car, something that you have done for years,

but you may have had a similar experience. I had a lot on my mind as I drove to an important project meeting. Thoughts were churning as I headed through town trying to keep up my speed and avoid slowdowns. Not long after leaving the office I got a call (hands free) from one of our technicians. After talking to him it seemed like only seconds had past when I suddenly realized that I was almost at the meeting location. With the realization of where I was I also realized I had no idea of what had happened on the drive to get there. Did I obey the traffic laws? Stop at the stop signs and stop lights? It was unnerving. How many other people are out there driving around and not actually thinking about driving, but focused on something else like I was?



LESSON

LEARNED?

Another example actually happened many years ago at a large food distribution center. The head of maintenance asked one of the staff to clean up the main electrical distribution room. “Make sure you get all the dust and cobwebs, since those can cause us problems with the switch gear,” he said. Knowing what he was supposed to do, the cleaner went into the electrical room, and as he always did in the past, he used a combination of an air hose to blow things clean and a push broom to sweep up the mess.

Upon opening one of the large panel doors in the electrical room, he spotted a big mess of dust and cobwebs, just out of reach of the air hose. So, to get closer, he puts a 6 foot ¼” pipe extension on the end of the air hose to reach the mess. This person was not thinking about where he was and what he was doing. He had developed a routine habit of improvising in difficult situations in order to get things clean, and this was the way he always did his job.

Unfortunately, in this case, the dusty mess he went to reach was in the back of the main electrical distribution panel, and he stuck his 6 foot metal pipe between the bus bars. It was a miracle that the staff member was not killed, and this scenario drives home a central point – routine can blind us to new operating situations, or new environmental factors that change the way we should work.

Another example of this happened several years ago. At another facility, one of the refrigeration operator’s maintenance tasks was to check for and drain oil from the drop leg of the system surge drums.

There were many surge drums at this facility, and for the operator, this had become a very routine task that he had completed many, many times. Probably because he had done this so many times and nothing happened, he no longer wore or even had with him his full faced ammonia cartridge mask, nor his gloves. Besides, the previous, now retired, refrigeration operator that had trained him never used a mask or gloves.

He gave no thought to the fact that there shouldn't be that much oil to routinely drain at the surge drums. And this particular day, as he had just opened the oil drain valve, his cell phone rang. Since it was a little smelly right there at the oil drain valve, he stood up and turned his back on the valve to answer the call.

A short time into the phone conversation, he suddenly noticed that the ammonia smell was getting much stronger. That smell sensation that jarred his mind off the phone conversation was quickly followed by the thought "I left the oil drain valve open!" Turning around, he was faced with a growing white ammonia cloud that filled the mezzanine hallway.

What had become a habit – not having the appropriate personal protective equipment – made a bad

mistake much worse. The only safe course of action was to leave the area, and fortunately he did have a safe escape route. But now he had to figure out how to isolate the leak from a remote location.

Obviously some habits are good. Getting in the habit of wearing hearing and eye protection and other appropriate PPE can protect us from sudden or longer term physical injuries. Getting in a habit of not using appropriate PPE can have serious consequences. Most of us, at least in some aspects of our lives, are in that 87 percent group I mentioned earlier where we do things without much, if any, thought. So how do we get into that 13 percent group where conscious thoughts drive our actions?

One good way is to change what we do. Changing what we do is a learning experience, and there are always more things we can learn. As in the examples above, we can improve, and we can do our work in a safer and possibly in a more efficient and effective manner. For those of us that are industrial ammonia refrigeration operators, designers, contractors, manufacturers, and educators, we all have opportunities available to us that can put us in that 13 percent group.

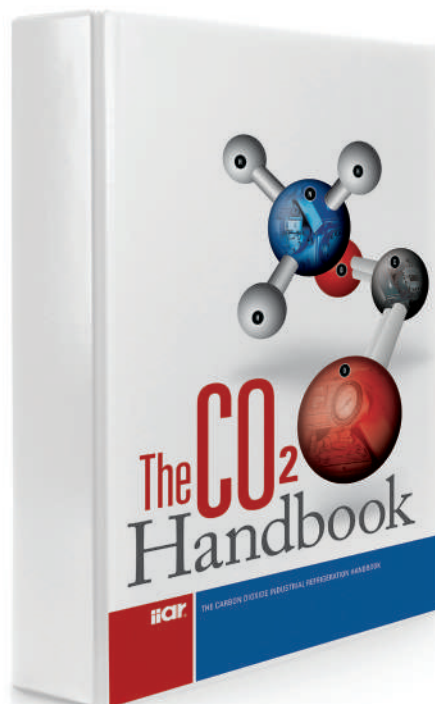
Some of these opportunities are right in front of us, and the best way to take advantage of them is to get involved in the work of the IIAR committees. Those committees are: Standards, Safety, Code, Piping, Compliance Guidelines, Education, International, Marketing, Research, Government Relations, CO₂, and Conference. What a great place to help others learn from what you've learned, and also to learn things you didn't even realize you didn't know! You also meet other people who can be very helpful resources.

Other ways to expand your industry-specific knowledge are to attend IIAR webinars, study and learn from the many IIAR publications, from Industry books, bulletins, standards, and videos.

Access to past technical papers on numerous subjects is also a great source of institutional knowledge. They are a valuable and helpful resource of information, as are the many activities at the IIAR conference, and, of course, Condenser articles.

You can change from a creature of habit. Get motivated as you get involved. Continue learning and improving. Remember as you learn you are not trying to be smarter or better than everyone else, but smarter and better than you were.

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RELATIONS

BY LOWELL RANDEL, IIAR GOVERNMENT RELATIONS DIRECTOR

In February 2016, the Occupational Safety and Health Administration (OSHA) announced that it is initiating a Small Business Advocacy Review (SBAR) Panel in order to get feedback on several potential revisions to OSHA's Process Safety Management Program (PSM) standard. The effort comes as a part of the Obama Administration's implementation of Executive Order 13650, "Improving Chemical Facility Safety and Security." Under the Executive Order, OSHA has been charged to identify issues related to modernizing the PSM Standard with the goal of preventing major chemical accidents. In 2013, OSHA released a Request for Information (RFI) seeking input on potential changes to PSM. The RFI served as a prelude to rulemaking and enabled groups like IIAR to express concerns about potential changes to PSM. OSHA has now had the chance to go through the comments received in response to the RFI, including those from the coalition led by IIAR. The next step in the regulatory process is the convening of a SBAR Panel.

The Small Business Regulatory Enforcement Fairness Act requires OSHA to convene a SBAR Panel for all rulemakings that could have a significant impact on small businesses subject to the regulation. Since a large number of small businesses are subject to PSM, OSHA is compelled to convene a panel. The SBAR Panel will consist of members from OSHA, the Small Business Administration's Office of Advocacy (SBA's Office of Advocacy, or Advocacy), and the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB). The SBAR Panel will provide an opportunity for Small Entity Representatives (SERs) to provide input on how the Agency's draft proposals may impact

small businesses and other small entities, and suggest ways to minimize those impacts while meeting OSHA's statutory goals.

OSHA has stated that it is conducting the SBAR Panel early in the regulatory process in the interest of assuring that the Panel's report and recommendations can be fully considered in any subsequent rulemaking activities by the Agency. According to OSHA, the agency has not yet decided the full scope of issues that will be considered in a proposed rulemaking and has not yet drafted regulatory text. However, OSHA has provided the following list of PSM topics that will be considered by the SBAR Panel:

- Clarifying the PSM Exemption for Atmospheric Storage Tanks
- Oil and Gas-Well Drilling and Servicing
- Oil and Gas-Production Facilities
- Expanding PSM Coverage and Requirements for Reactivity Hazards
- Expanding the scope of Paragraph (e) by requiring safer technology and alternatives analysis
- Updating the List of Highly Hazardous Chemicals in Appendix A of the PSM Standard
- Revising the PSM Standard To Require Additional Management-System Elements
- Amending Paragraph (d) of the PSM Standard To Require Evaluation of Updates to Applicable RAGAGEP
- Clarifying the PSM Standard by Adding a Definition for RAGAGEP
- Expanding the Scope of Paragraph (j) of the PSM Standard To Cover the Mechanical Integrity of Any Safety-Critical Equipment
- Revising Paragraph (n) of the PSM Standard To Require Coordination of Emergency Planning With Local

Emergency-Response Authorities

- Revising Paragraph (o) of the PSM Standard To Require Third-Party Compliance Audits
- Expanding the Requirements of § 1910.109 To Cover Dismantling and Disposal of Explosives, Blasting Agents, and Pyrotechnics
- Several additional minor modifications which largely codify existing OSHA interpretations of the PSM standard
- Solicit feedback on any similar provision of EPA's RMP rule and the PSM standard that could be streamlined.

Many of these topics, which were also included in the PSM RFI, would impact IIAR members with over 10,000 pounds of ammonia. While OSHA has not released any further details regarding the topics listed above, the RFI gives some perspective on the direction the agency may go. Below is a summary of the comments that IIAR submitted on some of the proposals of most interest and concern:

Expanding the scope of Paragraph (e) by requiring safer technology and alternatives analysis

Advancing inherently safety technology (IST) policies is a priority for both OSHA and EPA and the agencies published IST guidance in 2015. While the concept of utilizing inherently safer technologies is appropriate, the regulatory burden of requiring costly IST reviews tends to stifle innovation. For those companies who are already looking to improve safety by implementing IST options, a formal IST review would add costs to a process by forcing them to document the activities they are already performing. Small op-

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erations might not have the manpower or expertise to do this and lack the resources to hire it out cost effectively.

Revising the PSM Standard to Require Additional Management-System Elements

Revising the PSM Standard to require additional management-system elements raises a number of questions and concerns. Because the PSM Standard is supposed to be a performance-based, there are concerns about specifying management-system metrics required by those subject to the standard. Requiring facilities to use and share metrics is more prescriptive than a performance-based standard should mandate. In addition, the PSM Standard already includes management practices in almost all elements.

Amending Paragraph (d) of the PSM Standard to Require Evaluation of Updates to Applicable RAGAGEP

The issue of how existing facilities evaluate updates to applicable RAGAGEP is an important and sensitive topic. As IAR standards represent the primary source material for RAGAGEP in most ammonia refrigeration facilities, IAR believes that guidance on the process for evaluating updates should be provided by standard developers. The addition of a regulatory requirement to evaluate updates to applicable RAGAGEP is not necessary. The Management of Change (MOC) and Process Hazards Analysis (PHA) sections of PSM and RMP, coupled with guidance from organizations like IAR are sufficient to identify risks without a stand-alone regulatory requirement for evaluation of RAGAGEP.

Clarifying the PSM Standard by Adding a Definition for RAGAGEP

Adding a definition for RAGAGEP could be useful to help owners better understand requirements under the standard. A definition for RAGAGEP may also be helpful in reducing the instances of OSHA inspectors citing standards that are not as applicable to a given type of facility. For example, there have been occasions where OSHA inspectors have applied other industry standards to ammonia refrigeration facilities. Better defining

RAGAGEP can reduce the misapplication of standards by inspectors and facilitate better understanding and application by facility owners. A definition of RAGAGEP should include methods and “whys”, but not go so far as how to do something like inspect, which becomes a maintenance procedure. A definition of RAGAGEP should also

not take away the ability of a facility to identify which RAGAGEP they are applying to their operations.

Expanding the Scope of Paragraph (j) of the PSM Standard to Cover the Mechanical Integrity of Any Safety-Critical Equipment

Conceptually, the proposal to expand the coverage of the mechanical

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integrity element to all safety-critical equipment seems reasonable. For the ammonia refrigeration industry, covered facilities already must identify components, controls and PM frequency for them in accordance with OEM recommendations. In addition, IIAR is currently working on IIAR 6 that will be designed to specify the mechanical integrity requirements for all safety-critical equipment in an ammonia refrigeration system.

However, for such a change to be effective, a workable definition of “safety-critical” must be developed. The determination of what is safety-critical can be subject to broad interpretation. For example, the loss of any utility within the control of the owner could be construed to represent a significant risk to the process, even when the process is designed to safely shutdown on a loss of utilities. However, there would

likely be no special requirement for the utilities out of control of the owner.

Revising Paragraph (n) of the PSM Standard to Require Coordination of Emergency Planning With Local Emergency-Response Authorities

Coordination with local emergency planning and response authorities is an important aspect of safety. Such coordination is already specifically required through EPA regulations such as Hazard Communication, Emergency Action and HAZWOPER. As a result, there is not a direct benefit of OSHA adding this recommendation into the PSM code. Rather than an additional regulations to PSM, OSHA should reference other federal codes applicable to emergency response such that there is not a burden created if one code is updated while another is not. This could cause contradiction and complexity/confusion for implementation.

Revising Paragraph (o) of the PSM Standard to Require Third-Party Compliance Audits

Compliance audits are useful tools for evaluating a facility’s safety. However, IIAR is concerned about the intended definition of “third-party”. Third-party audits should not be limited to hiring outside personnel to perform the audit. Facilities should have the flexibility to choose external parties as well as utilize internal safety experts from other facilities or corporate headquarters to perform audits.

OSHA anticipates formally convening the SBAR Panel in February 2016 and engaging with SERs in March 2016. IIAR will continue to closely monitor the SBAR Panel and maintain an active engagement with OSHA to ensure that the perspectives of IIAR and its members are effectively communicated throughout the rulemaking process.



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Noncondensable Gases in Ammonia Refrigeration Systems

Noncondensable gases in industrial refrigeration systems are common, and although it may take years for those gases to accumulate, they must be addressed. If not, the steady accumulation can become problematic and have an adverse effect on systems.

Tony Lundell, director of standards and safety at IIAR, hosted a webinar to help owners, designers, in-house refrigeration operators and technicians understand the adverse effects that noncondensable gases can have on industrial refrigeration systems.

Noncondensable gases in industrial refrigeration systems are common, and although it may take years for those gases to accumulate, they must be addressed. If not, the steady accumulation can become problematic and have an adverse effect on systems.

Lundell explained that the noncondensable gasses are vapors that accumulate and have their own pressure. If noncondensable gases accumulate in a system, head pressure increases – due to the insulating properties of the noncondensable gases on condenser surfaces, which restricts the heat-exchanging process.

He added that the total condensing pressure is additive because the total condensing pressure is equal to the pressure due to the refrigerant plus the pressure due to the noncondensable gases.

Higher head pressures cause higher compressor discharge temperatures, longer compressor and condenser fan runtime, and increased wear and tear on equipment. They can also lead to a possible increase in system leaks, reduced system efficiency, a risk of reduced facility production capabilities

and an overall increase in system energy costs.

Water infiltrates into the system with air infiltration and, like noncondensable gases, must be removed. However, there is a difference in the techniques between a purger that removes the non-condensable gas contamination and a distiller that removes the water contamination.

Lundell said a purger chills the foul gas — the term for refrigerant contaminated with noncondensable gases — so the refrigerant condenses out and separates from the noncondensables, allowing the foul gas to be removed from the system. A distiller

heats the refrigerant to boil it off, separating it from the water so the water can be isolated and removed.

Overall, this results in an increase in system maintenance. “The elimination of any existing noncondensable gases in the ammonia refrigeration system will reduce your energy usage. This is a quick return on investment,” Lundell said.

During the webinar, Lundell reviewed the infiltration of noncondensable gases from inadequate evacuations and vacuum leaks, dissociation of the refrigerant, and compressor-oil breakdown.

He said there are several sources that can expose internal surfaces to the elements: rain, snow, sleet, high humidity, construction, inadequate evacuations after installation and before start-up, as well as after maintenance service in which the closed-circuit system needed to be opened.



Lundell said the “purity” of the ammonia is critical and said that complex chemical reactions occur between the system’s oil, oxygen, water and ammonia refrigerant. Problems can arise if a system is inadvertently filled or the system’s charge is replenished with contaminated or non-refrigeration grade ammonia.

“Unless steps are directly taken to control the amount of infiltration, there will be a continuous increase in contamination in the system over a period of time,” Lundell warned.

The webinar covered the increasing difference between the observed condensing pressure and the saturation pressure corresponding to the liquid refrigerant temperature exiting the condenser, as well as how to measure for excess pressure.

Operators must remove the contamination of noncondensable gases using a purging technique. Lundell said condenser coil outlets with appropriate drain traps are typically the most used location for purger-point connections.

Purging can be done either manually or automatically. Lundell said manual purging is troublesome and wastes refrigerant. What’s more, discharges may cause nuisances and regulatory issues and the contamination is easily neglected until problems exist.

With automatic purging, neither time nor refrigerant is wasted, Lundell said. Simple training with minimal risks can be easily provided and the contamination does not get neglected.

An automatic purger counts the purge point and purge times. The purge cycle and times are automatically reduced with the elimination of the foul gas and nuisances and regulatory issues are avoided.

Lundell said use of a “bubbler” dilutes any residual amounts of ammonia particles into water before it exists, containing the foul-gas contamination to a drain line.

Estimating purger refrigerant loss amounts was reviewed and discussed utilizing a developed chart. Purge rates can be verified by the purger manufacturer and used to estimate the amount of refrigerant lost. The estimate results can be used for the annual Form R submissions.

“The adverse effects of noncondensable gases in an ammonia refrigeration system may [occur for] years before the problem is recognized and addressed.”

Tony Lundell, director of standards and safety at IIAR

“The adverse effects of noncondensable gases in an ammonia refrigeration system may [occur for] years before the problem is recognized and addressed,” Lundell said.

In the meantime, room temperatures may have been compromised, more compressors may have been operated, suction pressures may have been lowered and additional electrical energy may have been consumed and wasted.

As a result of the contamination, energy cost increases and capacity is lost. “If an excess pressure of 20 pounds per square inch gauge condition exists, there is a 10 percent consumption increase and the compressor capacity is reduced an estimated 5 percent,” Lundell said.

During the session, Lundell went into detail on what the estimated savings could be in lower energy costs from removing the contamination. IIAR members can access Lundell’s webinar via the IIAR member website in the member only section.

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Understanding Your Cooling Capacity

For owners of a cold storage warehouse or food processing facility, selecting the right air cooler can significantly affect energy consumption. Purchasing properly-sized, efficient evaporators to produce maximum capacity with minimal fan power can mean the difference between energy overages and energy savings. And in order to make the best decision, facility owners must understand how the cooling capacities of air coolers are determined.

To do that, the gradients of temperatures in large rooms should be considered. The air coming directly off the evaporator is the coldest, while the air filtering out through the room is somewhat warmer, and the air coming back onto the coil is the warmest.

Using average room temperature when analyzing a refrigeration space sounds logical, but it's also essential to understand how coils are selected and rated. Applying incorrect ratings can result in the purchase of undersized air coolers that appear to satisfy the calculated refrigeration load. In that scenario, lower-than-expected operating suction temperatures will increase energy consumption.

"Selecting an evaporator comes down to making sure you understand the impact it will have on the resulting room temperature and what that means in terms of your operating cost and product quality," said John Kollasch, vice president of industrial refrigeration marketing at EVAPCO, Inc. "With the TD method, the equipment first cost will be higher but the operating cost will be lower. Using the DTM method at the same temperature difference will result in smaller evaporators, but they will have to run longer or will require a lower suction temperature to maintain the design room temperature."

"If you select the DTM method you must be willing to accept that the design room temperature is in reality the average as opposed to the maximum temperature," he said. "The difference between the temperatures impacts the performance of your operation and

what is being stored or processed. The warmer temperature resulting from the DTM method will have an impact. The TD method defines room temperature as the air entering the coil which is the warmest temperature in the room. The payoff for the end user who purchases coils rated for the TD method is the assurance of maintaining room temperature at the design suction with the fewest number of hours of operation."

The rating system commonly used in the United States is the TD method, which measures the air temperature entering the coil face minus the saturated refrigerant temperature to establish the rating temperature difference.

DTM rated capacity at the same temperature difference may be higher than the TD rated ratings for the same air cooler operating under the same conditions.

And that's because the effective initial temperature difference the evaporator coil encounters is higher by approximately one-half of the air temperature change. Therefore, the same evaporator can appear to produce more cooling capacity simply by changing the definition of the temperature difference.

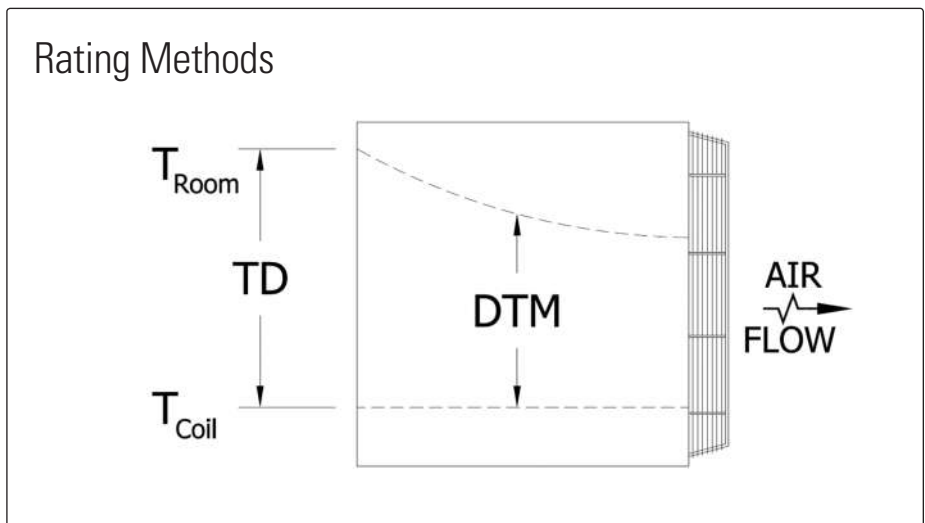
In that way, confusing ratings can result in a decrease in expected capacity. For example, if both rating methods use a 10-degree temperature difference, the air entering the coil is -10 degrees for a TD-rated coil, but only -5.8 degrees for a DTM coil.



When a DTM-rated coil is confused with a TD rating, the difference in capacity can approach 50 percent.

And energy savings vary depending on the size of the equipment and the room being cooled. Although air coolers using DTM ratings are smaller and less costly for the same cooling load and temperature difference than those using TD ratings, it stands to reason that DTM rated coolers will operate with a lower suction temperature for the same cooling load. This results in greater power consumption. The incremental return on investment on reduced power consumption using TD ratings can be as high as 156 percent for a single-stage compression system and 52 percent for a two-stage compression system, depending on the room temperature, resulting in pay-back as quickly as eight months.

The bottom line, said Kollasch, is that misunderstanding cooling ratings can result in the failure of a refrigeration system to perform as expected.



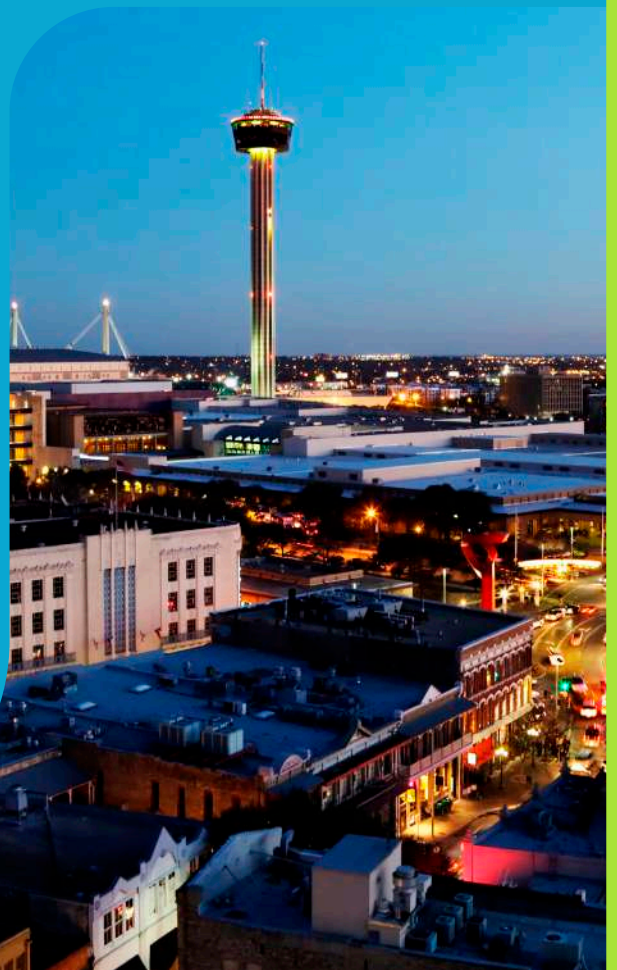


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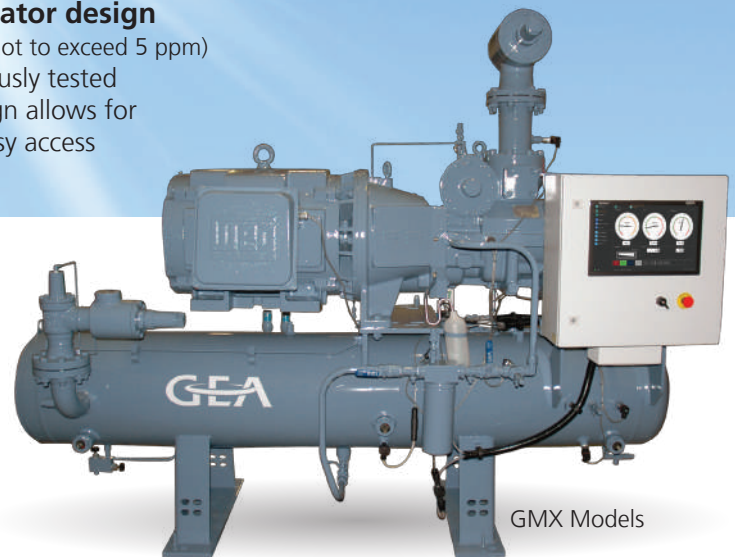
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