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THE OFFICIAL MAGAZINE OF THE AMMONIA REFRIGERATION INDUSTRY ■ **FEBRUARY 2023**

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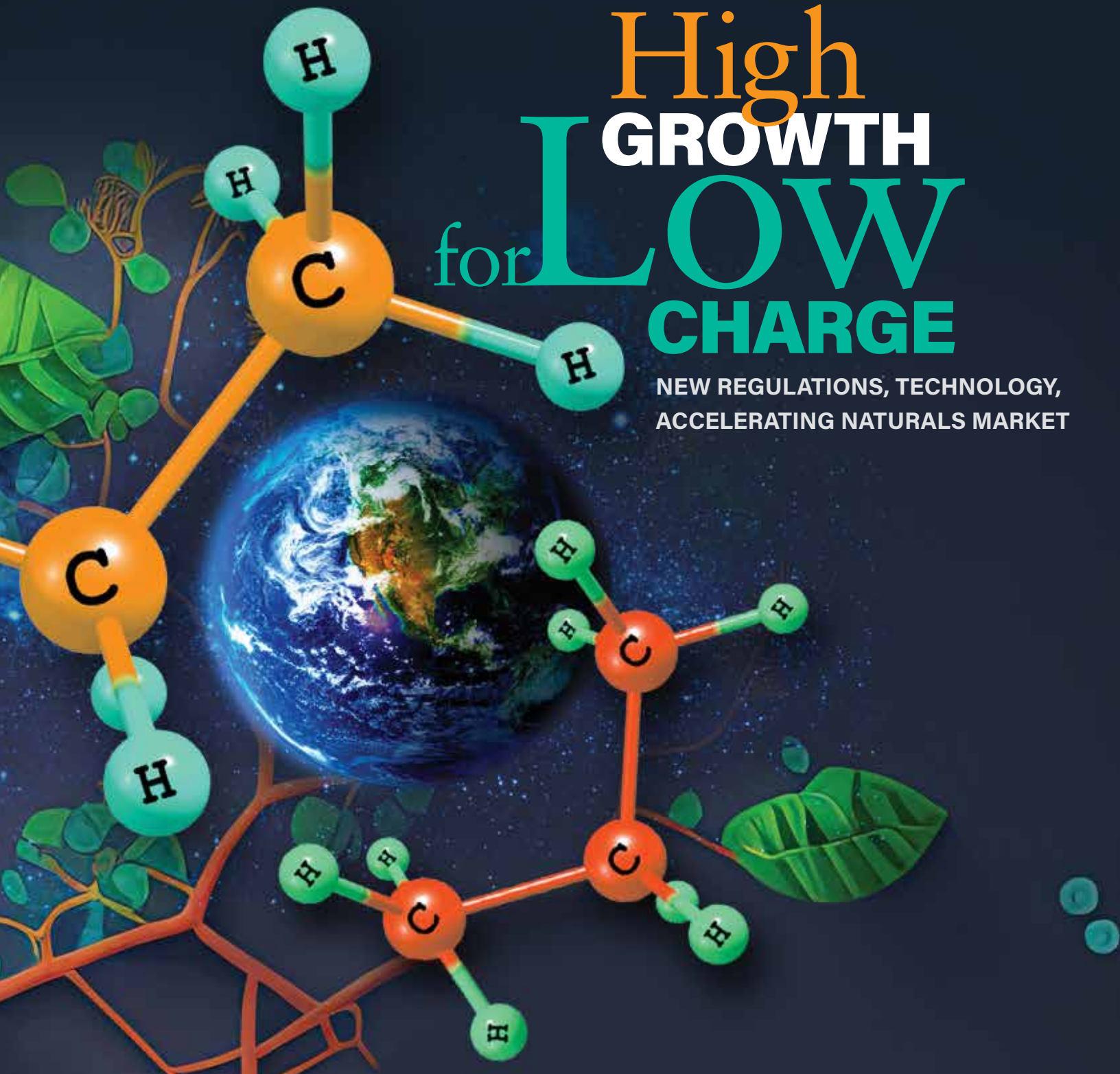

High GROWTH for LOW CHARGE

NEW REGULATIONS, TECHNOLOGY, ACCELERATING NATURALS MARKET

FEBRUARY 2023

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High GROWTH for LOW CHARGE

NEW REGULATIONS, TECHNOLOGY, ACCELERATING NATURALS MARKET

CONDENSER STAFF

Publisher
Gary Schrift

Editor-In-Chief
Andrea Fischer

Staff Writer
Mindy Long

Creative Director
Bill Ellis

V.P. and Technical Director
Eric Smith

International Institute of Ammonia Refrigeration

1001 North Fairfax Street, Suite 503
Alexandria, VA 22314
www.iiar.org

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president's MESSAGE

BY GARY SCHRIFT

The International Institute of Ammonia Refrigeration is growing, both within the United States and abroad, thanks to the use of natural refrigerants, and nowhere is this more evident than at the IIAR annual conference.

This year, we'll meet in person in Long Beach, California to discuss everything from HFC phaseouts to the AIM Act, to new technologies.

I always look forward to the annual conference (and the spirited discussions that happen there). This meeting is both a reflection of IIAR's growth and an opportunity to build membership and extend the adoption of natural refrigerants to new groups of end users.

This year, we'll meet in person in Long Beach, California to discuss everything from HFC phaseouts to the AIM Act, to new technologies.

As we welcome returning IIAR members, new members, and guests, I would like to call attention to a few of the exciting features of this year's conference and the opportunities we have for advancement in the coming months.

There will be numerous educational opportunities throughout the conference, and attendees can earn professional development hours.

The sessions get started on Sunday with the Vessel Design, Analysis and Inspection program, which will feature four speakers who will examine aspects of vessel design, specification, fabrication, inspection, and maintenance and repair. It is designed to give attendees a greater awareness and knowledge of the complete life cycle of pressure vessels.

We've also created several workshops, including an AIM Act workshop this year. Participants will be speaking on various aspects of the AIM Act, covering everything from EPA requirements, including what refrigerants will be phased out, to how the financial industry sees sustainability. The panel also includes a professor who will address how students see environmental work.

The workshop panel, Solving the Technician Shortage, will address the significant labor gap in the refrigeration trade. The panel will review the results of the North American Sustainable Refrigeration Council's recent technician workforce assessment, explore key challenges, and identify strategies to strengthen workforce recruiting, training, and retention.

I'm excited to be teaming up with NASRC this year, an organization that shares a common mission with IIAR, which is to advocate for natural refrigerants.

The NASRC focuses its attention on commercial refrigeration, especially for grocery stores. But we can certainly learn from each other and help each other reach our common vision.

Also new this year, IIAR will host a Women in Natural Refrigeration panel discussion and workshop on Tuesday afternoon, which is open to all attendees.

In this workshop, titled: Diversity and Inclusion in Natural Refrigeration, attendees will learn firsthand from other professionals and leaders in the industry about the experiences that helped them in shaping a successful career.

Meanwhile, the IIAR Regulatory Panel will feature longtime IIAR member Peter Thomas who has put together a terrific panel consisting of representatives from California state regulators and end users.

History shows that regulatory decisions enacted in California can influence federal law and federal enforcement interpretations, so we'll explore the current environment of California regulations with representatives from CalOSHA and CUPA/CalARP.

One of the most interesting developments, examined in this issue of the Condenser, is the growing adoption of natural refrigerants. There are more options than ever in packaged equipment, and package and low-charge systems are growing alongside traditional installations and natural refrigerants.

Several factors are driving that growth, including strong growth in the overall frozen food markets and construction markets requiring new refrigeration systems and interest in reducing the quantity of ammonia at a facility and staying below regulated thresholds.

It's an exciting time for natural refrigerants and I'm looking forward to having these conversations in person at our second post-pandemic conference this year.

As we respond to the interesting and challenging opportunities ahead of us, IIAR can make the world a better place through the safe and sustainable use of natural refrigerants. Whether it's signing up to work on a committee, or just participating in the many opportunities to learn and network, there will be no shortage of things to do in March, and I urge you to get involved in the work of your organization in any way you can. I look forward to seeing you at the conference!

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chairman's MESSAGE

BY TREVOR HEGG

As I wind up my year as chairman of our International Association of Industrial Refrigeration, I look back and see all the wonderful accomplishments that you – our members and committees have achieved –setting the stage for even more in the year ahead.

First on my list is the newly formed IIAR AIM Act Task Force.

The American Innovation and Manufacturing Act (AIM) Act is expected to increase the long-term use of natural refrigerants and bring significant new opportunities to the natural refrigerant industry.

To ensure that those in the industry are aware of the changes and opportunities the AIM Act will bring, we formed the AIM Act Task Force, which I see as one of the best vehicles for influencing everything from the regulatory environment to the refrigeration marketplace.

The AIM Act represents an important opportunity to highlight the role that natural refrigerants can play in addressing climate challenges by developing plans to increase awareness about the AIM Act, related regulations, and how companies can utilize natural refrigerants as they transition from high global warming potential refrigerants.

The task force has already met numerous times to develop resources and materials for the implementation of the AIM Act with several goals.

The first is to inform everybody about the AIM Act and keep people up to date on the rule-making while making sure that IIAR is well-positioned to present natural refrigerants as a logical response to the AIM Act.

Change is hard and often resisted. It won't be any different for those who haven't already – to make the move from HFCs to natural refrigerants.

And it's not just about embracing change as IIAR members. Our advocacy around the AIM Act is about influencing and encouraging change. We may be a small voice, but we are the experts, and we're embracing the challenge.

Being on the board for the last nine years, including this past year as chair, is a humbling experience. If I had not been fortunate enough to become an IIAR Chairman, I wouldn't have realized and been able to appreciate how much time, energy, and effort is put in by the board, the committee chairs, staff, and members, to make IIAR what it is.

I have been a part of a couple of other trade associations but none have volunteers with this level of commitment. The relationships that have been created are special and treasured. It is amazing.

IIAR members are IIAR's greatest asset. I would like to thank everyone who has volunteered their time and committed themselves to participate this past year – your effort is starting to pay off.

IIAR members are IIAR's greatest asset. I would like to thank everyone who has volunteered their time and committed themselves to participate this past year – your effort is starting to pay off.

I'd also like to take this opportunity to call for your renewed membership, for your increased participation and leadership in IIAR's committees, and development of conference technical papers. Whether you get involved as a committee member or as a tech paper author, or in some other way, your involvement is what makes IIAR a great organization.

Our publications address new trends and introduce new technologies, and you, as an IIAR member have the opportunity to contribute to them directly.

You have an unparalleled opportunity to influence the policies, codes, and standards that shape our industry. Our committees span all of these areas and beyond, and they all depend on your help and support.

This year's Natural Refrigeration Conference and Expo will feature new technologies, technical papers, and workshops. The conference in Long Beach is a great place for members to start getting involved in what is a group effort. We invite and look forward to everyone's participation. Thank you all for a wonderful year!

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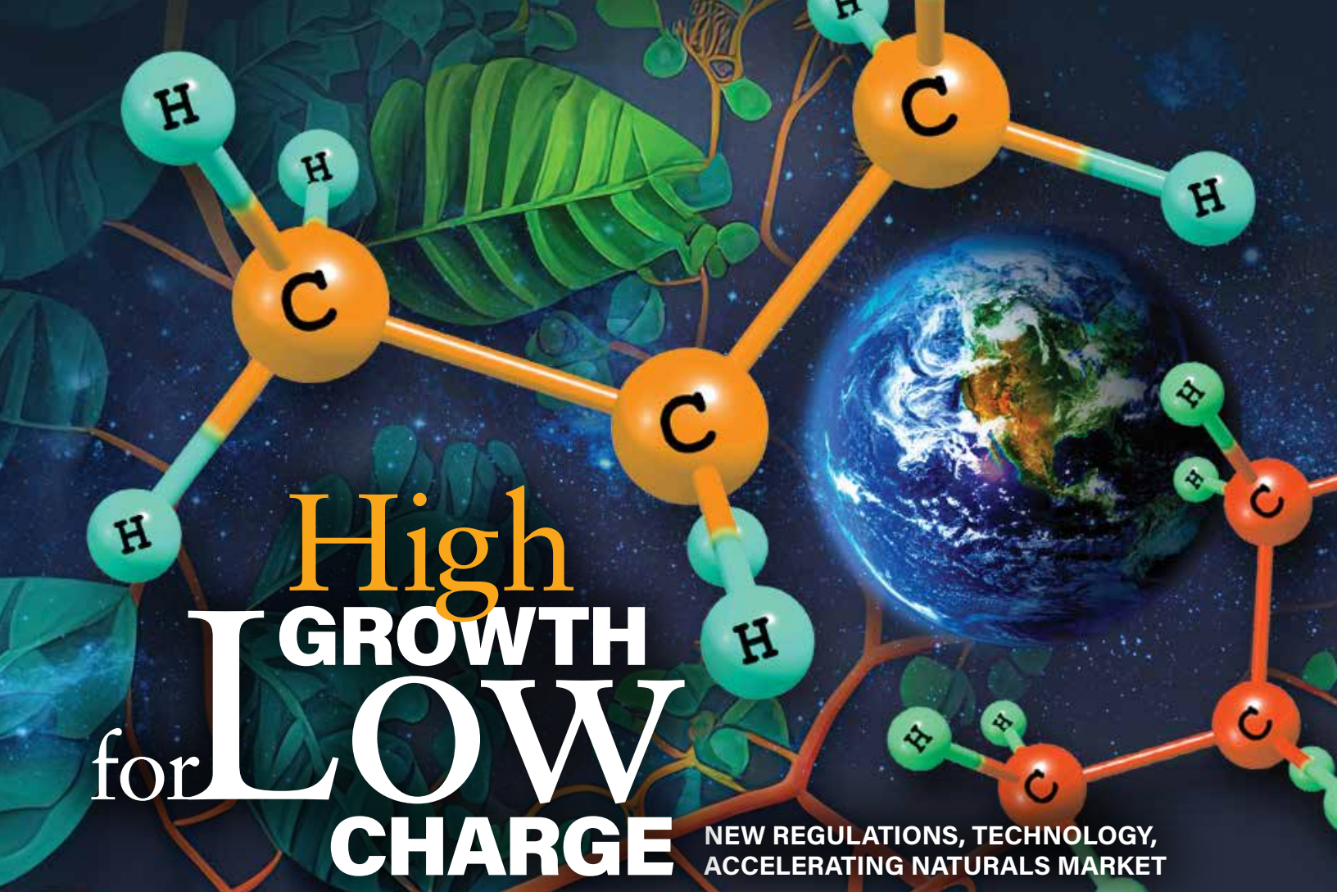


High GROWTH for LOW CHARGE

NEW REGULATIONS, TECHNOLOGY, ACCELERATING NATURALS MARKET

The pace of adoption of low-charge and packaged systems continues to increase as government regulations, sustainability initiatives, safety precautions, and technology advance.

"There has been a drive to reduce refrigerant charge in all refrigeration," said John Collins, industrial sales manager for Zero Zone. "The synthetic refrigerants containing HFC compounds are being regulated. Current and proposed regulations set definite limits which are driving system design for those types of systems and driving low-charge systems and more packaged unitary equipment because they're trying to get the charge down."

The U.S. Environmental Protection Agency has been given statutory authority to move forward with phasing down hydrofluorocarbons as part of the American Innovation and Manufacturing Act (AIM), which has impacted the refrigerant industry.

"Phasedown of HFCs under the AIM act is definitely a growing driver as users and potential users of synthetic refrigerants look for environmentally friendly alternatives," said Kurt Liebendorfer, vice president of Evapco.

The AIM Act and current EPA proposals could place a hard number of pounds on the refrigerant requirements. "Under the proposed regulations in California, if you have more than 50 pounds and it is higher than a certain global warming potential, you can't use it for new systems," Collins said. "There are ranges of GWP limits based on the application."

Those limits are central to growth. "The more stringent they are, the more end users will gravitate towards natural or other 'future proof' solutions," said Glenn Barrett, engineering manager at DC Engineering. "Down the road, natural refrigerants may end up being the only future-proof solution."

Europe has also placed regulations on synthetic refrigerants, which is adding to the adoption of low-charge and package systems technologies, but so is consumer and stakeholder awareness. Corporate sustainability statements are being scrutinized by employees and board members, explained Dave Fauser, director of sales for CIMCO Refrigeration.

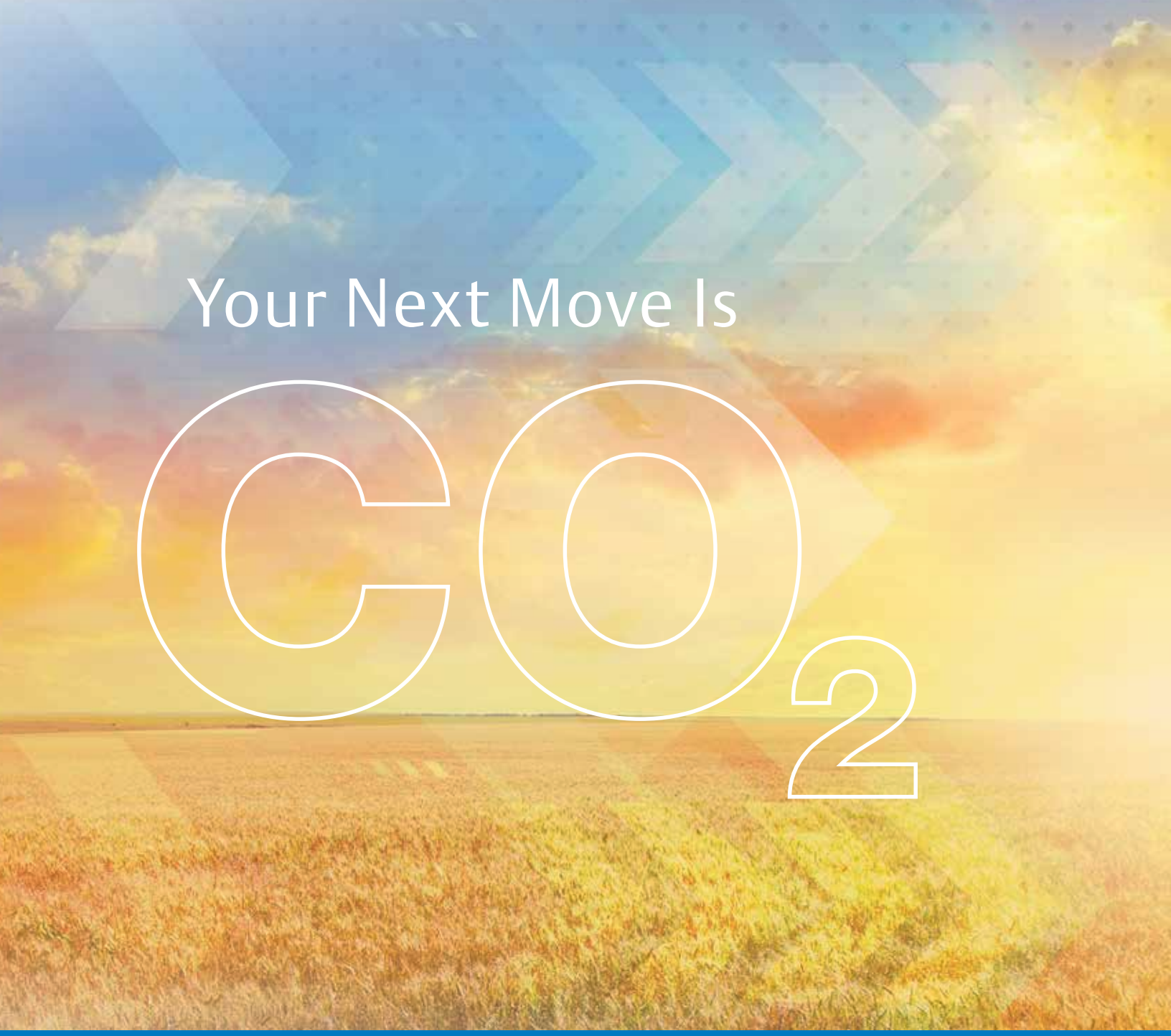
Safety is also driving the growth of low-charge systems, especially for ammonia. "When the amount of ammonia in a system is small, the risks of a refrigerant release with offsite impacts become very low. This is driving a trend toward low-charge ammonia systems in the refrigeration industry today," Collins said.

For CO2, reducing charge helps manage the refrigerant and reduces risk if there is a release within the system. "Even with an A1 refrigerant, there are hazards. CO2 is heavier than oxygen. If CO2 is released and settles, it displaces the oxygen in the area. It is colorless and odorless. So there isn't a realization that it is there until there is a physical reaction," Collins said.

SEEING GROWTH

There are more options than ever in packaged equipment, and package and low-charge systems are growing alongside traditional installations and natural refrigerants.

"The growth in the overall market has been very strong the last few years,"



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Liebendorfer said, adding that the one segment that packaged systems are displacing field-erected systems is the cold storage industry, where designers, builders, and owners have come to recognize the benefits of eliminating the central plant machinery room. "As a sign of this, commercial packaged CO2 transcritical systems have recently 'jumped out' of its strong growth in supermarket applications and into the cold storage market."

Liebendorfer said slower growth eight years ago is being overtaken by much faster adoption in the last few years for industrial low charge ammonia packages. "This seems to indicate the market is coming into a tipping point," he said. "The largest growth is in the cold storage market where they are a great fit, but other markets have been steadily increasing."

Several factors are driving growth, including strong growth in the overall frozen food markets and construction markets requiring new refrigeration systems and interest in reducing the quantity of ammonia at a facility and staying below regulated thresholds.

Other active market segments include food and beverage processing, the chemical industry, and dairy. "Ammonia is being inquired about for HVAC (chillers) and non-traditional industrial applications, while CO2 is experiencing even greater interest in the commercial refrigeration and HVAC markets," Liebendorfer said.

The recreational market is also embracing the systems. "For our ice rink side, almost everything is low-charge design," Fauser said, adding that customers in all sectors want to lower risk, lower cost and increase efficiency in all sectors.

Glenn Barrett, engineering manager for DC Engineering, said, historically, natural refrigerants were not used in supermarkets, but that is changing. He added that the use of low-charged packaged systems, commonly called "micro-distributed" in supermarkets, has grown tremendously over the past two to three years.

"These systems typically use R290 (propane) or an HFC/HFO blend as the refrigerant with charge sizes from 150 grams to 20 pounds of refrigerant per appliance. A typical HFC compressor rack averages between 700 and 2,000 pounds," Barrett said. "They are typically deployed with a hydronic loop as a source to reject heat from the evaporators and compressors and have sophisticate controls and alarm features."

Ammonia, especially in secondary chiller systems, is being used in non-industrial applications. "I don't see that going away or reducing, but we'll be seeing some other options," Collins said. "CO2 is taking more and more market share in filling those needs."

Collins said he is seeing more and more packaged units coming to the industrial sector due to the need to streamline the installation process and have a more repeatable process that can be used by technicians. He said there has also been a move towards more secondary chiller systems circulating chilled glycol.

In more traditional pumped ammonia systems, there could be 20 pounds of refrigerant per ton. "With other designs, we see large central plant installations with charges in the range of 10 pounds per ton. For chiller systems and package systems, charges are typically in the range of two to five pounds per ton; potentially even lower. It is a dramatic difference in how you design the system," he explained.

The next step is unitary type of equipment, using similar strategies on the system design side, with units of 10, 50, and 100 tons capacity. "You can reduce the amount of field pipe, so you don't have a lot of refrigerant in large pipes for hundreds and hundreds of feet," Collins said. "Right there, you're reducing the charge significantly.

Fauser added that end-users don't have to take an all-or-nothing approach to low-charge. For example, although low-charge packaged systems may not be feasible for massive food and beverage plants, low-charge technology can still be incorporated into the design. "There is a solution that works for everything, and it is nice to have those options."

Barrett said he could see the adoption of A2L refrigerants for many applications. Still, he wouldn't be surprised if the added costs to implement the mildly flammable A2L refrigerants will lower or eliminate the cost premium end users currently pay for natural refrigerant solutions.

"If the EPA regulations are implemented as proposed, some micro-distributed designs may need to migrate to a natural refrigerant, or an A2L, to remain under the GWP thresholds," Barrett said. "Although natural refrigerant solutions can carry a first cost premium when compared to synthetic refrigerant systems, the cost difference between a natural refrigerant system and an A2L system has not been determined due to unknowns regarding how the safety and leak detection requirements will affect equipment and construction costs."

CHANGING TECHNOLOGY

Technology has continued to evolve and improve, making low-charge systems more appealing. "Historically, engineers and maintenance professionals only used the small condensing units as a last resort or to fill a very small need," Barrett said. "When compared to typical HFC parallel compressor racks, condensing units were considered to be poorly controlled and energy 'hogs.' Maintenance costs could also be significantly higher and overall reliability is still an outstanding question."

Variable capacity compressors, the ability to adjust the discharge pressure according to ambient or loop temperature, electronic expansion valves, and case controllers are all new technologies in low-charge systems, Barrett said. "The ability to alarm, monitor, and review system operation from one 'supervisory' HMI device has also been improved," he said.

Additionally, control systems are getting smarter, package configurations are evolving to better match different building sizes or layouts, and there are more options to accessorize a design to fit specific needs and applications, Liebendorfer explained.

Fauser said contractors, manufacturers, and designers are challenging each other. The thermal space holds new opportunities for low-charge systems and natural refrigerants to play a bigger role in the fight against climate change. "When we look at heat and cold, there is no such thing as cold. There is heat or lack of heat. What we're seeing as a trend is refrigeration systems are becoming thermal systems," he explained. "As a thermal system, we're looking at refrigeration, cooling, and heating."

What makes the low-charge compatible with thermal designs is lowering the charge by putting a plate condenser on to recover the heat. "Because of this drive to net zero, this concept of one unit for thermal design makes sense from an environmental standpoint," Fauser said.

As end-users continue to adopt low-charge systems, technology will continue to change. "With the rapidly growing installations, the foundation is being laid now for the next generation of these low-charge systems and CO2 transcritical systems. This includes packages that are able to handle larger cooling capacities, versatility in fitting application and building layouts, and smarter controls systems," Liebendorfer said.

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IIAR Annual Conference Heads to Long Beach

The International Institute of Ammonia Refrigeration 2023 annual Natural Refrigeration Conference & Expo will take place in Long Beach, California, March 12th-15th with a Foundation Golf Outing on March 11th and the first ever Foundation Pickleball/Cornhole Tournament on March 12th. The event provides four days of technical knowledge, networking, and industry-sponsored events for those involved in the natural refrigeration industry.

"Our registration so far has outpaced last year's performance where we saw almost 1,300 registrations in total, so we expect to surpass that number," said Ben Dawes, advocacy and digital marketing manager for IIAR.

There will be numerous educational opportunities throughout the conference, and attendees can earn professional development hours. The sessions get started on Sunday with the Vessel Design, Analysis, and Inspection program, which will feature four speakers who will examine aspects of vessel design, specification, fabrication, inspection, and maintenance and repair. It is designed to give attendees a greater awareness and knowledge of the complete life cycle of pressure vessels.

"The vessels are an integral part of every refrigeration system. How you design them, how they are used, and how you install, maintain, and operate is critical," said Eric Smith, IIAR's vice president and technical director. "We have some of the foremost experts lined up to provide their insights on this important topic. "

IIAR has also created several workshops, including an AIM Act workshop. Participants will be speaking on various aspects of the AIM Act, covering everything from EPA requirements, what refrigerants will be phased out to how the financial industry sees sustainability. The panel also includes a professor who will address how students see environmental work. "Then we will be opening it up for about a half hour of audience questions," said Gary Schrift, IIAR's president.

The workshop panel, Solving the Technician Shortage, will address the significant labor gap in the refrigeration trade. The panel will review the results of NASRC's recent technician workforce assessment, explore key challenges, and identify strategies to

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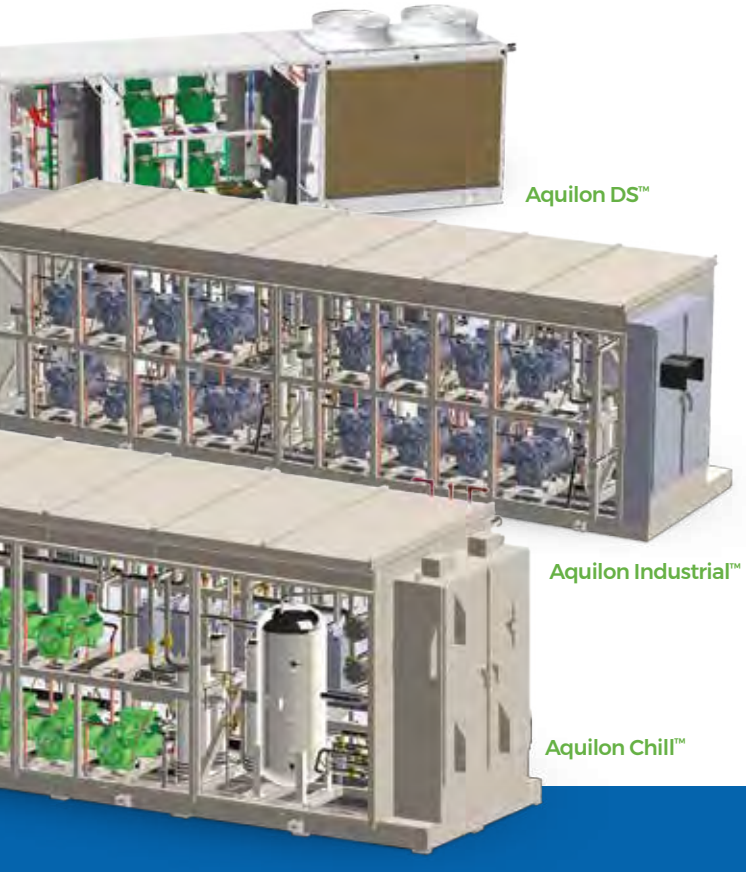

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"I am excited to be teaming with an allied association, NASRC, which shares a common mission with IIAR, which is to advocate for natural refrigerants. The NASRC focuses its attention on commercial refrigeration, especially for grocery stores. But we can certainly learn from each other and help each other reach our common vision," Schrift said.

IIAR is hosting a Women in Natural Refrigeration (WiNR) panel discussion and workshop on Tuesday afternoon, which is open to all attendees. In this workshop, titled: Diversity and Inclusion in Natural Refrigeration, attendees will learn firsthand from other professionals and leaders in the industry about their experiences that helped them in shaping a successful career. The workshop portion will also present an internationally published study about the experience of women and other groups within the industry which will help attendees identify opportunities arising from those experiences. "We want women and men to attend this panel discussion and workshop because everyone should understand how we can improve diversity in the industry, and the benefits that can be realized from doing so," Schrift said, adding that the workshop will present the Women in Cooling report.

Other workshops include Efficiency in Large Refrigerated Facilities for Perishable Foods, CO2 System Add-Ons: Calculations and Field Measurements and Next Generation CO2 Pumps.

Several technical papers will be presented during the conference.

The IIAR Regulatory Panel will feature longtime IIAR member Peter Thomas of Resource Compliance Inc. "He has put together a terrific panel consisting of representatives from California state regulators and end users," said David Sainato, IIAR's director of education.

History shows that regulatory decisions enacted in California can influence federal law and federal enforcement interpretations. "We'll explore the current environment of California regulations with representatives from CalOSHA and CUPA/CalARP, as well as an end-user from E&J Gallo," Sainato said.

Attendees can participate in several technomercials, presented during exhibit hall hours and in the exhibit hall, which cover updates to equipment and services. The sessions are commercial in nature and allow vendors to incorporate technical information and training into a program that promotes a product or service.

This year's keynote speaker, Dr. Janet Lapp, is a psychologist, author, and consultant for workplace transformation. Her unique interactive approach engages the audience in a change lab, where they first assess their leadership skills, then leave with tools to transform from where they are to where they need to be.

Networking opportunities will take place throughout the event. In addition to the WiNR Reception, there is a First Timer's Reception, Chairman's Reception, and several coffee breaks. On Monday, attendees can take part in a "Block Party" at The Cove at Long Beach Convention Center

The Exhibit Hall, which will feature several key industry partners, will be open on the 12th, 13th, and 14th. "We have a record number of island large booths—20 x 20 and larger—so we should have a record number of equipment pieces on display and a very full exhibit hall," Schrift said.

The largest spaces on the exhibit hall floor, each with 400 square feet or more of booth space, have been taken by Bitzer, Carnot, Century Refrigeration, Colmac Coil, Danfoss, Evapco, Frascold, Frick, Güntner, GEA, Heatcraft, Howden, Innovative Refrigeration Systems, Lu-Uve Group, M&M, Mayekawa, MrBraz and Associates, SGS, Vilter, and Zero Zone.

Register for the conference online at http://www.iiar.org.

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Friday, March 10, 2023				
12:00 PM	5:00 PM	Board Lunch and Meeting – *Invitation Only*		
5:30 PM	7:00 PM	Board Dinner – *Invitation Only*		
Saturday, March 11, 2023				
8:30 AM	5:00 PM	Registration Desk Open – *Sponsored by RE Lewis*	LBCC	Registration Desk
6:30 AM	4:30 PM	NRF Golf Tournament – *Paid Registration Required*	Anaheim Hills Golf Club	
9:00 AM	5:00 PM	Exhibitor Move-in	LBCC	Exhibit Hall A
5:00 PM	7:00 PM	NRF VIP Reception – *Invitation Only*		
7:00 PM	8:30 PM	International Dinner – *Invitation Only*		
Sunday, March 12, 2023				
7:00 AM	8:30 AM	Committee Meetings Coffee Break – *Sponsored by Isotherm*	LBCC	Meeting Room 100/200 Foyers
7:30 AM	5:00 PM	Registration Desk Open – *Sponsored by RE Lewis*	LBCC	Registration Desk
8:00 AM	5:00 PM	Exhibit Hall Setup	LBCC	Exhibit Hall A
8:00 AM	11:45 AM	Standards Committee	LBCC	Meeting Room 101A
8:00 AM	11:45 AM	Piping Committee	LBCC	Meeting Room 102B
8:00 AM	11:45 AM	Government Relations Committee	LBCC	Meeting Room 103B
8:00 AM	11:45 AM	Education Committee	LBCC	Meeting Room 103C
8:00 AM	10:00 AM	International Committee	LBCC	Meeting Room 101B
8:00 AM	11:45 AM	Research Committee	LBCC	Meeting Room 201B
8:00 AM	11:45 AM	Marketing Committee	LBCC	Meeting Room 202B
8:00 AM	11:45 AM	Energy and Sustainability Committee	LBCC	Meeting Room 202C
8:00 AM	11:45 AM	CO2 Committee	LBCC	Meeting Room 201A
8:00 AM	11:45 AM	AIM ACT Strategic Task Force	LBCC	Meeting Room 202A
10:15 AM	12:15 PM	Latin America (LATAM) Sub-Committee	LBCC	Meeting Room 101B
12:00 PM	2:00 PM	Pickle Ball & Corn Hole Tournament	LBCC	Terrace Plaza
1:00 PM	5:00 PM	Sunday Education Program – *Paid Registration Required* – *Vessel Design, Analysis and Inspection* – Speakers: Josiah Royer (Colonial Webb); Dave Crement (RVS); Doug Reindl and/or Todd Jekel (Univ of WI/IRC); Bent Wiencke (Chill On)	LBCC	Meeting Room 104A/B
5:00 PM	5:30 PM	Women in Natural Refrigeration (WiNR) Reception – *Invitation Only*		
5:30 PM	6:00 PM	First Timer Reception – *Sponsored by Shambaugh and Son*	LBCC	Terrace Plaza
6:00 PM	7:00 PM	Chairman's Reception	LBCC	Terrace Plaza
7:00 PM	8:30 PM	Scholarship Students Dinner – *Invitation Only*		
Monday, March 13, 2023				
7:00 AM	5:00 PM	Registration Desk Open – *Sponsored by RE Lewis*	LBCC	Registration Desk
7:00 AM	8:00 AM	Continental Breakfast – *Sponsored by Mayekawa U.S.A., Inc.*	LBCC	Grand Ballroom Foyer
8:00 AM	9:30 AM	Business Meeting (8:00 AM – 8:30 AM)	LBCC	Grand Ballroom
		Keynote (8:30 AM – 9:30 AM) – *Sponsored by Emerson Vilter*	LBCC	Grand Ballroom
7:30 AM	9:30 AM	**Spouse/Guest Program:** Breakfast – *Paid Registration Required*	Renaissance Long Beach Hotel	
10:00 AM	11:00 AM	**Spouse/Guest Program:** Private Yoga Class (10 minute walk from LBCC) – *Paid Registration Required*	Yoga 108	
9:30 AM	1:45 PM	Exhibit Hall Open	LBCC	Exhibit Hall A
9:30 AM	1:45 PM	IIAR Knowledge Center Open – *Sponsored by Gamma Graphics Services*	LBCC	Exhibit Hall A
9:30 AM	10:00 AM	**Technomercial #1:** *Heat to Cool: using heat pumps to cool our warming planet* – Presenter: Robert Unsworth, GEA	LBCC	Exhibit Hall A Technomercial Theater
10:00 AM	10:30 AM	Coffee Break – *Sponsored by Parker Hannifin*	LBCC	Exhibit Hall A
10:30 AM	11:00 AM	**Technomercial #2:** *First/Next: CO2 Transcritical Compressor Innovates Industrial Sustainability* – Presenters (3): Loren Sjoquist, VP/GM, industrial solutions; Lauren MacGowens, Director of Sustainability Programs; and Wayne Wehber, VP of Technology, Emerson Vilter	LBCC	Exhibit Hall A Technomercial Theater
11:15 AM	11:45 AM	**Technomercial #3:** *Solutions to enable decarbonization and system efficiency in NH3 and CO2 applications* – Presenter: Hernan Hidalgo, Danfoss	LBCC	Exhibit Hall A Technomercial Theater
12:00 PM	12:30 PM	**Technomercial #4:** *Güntner Adiabatic Technology for CO2 Gas Coolers* – Presenter: Tania Herrera, Güntner	LBCC	Exhibit Hall A Technomercial Theater
12:45 PM	1:15 PM	**Technomercial #5:** *Decarbonization Process – heat pumps utilizing natural refrigerants* – Presenter: Matteo Iobbi, Frascold	LBCC	Exhibit Hall A Technomercial Theater
12:00 PM	1:30 PM	Buffet Lunch	LBCC	Exhibit Hall A
1:45 PM		Exhibit Hall Closes	LBCC	Exhibit Hall A
1:45 PM	2:35 PM	**Tech Paper (Spanish):** *Integridad Mecánica en Evaporadores de Refrigeración* – Presenter: Gabriel Gutierrez, Colmac Coil Manufacturing	LBCC	Meeting Room 202
		Tech Paper: *Cybersecurity in Automated Industrial Systems* – Presenter: Josh Symonds, CrossnoKaye	LBCC	Meeting Room 201
		Research Panel (Double Session) – Panelists: William Greulich, Bent Wiencke, et al	LBCC	Meeting Room 102
		Workshop: *Solving the Technician Shortage (NASRC)* – Presenters: Danielle Wright and Bryan Beitler, NASRC	LBCC	Meeting Room 103

PROGRAM SCHEDULE

LONG BEACH CONVENTION CENTER

2:40 PM	3:30 PM	**Tech Paper:** *The Cost of Non-Compliance: An Objective Analysis of Federal EPA's Enforcement at Ammonia Facilities* – Presenter: Uriah Donaldson, Resource Compliance	LBCC	Meeting Room 201
		Tech Paper: *Ammonia Central Stage DX System: Firsthand Experience* – Presenter: Finn Dresen, Kältetechnik Dresen + Bremen GmbH	LBCC	Meeting Room 103
		Tech Paper (Spanish): *Válvulas de seguridad: una revisión desde las bases hasta los estándares y normas aplicables* – Presenter: Juan Carlos Noriega Vargas, Danfoss	LBCC	Meeting Room 202
		Tech Paper: *Performance Analysis of CO2 Heat Pump Modes for Refrigeration Systems: A Case Study* – Presenters: Will Slope, Air Treatment Corporation and Frédérick Lavallée-Trubiano, Carnot Refrigeration	LBCC	Meeting Room 203
3:30 PM	4:00 PM	Coffee Break	LBCC	Meeting Room 100/200 Foyers
4:00 PM	5:45 PM	**Panel:** *IIAR Efforts Regarding AIM Act and Impact on End* (Double Session) – Panelists: Miguel Garrido, Guntner; Mark Stencel, Bassett Mechanical; et al	LBCC	Meeting Room 102
4:00 PM	4:50 PM	**Workshop:** *Efficiency in Large Refrigerated Facilities for Perishable Foods* – Presenter: Henry B. Bonar, II; BONAR Engineering, Inc.	LBCC	Meeting Room 201
		Tech Paper (Spanish): *Ecuaciones simples para determinación del caudal másico en sistemas de refrigeración* – Presenter: Mauricio Quiroga; Johnson Controls	LBCC	Meeting Room 202
		Workshop: *Next Generation CO2 Pumps* – Presenter: Monika Witt; TH. Witt Kältemaschinenfabrik, GmbH	LBCC	Meeting Room 203
4:55 PM	5:45 PM	**Tech Paper:** *Supercritical carbon dioxide relief calculations* – Presenter: William Greulich; Kensington Consulting	LBCC	Meeting Room 103
		Tech Paper: *Hot Gas Bypass Defrost* – Presenter: Félix Sanz; AEFYT Spain	LBCC	Meeting Room 201
		Tech Paper (Spanish): *Stratum Coca Cola, Primer Proyecto Industrial en Costa Rica con Expansión directa en baja temperatura, con baja cantidad de amoníaco y alta eficiencia* – Presenters: Lisandro Salas Mora (RSF Costa Rica) and Mario Mora Carli (FrigoConsult and University of Costa Rica)	LBCC	Meeting Room 202
		Tech Paper (Spanish): *Cómo Conducir un Análisis PHA* – Presenter: Juan Carlos Zeledón, Cargill Nicaragua	LBCC	Meeting Room 203
6:00 PM	8:00 PM	Monday Night Block Party – *Sponsored by EVAPCO and M&M Carnot*	LBCC	The Cove
Tuesday, March 14, 2023				
7:00 AM	5:00 PM	Registration Desk Open – *Sponsored by RE Lewis*	LBCC	Registration Desk
7:30 AM		Exhibit Hall Open	LBCC	Exhibit Hall A
7:30 AM	1:15 PM	IIAR Knowledge Center Open – *Sponsored by Gamma Graphics Services*	LBCC	Exhibit Hall A
7:30 AM	8:30 AM	Buffet Breakfast – *Sponsored by Delta Tee International*	LBCC	Exhibit Hall A
7:30 AM	9:30 AM	**Spouse/Guest Program:** Breakfast – *Paid Registration Required*	Renaissance Long Beach Hotel	
8:00 AM	8:30 AM	**Technomercial #6:** *The Largest UL Approved CO2 Transcritical Compressor: Lab Testing and Design Features* – Presenter: Mr. Giacomo Pisano, Dorin USA	LBCC	Exhibit Hall A Technomercial Theater
8:30 AM	9:30 AM	Finance Committee Meeting	LBCC	Meeting Room 101
8:45 AM	9:15 AM	**Technomercial #7:** *Insulated Penthouse Evaporator Configurations – New Options and Solutions* – Presenter: Jeremy Olberding, VP, Colmac Coil Manufacturing	LBCC	Exhibit Hall A Technomercial Theater
9:30 AM	10:00 AM	**Technomercial #8:** *EVAPCO: The "One Stop Shop" for Customers Considering NH3 or CO2* – Presenter: Adam Radford, NA Sales Manager, Industrial Refrigeration, EVAPCO	LBCC	Exhibit Hall A Technomercial Theater
9:30 AM	11:00 AM	Outgoing & Incoming NRF Board Member Meeting – *Invitation Only*		
9:50 AM		**Spouse/Guest Program:** Santa Catalina Island Getaway (Departure Long Beach to Avalon) – *Paid Registration Required*	Catalina Express	
10:00 AM	10:30 AM	Coffee Break – *Sponsored by CIMCO Refrigeration*	LBCC	Exhibit Hall A
10:00 AM	12:00 PM	**Training Tutorial:** *Release Calculation Program* – Bent Wiencke, Chill On	LBCC	IIAR Knowledge Center
10:30 AM	11:00 AM	**Technomercial #9 –** *Cool(ing) Ideas for a More Sustainable World* – Presenter: Dave Anderson, Strategic Account Manager, Baltimore Air Coil	LBCC	Exhibit Hall A Technomercial Theater
11:00 AM	11:30 AM	NRF Board Photos – *Invitation Only*		
11:15 AM	11:45 AM	**Technomercial #10 –** *The Future of Digital Insights and Sustainability* – Presenters: Curtis Rager and Jorge De la Torre; Frick/JCI	LBCC	Exhibit Hall A Technomercial Theater
12:00 PM	12:30 PM	**Technomercial #11 –** *TBD* – Presenter: TBD, MSA Bacharach	LBCC	Exhibit Hall A Technomercial Theater
12:00 PM	1:00 PM	Buffet Lunch	LBCC	Exhibit Hall A
1:15 PM		Exhibit Hall Closes	LBCC	Exhibit Hall A
1:10 PM	4:15 PM	**Regulatory Panel** (Triple Session) – Panelists: Peter Thomas (Resource Compliance); Lowell Randle (GCCA); Michael Boyle (Cal-OSHA); Dennis Karidis (CalARP); Drew Hart (E&J Gallo)	LBCC	Meeting Room 102
1:10 PM	2:00 PM	**Tech Paper:** *Performance Analysis of CO2 Heat Pump Modes for Refrigeration Systems: A Case Study* – Presenters: Will Slope, Air Treatment Corporation and Frédérick Lavallée-Trubiano, Carnot Refrigeration	LBCC	Meeting Room 203
		Tech Paper (Spanish): *Integridad Mecánica en Evaporadores de Refrigeración* – Presenter: Gabriel Gutierrez, Colmac Coil Manufacturing	LBCC	Meeting Room 202
		Tech Paper: *Cybersecurity in Automated Industrial Systems* – Presenter: Josh Symonds, CrossnoKaye	LBCC	Meeting Room 201
1:15 PM	1:55 PM	IIAR Board Photos – *Invitation Only*		
2:00 PM	4:00 PM	Incoming IIAR Board Member Meeting – *Invitation Only*		
2:05 PM	2:55 PM	**Tech Paper:** *The Cost of Non-Compliance: An Objective Analysis of Federal EPA's Enforcement at Ammonia Facilities* – Presenter: Uriah Donaldson, Resource Compliance	LBCC	Meeting Room 201
		Tech Paper: *Ammonia Central Stage DX System: Firsthand Experience* – Presenter: Finn Dresen, Kältetechnik Dresen + Bremen GmbH	LBCC	Meeting Room 103
		Tech Paper (Spanish): *Válvulas de seguridad: una revisión desde las bases hasta los estándares y normas aplicables* – Presenter: Juan Carlos Noriega Vargas, Danfoss	LBCC	Meeting Room 202
		Panel: *Diversity and Inclusion in Natural Refrigeration: A Women in Natural Refrigeration Workshop - Part 1* – Panelists: Melissa Cassell, General Refrigeration / WiNR Committee Chair, RETA Board Member; Monika Witt, TH. Witt Kältemaschinenfabrik, GmbH; Tania Herrera, Guntner; Colleen Keyworth, International Network of Women in Cooling (INWIC) President; Kenny Williams, Past President RETA; Lee Pyle, SCS Engineers	LBCC	Meeting Room 203

Identifying Hazards Using Appropriate Assessment Techniques

BY TONY LUNDELL, CIRO, PMP,
IIAR SENIOR DIRECTOR OF STANDARDS AND SAFETY

The United States EPA National Enforcement and Compliance Assurance Program implemented several national compliance initiatives (NCIs) effective for FY2020-2023. One of these NCIs is titled "Reducing Risks of Accidental Releases at Industrial and Chemical Facilities". IIAR has received notice from the EPA and several end-users that one area of their focus is to determine whether facilities using hazardous chemicals have conducted a hazard analysis. The EPA is citing the Clean Air Act Section 112(r) which establishes the regulations of the Risk Management Program for facilities using large quantities of a hazardous substance. EPA is also citing the General Duty Clause which is also a part of CAA 112(r) and applies to facilities using any quantity of hazardous substances. In addition to its process safety management (PSM) regulations, the US Occupational Safety and Health Administration (OSHA) also enforces a general duty clause that requires a hazard analysis.

Most IIAR members will likely have a hazard analysis in place. However, if your facility does not, we encourage you to get this done soon. If you are a contractor, a consultant, or sell equipment or other goods, we encourage you to pass the word to your end-user clients, especially those with smaller facilities that might not have a hazard analysis in place.

At a minimum, a hazard or safety review is required and must be done for an ammonia refrigeration system "NO MATTER WHAT SIZE IT IS".

There are many IIAR members who can assist with establishing a hazard analysis and the other elements of a refrigeration management program, and IIAR offers several publications to aid in establishing a program based on the relative size of the system.

Here is more information about the general duty clauses for both OSHA and the EPA:

Most IIAR members will likely have a hazard analysis in place. However, if your facility does not, we encourage you to get this done soon. If you are a contractor, a consultant, or sell equipment or other goods, we encourage you to pass the word to your end-user clients, especially those with smaller facilities that might not have a hazard analysis in place.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) GENERAL DUTY CLAUSE (GDC):

Section 5(a)(1) of the Occupational Safety and Health Act (the "General Duty Clause") requires:

"Each employer shall furnish to each of its employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees."

Employers can be cited for violation of the General Duty Clause if a recognized serious hazard exists in their workplace and the employer does not take reasonable steps to prevent or abate the hazard. The General Duty Clause is used only where no standard applies to the particular hazard. The following elements are necessary to prove a violation of the General Duty Clause:

a. The employer failed to keep the workplace free of a hazard to which employees of that employer were exposed;

b. The hazard was recognized;

c. The hazard was causing or was likely to cause death or serious physical harm; and

d. There was a feasible and useful method to correct the hazard.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY US EPA) GENERAL DUTY CLAUSE (GDC):

Under the Clean Air Act Section 112(r)(1), the General Duty Clause states: "The owners and operators of stationary sources producing, processing, handling or storing such substances [i.e., a chemical in 40 CFR part 68 or any other extremely hazardous substance] have a general duty [in the same manner and to the same extent as the general duty clause in the Occupational Safety and Health Act (OSHA)] to identify hazards which may result from (such) releases using appropriate hazard assessment techniques, to design and maintain a safe facility taking such steps as are necessary to prevent releases, and to minimize the consequences of accidental releases which do occur."

THE OSHA AND US EPA GENERAL DUTY CLAUSES APPLY TO ALL SYSTEMS, SMALL OR LARGE.

OSHA's Process Safety Management (PSM) Standard 1910.119 and US EPA's Risk Management Plan (RMP) 40 CFR Part 68 require a Process Hazard Analysis (PHA) for systems with 10,000 lbs or more of ammonia in a refrigeration system.

A system with less than 10,000 lbs but more than 500 lbs requires a hazard review at a minimum.

A system with 500 lbs or less requires a safety review and/or an environmental safety evaluation, at a minimum.

Due to the General Duty Clauses, all systems, no matter the size, require a hazard or safety review for an ammo-

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nia refrigeration system that will, at a minimum, "identify hazards which may result from releases using appropriate hazard assessment techniques."

process being analyzed:

(i) What-if;

(ii) Checklist;

OSHA's Process Safety Management (PSM) Standard 1910.119 and US EPA's Risk Management Plan (RMP) 40 CFR Part 68 require a Process Hazard Analysis (PHA) for systems with 10,000 lbs or more of ammonia in a refrigeration system.

It is of utmost importance to inform an employer, owner, operators, and clients, who have or are planning for an ammonia refrigeration system "to identify hazards which may result from releases using appropriate hazard assessment techniques."

The hazard techniques can be one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the

(iii) What-if/Checklist; (most widely used for ammonia refrigeration systems)

(iv) Hazard and Operability Study (HAZOP);

(v) Failure Mode and Effects Analysis (FMEA);

vi) Fault Tree Analysis (FTA); or

vii) An appropriate equivalent methodology

TO MEET COMPLIANCE:

IIAR's Process Safety Management & Risk Management Program Guidelines & Templates can be used to meet General Duty Clause (GDC) & regulatory compliance for systems with 10,000 lbs or more of ammonia refrigerant.

IIAR's Ammonia Refrigeration Management (ARM) Guidelines & Templates can be used to meet General Duty Clause (GDC) requirements for systems with less than 10,000 lbs but more than 500 lbs of ammonia refrigerant.

IIAR's Low Charge Ammonia Refrigeration Management (ARM-LC) Guidelines and Summary Guideline can be used to meet General Duty Clause (GDC) requirements for systems with less than 500 lbs.

Any questions, please contact your qualified refrigeration contractor (designer/installer/servicer), compliance service provider, or the IIAR (www.iiar.org).

Technical Papers Provide In-Depth Thought Leadership at the IIAR Conference

During the annual IIAR Industrial Refrigeration Conference & Exhibition, industry experts will come together to present technical papers at the IIAR Technical Program. This year's papers will address several key categories, including carbon dioxide, security, and safety.

Eric Smith, IIAR's vice president and technical director, said the papers provide breadth and depth that isn't available in any other refrigeration-specific conference. Several papers stand out within this year's lineup.

Cybersecurity in Automated Industrial Systems by Josh Symonds, CrossnoKaye, will address the risks associated with the automation and internet control of facilities. Classes of attacks that were formerly the purview of Internet applications could become commonplace in industrial infrastructure.

"Cybersecurity is increasingly important as refrigeration systems are more and more automated and, thus, more and more susceptible to hacking or errors made by even authorized people," Smith said. "The ransomware phenomena are gaining in popularity and we don't want our industry to be a part of it."

On a different note, the use of carbon dioxide is increasing, and relief calculations are an important piece in the appropriate design of CO2 systems. "What has been recognized for several years now is that when CO2 refrigeration systems operate transcritically, the traditional methods of determining relief valve capacity are invalid," he said. "Bill Greulich, who chairs the IIAR Research Committee, realized that at least one good method to evaluate the relief valve capacity for supercritical operation already exists and this paper provides the beginning of a solution to solve the question of how to select such relief valves. "

In the paper Supercritical Carbon Dioxide Relief Calculations, Greulich, Kensington Consulting, and Cilliers Kruger, Korf Technology Ltd., will present an overview with a worked example of a rigorous two-step, isobaric – isentropic calculation method, commonly known as the Homogenous Direct Integration (HDI) method, to determine the maximum required orifice size for any carbon dioxide relieving condition expected in refrigeration service.

"Our goal is to remove the guesswork," Smith said. "We hope that it will lead to easily used formulas and tables that will be appropriate for selecting these relief valves. Should this method find acceptance, the next step will be to integrate it into the IIAR CO2 standard. More work to address downstream relief piping is expected to follow."

Transcritical CO2 heat pumps are emerging as a viable alternative to synthetic air or water source heat pumps. They present an opportunity for electrification while eliminating the use of high GWP refrigerants. The technical paper Performance Analysis of CO2 Heat Pump Modes for Refrigeration Systems: A Case Study by William Slope, Frédérick Lavallée-Trubiano, and Tommy Dolbec, Air Treatment Corp., assess the coefficient of performance of CO2 heat pumps at varying supply and return temperatures.

"This is pertinent—it is all about decarbonizing the atmosphere," Smith said. "There is an obvious need not to be so reliant on natural gas and coal and there is a worldwide trend to decarbonize and save energy. Heat pumps offer a way to achieve some of this goal."

There are more and more applications for heat pumps, particularly in industrial and large commercial settings where they can potentially save a lot of energy and expense by using waste heat and also heat from the atmosphere. "Heat pumps are coming into play to take the place of traditional heating technologies," Smith said. "This paper is a case study of a real-world installation and nicely lays out the considerations for optimal operation."

There will be several papers presented in Spanish, including some that are translations and representations of previously provided papers. "There have been a lot of great papers in the past written in English and presented in English and we know there is a strong need for this information to be disseminated to Spanish-speaking professionals," Smith said, adding that IIAR expects a large contingency of Spanish-speaking attendees.

TECHNICAL PAPERS AT A GLANCE

Each technical paper presented at IIAR's annual conference is full of specific, actionable information about the refrigeration industry. Here is a full list of the available papers, including those that will be presented in Spanish, as well as the presenters.

The Cost of Non-Compliance: An Objective Analysis of Federal EPA's Enforcement at Ammonia Facilities by Uriah Donaldson, Resource Compliance

Ammonia Central Stage DX System: Firsthand Experience by Finn Dresen, Kaeltetechnik Dresen+Bremen GmbH

Supercritical Carbon Dioxide Relief Calculations by William Greulich Kensington Consulting

Hot Gas Bypass Defrost by Félix Sanz, AEFYT

Performance Analysis of CO2 Heat Pump Modes for Refrigeration Systems: A Case Study by Will Slope, Frédérick Lavallée-Trubiano and Tommy Dolbec, M&M Carnot

Cybersecurity in Automated Industrial Systems by Josh Symonds, CrossnoKaye

Stratum Coca Cola, Primer Proyecto Industrial en Costa Rica con Expansión directa en baja temperatura, con baja cantidad de amoníaco y alta eficiencia by Lisandro Salas Mora, RSF Costa Rica, and Mario Mora Carli, FrigoConsult and University of Costa Rica

Cómo Conducir un Análisis PHA by Juan Zeledon Cargill de Nicaragua

Integridad Mecanica en Evaporadores de Refrigeracion by Luís Gabriel Gutierrez Padilla, Colmac Coil

Válvulas de seguridad: una revisión desde las bases hasta los estándares y normas aplicables by Juan Carlos Noriega Vargas, Danfoss

Ecuaciones simples para determinación del caudal másico en sistemas de refrigeración; translated and presented by Mauricio Quiroga (originally presented by Don Faust), Johnson Controls

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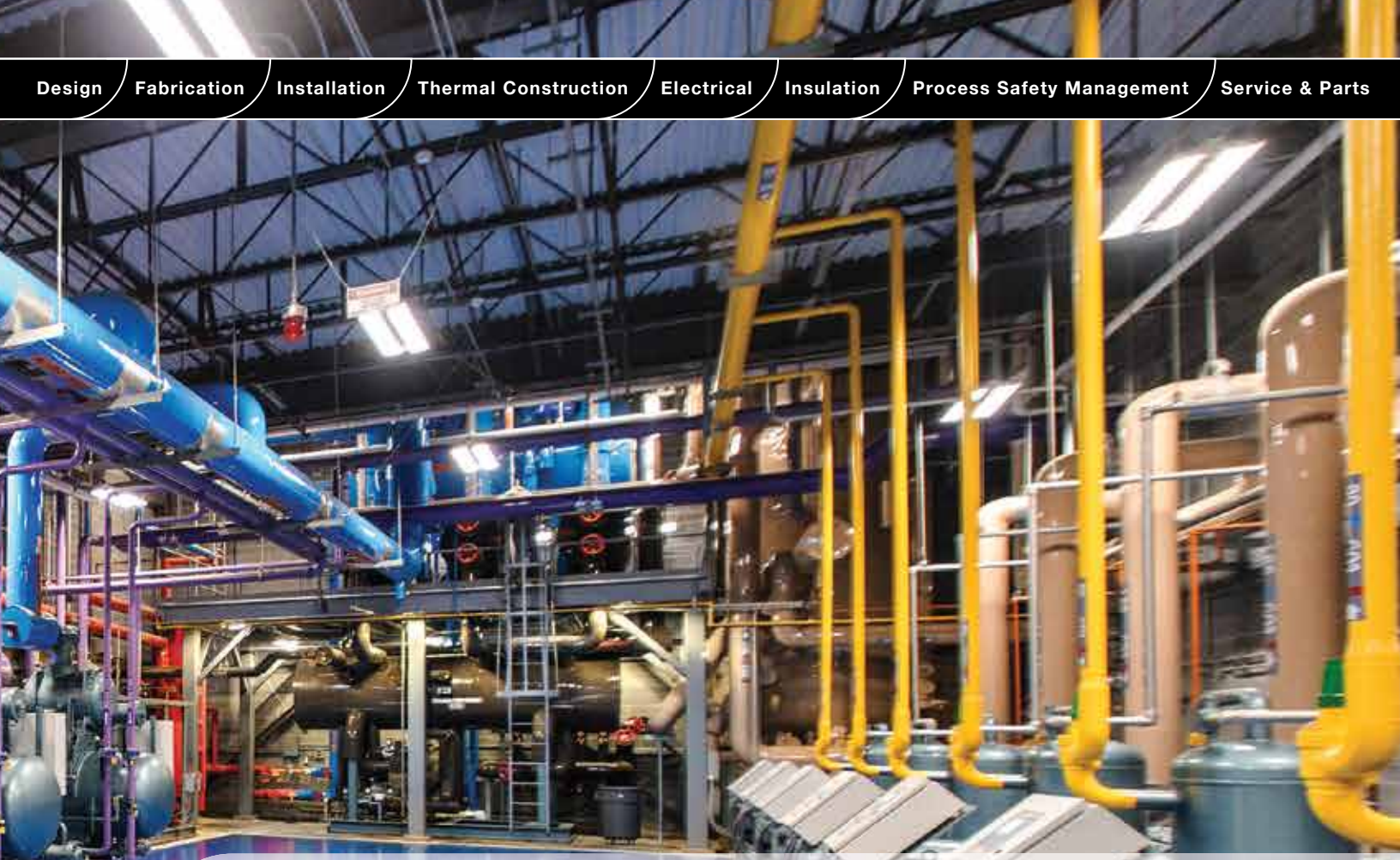

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IIAR Standards Continue to Gain Momentum Globally

IIAR is continuing to influence the natural refrigerant industry worldwide through its standards, information sharing and relationships. Here is what is happening across the globe.

[global VIEW]

Brazil

IIAR has established an official chapter in Brazil and is participating in a local conference in March. This year, the Brazil chapter will have an official IIAR symposium in San Paolo, Brazil, during the month of August 2023.

Chile

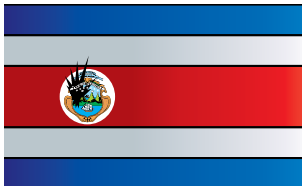
IIAR's Chile chapter will hold its biannual IIAR seminar in Santiago, Chile, during the month of November 2023.

China

IIAR has renewed its alliance with the Chinese Association of Refrigeration for another three years. IIAR will hold an in-person annual meeting with CAR representatives during the March IIAR Conference in Long Beach to re-establish mutual goals.

Costa Rica

Costa Rica continues to move forward with its plans to make all IIAR standards, including ANSI/IIAR CO2, mandatory. As part of this effort, Costa Rica is implementing the country's professional certification program for the safe use, operation and maintenance of ammonia refrigeration systems. This certification program is carried out through a joint venture between IIAR and the country's only professional certification organization, CFIA.



Ecuador

IIAR's Ecuador chapter will hold its biannual IIAR seminar in Guayaquil, Ecuador, in October.

Germany

IIAR recently participated in Chilventa in Germany after receiving an invitation from Euramonn, IIAR's memorandum of understanding (MOU) partner in Germany.

India

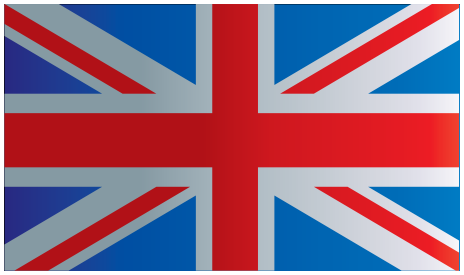
The Bureau of Indian Standards has finalized and published its national standard on ammonia refrigeration design, which is based on the IIAR-2 2014 Standard for the safe design of closed-circuit ammonia refrigeration systems. The recently published Indian standard is the result of a collaboration between experts in the industry with the support of IIAR USA.

Singapore

Singapore has developed a three-part standard for ammonia refrigeration systems. These documents have incorporated the ANSI IIAR 2-2014 standard as a normative reference.

Spain

Joining efforts with Spain's allied association, AEFYT, IIAR is providing support and online publication of the Condenser Selects Magazine; which is a hand-picked selection of Condenser articles published quarterly and in Spanish for the benefit of the Spanish and Latin America market. The Condenser Selects Issues are available online free of charge on the IIAR and AEFYT's websites (www.iiar.org and www.aefyt.es).



United Kingdom

In 2022, IIAR established another international alliance by signing an MOU with the Institute of Refrigeration (IOR) in the United Kingdom. This alliance establishes a framework for continuous communication and cooperation between the organizations, to share resources and information benefiting the natural refrigeration industry in both the USA and the U.K.

Update on IIAR Standards: 2023

IIAR is the world's leading advocate for the safe, reliable, and efficient use of ammonia and other natural refrigerants as well as an ANSI-accredited standards developer. IIAR is currently the only organization writing design and operation standards specifically for ammonia and other natural refrigeration systems. All IIAR Standards are developed to meet essential requirement criteria set by ANSI. All IIAR Standards must be re-affirmed every 5 years.

IIAR 1 – American National Standard for Definitions and Terminology Used in IIAR Standards. Provides a unified set of definitions for use in the IIAR Standards. Originally published in 2012 and sequentially re-affirmed and published in 2017. IIAR 1 was most recently re-affirmed and published in 2022.

IIAR 2 – American National Standard for Design of Safe Closed-Circuit Ammonia Refrigeration Systems. IIAR 2 is the definitive design safety standard for the ammonia refrigeration industry. Originally developed in 1974. IIAR 2 has seen many updates, addendums, and changes throughout the years. The update in 2014 saw changes that included code language to make IIAR 2 a single comprehensive standard covering the safe design of closed-circuit ammonia refrigeration systems. IIAR 2-2014 Addendum A was published in 2019, addressing ammonia absorption systems. IIAR 2-2021 is the latest re-affirmed and published edition.

IIAR 3 – American National Standard for Ammonia Refrigeration Valves. IIAR 3 specifies performance criteria for materials, design parameters, marking, and testing of valves and strainers used in closed-circuit ammonia refrigeration systems. IIAR 3 was first published in 2012 and was re-affirmed and published in 2017. IIAR 3 was most recently re-affirmed and published in 2022.

IIAR 4 – American National Standard for Installation of Closed-Circuit Ammonia Refrigeration Systems. First published in 2015, IIAR 4 was written to serve as a standard for the installation of closed-circuit ammonia refrigeration systems and overpressure protection relief piping systems. IIAR 4-2020 is the latest re-affirmed and published edition.

IIAR 5 – American National Standard for Startup of Closed-Circuit Ammonia Refrigeration Systems. This standard provides basic minimum requirements for the safe startup of closed-circuit ammonia refrigeration systems and for additions and modifications made to such systems. First published in 2013, IIAR 5-2019 is the latest edition. A review of IIAR 5 has started for its next update and re-affirmation targeted for completion in 2024.

IIAR 6 – American National Standard for Inspection, Testing, and Maintenance of Closed-Circuit Ammonia Refrigeration Systems. This standard provides the minimum requirements for inspection, testing, and maintenance (ITM) tasks and record-keeping applicable to closed-circuit ammonia refrigeration systems. IIAR 6-2019 is the latest edition. A review of IIAR 6 has started for its next update and re-affirmation targeted for completion in 2024.

IIAR 7 – American National Standard for Developing Operating Procedures for Closed-Circuit Ammonia Refrigeration Systems. First published in 2013, IIAR 7 defines the minimum requirements for developing operating procedures for closed-circuit ammonia refrigeration systems and is intended for those who develop, define, and/or review operating procedures for closed-circuit ammonia refrigeration systems. IIAR 7-2019 is the latest edition. A review of IIAR 7 has started for its next update and re-affirmation targeted for completion in 2024.

IIAR 8 – American National Standard for Decommissioning of Closed-Circuit Ammonia Refrigeration Systems. Developed in 2015, IIAR 8 specifies the minimum criteria for removing the ammonia charge in conjunction with the decommissioning (permanent retirement) of closed-circuit ammonia refrigeration systems. IIAR 8-2020 is the latest re-affirmed and published edition.

IIAR 9 – American National Standard for Minimum System Safety Requirements for Existing Closed-Circuit Ammonia Refrigeration Systems. This standard provides a method for existing stationary closed-circuit refrigeration systems using ammonia as the refrigerant to evaluate and document new and revised codes, standards, and practices to determine what provision should be implemented to the existing system. This standard also provides a method for determining and documenting existing equipment designed and constructed in accordance with prior codes, standards, or practices to ensure practices and system designs remain safe for operation. IIAR 9-2020 is the first published edition.

IIAR CO2 – Safety Standard for Closed-Circuit Carbon Dioxide Refrigeration Systems. This standard provides minimum requirements for safe design, installation, startup, and inspection, testing, and maintenance (ITM) tasks applicable to stationary closed-circuit carbon dioxide refrigeration systems. IIAR CO2-2021 is the first published edition.

In Development: IIAR HC - Safety Standard for Closed-Circuit Refrigeration Systems Utilizing Hydrocarbon Refrigerants is presently in development. This standard will specify minimum requirements for designing safe closed-circuit natural hydrogen refrigeration systems, as well as provide minimum requirements for the safe installation, startup, and inspection, testing, and maintenance of such systems. It is anticipated to be finished in 2023. Your input is welcomed.

Please visit the IIAR Standards Review page on the IIAR website.

All open and ongoing public review cycles are listed with access to review documents and commenting tools. IIAR Standards are available to IIAR members online through the "Members Only" elibrary portal.

When you belong to the IIAR Community, your voice adds impact to our natural refrigeration industry.

EPA Proposes HFC Phase Down Rule for Refrigeration Sector

iiar government RELATIONS

BY LOWELL RANDEL, IIAR GOVERNMENT RELATIONS DIRECTOR

On December 9th, the U.S. Environmental Protection Agency (EPA) announced a proposed rule under the American Innovation and Manufacturing (AIM) Act to advance the transition to more efficient heating and cooling technologies by restricting the use of hydrofluorocarbons (HFCs) in certain products and equipment. The AIM Act authorizes EPA to limit or prohibit the use of HFCs in specific sectors and to phase in these requirements over time as appropriate. The proposed rule addresses IIAR's petition to EPA, as well as other petitions granted in October 2021. The regulation would restrict the use of HFCs used in certain foams, aerosol products, and refrigeration, air conditioning, and heat pump equipment beginning in 2025. EPA has listed entities potentially impacted by the rule to include companies that manufacture, import, export, package, sell or otherwise distribute products that use or are intended to use HFCs, such as refrigeration and air-conditioning systems, heat pumps, foams, and aerosols.

Under the AIM Act, EPA is implementing a national HFC phasedown to achieve a 40% reduction below historic levels starting in 2024 and an 85%

> A global HFC phasedown is expected to avoid up to 0.5 degrees Celsius of global warming by 2100. EPA has estimated that this proposed rule would provide greenhouse gas emissions reductions of up to 35 million metric tons of carbon dioxide equivalent (MMTCO2e) per year.

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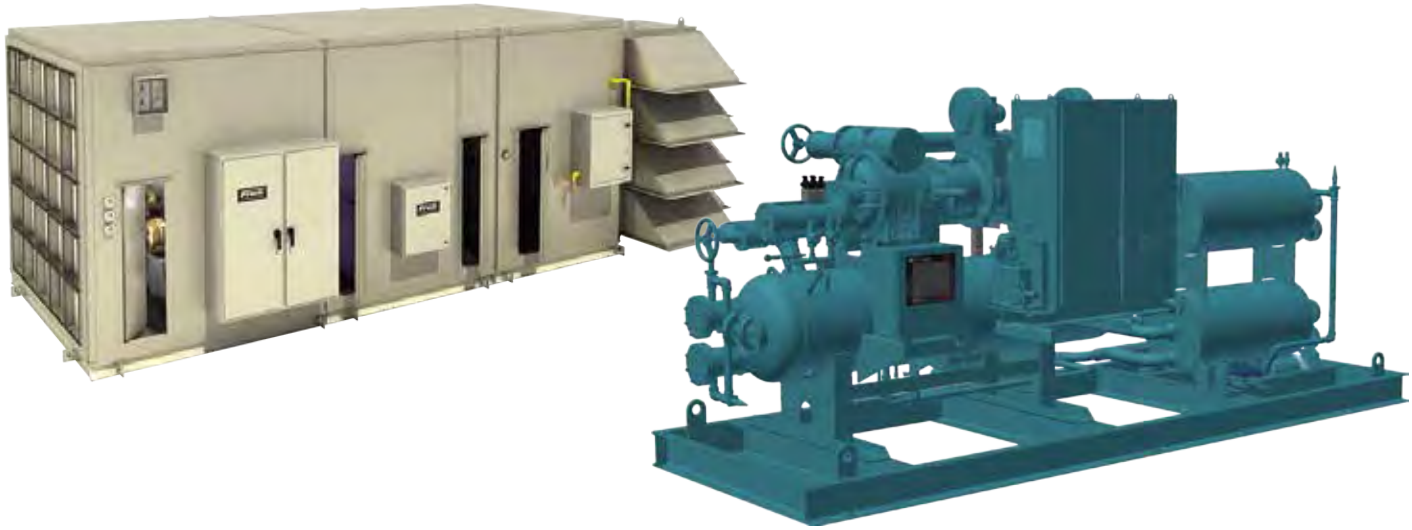

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reduction by 2036. The U.S. phasedown is also consistent with the schedule in the Kigali Amendment to the Montreal Protocol, which is a global agreement to phasedown HFCs that the United States joined on October 31, 2022. A global HFC phasedown is expected to avoid up to 0.5 degrees Celsius of global warming by 2100. EPA has estimated that this proposed rule would provide greenhouse gas emissions reductions of up to 35 million metric tons of carbon dioxide equivalent (MMTCO2e) per year.

EPA estimates that the proposed rule would result in significant GHG emissions reduction benefits while providing savings to American consumers and industry through energy efficiency gains and lower-cost alternatives. The proposal would result in cumulative GHG emissions reductions ranging from 134 to 903 MMTCO2e through 2050. EPA estimates that the cumulative net benefits of this proposed action are between $13.1 billion to $56.3 billion from 2025 through 2050. The GHG emissions reductions from this proposed action would provide between $5 and $51 billion in climate benefits. EPA further estimates that the proposed rule would also save U.S. industry and consumers between $5 to $8 billion from 2025 through 2050 as a result of improved energy efficiency in refrigeration, air conditioning, and heat pump products and lower cost alternatives.

EPA is proposing to restrict the use of certain higher-GWP HFCs in aerosols, foams, refrigeration, air conditioning, and heat pump products and equipment. The proposed rule would prohibit the manufacture and import of products containing restricted HFCs by January 1, 2025, in most cases, and would prohibit the sale, distribution, and export of products containing restricted HFCs a year later, which in most cases would be January 1, 2026.

EPA developed the proposed restrictions after reviewing petitions, holding stakeholder workshops, and considering an extensive list of factors as specified in the AIM Act, including the availability of substitutes, safety, and the overall economic and environmental impacts. This review included IIAR-submitted petitions and the resulting proposal incorporates many of the policies suggested by IIAR.

The proposed rule includes a list of proposed GWP limits for a variety of sectors and types of refrigeration systems. In many cases, EPA is proposing to set a 150 GWP limit for systems with a refrigerant charge of greater than 200 pounds and a 300 GWP limit for systems with a charge of less than 200 pounds. Below is a table of selected sectors relevant to IIAR members (chart below).

IIAR has provided written comments to EPA regarding the proposed rule to further clarify its position on GWP limits for various types of refrigeration systems and will continue to work closely with the agency as it moves forward with the rulemaking process. A final rule is expected by September 2023.

EPA is proposing to restrict the use of certain higher-GWP HFCs in aerosols, foams, refrigeration, air conditioning, and heat pump products and equipment. The proposed rule would prohibit the manufacture and import of products containing restricted HFCs by January 1, 2025, in most cases, and would prohibit the sale, distribution, and export of products containing restricted HFCs a year later, which in most cases would be January 1, 2026.

SELECTED PROPOSED GWP LIMIT RESTRICTIONS ON HFCS BY SECTOR AND SUBSECTOR

Sectors and Subsectors	Proposed GWP Limit
Industrial process refrigeration systems with refrigerant charge capacities of 200 pounds or greater	150
Industrial process refrigeration systems with refrigerant charge capacities less than 200 pounds	300
Industrial process refrigeration, high temperature side of cascade systems	300
Cold storage warehouse systems with refrigerant charge capacities of 200 pounds or greater	150
Cold storage warehouse systems with refrigerant charge capacities less than 200 pounds	300
Cold storage warehouse, high-temperature side of cascade system	300
Ice rinks	150
Chillers – industrial process refrigeration	700

The Secure Act 2.0

The Setting Every Community Up for Retirement Enhancements (SECURE) Act increases saving opportunities for Americans. SECURE Act 2.0 was recently passed and contains roughly 90 separate provisions, many of which became effective on January 1, 2023. Below is a summary of some of the more substantial changes:

TOPIC	PRE SECURE ACT 2.0 LAW	SECURE ACT 2.0	INDIVIDUAL INVESTOR CONSIDERATIONS	EFFECTIVE DATES
Reduce the Penalty for Failure to Take Required Minimum Distribution (RMD) From 50% to 25%	A penalty of 50% of the shortfall was imposed for failure to take an RMD.	Failure to take an RMD results in a 25% penalty on the amount not withdrawn. If the failure to take an RMD from an IRA is corrected in a timely manner, the excise tax is further reduced from 25% to 10%.	Correct RMD failures in a timely manner.	January 1, 2023
Taxes on Corrective Distributions From IRAs	Corrective distributions were subject to 10% penalty.	Corrective distributions and associated earnings from excess contributions to IRAs are no longer subject to the 10% early withdrawal penalty.	N/A	January 1, 2023
Increase in Age for Required Beginning Date (RBD) for Mandatory Distributions	RBD age previously was 72.	Participants are generally required to begin taking distributions from their retirement plans at age 73 starting January 1, 2023 and eventually increasing to age 75 starting in 2033.	Make sure RMDs are being taken, if required.	January 1, 2023
Tax Treatment of IRA Involved in a Prohibited Transaction	Previously not permitted.	If an individual has multiple IRAs, only the IRA for which the prohibited transaction occurred will be disqualified.	N/A	January 1, 2023
Rollovers From 529 Accounts to Roth IRAs, Under Certain Conditions	No 529 rollovers permitted.	Beneficiaries of 529 plans are permitted to roll over funds to a Roth IRA up to the annual contribution limits, subject to a lifetime maximum of $35,000. The 529 account must have been open for more than 15 years.	Consider rolling unused 529 plan assets to a Roth IRA in order to repurpose the funds for retirement.	January 1, 2024

[continued]

Clarification of Substantially Equal Periodic Payment (SEPP) Rule	Limited exceptions available.	The SEPP exception continues to apply in the case of a roll-over of the account, an exchange of an annuity providing the payments, or an annuity that satisfies the required minimum distribution rules.	N/A	January 1, 2024
Withdrawals for Emergency Personal Expenses	Emergency expenses would have a 10% penalty on withdrawals prior to age 59 ½ unless another exemption is met.	Certain distributions can be used for emergency expenses, which are unforeseeable or immediate financial needs relating to personal or family emergency expenses. The withdrawal is exempted from the 10% premature distribution penalty tax. Only one distribution is permissible per calendar year of up to $1,000. The distribution can be repaid within three years.	Consider this penalty-free withdrawal option that has been made available in your IRA.	January 1, 2024

IMPORTANT DISCLOSURES

The IIAR and NRF 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 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.

Stifel does not provide legal or tax advice. You should consult with your legal and tax advisors regarding your particular situation.

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Progress REPORT

Natural Refrigerants Codes and Standards

Code and Standards Road Map Overview

BY TONY LUNDELL, CIRO, PMP,
IIAR SENIOR DIRECTOR OF STANDARDS AND SAFETY

A lot has happened since 2019. IIAR, in its continuing mission to promote the safe and sustainable use of natural refrigerants, produced the ANSI/IIAR CO2-2021 Safety Standard for Closed-Circuit Carbon Dioxide Refrigeration Systems. As the phase-down of F-gas refrigerants continues to accelerate worldwide, CO2 technology has become an increasingly popular option utilized in the industrial refrigeration sector and more recently in the commercial refrigeration sector.

The ANSI-approved IIAR CO2 standard specifies minimum requirements for the safe design, installation, startup, inspection, testing, and maintenance (ITM) of closed-circuit carbon refrigeration systems and for any modifications or additions to an existing system.

IIAR recently presented the latest natural refrigerants codes and standards progress update at the North American Sustainability Refrigeration Council (NARSC) Codes and Standards Progress Meeting on December 7th, 2022.

Ammonia (NH3) (R-717) is SNAP (Significant New Alternative Policy) approved.

The IIAR Suite of Standards for Close-Circuit Ammonia Refrigeration Systems (C-C ARSs) consists of the following nine (9) standards:

- IIAR 1 - Definitions & Terminology Used in IIAR Standards
- IIAR 2 - Design of Safe C-C ARSs
- IIAR 3 - Ammonia Refrigeration Valves
- IIAR 4 - Installation of C-C ARSs
- IIAR 5 - Startup of C-C ARSs
- IIAR 6 - Inspection, Testing, and Maintenance of C-C ARSs
- IIAR 7 - Developing Operating Procedures for C-C ARSs
- IIAR 8 - Decommissioning of C-C ARSs
- IIAR 9 - Minimum System Safety Requirements for Existing C-C ARSs

Refrigerant	SNAP Approved	Equipment Safety	Engineering	Service*	Building Codes
Ammonia (NH3)	Yes	Yes	Yes	Yes	Yes
Carbon Dioxide (CO2)	Yes	Yes	Yes	Yes	Yes
HCs up to 500 grams	In Progress	Yes	Yes	No	In Progress
HCs as primary in Cascade/ Secondary Systems	Yes	Yes	Yes	No	No

As the phase-down of F-gas refrigerants continues to accelerate worldwide, CO2 technology has become an increasingly popular option utilized in the industrial refrigeration sector and more recently in the commercial refrigeration sector.

CARBON DIOXIDE (CO2) (R-744) IS SNAP APPROVED.

CO2 and Ammonia standards provide Equipment Safety, Engineering, Service, and meet Building Codes.

Hydrocarbons (HCs) are in the process of being SNAP approved.

For Propane (R290), the charge limit was 150 grams per circuit.

In 2019, the IEC 60335-2-89 standard was updated to allow 500 grams per circuit.

In 2021, the UL 60335-2-89 standard was updated to the following:

- 300 grams per circuit for closed appliances (cases with doors), and
- 500 grams per circuit for open appliances (open cases).

For HCs up to 500 grams per circuit, the HCs standards have Equipment Safety and Engineering addressed. Service is being addressed by Contractors and Service Technician Groups.

IIAR is presently developing an IIAR HC Safety Standard which is anticipated to be finalized in 2023. The IIAR HC Standard in Development is presently titled "Safety Standard for Closed-Circuit Refrigeration Systems Using Hydrocarbon Refrigerants". This standard will address Equipment Safety and Engineering, as well as, Service. Once this standard is finished and ANSI approved, it is targeted to become presented and adopted by Building Codes.

SIGNIFICANT NEW ALTERNATIVES POLICY (SNAP) PROGRAM — US EPA

EPA SNAP Approvals:

REFRIGERATION AND AIR CONDITIONING:	
Chillers (these are specific to comfort cooling)	R1234ze, R717, R744
Cold Storage Warehouses	R717, R744
Ice Skating Rinks	R717, R744
INDUSTRIAL PROCESS:	
Air Conditioning	R717, R744
Refrigeration	R1270 ({propylene), R290 (Propane), R600 (butane), R717, R744
RETAIL FOOD REFRIGERATION:	
Standalone	R290 & R600 (up to 500-gram charge limit), R717 with secondary loop, R744

FIGURE 1: ANSI/IIAR CO2-2021 ADOPTION BY IMC:

IAPMO CODES ADMINISTRATION

Item #: 217

UMC 2024 Section: 1102.1, 1102.2, Table 1701.1

SUBMITTER: Jeffrey Shapiro
International Code Consultants
Rep. IIAR

Appended Comments

PUBLIC COMMENT 1

Code Year: 2024 UMC Section #: 1102.1, Table 1801.1 Item #: 217

SUBMITTER: Jeffrey Shapiro
International Code Consultants
Rep. IIAR

Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal **as modified** by this public comment.

1102.1 General. Refrigeration systems using a refrigerant other than ammonia shall comply with this chapter and ASHRAE 15. Refrigeration systems containing carbon dioxide as the refrigerant shall also comply with IIAR CO2.

TABLE 1801.1
REFERENCED STANDARDS

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
IIAR CO2-2021	Safety Standard for Closed-Circuit Carbon Dioxide Refrigeration Systems	Carbon Dioxide Refrigeration Systems	1102.1

(portions of table not shown remain unchanged)

Note: IIAR CO2 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The above revision adds a reference to IIAR CO2, a new standard governing refrigeration systems that use carbon dioxide as the refrigerant. It is designed as a companion and supplement to ASHRAE 15, providing additional requirements that are unique to carbon dioxide systems. IIAR CO2 goes beyond the scope of ASHRAE 15 by regulating the complete life-cycle of carbon dioxide systems.

Carbon dioxide has become increasingly popular as an industrial refrigerant because it is efficient and climate friendly. Including this new standard will improve the UMC by helping to assure that carbon dioxide refrigeration systems are properly and sufficiently regulated.

Although the standard was completed before the Technical Committee meeting, the final published text was only made available to the Technical Committee shortly before the meeting. The Technical Committee wanted the published version to be available for a longer period of time to allow for review prior to considering approval. It has now been available for several months and is attached to this public comment.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 30

VOTING RESULTS: AFFIRMATIVE: 30

Be aware that SNAP approvals are "Application" specific as it pertains to Refrigeration and Air Conditioning for Chillers, Cold Storage Warehouses, Ice Skating Rinks, and Industrials Processes of Air Conditioning and Refrigeration, as well as, Retail Food Refrigeration as shown.

Hydrocarbon standards as the primary refrigerant in Cascade Systems and/or as Secondary Fluid Systems are SNAP Approved and cover Equipment Safety and Engineering. The IIAR HC Standard in Development will address the Service and adoption by Building Codes.

SNAP (SIGNIFICANT NEW ALTERNATIVES POLICY):

Be aware that SNAP approvals are "Application" specific as it pertains to Refrigeration and Air Conditioning for Chillers, Cold Storage Warehouses, Ice Skating Rinks, and Industrials Processes of Air Conditioning and Refrigeration, as well as, Retail Food Refrigeration as shown.

CO2:

The ANSI/IIAR CO2-2021 Standard is a companion with ASHRAE 15.

ASHRAE 15 covers general design for CO2 systems.

The ANSI/IIAR CO2-2021 Standard covers general design and further covers specific minimum design requirements. And as mentioned earlier, the ANSI/IIAR CO2-2021 standard, along with covering general and specific design, further covers installation, startup, inspection, testing, and maintenance (ITM

Tasks) for closed-circuit carbon dioxide refrigeration systems.

CO2 Occupancies:

- Public Assembly, Commercial, Residential, and Large Mercantile Occupancies
- Industrial Occupancies and Refrigerated Spaces
  - o Walk in Coolers, Freezers, & Refrigerated Cases
- Institutional and Residential Occupancies

AMMONIA:

Also as listed earlier in this article, the IIAR Suite of Standards for Ammonia cover design, installation, startup, and inspection, testing, and maintenance (ITM Tasks) for closed-circuit ammonia refrigeration systems in separate, but harmonizing, ammonia standards.

Ammonia Occupancies:

- Public Assembly, Commercial, Residential, and Large Mercantile Occupancies
- Industrial Occupancies

HYDROCARBONS:

The IIAR HC Standard in Development will cover design, installation, startup, and inspection, testing, and maintenance (ITM Tasks) for closed-circuit refrigeration systems utilizing (natural) hydrocarbon refrigerants.

Hydrocarbon Occupancies:

- Industrial Occupancies
- Commercial Occupancies

The IIAR HC Standard in Development specifically applies to the following hydrocarbon refrigerants with a Global Warming Potential (GWP) of less than 5:

1. Propane (R290)
2. N-Butane (R600)
3. Iso-butane (R600a)

The following hydrocarbon refrigerants are reserved for future revisions.

1. Propylene (R1270)
2. Ethane (R170)
3. Ethylene (R1150)

A Refrigeration Restriction for the total of all hydrocarbons on site shall not exceed 1,100 pounds (499 kg) except where approved by the Authority Having Jurisdiction (AHJ).

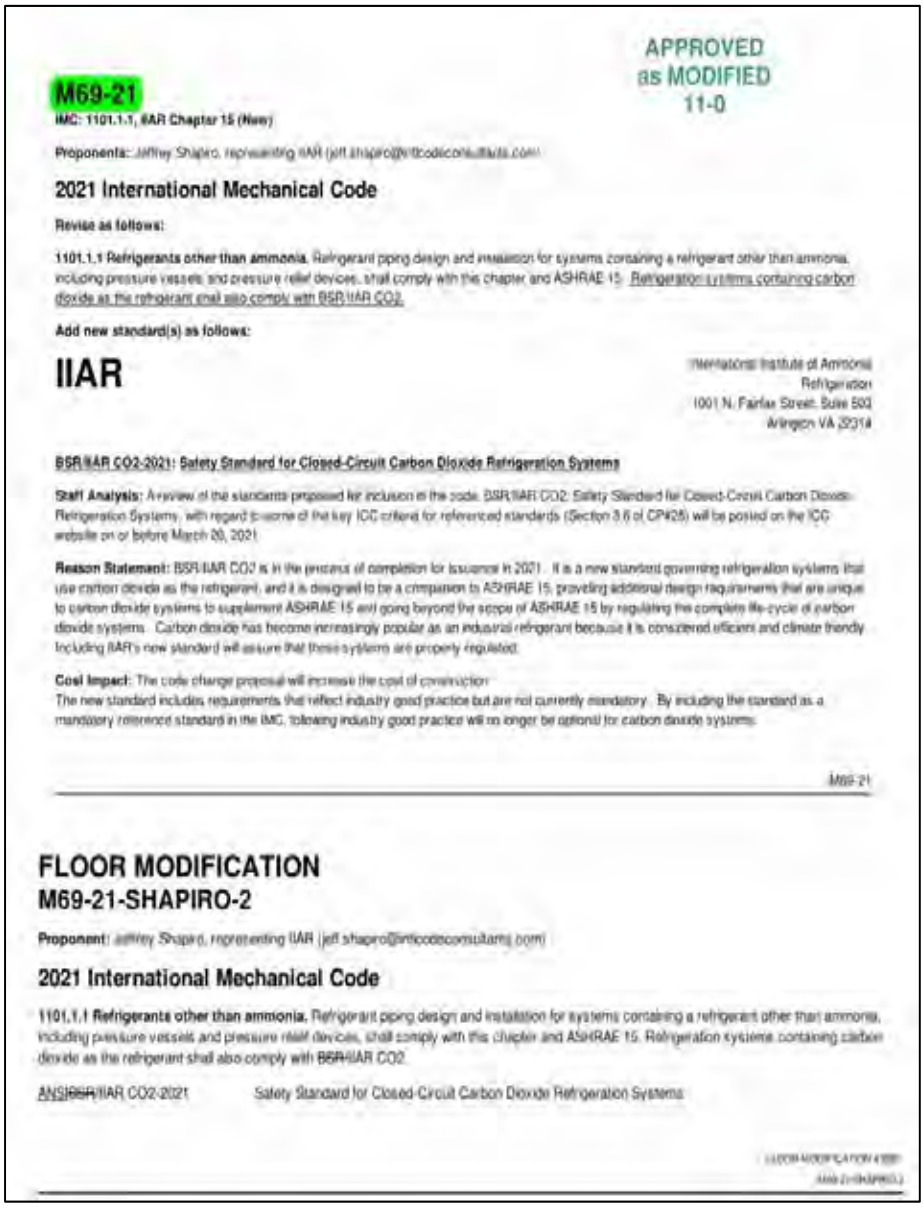
PURPOSE AND SCOPE:

The ANSI-approved IIAR Suite of Standards for Ammonia, The IIAR CO2 Standard, as well as the IIAR HC Standard in Development each have a Purpose and a Scope. The Scope includes what the standards apply to, as well as, what the standard does not apply to be clear on what is not covered.

For example, The ANSI/IIAR CO2-2021 does not cover listed equipment or systems. The intent of the standard is not to exempt an entire system based on the listing of individual components used in that system. The standard can use listed equipment and components to design and install a large system that is covered under their individual listing standards (e.g., UL), but the entire large system is covered under the standard itself. In other words, the standard covers the entire system, and the individual listed components where used are addressed with their listing standard requirements.

IIAR Standards are adopted by Model Codes during each of their cycles.

FIGURE 2: ANSI/IIAR CO2-2021 ADOPTION BY IMC:



APPROVED
as MODIFIED
11-0

M69-21
IMC: 1101.1.1, IIAR Chapter 15 (New)

Proponents: Jeffrey Shapiro, representing IIAR (jeff.shapiro@jmfcodeconsultants.com)

2021 International Mechanical Code

Revise as follows:

1101.1.1 Refrigerants other than ammonia. Refrigerant piping design and installation for systems containing a refrigerant other than ammonia, including pressure vessels and pressure relief devices, shall comply with this chapter and ASHRAE 15. Refrigeration systems containing carbon dioxide as the refrigerant shall also comply with BSR/IIAR CO2.

Add new standard(s) as follows:

IIAR

International Institute of Ammonia Refrigeration
1001 N. Fairfax Street, Suite 503
Arlington VA 22314

BSR/IIAR CO2-2021: Safety Standard for Closed-Circuit Carbon Dioxide Refrigeration Systems

Staff Analysis: A review of the standards proposed for inclusion in the code, BSR/IIAR CO2: Safety Standard for Closed-Circuit Carbon Dioxide Refrigeration Systems, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

Reason Statement: BSR/IIAR CO2 is in the process of completion for issuance in 2021. It is a new standard governing refrigeration systems that use carbon dioxide as the refrigerant, and it is designed to be a companion to ASHRAE 15, providing additional design requirements that are unique to carbon dioxide systems to supplement ASHRAE 15 and going beyond the scope of ASHRAE 15 by regulating the complete life-cycle of carbon dioxide systems. Carbon dioxide has become increasingly popular as an industrial refrigerant because it is considered efficient and climate friendly. Including IIAR's new standard will assure that these systems are properly regulated.

Cost Impact: The code change proposal will increase the cost of construction.
The new standard includes requirements that reflect industry good practice but are not currently mandatory. By including the standard as a mandatory reference standard in the IMC, following industry good practice will no longer be optional for carbon dioxide systems.

M69-21

FLOOR MODIFICATION
M69-21-SHAPIRO-2

Proponent: Jeffrey Shapiro, representing IIAR (jeff.shapiro@jmfcodeconsultants.com)

2021 International Mechanical Code

1101.1.1 Refrigerants other than ammonia. Refrigerant piping design and installation for systems containing a refrigerant other than ammonia, including pressure vessels and pressure relief devices, shall comply with this chapter and ASHRAE 15. Refrigeration systems containing carbon dioxide as the refrigerant shall also comply with ~~BSR~~/IIAR CO2.

~~ANSI/~~BSR/IIAR CO2-2021 Safety Standard for Closed-Circuit Carbon Dioxide Refrigeration Systems

FIGURE 3: ANSI/IIAR CO2-2021 ADOPTION BY IFC:

F55-21
IFC: 608.1.1, IIAR Chapter 80 (New)

APPROVED
as MODIFIED
by Unanimous Vote

Proponents: Jeffrey Shapiro, representing IIAR (jeff.shapiro@intlcodeconsultants.com)

2021 International Fire Code

Revise as follows:

608.1.1 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. Refrigeration systems containing carbon dioxide as the refrigerant shall also comply with BSR/IIAR CO2.

Add new standard(s) as follows:

IIAR

International Institute of Ammonia Refrigeration
1001 N. Fairfax Street, Suite 503
Alexandria VA 22314

BSR/IIAR CO2-2021: Safety Standard for Closed-Circuit Carbon Dioxide Refrigeration Systems

Staff Analysis: A review of the standard proposed for inclusion in the code, BSR/IIAR CO2 2021: Safety Standard for Closed-Circuit Carbon Dioxide Refrigeration Systems, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

Reason Statement: BSR/IIAR CO2 is in the process of completion for issuance in 2021. It is a new standard governing refrigeration systems that use carbon dioxide as the refrigerant, and it is designed to be a companion to ASHRAE 15, providing additional design requirements that are unique to carbon dioxide systems to supplement ASHRAE 15 and going beyond the scope of ASHRAE 15 by regulating the complete life-cycle of carbon dioxide systems. Carbon dioxide has become increasingly popular as an industrial refrigerant because it is considered efficient and climate friendly. Including IIAR's new standard will assure that these systems are properly regulated.

Cost Impact: The code change proposal will increase the cost of construction
The new standard includes requirements that reflect industry good practice but are not currently mandatory. By including the standard as a mandatory reference standard in the IMC, following industry good practice will no longer be optional for carbon dioxide systems.

F55-21

FLOOR MODIFICATION
F55-21-SHAPIRO-2

Proponent: Jeffrey Shapiro, representing IIAR (jeff.shapiro@intlcodeconsultants.com)

2021 International Fire Code

608.1.1 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. Refrigeration systems containing carbon dioxide as the refrigerant shall also comply with ~~BSR~~/IIAR CO2.

ANSI/~~BSR~~/IIAR CO2-2021 Safety Standard for Closed-Circuit Carbon Dioxide Refrigeration Systems

You can see that each Model Code has proposed adoptions for at least one or more of the IIAR Suite of Standards for ammonia refrigeration and the IFC, IMC, and UMC has proposed adoptions for the IIAR CO2 standard.

The following are considered as Building Codes that adopt IIAR Standards:

- International Fire Code (IFC)
- International Mechanical Code (IMC)
- Uniform Mechanical Code (UMC)
- National Fire Protection Association (NFPA):
  - o NFPA 1 Fire Code
  - o NFPA 70 National Electrical Code (NEC)

The next adoption cycle for the NFPA 70 NEC is 2023.

The next adoption cycle for the IFC, IMC, UMC, and the NFPA 1 Fire Code is 2024.

The model codes refer to IIAR for the standards that have been adopted.

For instance, where any of the IIAR Suite of Standards for ammonia has been adopted by a model code, the model code with have a general statement something such as "…for anhydrous ammonia refrigeration systems, refer to IIAR…".

MODEL CODE ADOPTIONS OF IIAR STANDARDS

2024 IFC

IIAR 2, 6, 7, 8, 9, CO2

2024 IMC

IIAR 2, 3, 4, 5, 6, and CO2

2024 NFPA 1 FIRE CODE

IIAR 2, 6, 7, 8

2023 NFPA 70 NEC

IIAR 2

2024 UMC

IIAR 2, 3, 4, 5 6, and CO2

You can see that each Model Code has proposed adoptions for at least one or more of the IIAR Suite of Standards for ammonia refrigeration and the IFC, IMC, and UMC has proposed adoptions for the IIAR CO2 standard.

CODE ADOPTION ADMINISTRATION:

Figure 1 (on page 31), Figure 2 (page 32 and Figure 3 (page 33) are examples of proposal submittals for IIAR CO2 code adoptions.

Any questions pertaining to the Codes & Standards Road Map Overview, SNAP (Significant New Alternatives Policy Approvals) for Ammonia, CO2, or HC refrigerants as natural refrigerants, the Purpose and Scopes of the Ammonia Suite of Standards, the CO2 Standard, and/or the IIAR HC Standard in Development as what they apply to and what they do not apply to, and the Model Code Adoptions of IIAR Standards, please contact Tony Lundell, IIAR Senior Director of Standards & Safety at tony_lundell@iiar.org.

Colors of Ammonia?

KEM RUSSELL, P.E

If you have been around the ammonia refrigeration industry for a while you know ammonia is clear (colorless) unless it has been contaminated with impurities. However, over the last several years ammonia is more often being referred to with a color, which is not referring to the ammonia, but the process used to manufacture it. The following is a brief overview of some of the methods of producing ammonia, which is now an area of intense research and investment:

GRAY AMMONIA SOMETIMES CALLED BROWN AMMONIA

In 1905 German scientist, Fritz Haber published his book on the thermodynamics of technical gas reactions, in which he recorded the production of small amounts of ammonia from N2 (taken from the air) and hydrogen at a temperature of 1000° C with the help of iron as a catalyst. In about 1908 this process was acquired by Badische Anilin- und Sodafabrik (BASF) who tasked and funded their chemist and engineer, Carl Bosch with developing this process on a large industrial scale. This task involved the construction of a production facility and apparatus which would stand up to working at high gas pressure and high reaction temperatures. Bosch's machine, unveiled in 1914 was able to produce almost 200 pounds of ammonia per hour which is not much but was the beginning of what was to be a very large industry.

Fritz Haber was awarded the Nobel Prize in 1919 for his research that unlocked the ammonia production process. Then in 1931, Carl Bosch and Frederick Bergius were awarded the Nobel Prize for their contributions to the invention and development of chemical high-pressure methods.

The Haber-Bosch process is the most economical for the fixation of nitrogen and with modifications continues in use as one of the basic processes of the chemical industry in the world. The majority of ammonia produced (80% or more) is used as a carrier of nitrogen and is used worldwide as a fertilizer to increase crop production to sustain and grow the population. The development of the Haber-Bosch process was critical to the growth of our society since more crops could be grown feeding more and more people.

In this Haber-Bosch process, fossil fuels, typically natural gas, which is CH4, are used (coal is also used.) Both are used to obtain hydrogen in a process of steam methane reforming (SMR) and to power the reaction. It is estimated that for every NH3 molecule generated

there is released one molecule of CO2 as a co-product. It has also been stated that there are approximately 2 tons of CO2 produced for every 1 ton of NH3 produced with some people estimating a ratio closer to 3:1. The Haber-Bosch process is fossil-fuel intense and due to the large amount of CO2 produced (around 1.8% of global carbon dioxide emissions) in the process this is being called "Gray or Brown Ammonia".

In addition, due to the widespread use of ammonia as a fertilizer as well as for many other products, it is piped and shipped pretty much all over the world. However, fossil fuels are used for the transport of ammonia which adds to ammonia's overall carbon footprint. The exact carbon footprint for the production of ammonia depends on the fuel used and the efficiency of the facility, so you could easily identify many shades of grey or brown. Your choice.

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GREEN AMMONIA

Green ammonia production is where the process of making ammonia is accomplished using 100% renewable energy sources and is carbon-free. The Haber-Bosch process is still used to produce ammonia, but water electrolysis which requires a considerable amount of energy is used to generate hydrogen and oxygen, using a sustainable carbon-free method to produce the electricity in the process. The sustainable and carbon-free power sources might be solar, wind, hydroelectric, or possibly nuclear.

There is considerable interest in "Green Ammonia" for several reasons, besides being zero-carbon. One, as an energy source, ammonia has approximately nine times the energy of lithium-ion batteries. Two, it is 1.8 times more energy-dense than liquid hydrogen. Three, ammonia is much easier to transport and store than liquid hydrogen using existing technology and infrastructure.

Green ammonia is now one of the main fuels being considered by the maritime sector to enable the shipping industry to meet new CO2 reduction targets proposed by 2030 and 2050. For cargo ships, ammonia would be used as fuel for their engines and in fuel cells.

Also, because ammonia has a high density of hydrogen, and is easy to transport it can be shipped to a point of intended use and then "cracked" to produce pure hydrogen that can be used as a fuel source.

BLUE AMMONIA

Blue ammonia is made from nitrogen again taken from the air and hydrogen again derived from natural gas feedstocks just as with "Grey Ammonia". After almost 100 years the production process has improved in efficiency but is still CO2 intense. However, the reason this process is identified as "Blue Ammonia" is because of what happens to the carbon dioxide by-product from hydrogen production.

One method to reduce CO2 is to capture and store it underground or use it in some other process. The storage of CO2 is challenging due to the resources required and the space or location for storage. The other suggested method is to plant trees to offset the CO2 that is released, which seems like a fair idea since due to forest fires over the last many years a lot of trees need to be replaced. In this case, someone has to estimate the number of trees to be planted to hopefully more than offset the CO2 being released. That has to be a lot of trees!

Depending on the fuel used, the share of CO2 captured, and the upstream methane emissions from natural gas exploitation, this "blue ammonia" process may range from pale to dark, or from, say, sky blue to navy blue. Still blue but potentially many different shades.

BLUE-GREEN AMMONIA OR SOMETIMES REFERRED TO AS "TURQUOISE AMMONIA"

As the name implies, this process is a combination of fossil fuel and carbon-free production. There is still, depending on the process, CO2 released that must be used in another process or captured and stored.

In this process, methane is used as a feedstock, but the process is driven by heat produced with sustainable and carbon-free electricity rather than through the combustion of fossil fuels. This methane pyrolysis produces hydrogen and carbon as outputs, however, unlike steam methane reforming (SMR), the carbon is in solid form rather than a gas. As a result, there is no requirement for carbon capture and storage and the carbon can even be used in other applications. Where the electricity driving the pyrolysis is renewable, the process is zero-carbon, or even carbon negative if the feedstock is biomethane rather than fossil methane (natural gas).

Methane pyrolysis greatly reduces the requirement for electricity estimated at 10-20 kWh per kg of hydrogen, versus 60kWh for electrolysis. The production of "Turquoise Ammonia" may be a good alternative to "Grey" or "Blue" ammonia production processes, especially as the process improves resulting in very little or no carbon released.

LESSON LEARNED:

There is a tremendous amount of interest and investment going into how to produce ammonia with a much lower or zero carbon footprint. Whatever the color of the ammonia production process is called, for the industrial refrigeration industry we still will get the anhydrous ammonia we know and love which is one of the best refrigerants available.

IIAR Task Force Keeps Members Up to Date on the AIM Act

The American Innovation and Manufacturing Act (AIM) Act is expected to increase the long-term use of natural refrigerants and bring significant new opportunities to the natural refrigerant industry. To ensure those in the industry are aware of the changes and opportunities the AIM Act will bring, IIAR has formed the AIM Act Task Force, which is being led by Miguel Garrido, executive president, Günter U.S.

"We have a great responsibility and opportunity to influence the marketplace and help to correct climate change," Garrido said while speaking during an IIAR webinar on the AIM Act.

The AIM Act represents an important opportunity to highlight the role that natural refrigerants can play in addressing climate challenges. "The AIM Act Task Force is developing plans to increase awareness about the AIM Act, related regulations, and how companies can utilize natural refrigerants as they transition from high global warming potential refrigerants," said Lowell Randel, senior vice president of government and legal affairs for the Global Cold Chain Alliance.

The task force has met numerous times to develop resources and materials for the implementation of the AIM Act. "The AIM Act is a very significant piece of legislature, and it is already having significant impacts on the industry," said John Collins, industrial sales manager for Zero Zone.

The task force has several goals. "One is to inform everybody about the AIM Act and keep people up to date on the rulemaking," Collins said, adding that IIAR is well positioned to present natural refrigerants as a logical response to the AIM Act. "We want to point out all of the benefits of natural refrigerants—energy efficiency, ease of use, low cost, and availability."

There is a button on IIAR's website dedicated to the AIM Act that features AIM fact sheets and additional details. "We are trying to educate the industry about it," said Eric Smith, vice president, and technical director for IIAR. "You don't have to be a member to access it."

IIAR is also putting together information to counter some of the negative information manufacturers are producing and promulgating about natural refrigerants.

Once the AIM Act is fully integrated and up to speed, it will position natural refrigerants as a more attractive option than it has been in the past because the new synthetic chemicals have some disadvantages by comparison.

"They are expensive, availability is a concern, especially in developing countries, and they have some characteristics that can cause operational or diagnostic issues, such as glide and fractionation. The main thing is that any of the new HFO blends are fluorinated and can release per- and polyfluoroalkyl substances (PFAS)," Smith said, adding that there are already movements in Europe to ban these types of refrigerants. "The good thing is that natural refrigerants don't have these, and they will never be banned."

IIAR can play a significant role in the market shift. "As an organization, we can be ready to fill the void that the industry has," Collins said, adding that IIAR has wanted to be proactive in aiding with the transition.

David Fauser, director of sales for CIMCO Refrigeration, said those in the industry always want to provide value to their customers, and education about the AIM Act is critical to help customers with a long-term decision. "When customers are deciding on an investment for a thermal system and then have to replace it before the end of its useful life, that is a terrible position," he said.

Because piping is so integrated in a building, the wrong choice of a system can be determinantal to its future. "It is important to understand the AIM Act. Bringing the facts and educating our client is a simple way we can bring value," Fauser said.

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IIAR, RETA, GCCA, ASTI Form Coalition to Promote Natural Refrigerants

Safety, prevention, and emergency response readiness are top priorities within the natural refrigerant industry, and the Ammonia Safety Training Institute, IIAR, Global Cold Chain Alliance, and Refrigerating Engineers & Technicians Association have come together to form the Ammonia Safety Day Coalition.

"It is important for IIAR, RETA, and GCCA to partner with ASTI because we all represent key parts of the industry and have resources to help support the effort," said Lowell Randel, senior vice president of government and legal affairs for the Global Cold Chain Alliance. "We all have a stake in safety, and it just makes sense for us to come together and leverage our resources and strengths to promote best practices and increase education and awareness."

The Ammonia Safety Day Coalition is a joint effort to promote the tripod approach, which brings together industry, government, and public safety to prevent and mitigate the impacts of accidental ammonia releases. "Each of those parts of the tripod has a critical role to play in promoting the safe and efficient use of ammonia and effectively responding when there is an incident," Randel said.

Gary Smith, president, and CEO of ASTI, said working together enhances the entire focus of support that the four associations do daily. "The leaders from IIAR (standards and publications), RETA (operator training and certification), and the GCCA (governmental relations) have had a great working relationship for many years," he said.

Gary Schrift, IIAR's president, said the collaboration shows ammonia users that the major organizations agree on the same safety processes and overall safety of ammonia and promote safety.

The coalition also ensures that the Coalition-sponsored Safety Days and seminars meet specifications that all the organizations agree to be safe. "Consistency is important as you train people across the country," Randel said.

ASTI drives and coordinates the safety days and provides most of the content. "ASTI is uniquely positioned to contribute on certain topics while RETA, GCCA, and IIAR are positioned in other topics," Randel said. "We can leverage the strengths of the various partners to make sure the curriculum is as strong as possible."

COMMUNICATING REGULARLY

In addition to the Safety Day Alliance, the groups regularly communicate with government agencies through a separate OSHA alliance.

"GCCA entered into an alliance with OSHA, and IIAR has been a part of that from the beginning. Then GCCA brought RETA and ASTI into the alliance activities as well," Randel said, adding that representatives from OSHA and EPA also participate in the calls. "That alliance has been very valuable in fostering good relationships with industry and OSHA and EPA."

Those relationships are essential given the government's role as one of the tripod's three legs. "Our ability to work together is critical for the health and strength of the tripod to address critical issues," Smith said, "For example, we are working with an OSHA team to create a better understanding of how to utilize industrial best practice SOPs, similar to findings of the 11th Circuit Court ruling in favor of the TECO (Tampa Electric inc.) responders use of their SOP for addressing emergency system control."

Having regular communication with OSHA and EPA also helps directionally. "As the coalition plans its activities, OSHA can share its perspective and ideas," Randel said. "Having OSHA involved also helps build broader awareness and participation at the local and regional levels."

Additionally, the calls allow OSHA and EPA to see that industry groups have a cohesive safety message and information. "It is important to provide evidence that the industry can safely apply these natural but also hazardous chemicals as refrigerants," he said.

During the calls, each coalition member gives an update on their association and shares any news or activities. The groups also discuss what is happening in the industry. "In one call, EPA and OSHA can learn what these organizations are working on or what they may have completed, such as a new training program or release a new guideline," Schrift said.

In addition to providing an update, call participants discuss ASTI safety days, upcoming events and locations, and if and how IIAR, GCCA, and RETA could support the event with materials, personal attendance, and training. There is also time to discuss new business, such as work being done by ASTI for the safe transport of ammonia for new applications.

"When we have a safety day, we have that efficient mechanism to ensure the local OSHA and EPA representatives are invited, aware, and engaged," Randel said. "Having them involved helps with overall planning but also with promotion and ensuring we have a broad scope."

Smith explained that the feedback received also shapes the strategy ASTI uses to address future tripod needs.

MAKING AN IMPACT

ASTI's work and the industry collaboration are making a difference. "There are thousands of people who have been trained through this program and probably dozens of sessions over the years," Randel said.

Smith estimates that last year alone, ASTI impacted around 1,000 people with the Safety Day program, tabletop exercises, and training. "We also have 20 years of experience in doing Safety Days throughout the U.S., Canada, South America, and Australia," Smith said.

Smith said each association's work is evident in the Safety Day attendance, which averages about 100 people per event.

ABOUT THE SAFETY TRAINING DAY COALITION

Mission: We exist to strengthen the Tripod relationship and communications between government, industry, and public safety by providing a forum to network and share insights, educate, and train on best practices regarding ammonia refrigeration system safety and related ammonia uses.

Vision: To leverage Coalition member strength to support and enhance ammonia safety training to further benefit the world by expanding the safe use of ammonia as an environmentally friendly natural refrigerant and substance for use in many other applications.

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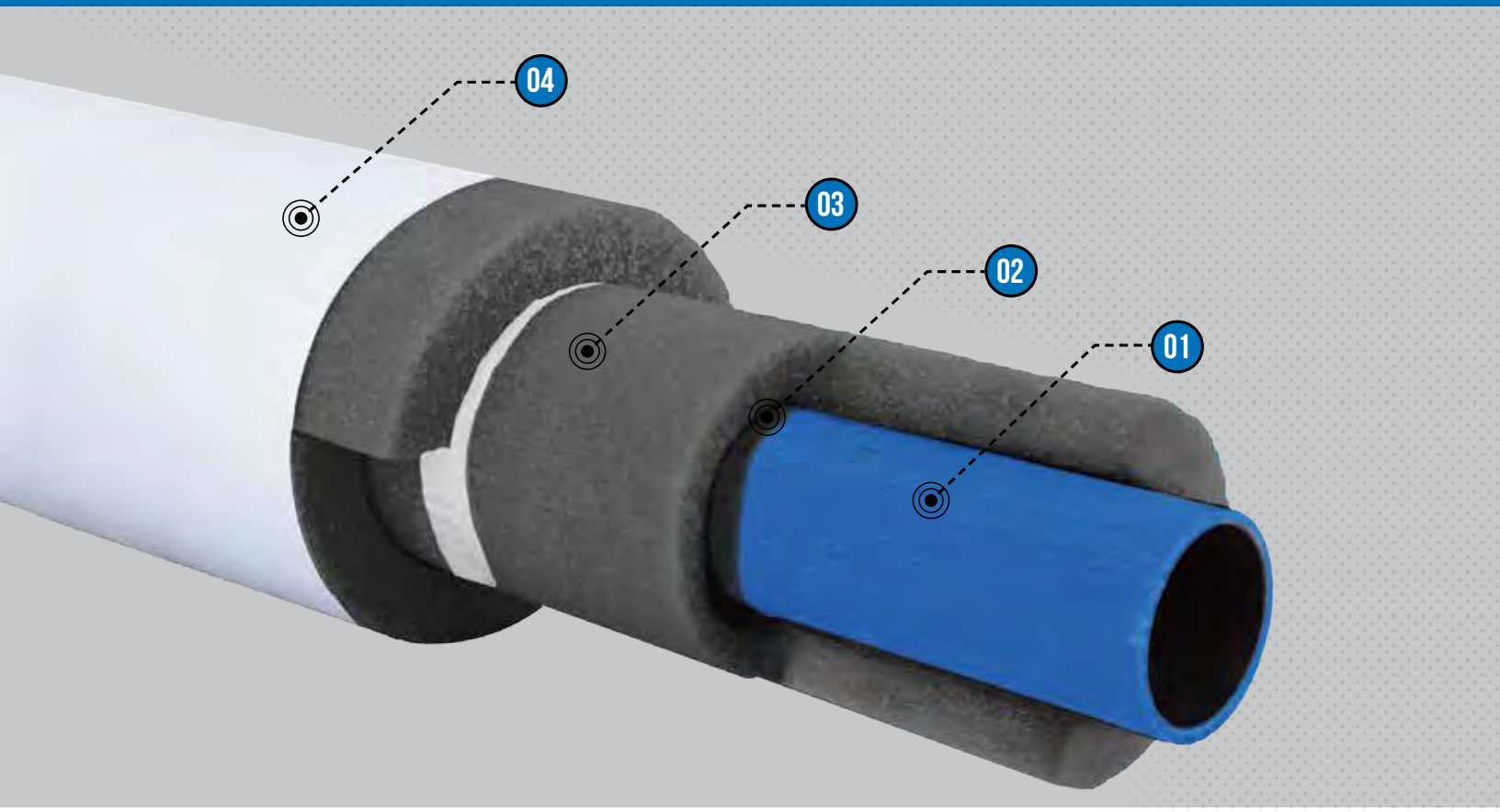

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