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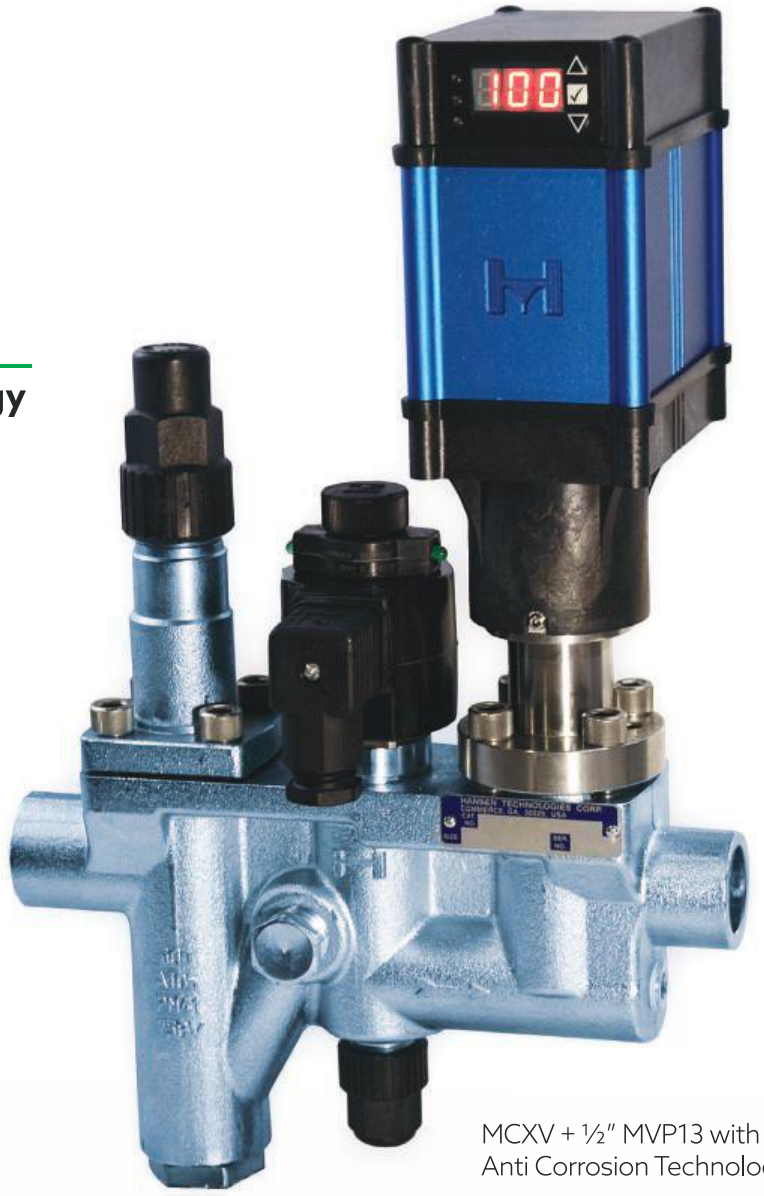

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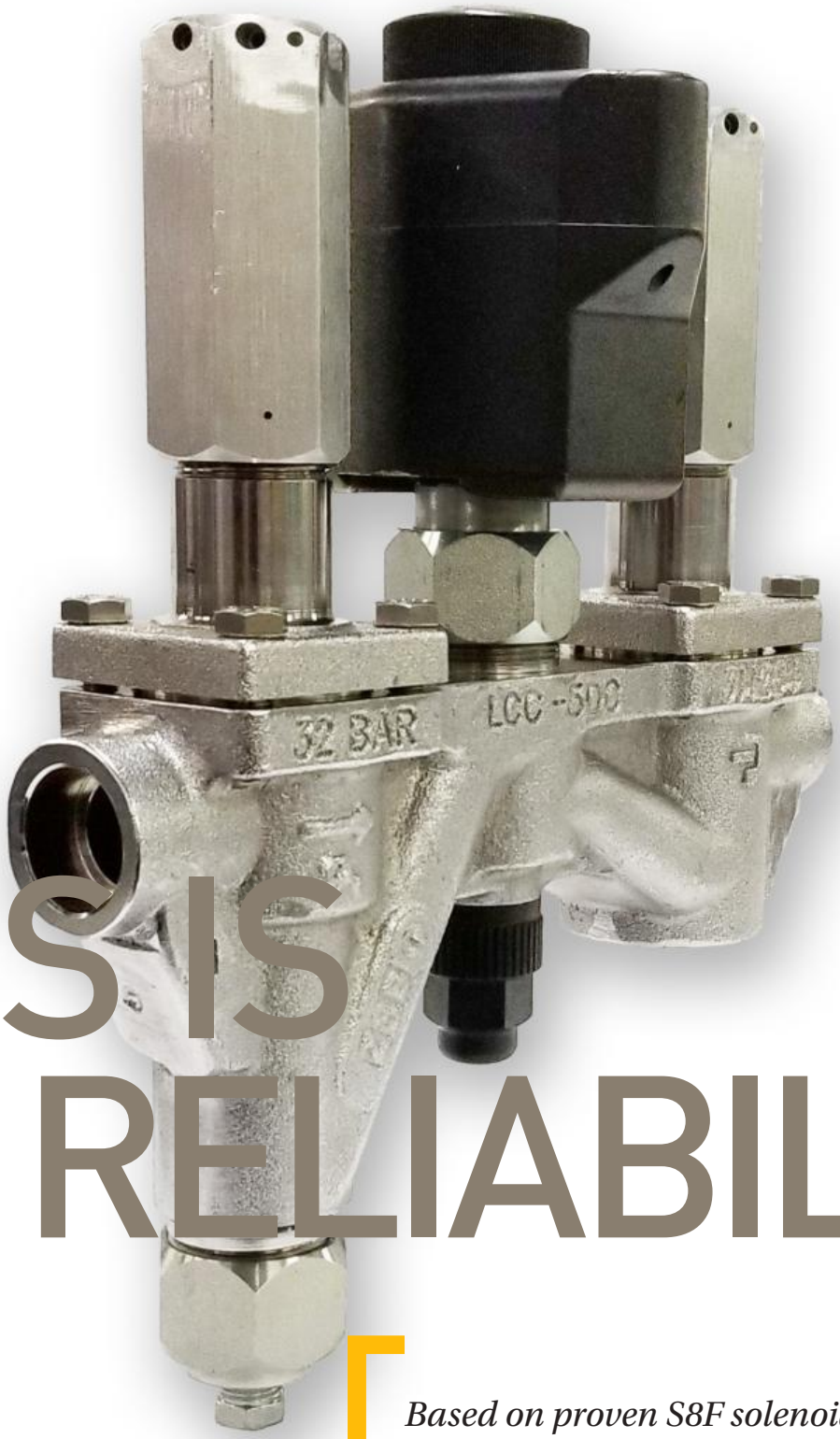


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The global need for cold storage space is increasing dramatically, driven by growth in the world's population, increased varieties of perishable commodities and consumer demand for fresh produce year-round. And these factors are pushing occupancy rates at cold-storage facilities to an all-time high.




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# president's MESSAGE

BY DAVE RULE

Business as usual is a term that has never applied well to industrial refrigeration. Our economic sector is constantly changing to meet the demands of a rapidly evolving supply chain, as we examine in this month's cover story. Regulatory change, new technology and equipment development has propelled us into ever broader markets and applications for natural refrigerants.

As change comes quickly, we're evolving right along with it - to meet new regulatory challenges, new operational challenges, and increasingly, to harness new markets and move into entirely different environments.

That forward propulsion has only served to re-energize the traditional industrial applications of ammonia and $CO_2$, and it has opened the door to new opportunities to learn about non-traditional applications, consider new markets, and make our own expertise available in business areas new to natural refrigerants.

I'm proud to announce that this year, we're broadening our conference educational program to make room for more networking, more technical papers and workshops and new outreach opportunities in the commercial as well as industrial refrigeration industry.

The 2019 conference will be fairly unique compared to the conferences we've produced in the past because we're partnering for the first time ever with the North American Sustainable Refrigeration Council to develop a dual track of technical papers, panels and workshops.

This partnership is one of the ways IIAR can provide members a broader look at the new technology and equipment driving the growth of natural refrigerants everywhere. And it's also a way to expand our educational resources and commitment to safety to a new group with less extensive experience handling ammonia and other natural refrigerants.

We've developed our typical tech paper and educational programs to form the core of our upcoming conference so we can deliver our usual extensive review of industrial applications. Built on that base, the new educational track will also include resources for light and commercial installations in typical food processing centers, industrial cold storage industries and the newer food retail sectors of our market.

This conference will be unique in that we'll see many new engineers and professionals working in our industry in these new areas, who will benefit from the broad experience and practical knowledge of the traditional IIAR member base.

Conversely, it will be a great opportunity for those among us in the traditional heavy industrial space to learn about the new technology, new operational challenges and educational demands of an emerging commercial sector. I'm looking forward to this opportunity to make new friends and provide a broader opportunity for networking to all IIAR and NASRC members.

At the same time, our exhibition space will be filled with our industry's best technology and services, along with the addition of new equipment and systems that serve the commercial sector. I hope you'll join me in learning about how natural refrigerants are evolving to meet these new industry opportunities.

The IIAR Expo itself is in a fantastic location in 2019. It's my pleasure to invite everyone to Phoenix, including our first-timers and all of our new end users, engineers and contractors who are attending as NASRC members.

We have a great venue lined up. All major hotels are within easy walking distance of an exceptional convention center, and as usual, there will be many social activities and opportunities to enjoy surrounding restaurants and entertainment.

Our conference registration, special education and technical tracks are currently being offered at a significantly reduced cost to members, and we're doing this to encourage your participation in this particular conference event.

It will be unique because it represents the first time IIAR has formally participated in the food retail and commercial sector. We have the opportunity to take a leadership role in addressing the use of natural refrigerants in all markets, and there's no better place to do that than an IIAR conference, where all of our enthusiasm and professionalism is on display.

Together, we must also make our voice heard in this time of significant change for our industry. As you will read in the following pages of this Condenser issue, there are some significant developments going on not just in the regulatory world, but also in the operating landscape defined by code development.

This conference will be an important moment – for all of us, across all sectors of our industry, old and new, to take a leadership role in defining how natural refrigerants will be used in the near future and beyond.

I'm looking forward to this challenge and hope to see you all in Phoenix!

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# chairman's MESSAGE

MIKE LYNCH

In this issue of the Condenser, you'll find several stories focused on new regulatory changes, code updates and the work of our many IIAR committees to keep the standards, education, and outreach efforts of our industry current and relevant.

These last three things: standards, education, and outreach, are perhaps the most important activities IIAR members conduct for each other and for the industrial refrigeration industry on the whole. And they are especially important during this time of rapid change, when regulatory developments as well as the evolution of new technology are shaping the business landscape for everyone.

IIAR is currently working to complete many new publications, and is more active than ever on regulatory issues, representing the rights of members and the operational challenges we deal with every day. And every day, we are taking leadership roles on the policies and procedures that govern how we will operate now, and in the future.

The rapid expansion of natural refrigerants into new markets, like food retail and commercial applications is a testament to how effective your organization has been at advocating for natural refrigerants and supporting their use.

As ammonia and $CO_2$ are put into new environments with new technology, that advocacy and support is more important than ever before. Now is the time for anyone involved in our industry to volunteer their time, knowledge and expertise to strengthen these pursuits.

The best way to do that, of course, is to become an IIAR member if you aren't one already, and to participate in IIAR's technical programs and the activities of our committees.

One of the best opportunities to get involved is right around the corner, the 2019 IIAR Conference and Expo in Phoenix.

At this conference, your input and participation is especially important because the North American Sustainable Refrigeration Council and IIAR are partnering to offer a new, expanded technical program and networking opportunity for NASRC's food retail and commercial members.

NASRC is an environmental nonprofit taking action to advance natural refrigerants in order to shape a more sustainable future for refrigeration.

We're excited to invite this new group of engineers, contractors and end users to learn about the application of natural refrigerants in their sectors, and I hope you'll join me in extending an enthusiastic welcome.

As IIAR president Dave Rule mentions in his column in this Condenser issue, this conference will have a double track program. We'll continue our usual focus on heavy industrial and traditional refrigeration systems. Meanwhile, the new program track will address engineering topics like food processing, retail and supermarket applications for natural refrigerants. Attendees will be able to select the tech papers, panels and workshops that enrich their own professional experience and learn about new areas that may be outside their operating environment.

In fact, one of the main goals for the 2019 conference is to bring together professionals from two traditionally separated markets, commercial and industrial, so that each group can learn from the other. IIAR is developing this upcoming conference with that goal in mind – to bring a broader educational experience to everyone.

As ammonia and $CO_2$ move into commercial applications, your experience as an IIAR member will be invaluable. Sharing our educational information and resources is one of the best ways we can break down barriers to commercial adoption.

The 2019 conference will be the first time IIAR takes a formal role in helping contribute to the training, safety and education for everyone involved in this new sector.

As new technologies that use ammonia and $CO_2$ expand, the new business opportunities for natural refrigerants in the commercial space will expand as well. And for those of us not working in those new markets, the wider use of ammonia and $CO_2$ means that we will see a broader embrace of the training and educational resources that define our industry as well as the advocacy that sustains it.

Our education program in Phoenix will feature a Sunday educational session focused on energy optimization.

And as always, the IIAR Expo hall will highlight the latest designs in cutting-edge commercial and industrial refrigeration equipment. With more than 150 exhibitors in attendance, the exhibition hall hosts product displays from the industry's leading manufacturers and service providers.

One of the most important functions of our annual conference is to provide a place for our committees to review their work, set new yearly goals and find new IIAR member volunteers.

As we close out 2018 and look forward to a new cycle of growth for our organization, I'd like to encourage you to explore our committee work and get involved. The projects our committees complete – from standards creation to safety guidelines to education initiatives are all the basic, vital activities that make a real difference in our regulatory and operating environment.

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# FRESH & Fast:

## HOW NEW CONSUMER EXPECTATIONS HAVE STOKED RECORD COLD STORAGE DEMAND

**The global need for cold storage space is increasing dramatically, driven by growth in the world's population, increased varieties of perishable commodities and consumer demand for fresh produce year-round rather than just when it is in season.**

Occupancy rates at cold-storage facilities are at an all-time high, said Corey Rosenbusch, president of the Global Cold Chain Alliance. "There is definitely growing demand," he said. "The industry feels like we're in a good position right now with supply and demand, but there is pressure for more space."

Ted Prince, chief operating officer at Tiger Cool Express, a provider of cold-chain transportation solutions, said the food and produce industry has gone global. "People are used to seeing grapes when they walk into the supermarket. They don't think about where they are coming from," he said.

A year ago, John Naylor, president of Western Distribution Services, a cold-storage provider based in Burien, Washington, built a new, 241,000-square-foot facility and filled it in just 10 weeks. "That tells you the demand," he said.

Naylor's warehouse came online just a couple of weeks ahead of the Northwest salmon season. "They fish for a short amount of time, we store it, and it moves out over the next 10-11 months until the next season," Naylor said, adding that the company augments the salmon business with other business. "We have a freezer and chill space. We also do a fair amount of retail for store deliveries and a lot of pick and pack and value-added services."

When Michael Winburn, vice president of operations at Shetakis Wholesalers/Cold Storage Solutions, based in North Las Vegas, was looking for a new building several years ago, he found one that had double the freezer space he needed. "We went from 40-percent full to over 100-percent full," he said. "I wish I could take on more."

Today's consumers have more choices than ever, and the proliferation of product options has had an impact on storage needs. "All of that has to go somewhere," Rosenbusch said, adding that several factors are contributing to the capacity crunch. "The biggest is manufacturers are starting to build up inventory. After 2008 we saw food companies lean down their inventory and get as much of that inventory off of their balance sheets as possible. Now that the economy has come back somewhat, the food-processing companies and manufacturers are starting to rebuild their inventory."

Prince said he is seeing an increased amount of health and beauty products and higher-end wine and beer moving via refrigerated container. Tiger Cool Express supplies 53-foot, intermodal refrigerated containers that can move on highways or by rail. It works directly with growers, retail customers, produce brokers, manufacturers and some third parties.

Seasonality issues also impact capacity, Rosenbusch said. "There is a big catch up in the Northwest with seafood that will fill up buildings. A drought has caused a lot of beef to be processed and that will go into cold-storage facilities," he said.

Shifting retail fulfillment policies are spurring cold-storage demand. "Many of the large retailers have penalties in place if you can't meet their fill rates," Rosenbusch said. "Food processors don't want to be caught without the inventory in place to fill those orders."

For grocers, produce is a top way to get people into the supermarket multiple times a week, so quality and availability is crucial. "The margins on that are a little better. When you see those Wednesday circulars advertising specials, it isn't milk or bread on the cover. It is the produce," Prince said.

Anne-Sophie Zerlang Karlsen, global head of reefer management for Maersk, said the overall refrigerated container market has grown 5 to 6 percent on average the last five years, outper-

forming global trade growth of 2 to 3 percent. She added that the market is expected to grow around 6.2 percent this year.

Maersk has a refrigerated warehouse in Vado, Italy, that focuses on fresh fruit, especially bananas, and the company operates a warehouse in Chile that focuses on fish as well as on fresh fruit.

Zerlang Karlsen said she is seeing increased cold- chain investments made in ports as everyone works to keep up with demand. "The large destination ports in Europe, like Rotterdam for instance, see a significant increase in cold warehousing capacity these days," she said.

## OPPORTUNITIES TO EXPAND

Many companies that operate cold-storage facilities are willing to put in more space, but cold storage requires capital-intensive projects. "They can be tens of millions of dollars, even $100 million," Rosenbusch said, adding that operators have to have a minimum commitment from customers before committing to that level of investment.

Naylor's latest warehouse cost in the mid-$30 million range.

Winburn said that in his area, the rough cost of a building suitable for cold storage cost between $110 to $120 a square foot, and that doesn't include the land. "The cost of everything is on the rise. It isn't something that is easy to respond to and you'd want some sort of level of commitment to lay out that amount of money to have business come and go," he said.

Although demand for cold storage is increasing, shippers are less likely to build their own facilities, relying on third-party storage instead, Rosenbusch said. "If you look at USDA's capacity report of cold-storage facilities, about 75 percent of the space in the U.S. is operated by third parties," he said. "Generally speaking, a food processor would want to make sure their capital is being deployed into their core competency, such as research and development, rather than distribution assets they can outsource."

Winburn agreed that companies don't want to invest in cold storage. "There are companies that have a production location and want to store their product regionally so they can service their customers better. Instead of investing in brick and mortar and the human assets, they hire a cold storage/third-party logistics company to handle the product for them. That is a big part of where our business comes from," he said.

Utilizing third parties also gives manufacturers more flexibility regarding location. "Their distribution needs are constantly changing," Rosenbusch said. "You look at a building that has a 30-year depreciated life to it. In that amount of time, product distribution and manufacturing needs change a lot. By using a third-party network, they are more agile."

Choosing the right locations for facilities is crucial. Naylor's latest building is positioned right in front of the airway at Sea-Tac airport in Seattle and is the closest cold-chain facility to the airport. "In today's environment, the cold chain is the most important right now," he said. "If you don't maintain the cold chain, by the time they get to the destination, you could peel off two days' shelf life."

Naylor discovered that there was a hole in the cold chain for fresh cherries in particular. "We're able to bring cherries over from eastern Washington and hold them in our cold facility for commercial or passenger flights going to Asia. We'll probably grow in that area," Naylor said.

In August, InterChange Group announced the construction of a new modern cold-storage facility in Mt. Crawford, Virginia, which will support the region's growing food and beverage industries. There hasn't been new cold storage construction in the area for at least 20 years, while the needs of the food and beverage producers have continued to increase, InterChange Group said in a statement. Producers had found it necessary to utilize cold-storage capacity outside of the area, which increases transportation costs.

The new InterChange Cold Storage facility will allow the products to be stored locally.

"This project creates vital infrastructure for the large and growing cluster of food and beverage industries in the Shenandoah Valley, which in turn produces major markets for Virginia farmers," said Virginia Gov. Ralph Northam.

## REFRIGERATION OPPORTUNITIES

Rosenbusch said he has seen an increase in demand for low-charge, easy-to-install packages that use natural refrigerants. "We see it frequently, mainly driven by regulatory compliance challenges," he said. "The shortage of refrigeration technicians and the availability of labor to maintain the large systems have also driven owners to look at alternatives that may not require highly skilled labor.

Low-charge systems require less square footage, which can appeal to operators. "If you have packages on the roof, you don't need a central refrigeration room, so that could be additional storage space or you could have a smaller footprint," Rosenbusch said.

Rosenbusch said he sees opportunity within the retail distribution space, particularly e-commerce and e-fulfillment. "I don't think it will mean the types of buildings will drastically change or the member companies doing the business will change, they'll just be adding a different business line," he said.

## THE ROLE OF RIPENING

Handling the ripening of fruit can be a delicate balance. Zerlang Karlsen said extending the shelf life of the produce is key, and Maersk operates the largest fleet of controlled atmosphere containers in the world. "Here we can manipulate the atmosphere around the fruit during the transportation, through adjusting O2 levels, and hereby slow down the ripening of the fruit in transit, which means a longer shelf life of the produce when it hits the supermarkets," she explained.

Controlled atmosphere is the most relevant technology for extending shelf life, Zerlang Karlsen said. Maersk has developed a product called Remote Container Management, which is all about transparency into the perishable supply chain. "With this product, customers have real-time access to data on location, temperature, humidity and O2 levels in their container. This enables them to make faster and better decisions, improve their communication with both customers and suppliers, as well as place liability in the supply chain in the off-case when something goes wrong," Zerlang Karlsen said.

Fruit companies typically take over the ripening process once produce is delivered, to ensure that the fruit has the right maturity when presented to its customers, Zerlang Karlsen explained. She added that ripening is very relevant for bananas, avocados and mangos.

Rosenbusch said most ripening is done in retail distribution centers. "If you go into a Safeway, their distribution centers will have ripening rooms, mainly for bananas," he said.

Demand for facilities that companies can use to control ripening is most prevalent in apples and are privately held, "Those don't necessarily fall into our industry that we would consider third-party cold storage facilities that are storing for multiple clients, but there are some exceptions," Rosenbusch explained.

# IIAR Standards Suite Gets Update

IIAR is working on changes to many of IIAR's suite of standards. In a conversation with the *Condenser*, Standards Committee Chair Bob Czarnecki discussed each individual standard, providing detailed updates on the work being done. Here, the changes under consideration are outlined, organized by standard.

The issue has drawn many viewpoints from within the industry, and Czarnecki said that committee worked to consider all perspectives. "The committee did take a vote on what would be included in the standard, and that's being finalized. It's basically a consensus vote." The rewrite is part of IIAR's five-year cycle program to update standards per ANSI guidelines.

**"It's anticipated that sometime this fall, IIAR-2 addendum A will be approved and published," Czarnecki said. Additionally, headway is being made for the rewrite of the entire standard, set for publication in 2019. This will be an update to the original 2014 document and will address any issues that have come up since its original publication."**

**–Bob Czarnecki , IIAR Standards Committee Chair**

### IIAR-2 AMERICAN NATIONAL STANDARD FOR SAFE DESIGN OF CLOSED-CIRCUIT AMMONIA REFRIGERATION SYSTEMS:

There are two major changes being worked on to update IIAR-2, Czarnecki said. The first is Addendum A, which completes two tasks. Essentially, it takes all the information that needed to be addressed from ASHRAE 15 and places it in IIAR-2. Also, the language was cleaned up and clarified. Comments are being finalized from the second public review period, preparing for a limited third public review.

"It's anticipated that sometime this fall, addendum A will be approved and published," Czarnecki said. Additionally, headway is being made for the rewrite of the entire standard, set for publication in 2019. This will be an update to the original 2014 document and address any issues that have come up since its original publication.

The second item being updated is the corrosion element for vessels and other components in IIAR-2, Czarnecki said.

### IIAR-4 INSTALLATION OF CLOSED-CIRCUIT AMMONIA REFRIGERATION SYSTEMS:

Work on this standard is just getting underway, Czarnecki said. The standard is scheduled to be updated in 2020, but the subcommittee is acting now to get a jump start on the process. As work has just started, there isn't much concrete information to report at this time, he said.

### IIAR-5 START-UP AND COMMISSIONING OF CLOSED-CIRCUIT AMMONIA REFRIGERATION SYSTEMS:

This document's scheduled five-year update is complete, and comments are back from a pre-public informal review. "We're ready to adjust the document for those comments," Czarnecki said. "As a result, public review number one should be going out shortly."

### IIAR-6 - STANDARD FOR INSPECTION, TESTING, AND MAINTENANCE OF CLOSED-CIRCUIT AMMONIA REFRIGERATION SYSTEMS:

IIAR-6 is a new document. It has been through two public reviews, and the comments from those reviews are now being considered so that the document can be updated and sent out for a third review process. "We have a strong desire to have this reach a conclusion by October," Czarnecki said. "The schedule is important in order for the new standard to be recognized in the correct code body cycle. That's a big deal."

### IIAR-7 DEVELOPING OPERATING PROCEDURES FOR CLOSED-CIRCUIT AMMONIA REFRIGERATION SYSTEMS:

The document's scheduled five-year update is under way and although the standard will require a substantive change and a subsequent fourth public review process, Czarnecki said he is confident that it can be resolved relatively easily, concluding the scheduled update.

### IIAR-9 RECOGNIZED AND GENERALLY ACCEPTED GOOD ENGINEERING PRACTICES (RAGAGEP) FOR EXISTING CLOSED-CIRCUIT AMMONIA:

This proposed standard is a new document. It aims to help companies decide whether or not their existing systems should be updated to reflect new requirements, according to IIAR materials.

It will provide a method for evaluating existing systems against requirements that should apply to all closed-circuit ammonia refrigeration systems regardless of age and will help determine what can or cannot be "grandfathered" regarding system design and regulatory compliance. This document has been through one public review, and the responses are currently being worked through, Czarnecki said. The goal is to have it finalized by the end of October However, since most documents go through three rounds of 30- to 45-day public review, the October deadline may be extended.

Czarnecki added that in October, IIAR will conduct a webinar for members, hosted by Tony Lundell, to present information about the changes in detail, giving members an opportunity to ask questions and provide feedback.

# Trade Groups, Lawmakers Speak Out in Support of the Kigali Amendment

Trade Groups, Lawmakers Speak Out in Support of the Kigali Amendment

Several groups are focusing on advancing the Kigali amendment to the Montreal Protocol, which calls for a worldwide phase-down in the production and consumption of hydrofluorocarbons. The Kigali amendment, if ratified, establishes multiple legally binding schedules for participating countries to cap and phase-down the use of HFCs in favor of alternatives with lower global warming potential.

In July, the Let America Lead coalition announced its formation to work with conservative leaders at the local, state and national level, manufacturers and businesses.

Jamie Rhoades, a spokeswoman for Let America Lead, said the group plans to demonstrate to President Trump why support for the Kigali Amendment is a win for American workers and urge him to send it to the U.S. Senate for ratification. However, Rhoades said the group won't be lobbying as part of its efforts.

"Our coalition is focused on showing the public the benefits of Kigali ratification, and hoping that our work will help convince President Trump to send the amendment to the Senate for its advice and consent," Rhoades said, adding that the Kigali amendment provides the opportunity to level the global playing field for American workers and the companies that employ them.

"And given a fair shot, American workers and innovation will compete and win in a global market. Our companies have invested billions of dollars in research and development of next-generation cooling technology that has already created new jobs," Rhoades said. "They are eager to hire additional American workers to help meet anticipated global demand. By ratifying this amendment, we can clear the way to let them lead."

Founding members of Let America Lead include the National Association of Manufacturers, the U.S. Chamber of Commerce, the American Chemistry Council and the American Council for Capital Formation.

"President Trump's record demonstrates his commitment to making leadership decisions based on their ability to deliver for American workers and American families. Our nation's manufacturers -- large and small – serve as the foundation of our nation's strength and will see positive benefits from the Kigali Amendment," said George David Banks, President Trump's former adviser on international energy and environment policy who is serving as a senior advisor to Let America Lead.

Establishing a platform for conservative voices, working Americans and members of the manufacturing community to demonstrate support for the Kigali amendment will help President Trump hear from the people he values most why it is such a powerful opportunity to level the playing field for America, Banks said.

In June, 13 Republican senators sent a joint letter of support to President Trump urging him to send the amendment to the Senate for its advice and consent. They wrote: "The Kigali Amendment will protect American workers, grow our economy, and improve our trade balance, all while encouraging further innovation to strengthen America's leadership role."

Also in June, three leading conservative groups, Americans for Tax Reform, FreedomWorks and the American Council for Capital Foundation stated their support for the amendment, writing to the president that, "This agreement has our support because it will ensure that U.S. manufacturers are able to thrive in the global economy and create more wealth and jobs in America."

The Alliance for Responsible Atmospheric Policy and the Air-Conditioning, Heating, and Refrigeration Institute have also shown support for the Kigali amendment. In May the groups released their comprehensive study, entitled "Economic Impact of Kigali Ratification & Implementation, supporting the ratification of the Kigali amendment."

According to the study, with Kigali, U.S. exports will outperform, increasing U.S. share of the global market to 9 percent from 7.2 percent. The study also said the Kigali amendment is projected to add 33,000 U.S. manufacturing jobs by 2027, increase exports by $5 billion, reduce imports by nearly $7 billion, and improve the heating, ventilation, air conditioning and refrigeration balance of trade.

"U.S. ratification of the Kigali Amendment is good for American jobs, good for the economy, and crucial for maintaining U.S. leadership across the globe, said John Hurst, chairman of the alliance and vice president of Lennox International.

Hurst added that more than 30 countries have ratified the amendment. "America cannot afford to be on the sideline. America must continue to lead," he said.

**"Given a fair shot, American workers and innovation will compete and win in a global market. Our companies have invested billions of dollars in research and development of next-generation cooling technology that has already created new jobs."**

**–Jamie Rhoades, spokeswoman for Let America Lead**

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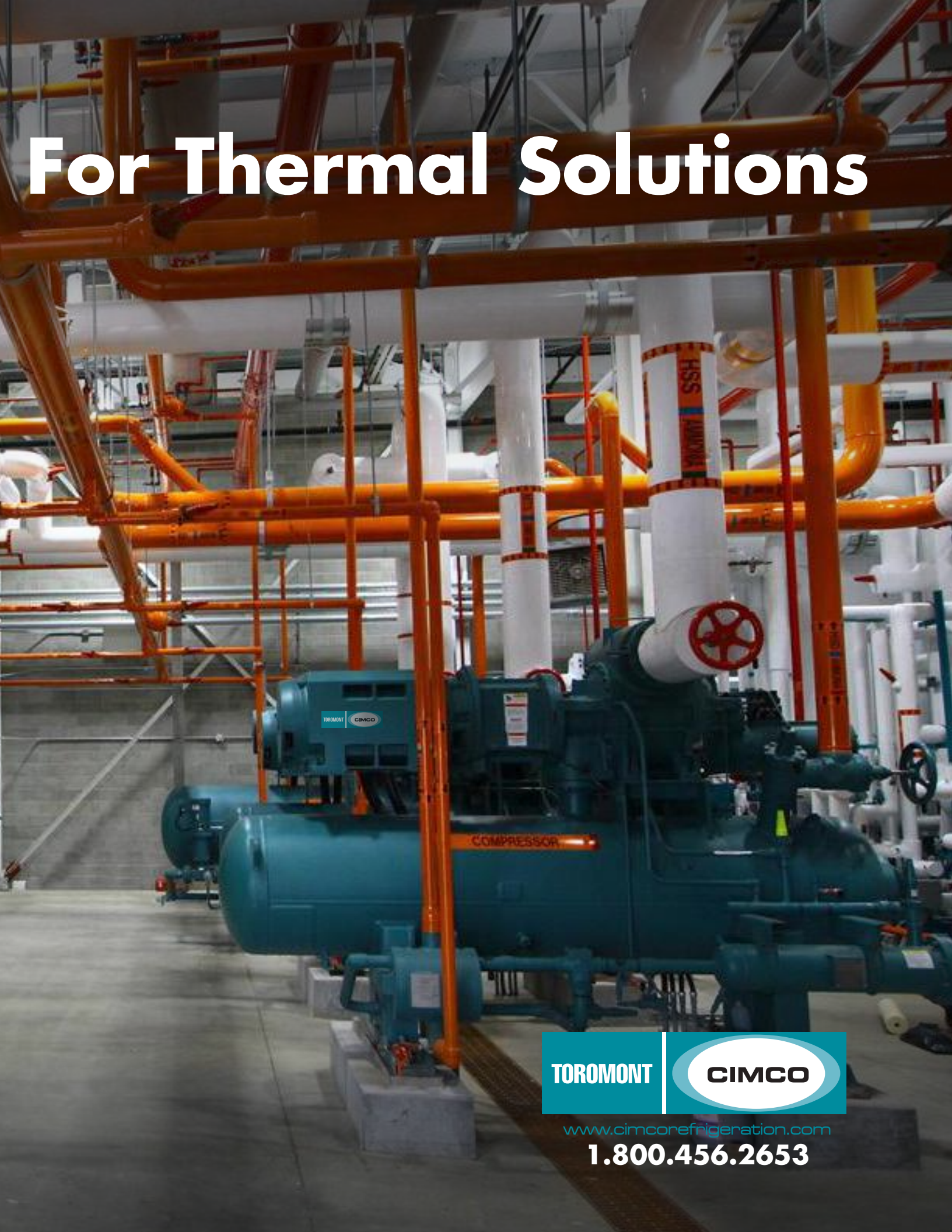
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# Federal, State Programs Open Opportunity for Natural Refrigerants

Interest in natural refrigerants is continuing to increase, and several federal and state projects, led in particular by California legislation and agencies, are investing significant amounts of money into research and development programs designed to advance technology that could increase natural refrigerant use.

## INVESTING ON A NATIONAL LEVEL

At the federal level, the Department of Energy has a multi-pronged strategy to develop, demonstrate, and deploy low-to-zero GWP heating, ventilation, air conditioning, water heating and refrigeration technologies. Part of the DOE's work has been to evaluate the performance of low-GWP refrigerants, and the agency recently released the results of a testing program evaluating the performance of HFC alternatives in rooftop air conditioning units in hot or very hot temperatures.

"We're agnostic to the refrigerants. It just happens that there has been a good intersect between research and natural refrigerants that we've done in the past and will continue to do," said Antonio Bouza, HVAC, Water Heating, and Appliance Technology Manager in the Building Technologies Office, which is part of the Office of Energy Efficiency and Renewable Energy,

Natural refrigerants have been an important part of the BTO's portfolio. "$CO_2$ has received some funds from us historically and we'll probably be continuing that in the future. Ammonia has been very successful with natural gas being used for fuel-fired applications. With the electrical chemical compression work, using a very small amount of hydrogen for electro-chemical compression is up and coming," Bouza said.

"BTO is currently pursuing some work with ammonia at Oakridge National Lab for water heating and also funded a project with Stone Mountain." [Stone Mountain Technologies is a Johnson City, Tennessee, developer of heating technologies.]

Bouza said the department is open to working with private industry. "We have a history of working with big corporations but also working with the next generation of small businesses," Bouza said. "We're open to working with small companies and large corporations."

Operators can get on the agency's mailing list to get notice of opportunities, Bouza said. There is a sign-up option at: www.energy.gov/eere/buildings/building-technologies-office, and BTO also provides funding information on the website. DOE posts funding opportunities online at: www.energy.gov/eere/funding/eere-funding-opportunities.

Once an applicant submits a proposal, BTO uses external reviewers that are subject-matter experts to evaluate and score the proposals. The annual Building Technologies Peer Review Report, which is available at: www.energy.gov/eere/buildings/building-technologies-office-peer-review, outlines the formal process through which BTO research projects are reviewed by external experts. "Depending on their scoring, we make awards and measure their progress over time. Sometimes this can span multiple funding actions," Bouza said.

To help keep those within the industry informed, BTO publishes technical reports related to commercial appliances and refrigeration in general. "It gives a lens to look at what is coming down the road," Bouza said.

## COLLABORATING TO ADVANCE THE INDUSTRY

Working with other agencies can help advance technologies, and DOE is working with the National Institute of Standards and Technology and others such as the Air Conditioning, Heating, & Refrigeration Institute to create the knowledge base necessary for the International Code Council's International Mechanical Code and International Residential Code to be modified to accept these low-GWP refrigerants, DOE said.

That work will be a combination of laboratory work and field testing to provide data that will be used to help ensure that the ICC model codes are prescribing what is safe, and manufacturers can build compliant equipment.

## CALIFORNIA LEADERSHIP

California has been an early leader in its work to improve air quality. At the state level, the California Energy Commission is currently involved in several research projects to get more information on the performance and feasibility of different types of low global warming potential (GWP) refrigerants, said Virginia Lew, energy efficiency research manager for the California Energy Commission.

"A research plan published earlier this year identified the potential for additional research in testing and evaluating alternative refrigerants, such as propane, $CO_2$ and others for both small and large refrigeration units in commercial/industrial applications in various climate zones," Lew said.

A project that just launched is the Food Production Investment Program, which provides grants to food processing facilities to reduce greenhouse gas emissions at their plants, Lew said. "The grants are awarded competitively and projects that use alternative refrigerants with low global warming potential in refrigeration systems are eligible," she explained, adding that all funding opportunities are listed at: www.energy.ca.gov/research/funding_opportunities.html.

The California Energy Commission (CEC) has also invested in a commercial refrigeration facility located at the Port of Long Beach. "Shipped cargo of frozen fish, turkeys, refrigerated avocados, citrus, berries and a host of other foods are stored in the chilled storage rooms, before being loaded onto trucks for distribution centers," Lew said.

"To keep the rooms cooled, the facility uses a low-charge distributed ammonia refrigeration system. The chilling system is distinctive because it replaces environmentally harmful refrigerant with a fairly neutral one, ammonia, and because it uses lower quantities of the refrigerant than a typical facility of its size."

Each chilled room has its own refrigeration unit so there's no central chiller that all the refrigerant goes to. "It's akin to having room air conditioners instead of central AC. The Energy Commission's funding is focused on developing and testing controls that can reduce electrical demand as needed, so the warehouse can participate in demand response programs and reduce energy costs while also providing electric grid flexibility," Lew said.

Each year, the CEC invests about $125 million through its Electric Program Investment Charge (EPIC) pro-

gram for research projects that advance pre-commercial clean-energy technologies and approaches, Lew said. For example, EPIC funded research grants for the Electric Power Research Institute to develop climate appropriate HVAC systems to reduce energy use and demand, including testing the performance and energy efficiency of a variety of low GWP refrigerants, such as ammonia, propane and $CO_2$ and to develop and test an energy efficient ultra-low charge ammonia refrigeration system.

Lew suggested those within the industry can help the CEC by taking part in public workshops the agency holds, such as the HVAC workshop it held in December. Those interested in funding opportunities sign up on the CEC's "Opportunity" and "R&D" listservs. She added that it may also be helpful to sign up for California Air Resources Board listservs, such as the Refrigerant Management Program at: https://ww2.arb.ca.gov/our-work/programs/refrigerant-management-program.

The California Air Resources Board (CARB) is also working to reduce greenhouse gas emissions in California from all sources, including high-global warming potential refrigerants. Legislation such as California's Global Warming Solutions Act mandated California to reduce emissions, and SB 1383 specifically requires 40 percent reductions in HFC emissions below 2013 levels by 2030, said David Clegern, a spokesperson for CARB.

What's more, the California Short-Lived Climate Pollutant (SLCP) Strategy of March 2017 recommended mitigation measures or regulations to prohibit the use of high-GWP refrigerants in new stationary refrigeration and air-conditioning equipment. "CARB is technology neutral and does not specifically promote the adoption of natural refrigerants, but rather promotes the adoption of low-GWP refrigerants, which can include synthetic refrigerants such as hydrofluoro-olefins," Clegern said. "Of course, all of the common natural refrigerants—ammonia, carbon dioxide, and hydrocarbons—are low-GWP, and as such, would be part of the solution to reducing GHG emissions from refrigeration and air-conditioning."

As of August 2018, SB 1013, the California legislature was considering the California Cooling Act. "The bill would require the same high-GWP HFC prohibitions in new refrigeration and air-conditioning equipment that were previously required under the U.S. EPA's Significant New Alternatives Policy (SNAP) program Rules 20 and 21," Clegern said. "The SNAP rules were partially vacated by a District of Columbia Circuit Court of Appeals decision in August 2017 and the high-GWP HFC prohibitions are no longer in effect," Clegern said. He added that many equipment manufacturers will begin manufacturing equipment using HFOs or natural refrigerants in order to comply with the high-GWP refrigerant bans, should SB 1013 go into effect.

In addition to high-GWP refrigerant prohibitions, SB 1013 also includes provisions for funding an incentives program in California that would enable retail food operators and other businesses to receive some form of financial incentive to use low-GWP refrigerants when purchasing new equipment and replacing old equipment. "We anticipate that many of the new refrigeration systems will use natural refrigerants. Several retailers already use natural refrigerant refrigeration in a significant

number of their stores, including Aldi, Target, Trader Joe's, and Whole Foods," Clegern said.

CARB expects to announce refrigerant regulations as first described in the SLCP Strategy: New refrigeration systems would be prohibited from using refrigerants with a GWP of 150 or greater, at a date to be determined; and new stationary air-conditioning systems would be prohibited from using refrigerants with a GWP of 750 or greater, also at a future date. The effective date of the high-GWP refrigerant prohibitions would be determined through the public rule-making process with active input and feedback from all stakeholders, Clegern said.

CARB funded a recently completed research project on the energy efficiency of low-GWP refrigeration systems, which included the efficiency of natural refrigerants including carbon dioxide and ammonia. The results show that natural refrigerants are as energy efficient as HFC refrigerants in almost all of the 16 climate zones in California. Although very high ambient temperatures are challenging for energy-efficient transcritical $CO_2$ systems, modifications such as adiabatic cooling bring the energy efficiency of $CO_2$ systems into parity with HFC systems.

CARB is also planning to fund an inventory study for refrigeration systems using less than 50 pounds of refrigerant. "We'd like to inventory the GHG emissions more accurately from these systems, which are used by most small grocery markets and convenience stores. The numbers and emissions impact from these smaller commercial refrigeration units may be underestimated," Clegern said.

## REDUCING BARRIERS TO ENTRY

There are several barriers that are preventing the widespread adoption of natural refrigerants, such as higher upfront cost of natural refrigerant systems, concern about the potential higher energy use of these systems, lack of familiarity with these systems, safety concerns about flammable natural refrigerants, slow-moving codes and standards process, state policies that focus only on energy efficiency or refrigerant emissions and a lack of trained service technicians, Clegern said.

CARB is working on several fronts to address those barriers. The agency funded a research study at San Francisco State University to demonstrate the energy efficiency of natural refrigerant systems when compared with traditional systems. CARB is also conducting in-house research to understand the energy use, performance and limitations of these systems, and Clegern said the board is participating in a number of codes and standards bodies to understand the process better and potentially speed it up.

If approved, The California Cooling Act (SB 1013) will provide incentives for the early adopters of natural refrigerants until these systems reach economies of scale, Clegern said. SB 1013 could potentially pave the way for incentives for environmentally friendly options such as natural refrigerants, Clergern said. "Members of the industry can choose to support the bill and follow its progress," he explained.

> "A misunderstanding among some operators about proposed California refrigerant regulations is that high-GWP refrigerant restrictions apply to existing equipment. This is not accurate. High-GWP restrictions modeled after the U.S. EPA SNAP Program apply to new equipment."
>
> **–David Clegern, spokesperson for CARB**

## UNDERSTANDING THE REGULATIONS

Clegern said that right now there is a lot of confusion about the current status of refrigerant regulations in the United States. "Although the U.S. EPA SNAP rules do not apply currently for HFC prohibitions in new equipment, similar restrictions will apply in California beginning January 1, 2019," he said. The full text of the California regulation incorporating the SNAP prohibitions in new equipment is on the CARB website at: https://www.arb.ca.gov/regact/2018/casnap/isorappa.pdf.

"A misunderstanding among some operators about proposed California refrigerant regulations is that high-GWP refrigerant restrictions apply to existing equipment. This is not accurate. High-GWP restrictions modeled after the U.S. EPA SNAP Program apply to new equipment," Clegern said.

For example, if an old R-22 refrigerant systems or R-404A system was manufactured prior to effective dates covering new equipment, operators can use that older system as long as they want to. "For example, no new R-22 may be produced or imported into the U.S. after January 1, 2020, but recovered and recycled R-22 can be used indefinitely," Clegern said. "Therefore, you could keep your R-22 refrigeration and AC equipment operating many years past 2020."

Other states are working with California and are considering adopting the SNAP requirements as well, Clegern said.

## TAKING A UNIFIED APPROACH

To be successful, the industry must work together to move towards natural refrigerants, Clegern said. "Technicians do not want to invest in training courses if there are not enough customers that use natural refrigerants and vice-versa, consumers do not want to invest in these systems if they will have trouble finding trained technicians," he said.

"More training courses can be offered that emphasize the benefits and the safe use of natural refrigerants, especially flammable refrigerants. There are many fears about the use of flammable refrigerants and rigorous training and awareness is required to dispel those fears. Strict adherence to safety guidelines should be emphasized. Natural refrigerant systems have been safely used around the world for many years now," Clegern said.

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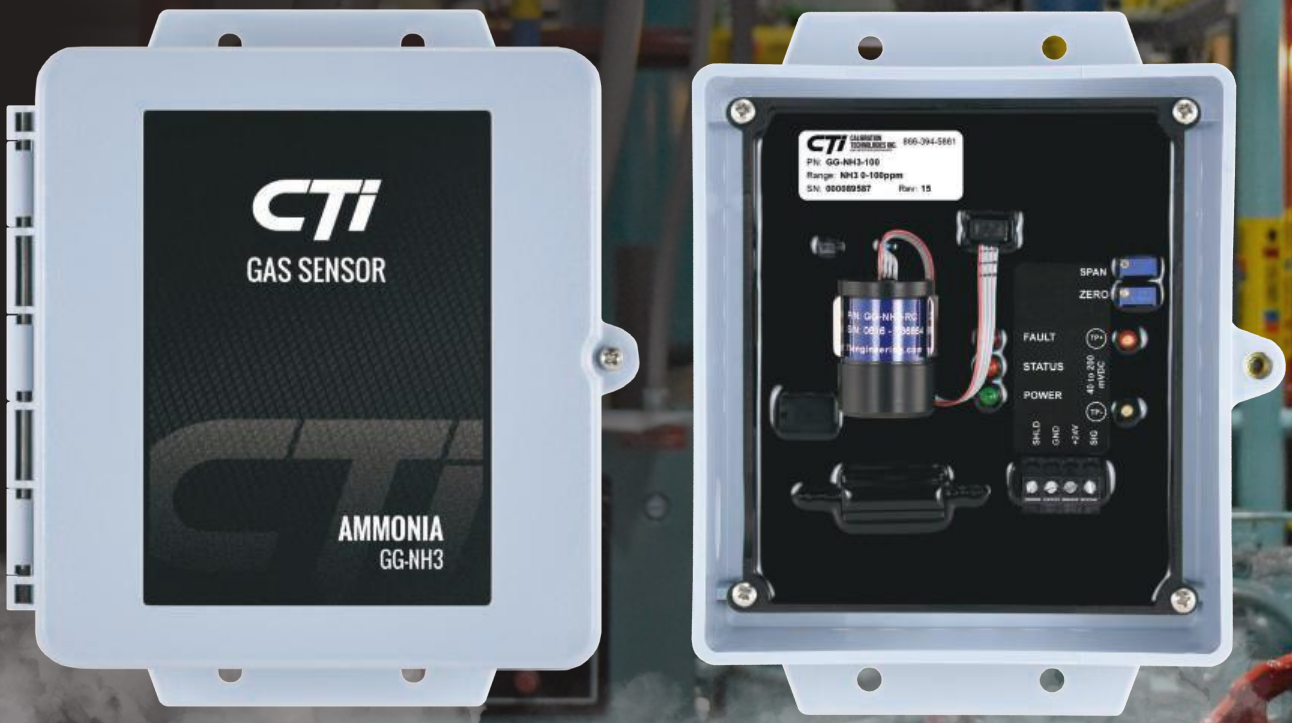


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# IIAR Updates PSM/RMP

Project safety management and risk management plans are the subject of a recent IIAR publication update. IIAR has updated its PSM/ RMP manual, a compilation of all relevant Occupational Health and Safety Administration and Environmental Protection Agency requirements that would concern end users of ammonia refrigeration systems over 10,000 pounds.

Drafted in 2011, the manual has served as a guide for developing programs to be in compliance with the regulations set by both federal regulatory bodies, said Jeanna Emmons, chair of the Compliance Guideline Committee. "If you didn't have any paperwork, you could buy this document and tailor it to your facility's needs so you could comply with both OSHA and EPA," she said. While the manual has been used as a tool in developing compliant programs, its organization and accessibility were lacking. "What we did was take that 2011 version and updated it and refreshed it," Emmons said. "We believe it's now more user-friendly."

Making the document easier to digest was an important goal, Emmons said, but it was also important to update the document to reflect modern practices. "It was outdated," she said. "Regulations and their implementation evolve over time, and we wanted to make sure we captured that. There have been substantial changes [since 2011] in the way the industry implements the document, so the idea was to take the document, have fresh eyes look at it, and have them take it apart, revise, and put it back together."

Lesley Shafer, IIAR PSM & RMP Program Guidelines Sub-Committee chair, agrees. "Some of the things in the old guidelines, you kind of had to dig through the background and explanations to figure out why you have to do things [in a certain way.] Shafer said. "This [new manual] is a little more useful because it helps people understand why they need to do things and how."

Shafer explained that the concept was to break up the manual into four discrete parts. The introduction explains at a very high level what the regulations say, and what must be done to satisfy them. This provides baseline information and explanation to users with little institutional understanding.

The second and third elements are the templates and attachments. Available for purchase separately or as part of the complete manual, these new, more user-friendly templates help users create site-specific, compliant programs according to their needs, Shafer said. "With a little tweaking, users can create a program that is in line with the regulations and requirements and is in line with both OSHA and EPA." The attachments provide insight into why operations are performed in certain ways.

The fourth element is unique to the new manual. The how-to section states the actual language from the regulation and then explains in standard language how to go about satisfying it. "The template will get you to the point that you have the program in place," Schafer said. "But a lot of people have a hard time following through and actually implementing the things written down in the programs. We're really excited about this section."

The revision process began in early 2015, Schafer said, and initially, progress was slow. Over the past year or so, development of the manual has increased dramatically, and the goal is to have a completed draft to the IIAR board for approval in October. Once it's approved, the manual should be available to the public sometime in early 2019.


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## 2019 Technical Program

**NEW for the 2019 Technical Program – Natural Refrigerant Commercial and Food Retail Track**

IIAR, in partnership with the North American Sustainable Refrigeration Council (NASRC), will be introducing a Commercial and Food Retail Refrigeration Track to the annual IIAR Natural Refrigeration Conference & Expo technical program. Launched in 2015, the NASRC is an action-oriented nonprofit dedicated to advancing natural refrigerants in commercial applications.

NORTH AMERICAN SUSTAINABLE REFRIGERATION COUNCIL

Since 1971, the mission of IIAR has been to promote the safe, efficient and sustainable use of ammonia as a refrigerant. In the last decade that mission has expanded to include all other natural refrigerants. International and national regulations have prompted the ACH&R industry to adopt new, more environmentally friendly technologies. IIAR sets the standard for the providing advocacy, education and the most up-to-date technical information to the ammonia and natural refrigeration community.

The goal of IIAR's partnership with the NASRC is to continue to advocate and educate on behalf of ammonia and other natural refrigerants.

## 2019 Technical Paper Topics Include:

- Operating Cost Comparison Between Transcritical $CO_2$ and Ammonia Recirculation Systems in a Cold Storage Warehouse
- Personal Protective Equipment: Respiratory Protection Best Practices
- Best Practices for Writing Ammonia Refrigerating System Operating Procedures
- Avoiding Brittle Fracture When Repressurizing Carbon Steel $CO_2$ Vessels That Have Lost Pressure
- CFD Study of Hydraulic Shock in Two-Phase Anhydrous Ammonia
- Access and Fall Prevention Requirements for Rooftop Refrigeration Equipment
- Propane Rack System: A Discussion of the Whole Foods Santa Clara Propane System
- Using Incentives to Drive the Adoption of Natural Refrigerants
- Emerging Trends in Commercial Refrigeration - What Stakeholders Think
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# Energy Efficiency in Natural Refrigeration Systems

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Esteemed engineers will discuss a variety of topics related to design, retrofit, and operation of refrigeration systems with the goal of saving energy. The session will include discussions about overall system analysis, goals setting, demand pricing and peak loading, rebate programs, compressor set-up and operating techniques, equipment and piping selection and more. Attendees will gain useful tools such as "back of the envelope" methods for high level analysis. Case studies will also be presented to demonstrate the effectiveness of various energy saving techniques.

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## 2019 Workshop Presentation Topics Include:

- Lessons Learned in Ammonia Refrigeration: Design, Safety, and Regulation
- Utilizing Thermal Energy Storage in the Cold Chain to Save Money: A Case Study
- Safe Secondary Refrigeration Fluids
- Using ARM-LC to Apply Ammonia to Commercial Applications
- $CO_2$ Transcritical Systems: An Overview of the Benefits, Latest Advances, and How Contractors Can Be Ready to Service These Systems
- Commercial Heat Exchangers: Applications in Commercial System Evaporators, Condensers, and Gas Coolers
- Commercial Service Readiness: Challenges and Solutions in the Commercial Sector

Panels include Codes and Regulations in the Natural Refrigerant industry. The Closing Forum will be an update on IIAR Standards.

** Technical Program topics subject to change prior to the 2019 IIAR Natural Refrigeration Conference & Expo*

**FOR REGISTRATION RATES AND SCHEDULE OF EVENTS.**

# Latin American Countries Draft IIAR-Informed National Standards

The refrigeration industry in Latin America is critical to the regional and global economy, and thanks to an increasing awareness of environmental issues, government leaders are partnering with local chapters of IIAR to use their standards in drafting national regulations for the industry.

Yesenia Rector, the international director at IIAR, said IIAR's relevance in Latin America is growing, and nowhere is that more apparent than in Costa Rica.

Costa Rica wants to adopt IIAR-2 to help develop the country's national standard in the regulation of ammonia refrigeration systems, Rector said. To do so, the country's Institute of Technical Norms (INTECHO) is working with the local IIAR chapter to draft national standards. The first meeting was in July, and regular meetings between the two bodies are scheduled.

"The intent is to enhance the safety of the systems within Costa Rica that use ammonia and eventually all natural refrigerants," Rector said. "They're meeting regularly and actively studying the standard section by section. They're very enthusiastic and moving quickly."

Also assisting in the process is a group called CIEME – IIAR's memorandum of understanding partners. Rector explained this is a national group of electrical, mechanical and industrial engineers. The head of CIEME, Marco Calvo, has been working actively in this initiative.

As far as timelines go, Rector said the future isn't certain, but progress is being made. For the rest of the year, it appears the committee will work on drafting the norm, but added that she expects that in about a year's time, they will be getting very close to finalization. "They've made the decision to implement it, and they are proactively creating the norm now. It's a very technical team that's developing it."

This is an important step, because IIAR's standard will be the basis of a codified law in the country. IIAR is serving as a thought leader in the region, and many countries are looking at what's currently happening in Costa Rica as a model for what is possible in their countries, she said.

"The role [IIAR] has played is to gather the right decision-makers in the country, and the IIAR chapter presidents have been following up on what's been started," Rector said. "Having the right people at the right time with the right interests has kick-started the whole thing, but IIAR has served as the spark that lit the match."

Mirroring what's being done in Costa Rica, but to a slightly lesser extent, Chile has drafted a fairly simple regulation, based on IIAR standards and the Ammonia Risk Management program administered by the Ministry of Health. "As of now, they are not quite ready to implement it," Rector said. "They are still trying to account for legal kinks having to do with commerce law, before implementation." Although this regulation is basic, Rector said it's an important step forward for the county and the region as a whole.

Argentina and Columbia are "very much interested" in following the model set by Costa Rica, Rector said.

In Argentina, IIAR had a meeting this summer with relevant government officials regarding the possibility of creating a national standard using IIAR-2 as a base, essentially replicating Costa Rica's process.

Last July, a significant seminar was held by the MoU partner in Argentina. "They were very enthusiastic about the process that's happening in Costa Rica, and they want to see how they can start implementing something similar as well," Rector said. She added that Mexico and Peru have also expressed interest and will potentially be moving forward in drafting their own regulations with IIAR's help.

Looking at the region as a whole, Rector said this is a very exciting time for the refrigeration industry. These systems are extremely important in Latin American counties – there's a huge need for it across many market sectors including fishing, wine, produce and meat storage. Refrigeration is critical to numerous economies, she said, and it appears that Latin America is developing its environmental consciousness and making meaningful strides in becoming more ecologically friendly.

"The spotlight is going to be on natural refrigerants, and of course ammonia is the refrigerant of excellence," Rector said. "Because of that, we need to make sure they create a safe environment to use ammonia refrigeration. Awareness is growing, and the interest in safety is receiving greater emphasis. It's a big step forward for our industry."

Looking to the future, Rector said she expects the "Costa Rica model" to be replicated further, and that IIAR will be recognized as a leader in the region and an advocate for the safe use of ammonia and natural refrigerants. "Since that's our vision, and that's what we're striving for on a global scale, it's important that we do this in Latin America," she said. "The goal is for IIAR to have an active part in this development, and inspire and guide this effort."

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# Market-Driven Energy Efficiency


Building a facility and then retrofitting it to be more energy efficient has been a practice used in the refrigeration industry for years; however, some forward-thinking companies are planning for efficient facilities from the start, and as costs come down, more organizations are willing to spend more upfront to see returns in the long-term.

However, due to regional disparities in energy costs, more progress is being made in the Northeast United States, and less in the Pacific Northwest.

As with most industries, cost is king, but somewhat counterintuitively, energy efficiency hasn't been a primary consideration in the planning process of facility development.

"The driving force isn't so much on energy efficiency; what's really happening in the industry is that because the profits are so high, energy efficiency isn't thought about [as much as other factors as a cost-cutting measure] in the initial construction of a facility," said Jeremy Olberding, vice president of sales at Colmac Coil Manufacturing. More thought is given to first costs, capacity, throughput and how soon everything can be delivered. "All of those things are way more important than energy efficiency up front," he added.

Olberding likened it to building a house. An individual hires a contractor, and says they want to keep the costs below $400,000. The contractor delivers, and the home is built on budget, but once the family moves in, they realize their energy costs are higher than they would have liked them to be. "Then they say, 'I wish I would have put in solar panels, thicker walls or an energy-efficient furnace.' What's driving the energy-efficiency movement is people wanting to save money after the fact," he said.

It might seem backwards, but to understand this thought process, Olberding said it has to be thought of in the context of payback. "Most of these energy efficiency systems wouldn't meet a 12- 18- or even 24-month payback that other things in the plant would meet," he said.

Joe Fazzari, Colmac's vice president, added, "The payback is too long for [these systems] to make the cut [in the planning stage], but it eventually gets on the list."

**"It has to pay back or improve product quality or improve safety. Energy bills are big, but it's one of the lower operational costs."**

**– Joe Fazzari, vice president, Colmac**

However, as costs come down and environmental awareness mounts, some companies are making energy considerations and having conversations about energy efficiency before construction starts. "It's probably one-in-ten or one-in-twenty at this point," Fazzari said, "but that absolutely will increase in the future."

The change will be driven by market forces, Olberding said. "It has to pay back or improve product quality or improve safety," he said. "Energy bills are big, but it's one of the lower operational costs." In some cases, especially where energy costs are low, such as in the Pacific Northwest, some energy retrofits wouldn't even have a 10-year payback. If that's the case, Fazzari said it simply isn't feasible.

What is driving this in other places, such as the Northeast, Olberding said, is the last push in the form of utility incentives. "If a utility will put up x amount, and you'd save x on the energy bill, you combine those together, and now you have the money to spend on energy efficiency," he said, "It takes this type of formula."

There are examples of this currently happening, but only in certain parts of the country. "It's happening in the Northeast where the power is expensive, and they don't want to bring on additional demand," said Olberding. "They're working with facilities to do that work."

"For example, they'll pay a cold store to shut off their compressors during the day," Fazzari said. "They'll incentivize them to run the compressors at night, they'll get temperature down to minus-10 and let it creep back up to positive-10 during the day."

While this doesn't make the facility any more efficient, it does make the entire grid more efficient by not requiring the construction of additional capacity. "You're reducing your bill, and you're reducing the need to build a new power plant," Olberding said.

Operating under this type of model, Olberding said solar panels on cold-store facilities are starting to make more sense. "You're not going to get a two-year payback, but it's a tremendous ten-year payback," he said. "Because they're thermal batteries, you can be running that during the day when you get peak demand, you'll never have to sell energy back. You size the system so that it's running your compressors during the peak of the day, then it's a giant thermal battery all night."

Bidvest, a facility located in Perth, Australia, experimented with this concept and saw great successes, Fazzari said, adding that this could be the prototype of how some facilities can be constructed and run in the future. "We expect to see a lot more of this," he said.

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# Estate Planning: Key Documents You Need


*The IIAR and ARF reserve investment funds are currently managed by Stifel Financial Services under the investment policy established by their respective board of directors. In this and subsequent issues of the Condenser, you'll find a "financial tech tips" article from the firm on this page. Members of IIAR may use the financial services of Stifel for personal and business investments and take advantage of the reduced rate structure offered with IIAR membership.*

There are five estate planning documents you may need, regardless of your age, health, or wealth:

1. Durable power of attorney
2. Advance medical directives
3. Will
4. Letter of instruction
5. Living trust

The last document, a living trust, isn't always necessary, but it's included here because it's a vital component of many estate plans.

## DURABLE POWER OF ATTORNEY

A durable power of attorney (DPOA) can help protect your property in the event you become physically unable or mentally incompetent to handle financial matters. If no one is ready to look after your financial affairs when you can't, your property may be wasted, abused, or lost.

A DPOA allows you to authorize someone else to act on your behalf, so he or she can do things like pay everyday expenses, collect benefits, watch over your investments, and file taxes.

There are two types of DPOAs: (1) an immediate DPOA, which is effective immediately (this may be appropriate, for example, if you face a serious operation or illness), and (2) a springing DPOA, which is not effective unless you have become incapacitated.

**Caution:** *A springing DPOA is not permitted in some states, so you'll want to check with an attorney.*

## ADVANCE MEDICAL DIRECTIVES

Advance medical directives let others know what medical treatment you would want, or allows someone to make medical decisions for you, in the event you can't express your wishes yourself. If you don't have an advance medical directive, medical care providers must prolong your life using artificial means, if necessary. With today's technology, physicians can sustain you for days and weeks (if not months or even years).

There are three types of advance medical directives. Each state allows only a certain type (or types). You may find that one, two, or all three types are necessary to carry out all of your wishes for medical treatment. Just make sure all documents are consistent.

First, a living will allows you to approve or decline certain types of medical care, even if you will die as a result of that choice. In most states, living wills take effect only under certain circumstances, such as terminal injury or illness. Generally, one can be used only to decline medical treatment that "serves only to postpone the moment of death." In those states that do not allow living wills, you may still want to have one to serve as evidence of your wishes.

Second, a durable power of attorney for health care, known as a health-care proxy in some states, allows you to appoint a representative to make medical decisions for you. You decide how much power your representative will or won't have.

Finally, a Do Not Resuscitate order (DNR) is a doctor's order that tells medical personnel not to perform CPR if you go into cardiac arrest. There are two types of DNRs. One is effective only while you are hospitalized. The other is used while you are outside the hospital.

## WILL

A will is often said to be the cornerstone of any estate plan. The main purpose of a will is to disburse property to heirs after your death. If you don't leave a will, disbursements will be made according to state law, which might not be what you would want.

There are two other equally important aspects of a will:

1. You can name the person – executor – who will manage and settle your estate. If you do not name someone, the court will appoint an administrator, who might not be someone you would choose.
2. You can name a legal guardian for minor children or dependents with special needs. If you don't appoint a guardian, the state will appoint one for you.

Keep in mind that a will is a legal document, and the courts are very reluctant to overturn any provisions within it. Therefore, it's crucial that your will be well-written and articulated, and properly executed under your state's laws. It's also important to keep your will up-to-date.

## LETTER OF INSTRUCTION

A letter of instruction, also called a testamentary letter or side letter, is an informal, nonlegal document that generally accompanies your will and is used to express your personal thoughts and directions regarding what is in the will, or about other things, such as your burial wishes or where to locate other documents. This can be the most helpful document you leave for your family members and your executor.

Unlike your will, a letter of instruction remains private. Therefore, it is an

opportunity to say the things you would rather not make public.

A letter of instruction is not a substitute for a will. Any directions you include in the letter are only suggestions and are not binding. The people to whom you address the letter may follow or disregard any instructions.

### LIVING TRUST

A living trust, also known as a revocable or inter vivos trust, is a separate legal entity you create to own property, such as your home or investments. The trust is called a living trust because it's meant to function while you're alive. You control the property in the trust, and, whenever you wish, you can change the trust terms, transfer property in and out of the trust, or end the trust altogether.

Not everyone needs a living trust, but it can be used to accomplish various purposes. The primary function is typically to avoid probate. This is possible because property in a living trust is not included in the probate estate.

Depending on your situation and your state's laws, the probate process can be simple, easy, and inexpensive, or it can be relatively complex, resulting in delay and expense. This may be the case, for instance, if you own property in more than one state or in a foreign country, or have heirs who live overseas.

Further, probate takes time, and your property generally won't be distributed until the process is completed. A small family allowance is sometimes paid, but it may be insufficient to provide for a family's ongoing needs. Transferring property through a living trust provides for a quicker, almost immediate transfer of property to those who need it.

Probate can also interfere with the management of property such as a closely held business or stock portfolio. Although your executor is responsible for managing the property until probate is completed, he or she may not have the expertise or authority to make significant management decisions, and the property may lose value. Transferring the property with a living trust can result in a smoother transition in management.

Finally, avoiding probate may be desirable if you're concerned about privacy. Probated documents such as a will and inventory become a matter of public record. Generally, a trust document does not.

**Caution:** *Although a living trust transfers property as a will does, you should still also have a will because the trust will be unable to accomplish certain things that only a will can, such as naming an executor or a guardian for minor children. Also, living trusts do not generally minimize estate taxes or protect property from future creditors or ex-spouses.*

The IIAR and ARF reserve investment funds are currently managed by Stifel Financial Services under the investment policy established by their respective board of directors. Members of IIAR may use the financial services of Stifel for personal and business investments and take advantage of the reduced rate structure offered with IIAR membership. For additional Wealth Planning assistance contact your Stifel representative: Jeff Howard or Jim Lenaghan at (251) 340-5044.

# Adding and Removing Oil

BY KEM RUSSELL


One of the important maintenance tasks in the operation of a refrigeration system is adding and removing oil. Oil is necessary in systems as a lubricant and, or, a sealant. Knowing how to identify and deal with the oil balance in a system is very important. Improper balance can have multiple effects on system operation.

The efficiency of the compressor's oil separator will determine how much oil leaves the compressor along with the discharge vapor. Oil passing through a separator into the system should be removed.

**Oil is necessary in systems as a lubricant and, or, a sealant. Knowing how to identify and deal with the oil balance in a system is very important. Improper balance can have multiple effects on system operation.**

It is also possible to have oil leave a screw compressor through the suction line if the suction check valve fails to function properly.

Earlier this summer I was visiting a fairly large freezing facility, and the following story was related to me:

It was a dark and stormy night (really) when a frantic call came from the corporate office asking a very capable refrigeration operator at a large refrigerated facility to go to another plant location immediately because that facility was not able to freeze product. The season length for the particular product was short, so having the refrigeration system function properly was extremely important.

Upon entering the machine room, it became quickly apparent to the visiting operator what one of the major problems was. The mechanical ammonia pumps would not produce enough pressure to properly circulate ammonia, and when stopped they would not rotate freely. They appeared to be oil-bound.

Another clue was the ammonia pump parts strewn about the machine room. The facility operators knew they had a problem with very little or no liquid getting to the freezing equipment, and because of this the facility was way short of its required freezing capacity.

Upon asking the refrigeration operators what their procedure was for getting the pump(s) to work, the answer was: "Well, we shut down the refrigeration, wait until the system pressure reaches about 20 psig, then we can turn the pump(s) back on, and get pressure."

This procedure only sort-of worked. By allowing the system pressure to rise, the ammonia and oil temperatures rose. At their restart pressure of 20 psig both the ammonia and oil were warm enough that the pumps could produce discharge pressure. Yes, ammonia was circulating, and the evaporators could now start cooling, but also, whatever oil had been binding up the pump was sent out to the evaporators. Probably not the best plan.

Due to the critical nature of getting the system freezing properly as soon as possible, the facility had flown in two completely brand-new ammonia pumps. However, when ordering the pumps, the size and horsepower required was not checked. The new pumps were 2 HP, but they needed 3 HP for this system to have sufficient ammonia flow. Even though the pumps were undersized, at least they had something.

After further conversation with the facility operators, the visiting operator learned that they were not sure how to drain oil from the system, or from a piece of equipment such as the ammonia pumps, or from the oil pot. Also, they did not understand why it would be important to drain oil. The facility operators really needed proper training.

There was no oil log or tracking of how much oil was put into the system. It would have been helpful to have some idea of how much was also removed from the system. In this case no oil had been removed since they didn't know how, or why.

Someone had installed a beautiful oil-fill system, with a nice oil pump, and stainless-steel tubing to each compressor. This allowed easy oil make-up to any compressor needing additional oil. Maybe a good idea, but in this case not so much. When a compressor needed oil, they filled it back to its proper operating level. That was good, but they didn't seem to understand that oil disappearing from the compressors goes someplace in the system; it is not consumed.

The visiting operator went to work and soon learned that it took about two hours for an ammonia pump to become oil-bound and quit pumping. At that point he would switch to the next pump, then isolate and evacuate the oil-bound pump, drain oil from the pump, then repeat the process. This sequence continued for three weeks, enabling the facility

to keep freezing product. The visiting operator became an expert at de-oiling the ammonia pumps. He said, "If this was an Olympic event, I could at least have gotten a Silver." During the three-week struggle, the operator found that it was actually quicker to isolate and evacuate a pump, unbolt it from the volute, swab out the oil, put a new volute seal in and put it back together.

As this three-week process was going on, the visiting operator spent time looking over the piping design associated with the low-pressure receiver (LPR) and its oil pot. The oil pot did not vent to a high place on the LPR, but was connected below the LPR operating liquid level. How does that work? Not well.

The pump volute/evacuation line also connected below the LPR operating level. Further, each pump's suction connection to the LPR dropleg was installed in such a way that it would allow oil to flow into a pump. In addition, the LPR float column was continually filling with oil because it was connected to the bottom of the LPR, not into the vessel dropleg, which would have allowed any oil present to flow into the dropleg. Float switches don't like oil. The visiting operator said that the float column had to be evacuated and drained about every three days to allow the floats to operate properly. The oil just kept coming.

Because the pumps were pumping ammonia entrained with oil out to the system, this provided the operator with something to do in his spare time. Anything the oil picked up as it washed through vessels and piping was sent out to each evaporator liquid control assembly. During the three-week freezing run, every liquid-line strainer in the system had to be cleaned twice. Time to sleep was hard to come by.

After the very hard three-week marathon, the visiting operator was finally able to shut the system down. As the system temperatures warmed up, he began draining oil from the LPR. 350 gallons of oil were removed just from this one vessel!

There are several lessons that can be learned from this event:

**One:** Adequate training of refrigeration operators in all of their duties to safely and properly operate a system is required.

**Two:** Develop and use well-thought-out and understandable operating procedures, including maintenance and inspection procedures.

**Three:** Oil management is very important. Oil in must closely equal oil out.

**Four:** The piping design/configuration needs to be evaluated by a component person or group prior to assembly. This should be addressed following the "Management of Change" procedure.

**Five:** An active PSM/RMP or ARM program can address all of these issues and more.

The International Institute of Ammonia Refrigeration has helpful resources addressing oil draining such as:

**Video:** Series III Module 1, "Removing Oil from an Ammonia Refrigeration System";

**Poster:** "IIAR Recommended Oil Draining Guidelines".

Also, search through the e-library of past conference tech papers and you can find lots of information regarding oil in a system.

# Appeals Court Vacates Trump Rule Delaying RMP Changes

iiar government RELATIONS

BY LOWELL RANDEL, IIAR GOVERNMENT RELATIONS DIRECTOR

A federal appeals court in August vacated a delay in Obama-era changes to the Environmental Protection Agency's Risk Management Program (RMP) that would add compliance requirements to regulated facilities. Shortly after taking office, the Trump Administration issued a series of delays to the effective date of the RMP amendments, resulting in a final effective date of February 19, 2019.

The International Institute for Ammonia Refrigeration (IIAR) supported the delay in public meetings and provided written comments to the EPA.

While many industry groups joined IIAR in backing the delay, environmental groups challenged the 20-month delay. On August 17th, the District of Columbia Circuit Court of Appeals ruled that EPA acted in an arbitrary and capricious manner in delaying the effective date until February 19, 2019.

## SUMMARY OF COURT RULING

The appeals court found that EPA exceeded its authority in going beyond the 90-day delay authorized under the Clean Air Act and did not provide sufficient reasoning for why an extended delay was necessary.

The court criticized the delay rule by stating that EPA neglected to explain why allowing the amendments rule to go into effect would prevent EPA from undertaking notice and comment or other tasks for reconsideration and why a delay was needed to prevent impediments to reconsideration. The court also stated that nothing in the delay rule explained EPA's departure from its stated reasoning in setting the original effective date and compliance dates.

The court also rejected EPA's claim that a Bureau Alcohol, Tobacco, and Firearms finding that a 2013 Texas fertilizer plant explosion was caused by arson rather than by an accident supported the need for a 20-month delay. "Because EPA has not engaged in reasoned decision making, its promulgation of the Delay Rule is arbitrary and capricious," The court ruled.

## RECONSIDERATION RULE STILL MOVING FORWARD

While vacating the delay, the court specifically acknowledged that EPA does retain authority to change regulations pertaining to RMP through its normal notice and comment rulemaking process. EPA has already begun a rulemaking effort by proposing a rule to reconsider the regulation. The reconsideration rule proposes rescission of problematic provisions included in the amendments rule, included removal of provisions related to third-party audits, root-cause analysis, information sharing and safer-technology analysis.

IIAR has presented oral and written comments to EPA supporting the reconsideration rule.

## PRACTICAL IMPACT OF RULING AND NEXT STEPS

From the date of the ruling, EPA has 45 days to petition for a rehearing or appeal to the Supreme Court. While the delay has technically been lifted, the rule will not go into effect until at least 45 days after the ruling. EPA has yet to indicate how it will respond to the ruling.

In addition to actions by EPA, there is a potential that industry will challenge the court's decision or reactivate litigation that had previously been filed challenging the amendments rule. Prior to the 20-month delay, industry groups sued EPA challenging the amendments rule. The lawsuit was put on hold when the delay went into effect. Industry could restart its lawsuit and request the courts to stay the effectiveness of the amendments rule while the litigation moves through the legal process.

Even if the amendments rule were to become effective 45 days after the court ruling, the immediate impacts on regulated facilities would be limited to only those provisions with effective dates that have already passed. The only major provision with a compliance date that has passed is the requirement for emergency response coordination activities.

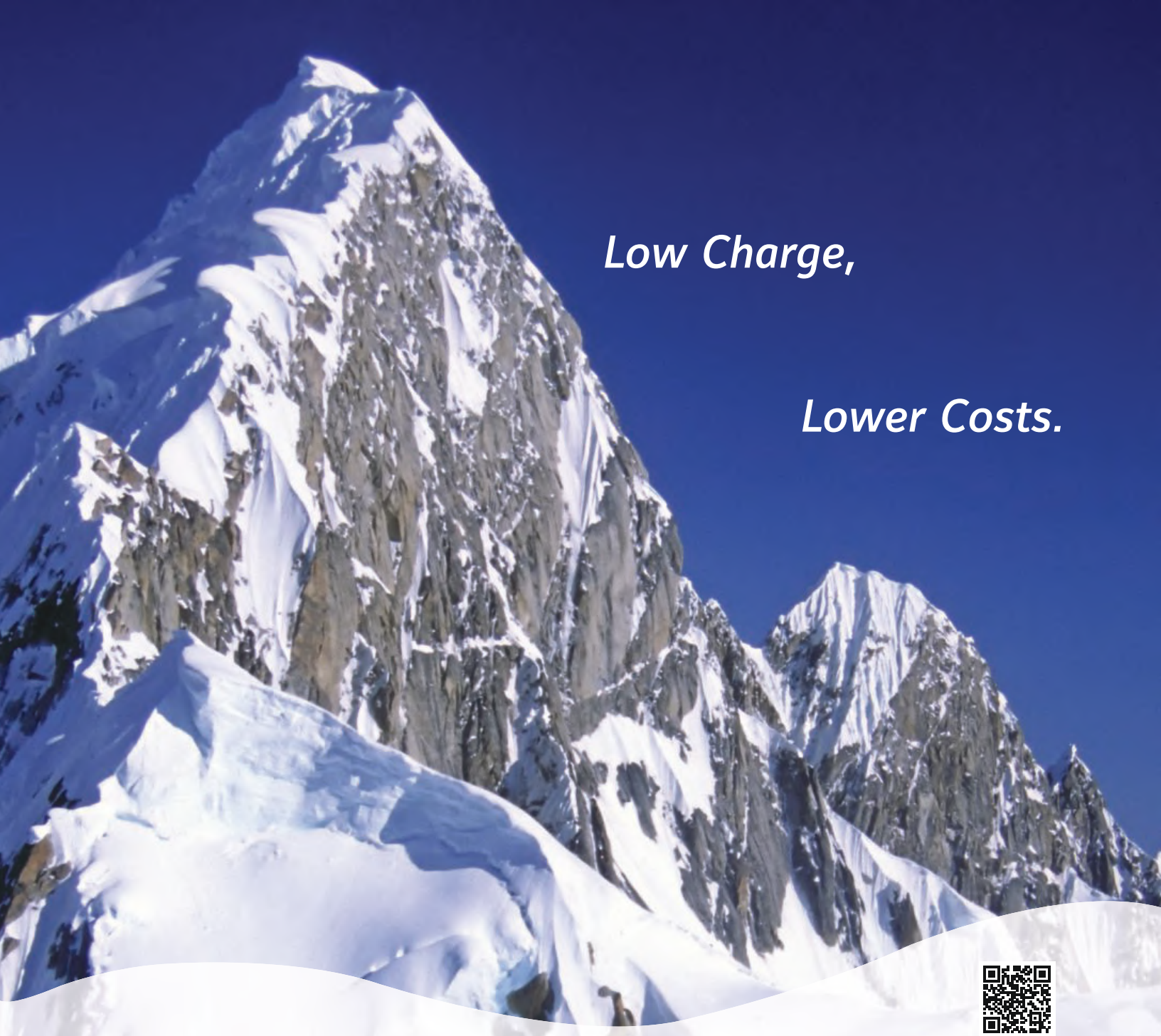
If the amendments rule becomes effective during the fall of 2018, regulated facilities will be immediately required to have documentation that they are coordinating with their local emergency responders. The reconsideration rule proposes to maintain the coordination requirements, so such coordination will eventually be required by RMP.

IIAR has long been encouraging members to engage with local responders and document their coordination, regardless of whether it is a regulatory requirement. IIAR continues to urge members to build and document relationships with their local responders.

The compliance date for the other major provisions, including third-party audits, root-cause analysis, information sharing and emergency response exercises is March 15, 2021.

All of those provisions are subject to rescission or significant change as a part of the reconsideration rule.EPA is expected to finalize the reconsideration rule well before the 2021 compliance dates for these provisions. Even if the amendments rule goes into effect this year, there will not be an immediate impact on regulated facilities related to these provisions.

While some uncertainty remains about the effect of the court's ruling to vacate the delay of the RMP amendments rule, the immediate impacts appear to be minimal. Potential appeals or other legal actions may cause a reinstatement of the delay, and EPA is continuing efforts to complete the reconsideration rule, which would rescind the problematic provisions. Facilities not currently coordinating with the local emergency responders are strongly encouraged to build and document those relationships in the near future, regardless of the regulatory outcome. IIAR will continue to actively engage with EPA and its industry partners as the process moves forward.



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# The 2018 and 2021 Codes Where We Are & Where We Are Headed

iiar code advocacy **UPDATE**

BY JEFFREY M. SHAPIRO, P.E., FSFPE

**EDITOR'S NOTE:**

*Jeff Shapiro is president of International Code Consultants and serves as IIAR's code consultant. This article is the first in a two-part series examining 2018 and 2021 codes and the future of code development.*

The 2018 editions of the International, Uniform and NFPA codes that affect the ammonia refrigeration industry, including the International Mechanical Code (IMC), International Fire Code (IFC), International Building Code (IBC), Uniform Mechanical Code (UMC) and NFPA Fire Code (NFPA 1) are now published and are pending adoption in many jurisdictions in the United States. There are a number of changes in these latest editions that are of interest to IIAR members, and this article summarizes those that are most significant. In addition, important changes to the 2017 edition of the National Electrical Code (NEC) and the latest Factory Mutual Data Sheets affecting ammonia refrigeration are discussed.

In Part 2, which will be published in the next Condenser, a preview of IIAR's proposals to ASHRAE 15 and the 2021 model codes will be provided. These proposals are just beginning the code development processes for the various model codes.

Some changes in code text in this article are shown in "legislative format" to indicate deleted text (strike-out format) and new text (underline format) for clarity.

## APPROVED PROPOSALS

This article outlines the significant changes affecting ammonia refrigeration that were approved for inclusion in the 2018 editions of the IMC, IFC, IBC, UMC and NFPA 1, and the 2017 edition of the NEC. All of these changes are considered as positive for the ammonia refrigeration industry.

## 2018 IMC

- **Section 202 Definitions:** MACHINERY ROOM. An enclosed space that is required by Chapter 11 to contain refrigeration equipment and to comply with Sections 1105 and 1106.

  **Discussion:** *The definition of "Machinery Room" has been changed to clarify that spaces must only meet machinery room construction requirements when the machinery room is required by code. Spaces that contain equipment that does not trigger a machinery room requirement in Chapter 11 are now clearly NOT required to be constructed as machinery rooms simply because some ammonia related equipment happens to be present. This issue had sometimes been a point of contention with code officials in the past.*

- **Section 202 Definitions:** LOW-PROBABILITY PUMP. A pump that is designed to prevent atmospheric release of the pumped fluid in accordance with one of the following methods: 1. The pump is permanently sealed, 2. The pump incorporates a static seal, or 3. The pump incorporates not less than two sequential dynamic shaft seals to isolate the pumped fluid from atmosphere at shaft penetrations and automatically shuts down upon failure of any seal.

  **Discussion:** *See Section 1104.2.2(6) below for how this definition applies. Also note that early printings of the 2018 IMC included a different definition, which is incorrect. The International Code Council, which publishes the IMC, has noted this as an errata issue, and future IMC printings will correct the definition with the text shown above.*

- **Section 1104.2.2 Industrial occupancies and refrigerated rooms:** This section applies only to rooms and spaces that: are within industrial occupancies; contain a refrigerant evaporator; are maintained at temperatures below 68°F (20°C); and are used for manufacturing, food and beverage preparation, meat cutting, other processes and storage. Machinery rooms are Where a machinery room would otherwise be required by Section 1104.2, a machinery room shall not be required where all of the following conditions are met:

  **Discussion:** *Section 1104.2.2 establishes a list of conditions that must all be satisfied to legally permit refrigeration equipment outside of a machinery room in industrial process and storage areas. Were it not for this exception, refrigerant concentration limits would force most direct evaporators and condensers on ammonia systems to be located in machinery rooms, which would essentially prevent the use of large, direct ammonia systems.*

  *In the 2018 edition, IIAR was successful in gaining approval of a modification to Section 1104.2.2 to clearly state that the conditions in this section ONLY apply to cases where a machinery room was otherwise required. This differs from the previous text, which triggered all of the conditions anytime that direct evaporators or condensers were not in a machinery room. The change opens the door for small charge systems to possibly be used in process and storage areas without having to comply with the listed conditions.*

  *Text extracts below show the conditions/numbered items under Section 1104.2.2 that were modified in the 2018 edition based on IIAR proposals. For the remaining conditions that are not shown here, see the IMC.*

3. ~~The floor area per occupant is not less than 100 square feet (9.3 m2) where machinery is located on floor~~


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~~levels with exits more than 6.6 feet (2012 mm) above the ground. Where provided with egress directly to the outdoors or into approved building exits, the minimum floor area shall not apply.~~

**Discussion:** *Item 3 in the 2015 and prior editions of the IMC has been deleted. The provision had implied that industrial process and storage areas had to be designed and occupied with a minimum occupant load density of 100 square feet per person. However, the requirement was essentially moot because the second sentence typically negated the first. Furthermore, there was no logical reason to mandate a minimum occupant density for refrigerated areas when no similar requirements existed for other industrial or hazardous occupancies. The section was apparently often overlooked, and deleting it gets rid of one more ambiguity that encumbers the design and operation of refrigerated process and storage areas.*

3. Refrigerant detectors are installed as required for machinery rooms in accordance with Section 1105.3.

**Exceptions:**

1. Refrigerant detectors are not required in unoccupied areas that contain only continuous piping that does not include valves, valve assemblies, equipment, or equipment connections.
2. Where approved alternatives are provided, refrigerant detectors for ammonia refrigeration are not required for rooms or areas that are always occupied, and for rooms or areas that have high humidity or other harsh environmental conditions that are incompatible with detection devices.

**Discussion:** *Item 3 in the 2018 edition (previously Item 4) has two new exceptions that were added to allow omission of refrigerant leak detection in areas where refrigeration equipment is located outside of a machinery room. The detection requirement in this item are seemingly not well-known, which may have resulted in some refrigerated process and storage areas not including required refrigerant leak detection equipment. Nevertheless, the blanket requirement that was in previous code editions was unreasonably restrictive or impractical for some situations, and IIAR was successful in gaining two new exceptions to the requirement.*

*Leak detection is no longer required where: 1) A space is unoccupied and contains only continuous piping that does not include valves, valve assemblies, equipment, or equipment connections, such as pipe chases, and 2) Where approved alternatives are provided for rooms or areas that are always occupied, and for rooms or areas that have high humidity or other harsh environmental conditions that are incompatible with detection devices. Such alternatives might involve having an emergency plan that includes provisions for scheduled periodic rounds by authorized personnel to check for leaks and a protocol for reporting and responding to any release that may occur.*

6. All refrigerant-containing parts in systems with a total connected compressor power exceeding 100 horsepower (hp) (74.6 kW) drive power, except evaporators used for refrigeration or dehumidification, condensers used for heating, control and pressure relief valves for either, low-probability pumps and connecting piping, are located either outdoors or in a machinery room.

**Discussion:** *Item 6 lists the equipment that is allowed by Section 1104.2.2 to be outside of a machinery room. One change promoted by IIAR was clarifying that the 100 hp limit on equipment permitted outside of a machinery room applies to the total connected compressor power per system vs including other motor-driven equipment, such as condensers or liquid pumps.*

*A second revision added provisions for "low probability pumps." In addition to the previous allowance for evaporators, condensers and ancillary piping and valves, the IMC now allows low-probability pumps (as defined above to mean pumps that are constructed in such a way as to have a reliable means of preventing leakage of refrigerant to atmosphere) to be located outside of a machinery room in refrigerated industrial process and storage areas. This coordinates with provisions that were added to the 2014 edition of IIAR 2 and allows the use of low-probability liquid pumps in close proximity to evaporators. Pumps that are not low-probability are still permitted, but they must be enclosed in a space meeting the requirements for a machinery room.*

- **Section 1106.1 General:** Refrigeration systems shall comply with the requirements of this code and, except as modified by this code, ASHRAE 15. Ammonia-refrigerating systems shall comply with this code and, except as modified by this code, ASHRAE 15 and IIAR 2, IIAR 3, IIAR 4 and IIAR 5.

  **Discussion:** IIAR 3, IIAR 4 and IIAR 5 have been adopted as official, enforceable reference standards.

## 2018 IFC

- **Section 605.1 Scope:** Refrigeration systems shall be installed in accordance with the International Mechanical Code.

  **605.1.1 Refrigerants other than ammonia.** Where a refrigerant other than ammonia is used, refrigeration systems and the buildings in which such systems are installed shall be in accordance with ASHRAE 15.

  **605.1.2 Ammonia refrigeration.** Refrigeration systems using ammonia refrigerant and the buildings in which such systems are installed shall comply with IIAR-2 for system design and installation and IIAR-7 for operating procedures. Decommissioning of ammonia refrigeration systems shall comply with IIAR-8.

  **Discussion:** *This revision is part of IIAR's ongoing effort to sepa-*

*rate ammonia refrigeration from ASHRAE 15 and gain recognition of IIAR standards as a standalone basis for regulation of ammonia refrigeration systems. The first step in this process, which has now been accomplished in the 2018 International Fire Code, is having codes reference ASHRAE 15 for refrigerants other than ammonia and only IIAR standards for ammonia systems.*

- **Section 605.8 Refrigerant detectorion.** Machinery rooms shall be provided with a refrigerant detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The alarm shall be actuated at a value not greater than the corresponding TLV-TWA values shown in the International Mechanical Code for the refrigerant classification. Detectors and alarms shall be placed in approved locations. The detector shall transmit a signal to an approved location with an audible and visible alarm. Where ammonia is used as the refrigerant, detection shall comply with IIAR 2. For refrigerants other than ammonia, refrigerant detection shall comply with Section 605.8.1.

  **605.8.1 Refrigerants other than ammonia.** A detector, or a sampling tube that draws air to a detector, shall be provided at an approved location where refrigerant from a leak is expected to accumulate. The system shall be designed to initiate audible and visible alarms inside of and outside each entrance to the refrigerating machinery room and transmit a signal to an approved location where the concentration of refrigerant detected exceeds the lesser of the following:

  1. The corresponding TLV-TWA values shown in the International Mechanical Code for the refrigerant Classification.
  2. Twenty-five percent of the lower flammable limit (LFL). Detection of a refrigerant concentration exceeding the upper detection limit or 25 percent of the lower flammable limit (LFL), whichever is lower, shall stop refrigerant equipment in the machinery room in accordance with Section 605.9.1.

  **Discussion:** *The 2018 edition of the IFC includes a comprehensive rewrite of provisions for all gas detection systems. Among the revisions is a new Section 916 for this topic. Although refrigerant leak detection was included as part of this revision, ammonia refrigeration was granted a unique exemption from the new requirements because the 2014 edition of IIAR 2 provides comprehensive regulations for ammonia refrigerant leak detection systems. This exemption is embedded in IFC Section 605.8, which defers to IIAR 2.*

## 2018 IBC

- **Section 1006.2.2.2 Refrigeration Machinery Rooms:** Machinery rooms larger than 1,000 square feet shall have not less than two exits or exit access doorways. Where two exit access doorways are required, one such doorway is permitted to be served by a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the maximum horizontal dimension of the room.

  All portions of machinery rooms shall be within 150 feet (45 720 mm) of an exit or exit access doorway. An increase in exit access travel distance

is permitted in accordance with Section 1017.1.

Doors Exit and exit access doorways shall swing in the direction of egress travel, regardless of the occupant load served. Doors Exit and exit access doorways shall be tight fitting and self-closing.

**Discussion:** *Machinery room door requirements have been changed to make it clear that ONLY those door that serve as a means of egress are required to swing outwards from the machinery room and be tight-fitting and self-closing. Previous IBC code text suggested that all doors leading out of a machinery room were required to swing in the outward direction, even if they led to a control room, electrical room or other space that was not part of the intended egress path.*

*The provisions related to doors being tight-fitting and self-closing were also changed to only apply to exit and exit access doors. However, that change was essentially editorial and was only made because exit and exit access doors are the only door types regulated by IBC Section 1006. IIAR 2 will still require ALL machinery room doors be tight-fitting and self-closing. It is also important to remember that IIAR 2 requires exit and exit access doors to have panic hardware.*

## 2018 UMC

- **1102.0 Refrigeration Systems.**

**1102.1 General.** Refrigeration systems using a refrigerant other than ammonia shall comply with this chapter and ASHRAE 15.

**1102.2 Ammonia Refrigeration Systems. Exception:** Refrigeration systems using ammonia refrigeration systems as the refrigerant shall comply with IIAR 2, IIAR 3, IIAR 4, and IIAR 5 and shall not be required to comply with this chapter.

**Discussion:** *This revision is part of IIAR's ongoing effort to separate ammonia refrigeration from ASHRAE 15 and gain recognition of IIAR standards as a standalone basis for regulation of ammonia refrigeration systems. The first step in this process, having codes reference ASHRAE 15 for refrigerants other than ammonia and only IIAR standards for ammonia systems, was completed in the 2015 UMC.*

*The second step in this process, having codes entirely defer to IIAR standards for ammonia systems, was completed for the UMC in the 2018 edition. Based on the above change and several other revisions to UMC Chapter 11 that eliminated all references to ammonia refrigeration, UMC Chapter 11 no longer applies to ammonia refrigeration systems. Instead, the code now simply requires compliance with IIAR 2, 3, 4 and 5, recognizing that IIAR's documents are comprehensive and no longer rely on codes or other standards for supplemental requirements.*

*Note that IIAR's other standards, which relate to system operation, maintenance and decommissioning, are not referenced by the UMC, but are instead referenced by fire codes. This is because the UMC is geared to new construction; whereas, fire codes include regulations for existing occupancies and equipment.*

*The UMC's complete deferral to IIAR ammonia refrigeration standards is the most significant acknowledgement to date of IIAR's status as the leading standards development organization (SDO) representing the interest of the ammonia refrigeration industry.*

## 2018 NFPA 1

- **Sections 53.2.3.1.1 and 53.2.3.3.3:**

  **53.2.3.1.1 Alarm Threshold.** The refrigerant vapor detector shall activate approved visual and audible alarm signaling devices at one of the following refrigerant thresholds:

  (1) At a value not greater than the corresponding TLV-TWA (or toxicity measure consistent therewith); not to exceed 25 percent of the lower flammable limit (LFL)

  (2) For ammonia, at a concentration not exceeding 1000 25 parts per million

  **53.2.3.3.3** For systems using a refrigerant other than ammonia, pPurge fans shall also respond automatically to the refrigerant concentration detection system set to activate the ventilation system at the threshold levels set forth in 53.2.3.1.1. For systems using ammonia, purge fans shall also respond automatically to the refrigerant concentration detection system set to activate the ventilation system at an ammonia concentration not exceeding 150 parts per million.

  **Discussion:** *These sections were revised to correlate the provisions for refrigerant detection alarm and emergency ventilation activation fan thresholds with IIAR 2, which specifies 25 ppm for alarms and 150 ppm for emergency ventilation. Previously, NFPA 1 specified 1,000 ppm for both, which created a conflict between the code and its IIAR reference standard.*

- **Section 53.3 Operations, Maintenance, and Testing, and Decommissioning.**

  **53.3.3 Decommissioning of Ammonia Refrigeration Systems.** Decommissioning of closed-circuit ammonia refrigeration systems shall comply with ANSI/IIAR 8, Decommissioning of Closed-Circuit Ammonia Refrigeration Systems.

  **Discussion:** *IIAR 8 has been adopted as official, enforceable reference standard.*

**2017 NEC (CLASSIFIED ELECTRICAL EQUIPMENT):**

- **500.5(A) General.** Locations shall be classified depending on the properties of the flammable gas, flammable liquid–produced vapor, combustible liquid–produced vapors, combustible dusts, or fibers/flyings that could be present, and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area shall be considered individually in determining its classification. Where pyrophoric materials are the only materials used or handled, these locations are outside the scope of this article.

Informational Note No. 1: Through the exercise of ingenuity in the layout of electrical installations for hazardous (classified) locations, it is frequently possible to locate much of the equipment in a reduced level of classification or in an unclassified location and, thus, to reduce the amount of special equipment required.

Refrigerant machinery rooms containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm at a concentration not exceeding 150 ppm shall be permitted to be classified as "unclassified" locations.

~~Rooms and refrigerated areas containing ammonia refrigeration systems that are equipped with adequate mechanical ventilation that operates continuously or is initiated by a detection system that alarms at 1000 ppm may be classified as "unclassified" locations.~~

Informational Note No. 2: For further information regarding classification and ventilation of areas involving closed-circuit ammonia refrigeration systems, see ANSI/ASHRAE 15-2013, Safety Standard for Refrigeration Systems and ANSI/IIAR 2-2014, Standard for Safe Design of Closed-Circuit Ammonia Refrigeration Systems.

**Discussion:** *IIAR was successful in advocating two changes to the NEC that appear in the 2017 edition. These changes eliminated the longstanding requirement for refrigerated process and storage areas to either be provided with an emergency ventilation system or contain only electrical equipment that complies with Class I, Division 2 or Class I, Zone 2 hazardous (classified) location requirements. The text of Section 500.5 above relates to the NEC's Class/Division scheme for protection of hazardous electrical locations. A similar revision, not shown, was made in Section 505.5 for the Class/Zone scheme, which is an optional compliance path commonly used outside of the U.S.*

*The requirement to provide ventilation or classified electrical equipment in ammonia machinery rooms is widely accepted; however, it has never been industry practice to use this approach for refrigerated process, storage or other areas. Nevertheless, literal application of the previous NEC text, which has now been stricken, put designers and owners at risk of a "gotcha" if a local code official enforced the literal text. The revised provisions in the 2017 edition eliminate the offending text, and instead fall back to the general assessment that is applicable to determining the electrical classification where any flammable liquids or gases are present. In addition, the reference to IIAR 2 and ASHRAE 15 directs code users to the specific guidance in these documents for determining electrical classification and ventilation requirements.*

*It should be noted that ASHRAE 15 was retained as a reference standard in this edition of the NEC because, at the time this revision was approved, ASHRAE 15 was still scoped to include ammonia refrigeration.*

Historically, FM Global staff members have not sought outside input when developing or updating their provisions, but in the most recent update, they made a unique exception and invited input from IIAR. As a result, the revised FM Global provisions are more closely aligned to industry standards than preceding data sheets.

### FM DATA SHEETS 7-13, 12-61, AND 12-61R

**Discussion:** *IIAR members who are insured by Factory Mutual (FM Global), have long dealt with supplemental recommendations documented in Historically, FM Global staff members have not sought outside input when developing or updating their provisions, but in the most recent update, they made a unique exception and invited input from IIAR. As a result, the revised FM Global provisions are more closely aligned to industry standards than preceding data sheets.*

*The updated approach was to merge appropriate provisions from all three data sheets into a single document, a revised DS 7-13 (2018). In addition, provisions were updated Data Sheets 12-61 and 12-61R, which had separately dealt with mechanical integrity, were retired.*

*Changes to FM recommendations vs. prior provisions are too numerous to cover here, but IIAR members with FM Global insurance can download a free copy of the updated DS 7-13 here: https://www.fmglobal.com/research-and-resources/fm-global-data-sheets.*

Part 2 of this article, which includes a review of major changes processing for ASHRAE 15 and the upcoming 2021 model codes, will be published in the next issue.

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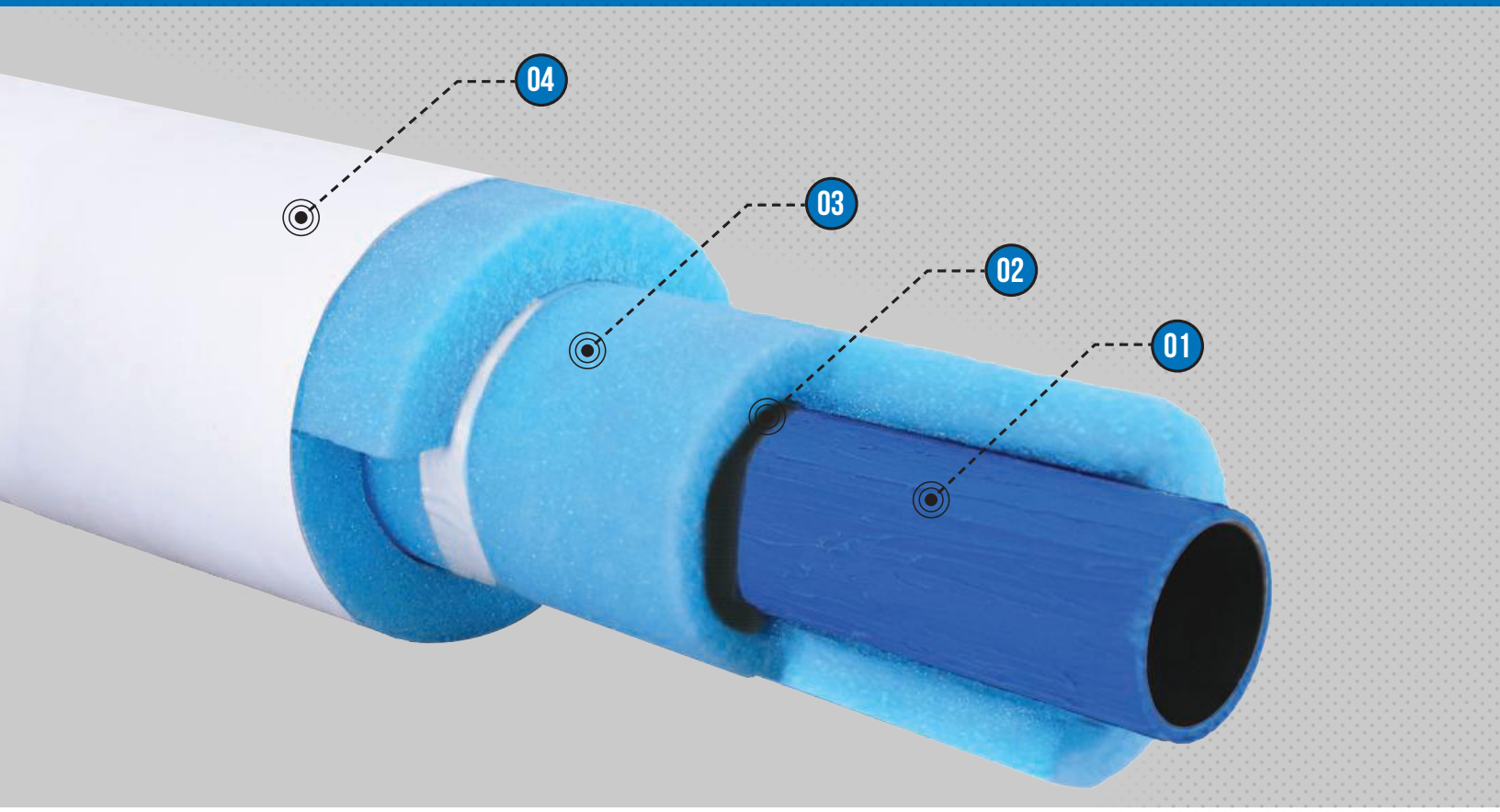


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