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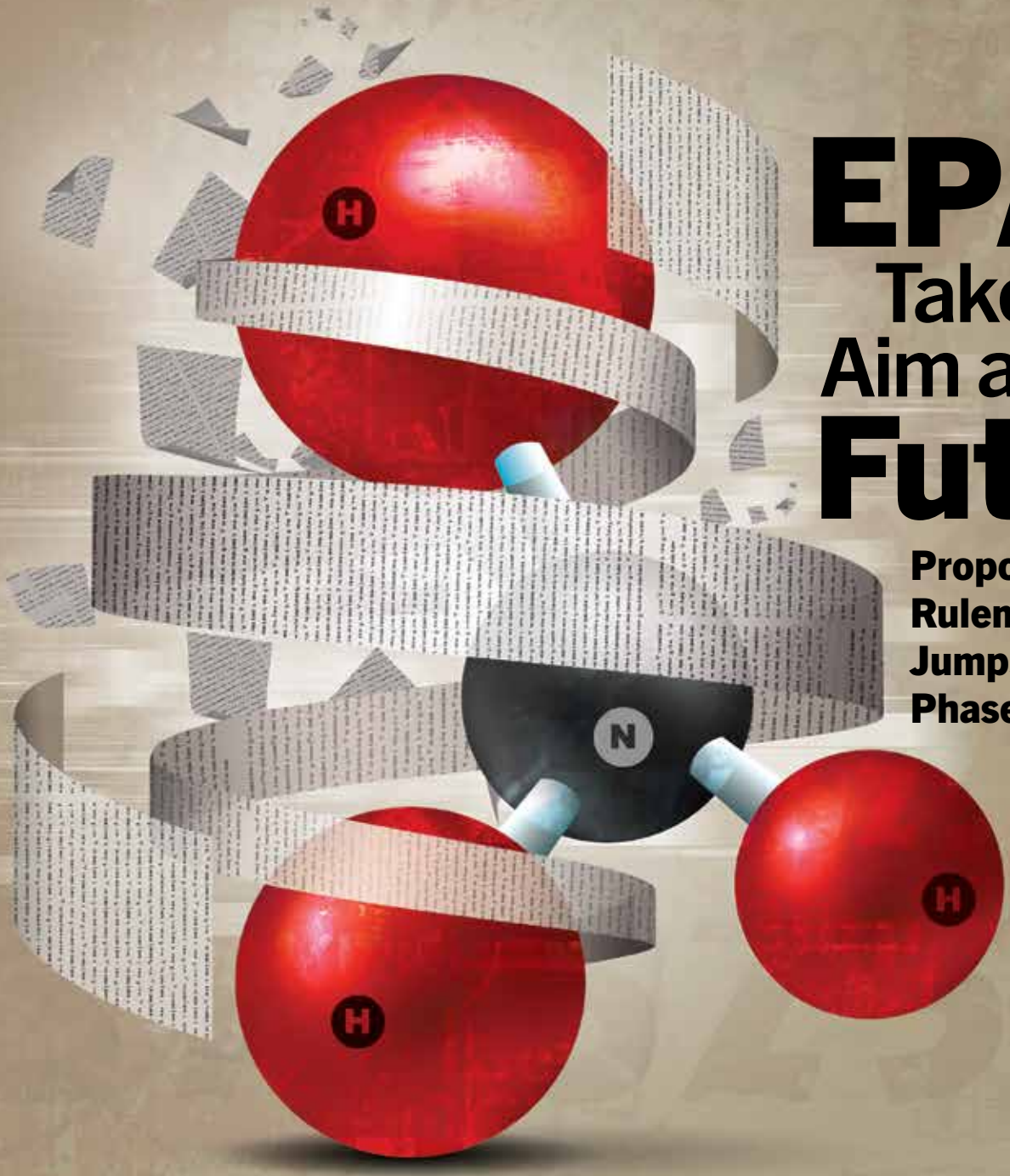

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Proposed Rulemaking Jumpstarts HFC Phasedown

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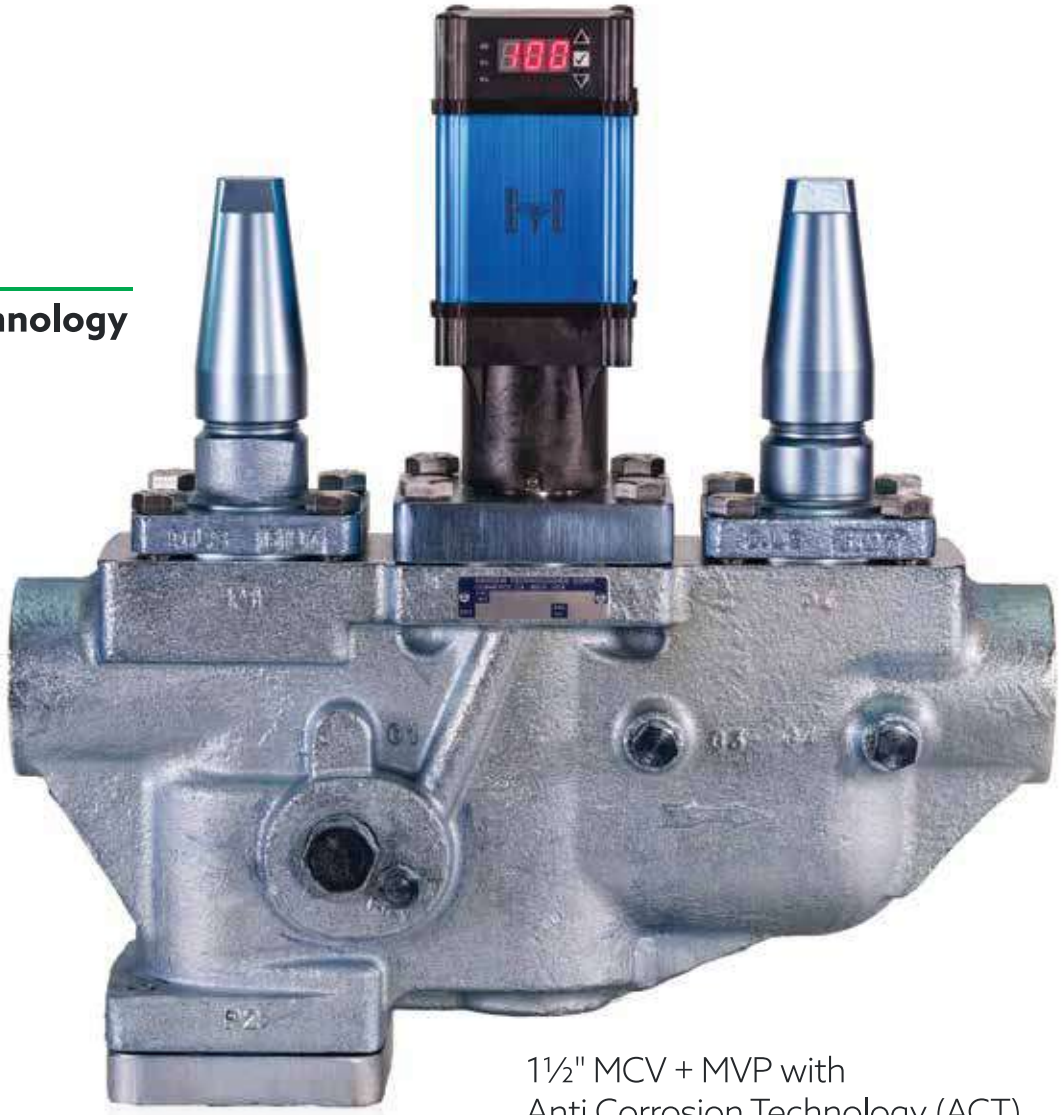

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contents

COVER STORY

8

EPA Takes Aim at the Future

Proposed Rulemaking Jumpstarts HFC Phasedown

4 President's Message

6 Chairman's Message

7 Pressure Relief Design Considerations From a PSM Compliance Standpoint (Part Two)

12 IIAR Brings Synchronous Learning Opportunities to Industrial Refrigeration

14 IIAR Annual Conference Continues with Virtual Platform

16 Industry Joins Together to Provide Valuable Training to OSHA Inspectors with Ongoing Research and Standards

20 2021 IIAR Online Conference and Virtual Exposition

26 The Industry at Rest: How SEC Benchmarking will Create New Momentum in the Refrigeration Sector for Mixed-Use Refrigerated Warehousing.

30 Financial Tech Tip

32 Government Relations

36 Different Views on Regulations in Europe and the USA

38 Scholarships Provide Multiple Learning Opportunities for Recipients

40 IIAR Standards: A Look Back

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president's MESSAGE

BY GARY SCHRIFT

Buckling our seatbelts, filling our own gas tanks, sending an email, and burning propane or natural gas in our homes for heating was once unthinkable. These technologies replaced dad's arm across your chest during a fast stop, the serviceman pumping gas and checking your oil level, typewriters and the mail service, and coal or wood-burning stoves. There are times I wish to go back. Like when it's pouring rain and I am nearly out of gas, or when my PC fails, and I feel helpless. Boy wouldn't that gas station attendant or typewriter be great now. However, I often wish that I had had a laptop and word processing software back in the early '80s instead of using a typewriter, miles of correction tape, and hand-drawn graph paper for creating the many engineering lab reports in college. I appreciate the no waiting at the gas station pumps and the ease of use, comfort, and energy efficiency provided by natural gas and propane furnaces.

At one time these changes faced severe public distrust, concerns for safety, and concerns for additional regulation (too much, too little). I would be naïve to think that everyone now trusts and does not fear or even despise these common-day technologies. However, the vast majority partake in each one of these technologies every day.

The change from reluctance to everyday acceptance occurred because of safety standards, regulations, repetition, and measurable results, and of course, the technologies had to work well. Our industry, commercial and industrial refrigeration using natural refrigerants, and its technology works well, and it has for decades. Our industry has measurable results showing energy savings and safe operations, with even greater energy savings and safer operations in the past decade. Our design standards, second to none, provide a guide to ensure repeatable quality refrigeration systems for end-users. But still, our industry's vast expansion is limited by concerns for safety and concerns for regulation (too much or too little).

Our design standards, second to none, provide a guide to ensure repeatable quality refrigeration systems for end-users.

We have tackled the safety issue but need to do a better job marketing that effort. We have decades of demonstrated safe use and operation of refrigeration systems using Ammonia, CO_2, and hydrocarbons. We have design and operational standards that are recognized by all model codes in the USA and internationally, which, because of their requirements, continues to further increase safe application. We have training programs provided by excellent organizations of common interest such as RETA, ASTI, IRC, and IIAR of course. Such knowledge also increases safety.

I suggest the one item that is limiting our vast expansion is regulation. What is scarier, the unknown, or regulation? I say the unknown. Regulation or rules and requirements are known but are inconvenient and can be initially costly to have to follow until we get used to them from education and then repetition. The unknown and no regulation is convenient and initially less costly to implement, but this has left us with ozone-depleting and global warming refrigeration chemicals that were believed to be safe to use and required minimal regulations for use.

Because of this, countries have created, or are now creating, regulations for limiting the application and use of HFC's, most recently in the USA via the adoption of the AIM Act. I suggest rather than be concerned with more regulation, that our members who support existing and expanded use of natural refrigerants celebrate these new regulations because we have documented and adopted standards, guidelines, and training programs far better than most other industries, so we are well poised to meet and exceed the existing regulatory requirements. For those end users considering the use of natural refrigerants, do not fear the tasks required to meet regulations that exist. The car industry and car buyers adapted to adding and using seatbelts and the housing and utility industry adapted to piping flammable gases into our homes and buildings because of the creation, adoption, and execution of necessary safety regulations and standards. Our natural refrigeration industry already has the necessary regulations, code, adopted standards, and training needed. And once an end-user installs a refrigeration system using a natural refrigerant, they need not fear having to replace it because of new regulations against the naturals or findings of harmful long-term environmental effects.

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chairman's MESSAGE

BY ERIC JOHNSTON

Conference time is here again and although it's hard to think we'll spend one more year meeting online rather than in person, there's a lot to look forward to.

For the executive committee and your staff at headquarters, that means everyone is working hard to make sure our recent initiatives – from the renewed focus on IIAR member benefits to the many new projects our committees have started – will put us in the best possible position as we look forward to the eventual end of this pandemic.

As your new chairman, my priority this year is to carry those initiatives forward and make sure the growth of the industry is well supported by our organization's leadership.

As Dave Schaefer hands over the reins as IIAR Chairman, he's handing over a financially stable, productive organization that has weathered unprecedented times thanks to the solid foundation he and so many others have worked hard to build.

Under his leadership, our committees have seen one of their most productive years yet, despite having to forgo in-person meetings. In the international arena, IIAR has continued to establish close ties with regions where ammonia refrigeration and the global cold chain is growing. And on the regulatory front, IIAR's communication with the EPA could well impact the landscape for natural refrigerants for years to come (see this issue's cover story).

As Dave Schaefer hands over the reins as IIAR Chairman, he's handing over a financially stable, productive organization that has weathered unprecedented times thanks to the solid foundation he and so many others have worked hard to build.

Both Dave Schaefer and IIAR president Gary Schrift deserve a huge thanks from all of us for their leadership in prudently managing our organization's finances and taking the cost-cutting measures to keep our organization solvent.

Key to that effort is our newly formed virtual conference format. In addition to serving as a vital educational resource within our industry – it is also laying the groundwork for the future. Our virtual conference format developed during the pandemic will help IIAR reach a broader swath of members, regulators, and international partners when it is held in conjunction with our regular in-person meetings beginning next year.

My priority this year will be to make sure that our standards, educational and conference programs continue to make gains in delivering the best collective knowledge and resources our industry has to offer, both internally, to our members, and externally, to any regulators, support personnel or industries that touch industrial refrigeration.

I view these projects and my tenure as your Chairman as a continuation of a new phase of IIAR leadership. As we begin this new membership year together, I hope you feel free to contribute with the new ideas and levels of participation that have become the hallmark of this group.

Speaking of participation, no introductory Chairman's column would be complete without giving recognition to the outpouring of support and involvement of IIAR members.

Last year's virtual conference was one of our best conferences yet, and I believe this year's conference will be as well. The packed technical paper sessions and workshops are the usual highlights of our annual meeting. And while we can't return to a packed exhibit hall just yet, there are plenty of opportunities to take advantage of the educational resources on offer until we can.

I'm looking forward to accomplishing several goals as your Chairman this year. As members, your ongoing work and participation make all of our activities possible. Thank you for continuing to enrich our industry with your support.

Pressure Relief Design Considerations From a PSM Compliance Standpoint (Part Two)

BILL LAPE, SCS ENGINEERS

In the first article of this series, some of the factors that affect the relief capacity of a relief system that are often overlooked were highlighted to raise awareness of what is needed to properly document the safety relief design. In this article, we will discuss some of the pitfalls associated with internally relieving relief valves.

It has long been held that the best way to relieve overpressure in an ammonia refrigeration system is to have the safety relief valves (SRVs) relieve into another part of the system, often simply on the opposite side of the downstream isolation valve. While this can be a viable option, it is often fraught with pitfalls.

One of the common pitfalls centers on selecting a proper set pressure for the internally relieving SRV. Typical SRVs used in ammonia refrigeration operate on differential pressure between their inlet and their outlet. So, an ammonia safety relief valve with a set pressure of 150 psig will pop at 150 psig, if the outlet pressure is atmospheric pressure. When installed to relieve into another part of the system, the pressure in that part of the system must be added to the SRV set pressure to get the actual popping pressure of the SRV.

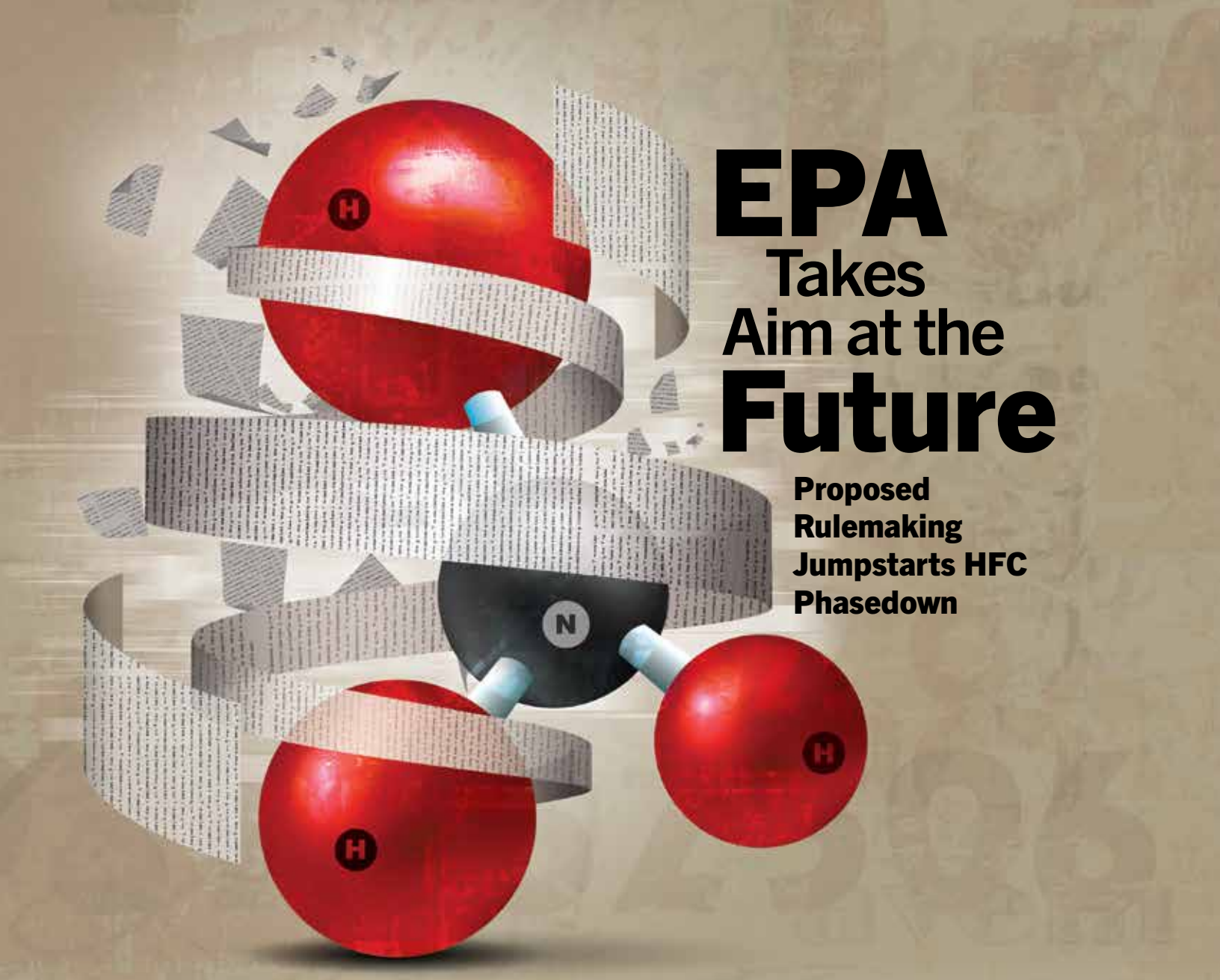
For instance, let's say that we have a surge drum on a product silo that is tied back to a suction accumulator with dual SRVs with set pressures of 150 psig. For argument's sake, let's assume that the surge drum SRVs have a set pressure of 150 psig, which is often the case. If the SRVs on the surge drum relieve to atmosphere, they will open at 150 psig. However, if they are piped to relieve into the suction header on the opposite side of the isolation valve for the surge drum, we must take the 150 psig set pressure of the surge drum SRVs PLUS the suction pressure in the header and the accumulator. If the suction pressure typically operates at 30 psig, then the internally relieving SRVs will not pop until the pressure in the surge drum exceeds 150 psig plus 30 psig, or 180 psig. If the Maximum Allowable Working Pressure (MAWP) of the surge drum is 150 psig, then this installation is not compliant with IIAR2 or the Boiler & Pressure Vessel Code. Moreover, we know the suction line is connected to the accumulator with its own relief valve, so before we place an order for a surge drum with a 200 psig MAWP, we have to ask ourselves, "What is the absolute worst-case pressure that will be seen on the low side of this system between the suction accumulator and the surge drum?" Note that this is not the worst case that is likely to happen. It is the worst case that is allowable by the installed engineering controls. In this case, the absolute worst-case pressure would be 150 psig, equal to the set pressure of the suction accumulator SRVs that discharge to atmosphere. With this, to internally relieve the surge drum, it needs to have an MAWP of 300 psig, equal to the set pressure of the SRVs on the accumulator plus the set pressure of the SRVs on the surge drum. This can be reduced if SRVs with a lower set pressure, say around 75-100 psig are selected to relieve the surge drum. With a set pressure of 100 psig, a 250 psig MAWP for the surge drum will suffice.

For new construction, this is all part of the design process, but what do you do if the surge drum has an MAWP equal to the MAWP of the accumulator? There are a couple of options. First, a balanced SRV that is not affected by back pressure can be used to relieve the surge drum. These are typically bellows-type valves that can be found through an internet search. Be careful when selecting such valves that their materials of construction are compatible with ammonia. Another option is a little more controversial but is code compliant.

The Boiler and Pressure Vessel Code requires that a direct, spring actuated, SRV with the ASME mark be used to relieve any equipment that is built to the Boiler & Pressure Vessel Code and is stamped with the ASME mark. It does not state that alternative means of relieving pressure cannot be used in conjunction with the ASME stamped SRVs. So, the surge drum could be equipped with ASME SRVs with a set pressure of 150 psig that relieve to atmosphere AND a reseating relief regulator that is set to relieve at some point below 150 psig, typically 75-100 psig, that that will prevent the surge drum pressure from ever reaching the 150 psig set pressure of the atmospheric reliefs. The bulk of the overpressure relief is accomplished by the reseating relief regulator that keeps the ammonia in the system, and the vessel meets code because it is ultimately protected by the atmospheric reliefs that would only pop if there was a failure of some sort with the reseating relief regulator. Note that the reseating relief regulator CANNOT be used by itself to protect an ASME stamped piece of equipment, such as a thermosiphon oil cooler. It MUST be used together with an ASME stamped SRV.

Another pitfall that is often encountered when piping SRVs to relieve internally is interposing isolation valves. It is generally accepted that the isolation valve immediately downstream of the internally relieving SRV discharge must be locked, or car sealed, open. However, this also applies to any other isolation valves between the SRV discharge and the next ASME SRV. For example, from our scenario above, an isolation valve in the outlet of the surge drum relief piping would need to be locked open, as well as the isolation valve in the suction line to the accumulator. While there are some instances in Non-Mandatory Appendix M of the ASME Boiler & Pressure Vessel Code that do not trigger a need for locking elements or administrative controls, the calculations to document these cases exceed what most facilities can, or are willing, to do. So, the easiest way to comply with the ASME Boiler & Pressure Vessel Code is to lock ALL isolation valves between this surge drum and the accumulator SRVs.

The purpose of this article was to discuss some of the pitfalls associated with internally relieving relief valves. In the next article, we will discuss the considerations that impact the discharge piping of relief valves.



EPA Takes Aim at the Future

Proposed Rulemaking Jumpstarts HFC Phasedown

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 is expected to increase the long-term use of natural refrigerants. The agency has taken rapid action, and on May 3, it released its first proposed rulemaking under the AIM Act to establish an allocation system for the HFC phasedown.

The rule proposes an allowance allocation and trading system, which will determine the amount of HFCs an entity can produce or consume, and it creates the mechanism to phasedown domestic HFCs.

"By phasing down HFCs, which can be hundreds to thousands of times more powerful than carbon dioxide at warming the planet, EPA is taking a major action to help keep global temperature rise in check," said EPA Administrator Michael S. Regan. "The phasedown of HFCs is also widely supported by the business community, as it will help promote American leadership in innovation and manufacturing of new climate-safe products. Put simply, this action is good for our planet and our economy."

EPA's proposal would set the HFC production and consumption baseline levels from which reductions will be made, establish an initial methodology for allocating HFC allowances for 2022 and 2023, and create a robust, agile, and innovative compliance and enforcement system, the agency said.

"EPA intends to use the approach established through this rulemaking to issue allowances for 2022 by October 1, 2021 and plans to revisit the approach for subsequent years in a later rulemaking. In addition to proposing to establish a general HFC allowance pool and a set-aside pool (e.g., for new market entrants), the proposal outlines how EPA plans to issue allowances for specific applications listed in the AIM Act that the agency was directed to provide allowances for, such as mission-critical military applications," EPA wrote in a release.

EPA will accept comments on this proposal for 45 days after publication

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in the Federal Register and hold a public hearing. The agency plans to finalize this rule later this year.

The Environmental Investigation Agency is among those who petitioned the EPA to restrict the use of HFCs in key cooling sectors under the AIM Act. "We are incredibly excited by the swiftness with which EPA is setting up a framework to implement landmark climate regulation to eliminate HFCs that will achieve emission reductions of 4.7 billion metric tons of CO_2e by 2050," said Avipsa Mahapatra, climate campaign lead for EIA.

Natural refrigerants will provide a critical role in the HFC phasedown and can help businesses comply with regulations even if they change. "If you choose a natural refrigerant, you don't have to worry about EPA coming back and saying, 'Well, we set the global warming potential limit at X, but in five years we may move it down to another level and then another," said Lowell Randel, director of government affairs for IIAR. "Natural refrigerants are a good long-term solution and have a long track record of success."

The AIM Act will result in an 85 percent phase-down by 2035, and it gives the EPA a mechanism to fill a gap created when courts ruled the agency did not have the authority to phase down HFCs when the Obama administration attempted to use the Significant New Alternatives Policy (SNAP) Program to advance the goals within the Kigali amendment.

When the courts ruled that SNAP and the Clean Air Act only gave EPA the authority to regulate for ozone and not global warming potential, it forced EPA to change course, Randel said. "EPA had to roll back efforts to phase down HFCs. That led to a gap for the EPA to address HFCs. The AIM Act fills that authority gap that the EPA had due to the court findings," he explained.

The Biden Administration recently announced it would send the Kigali Amendment to the Senate for ratification, the global HFC phase-down agreement, but the AIM Act authorizes the EPA to implement the amendment domestically.

> **"EPA had to roll back efforts to phase down HFCs. That led to a gap for the EPA to address HFCs. The AIM Act fills that authority gap that the EPA had due to the court findings."**
>
> – Lowell Randel, director of government affairs for IIAR and senior vice president of government and legal affairs for the Global Cold Chain Alliance

Addressing how things are cooled is one of the top things we can do to limit our impact on the environment, said David Fauser, director of sales for Toromont. "Refrigerants, in general, are a rather straightforward thing we can address right now. We have the technology, installation base, and know-how already, and the overall cost of ownership is typically more attractive," he said, adding that net-zero has become a buzzword, and natural refrigerants need to be part of an overall climate pledge by any organization.

Christina Starr, senior policy analyst for EIA, said this is a key moment for the U.S. to demonstrate true climate leadership by implementing the most ambitious feasible restrictions on HFC use. "These regulations are essential to meet the Kigali Amendment HFC phase-down schedule," she said. "If strong enough, they can make it feasible to accelerate it in several years and help lead the world into the next chapter of Montreal Protocol climate action."

Through the Montreal Protocol, necessary steps were taken to eliminate the very high ozone depletion potential substances, such as CFCs, which led to the formation of new synthetic refrigerants in the form of HCFCs and HFCs that had a lower potential for ozone depletion, said Trevor Hegg, vice president, product development, industrial refrigeration, and water systems, EVAPCO Inc.

"However, these refrigerants have high global warming potential, and their use will continue to have a negative impact on the environment," Hegg explained. "For the benefit of the environment, it is important that the use of any refrigerant with ozone-depleting and global warming potential be reduced and eliminated, which is what the AIM Act and the Kigali Agreement support."

EIA has requested that the EPA prohibit using many HFCs in newly manufactured refrigeration and air conditioning systems ranging from small residential air conditioners to large refrigeration systems in supermarkets, targeting the largest sectors of HFC consumption and emissions. It also called for replicating a proposed regulation recently approved in California.

There are currently several synthetic refrigerants on the market, including HFCs, HFOs, and blends, which all have varying global warming potential numbers associated with them, Randel said.

"The EPA must make up for the lost time and utilize its authority to implement the new climate law, AIM Act in the most ambitious and effective way. Eliminating these potent super pollutants can save hundreds of millions of tonnes of carbon equivalent, pivotal to achieve near-term emissions reduction," Mahapatra said.

The exact GWP levels the AIM Act will require haven't been established. "It will depend on the situation, the type of equipment, and the type of application. I suspect it will be different in different applications. We're going to push for 150 or less," Schaefer said.

Which refrigerants will be allowed long-term will depend on EPA's short-, medium- and long-term specifications. "Let's say they make it the 150 GWP,

which is similar to what they did in California, that is going to restrict the pool of synthetics that can be utilized because of that lower GWP," he said.

Dave Schaefer, chief engineer for Bassett Mechanical, said the global warming potential on some synthetic refrigerants is high, which means they aren't a good long-term solution. "We at IIAR are proponents of the natural refrigerants—the ones that have very low or no GWP. Natural refrigerants have been around for a long time. I don't see any reason why they would ever get phased out," he said.

Natural refrigerants are very efficient, and the technology is continuing to evolve. "There are a lot of options," Randel said. "You can do conventional ammonia refrigeration system, low charge, cascade with CO_2 and ammonia, or transcritical CO_2, and in certain applications, you can use hydrocarbons or propane. All are very efficient, and the technology just keeps getting better and better."

Hegg said that CFCs, HCFCs, and HFCs have been scientifically proven to hurt the environment through ozone depletion and global warming. "Sustainability metrics like global warming potential and ozone depletion potential largely exist today because of synthetic refrigerants," he said.

Natural refrigerants are environmentally friendly. "Refrigerants like ammonia, carbon dioxide, and hydrocarbons have zero ozone depletion potential. Additionally, the global warming potential is non-existent for ammonia and carbon dioxide and minimal for hydrocarbons," Hegg said. "Natural refrigerants are pure, unlike the newly developed HFO's which are blends of refrigerants that can be difficult to analyze and recharge."

Another benefit of natural refrigerants is their favorable thermodynamic properties which support higher refrigeration system efficiencies and reduced carbon footprint. "These better system efficiencies also translate into lower lifecycle costs for the end-user," Hegg said.

Natural refrigerants also do not contain fluorine, which could also be regulated in the future, Hegg said.

Meeting upcoming requirements shouldn't be a challenge. "I think that one of the things about the AIM Act that strikes me as interesting is that the 85% required reduction by 2035 could be done by 2025," Fauser said. "We can see the increasing pressure by the public for government to address this for example in Canada, as we're heading into our next election, the topic of climate change is the cornerstone of campaign messaging."

There should be plenty of natural refrigerants to meet demand, and Schaefer said that natural refrigerants are relatively inexpensive and readily available right now.

What's more, there are natural refrigerant equipment and solutions available now, and there will be innovative advances in natural refrigeration technology by the time phaseout of HFCs is complete, Hegg said. "Manufacturers of equipment and system designers faced similar challenges with the phaseout of CFCs and HCFCs," he explained. "Now is the opportunity to innovate and develop more equipment and systems utilizing natural refrigerants like ammonia, carbon dioxide, and hydrocarbons."

With man-made refrigerants, there is a strong chance they will get phased out as technology improves. As they do get phased out, there becomes a need to get rid of them safely.

Having regulations provides guidelines and helps businesses eliminate grey areas, Fauser said. It also helps with long-term planning.

"If you're a food production plant that puts in a synthetic refrigerant, but then you have an unforeseen regulation come along, you have to deal with it. It will either hinder or shut down your production. Switching refrigerants and systems on the fly is not an easy task, it is severely disruptive to their business, especially if they have to do it before the end of the lifecycle of their equipment. With natural refrigerants, phase-out/down is not a concern which mitigates that risk" Fauser said.

Randel said the challenge to phase down is less about the availability of technology and alternatives but is more likely to be capital expenses. "The fact is that people are coming out of a pandemic, and capital budgets might be constrained, but if a company is going to convert from HFC to a natural, the technologies are there for them to make that choice efficiently," he said.

When examining costs, Fauser said users should explore how long they want the equipment installed for, energy costs, maintenance costs as well as overall safety. In addition, he urged end-users to look beyond price. "You have to ask around and get multiple perspectives and get past the price. Refrigeration is complicated and there are many design paths that could be taken. One of our biggest roadblocks is the buyers' understanding of the future impact of their decisions today. The ones responsible for making the decision are typically not the ones who deal with the long-term costs," he said.

"Refrigerants like ammonia, carbon dioxide, and hydrocarbons have zero ozone depletion potential. Additionally, the global warming potential is non-existent for ammonia and carbon dioxide and minimal for hydrocarbons."

– Trevor Hegg, vice president, product development, industrial refrigeration, and water systems, EVAPCO Inc.

Schaefer said owners and operators must review the total cost of ownership. "Some equipment that uses natural refrigerants can last 50 years. However, the commercial type using synthetics can be obsolete in 15 years," he explained. "Your first cost of ownership might be less, but your long-term cost of ownership could be higher because you have to replace the unit more often."

As regulations change, manufacturers will ramp up to get acclimated, Schaefer said. "It does take time, but I don't think it will take years and years to change over. It is already occurring because companies want to do the right thing," he said.

An added benefit of the AIM Act will be the creation of new jobs and manufacturing output to support new technologies that will be needed, Hegg said.

There will be a need for technicians, engineers, and certified operators within the natural refrigerant space. "It is something that highlights the importance of IIAR's Academy of Natural Refrigerants, RETA's certification, and other workforce development efforts," Randel said. "Having the pipeline and the training and education available to bring new people into the industry is extremely important. As we look to meet those future demands, I think IIAR and the industry are well-positioned to educate and train the future workforce that will help take us to the next level."

Randel added that IIAR is actively engaging with EPA as they move to implement the AIM Act. "We are developing materials and recommendations for EPA related to the AIM Act. We're also working with partners in the industry to magnify our voice with the agency," he said.

IIAR Brings Synchronous Learning Opportunities to Industrial Refrigeration

COVID-19 has changed the way learning takes place across the globe with virtual opportunities and distance learning taking off as social distancing and travel restrictions have kept people out of classrooms. IIAR is among those groups that pivoted to provide valuable learning opportunities to those within the refrigeration industry.

In March, IIAR partnered with Don Fenton, a professor of mechanical and nuclear engineering at Kansas State University, to bring the 54th offering of the Industrial Refrigeration Workshop to participants through online synchronous learning, which allowed participants to interact with instructors in real-time.

"This was a unique opportunity brought on by the COVID-19 pandemic. Any other year, this would have been held in person," said Eileen McKeown, vice president for marketing and sales for IIAR. "We were happy to help him facilitate the 54th program so that he did not lose continuity or momentum."

IIAR used its Learning Management System to deliver content daily to attendees and to track participation. "We also used our online meeting platform to engage with attendees directly," McKeown said.

Fenton has traditionally held a week-long in-person training at various venues, including Kansas State University. While the format changed, the training did not. "The workshop had the same goals as in the past: to deliver the technical content, the same technical content and we covered exactly what we wanted to," Fenton said.

Rather than do the workshop in one whole week, IIAR and Fenton divided it out over two weeks, requiring a half-day from attendees. "That way we could not take a person's entire day to attend the workshop, and our attendees could continue working at their place of employment," Fenton said.

The class is technical in nature and covered the design of ammonia refrigeration systems and facilities. "From the importance of how building materials affect refrigerant load to designing a closed loop ammonia refrigeration system, this course covered it all," McKeown said.

The course is hands-on with participants designing a refrigeration system for a fictional facility and calculating all of the refrigeration needs. "We're trying to engage them and get them thinking about the actual refrigeration requirements," Fenton said.

Fenton taught the class along with Gary Wilson, an emeritus professor at the University of North Carolina – Charlotte. Other instructors included Joe Bove of Stellar, John Kollasch of Evapco, John Shell of Morris & Associates Inc., Donald Faust of Frick Industrial Refrigeration, Laura Marshall of Baltimore Aircoil Co.

"As university professors, Gary Wilson and I bring the technical fundamentals pertinent to industrial refrigeration while the industry presenters apply their practical experience and know-how to the workshop. Those technical fundamentals combined with the experience from our other presenters generate a blend that really works well," Fenton said.

McKeown said the instructors were chosen for their expertise in refrigeration and came from all aspects of the refrigeration industry.

One of the biggest benefits of moving training online is the ability to attract a wider audience. "We had students from Romania to Tasmania. It truly was an international program," McKeown said. "We were really surprised that the class doubled in size from a traditional classroom event. International attendees were a big part of that."

IIAR along with other industry groups have several synchronous upcoming trainings available, including a for Mechanical Integrity for Ammonia Refrigeration Systems. "The program was created by the Industrial Refrigeration Consortium and will be facilitated by the IIAR, "McKeown said, adding that the session is available at https://www.iiar.org/IIAR/Education/Mechanical_Integrity_Education_Program.aspx

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IIAR Annual Conference Continues with Virtual Platform

The International Institute of Ammonia Refrigeration 2021 annual Natural Refrigeration Conference & Expo will continue with its virtual format, providing four days of technical knowledge, networking, and industry-sponsored events for those involved in the natural refrigeration industry. The event first went virtual in 2020 due to the COVID-19 pandemic.

"This year, with the cancellation of the in-person conference occurring with much more advanced notice, we were more prepared to try to deliver a conference that can feel as much like the traditional in-person conference, which will include the social networking events, the business meeting, and a keynote speaker along with the technical content," said Trevor Hegg, vice president, product development, industrial refrigeration and water systems, EVAPCO Inc., and chair of IIAR's Conference Committee.

IIAR had hoped to have its conference in person in California, but the pandemic continued to dictate events. "It wasn't really a choice. California has been in a constant state of lockdown for quite some time. In early 2021 it became apparent that we would not be able to produce an event there in June," said Eileen McKeown, vice president for marketing and sales for IIAR.

Gary Schrift, president of IIAR, said the association is still able to offer members quality technical papers and workshops.

What's more, there are several benefits to going virtual, including the ability to attract end-users who aren't able to attend an in-person event. "I know many are anxiously waiting for the day we can meet in person again but one of the bright spots of the virtual conference is being able to deliver this content to more people that wouldn't normally attend," Hegg said. "Not having travel expenses associated with each attendee opens the door to a lot more members to hear and absorb the valuable content provided."

McKeown agreed. "We will probably be able to attract new attendees who would never be able to come to our show view our content," she said.

The conference will be offering multiple concurrent sessions. "All of the presentations will be available on-demand after an initial live presentation. If attendees miss a session, they won't be able to interact with the speaker in real-time, but they can still ask questions in a chat session and the presenter can answer questions throughout the event," McKeown said.

Several technical papers will be presented during the conference, and five will be done in Spanish. Attendees can receive educational credits for taking part in sessions, even if they review recordings later. "Our programs will be presented live once, they will be recorded and be made available on-demand in a way that people can communicate with presenters, which makes them available for continuing education units," McKeown said.

Technical paper topics include Sustainable Use Cases for Ammonia as a Refrigerant in Residential/Light-Commercial HVAC, Considerations in Designing Industrial Refrigeration Systems for Full Vacuum, and more.

The three workshops are: From Dry to Hybrid: A 360 Degree View of Cooling Technologies, Defrosting Finned Air Cooling Heat Exchangers - An Optimization Based on Practical Experiences and Theoretical Research and Determining Leak Rates in Ammonia Refrigeration Piping.

There will also be two panels, including an IIAR Research Panel and a Code and Regulatory Panel.

This year's keynote speaker, Kevin Brown, will deliver a message about being a hero in less-than-ideal circumstances. "He will talk a little bit about what everybody went through during the pandemic and the past year," McKeown said.

Hegg said he is particularly excited to hear from Brown. "Having heard pieces of Kevin's message and talking with him, he seemed an ideal speaker after what our country has gone through over the last year and couple months," he said. "He is uplifting and inspiring, which will hopefully turn our thoughts and attention to the future, not the past."

This year, IIAR has facilitated more interactivity with exhibitors, and they will be able to interface with attendees. "We will have Zoom meetings on-demand during exhibit hall hours, and we are going to use some gamification to get people to go to the booths," McKeown said.

IIAR is also offering lead retrieval and a full-service back-end experience for exhibitors. "They can upload content and videos and be available in the booth for an instant chat or an on-demand Zoom call with attendees. It is more interactive this year," McKeown said.

When it comes to virtual events, McKeown said communication is critical. "You can never have too much communication in the virtual setting," she said.

Networking can be one of the most valuable aspects of an annual conference, and IIAR has created several virtual networking opportunities, including coffee breaks. "We're giving away little coffee QR codes for Starbucks for people that come to those events, and we're going to tie those to industry conversations," McKeown said.

Hegg said this is an industry that is built on relationships. "A lot of members have special relationships with other members, especially over the course of 50 years," he said, adding that he hopes attendees will take advantage of all of the interactive opportunities IIAR is offering. "The success of our in-person conferences is because people get engaged. There is no reason why a virtual conference can't be just as successful, but everyone has to be engaged," he said.

This year's conference is also an opportunity to celebrate IIAR's 50th year. "I don't want to do the 50th year of IIAR any injustice. It's impressive what this organization has done to support, grow and promote the safe and sustainable use of natural refrigerants," Hegg said. "The staff is so dedicated and great to work with and the voluntary contribution of our membership is amazing."

IIAR and the committee have focused on making this year's conference like any other, Hegg said. "We're hopefully going to get that feeling of an in-person conference," he said. "We have to plan the conference differently and people have to plan to attend differently right now, but you can still make it worthwhile."

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

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Industry Joins Together to Provide Valuable Training to OSHA Inspectors

Occupational Safety and Health Administration compliance officers are continuing to benefit from ammonia refrigeration education presented by the Industrial Refrigeration Consortium. The training, which is funded by IIAR, the Global Cold Chain Alliance, IRC, and OSHA, first launched in the fall of 2014.

"As we all continue to advocate for expanded use of ammonia and other natural refrigerants for all types of applications, having such critically needed training for government agencies on regulation can only help with an end user's ability to more easily comply with safety and environmental regulations when they hopefully make the wise but difficult choice to move away from synthetics," said Gary Schrift, president of IIAR.

The training covers industrial refrigeration technology with an emphasis on ammonia, said Douglas Reindl, a professor at the University of Wisconsin, director of the IRC, and a previous member of the IIAR board.

Reindl conducts the sessions. The training is designed to develop OSHA's compliance safety and health officers' (CSHO) understanding of industrial ammonia refrigeration systems and their principles of operation, the types of engineered safety systems applied to ammonia refrigeration technology, the generally accepted good engineering practices (RAGAGEP) that applies to industrial ammonia refrigeration systems, and the common failure mechanics that can compromise the mechanical integrity of industrial ammonia refrigeration systems.

The training is updated each year as content as well as the homework assigned to attendees evolves. Although CSHOs take part in the training, everyone within the refrigeration industry benefits.

"We talk about how systems function, refrigerant properties, major components that comprise an ammonia refrigeration system," Reindl said. "We spend a significant amount of time on industry-

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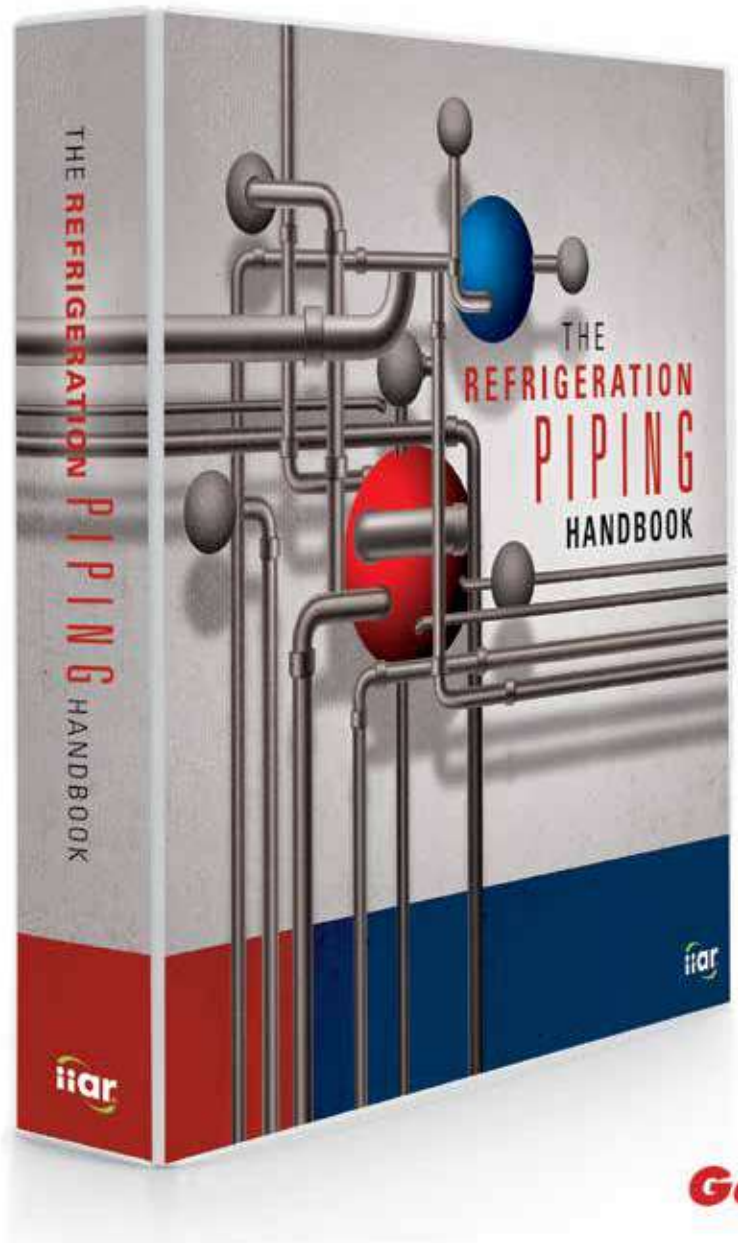

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related codes and standards with an emphasis on IIAR's suite of standards but also highlighting related recognized and RAGAGEP standards published by ASME, ISEA, and the model codes."

The course discusses the basics of mechanical integrity as it is the most frequently cited element for PSM-covered processes. "Finally, we cover safety systems that are relevant for industrial refrigeration systems," Reindl said.

The training is updated each year as content as well as the homework assigned to attendees evolves. Although CSHOs take part in the training, everyone within the refrigeration industry benefits.

"The training has really helped to communicate information about industrial refrigeration systems and the technology-specific RAGAGEP, which has avoided CSHOs trying to enforce other codes and standards that are not technology-relevant but may be more familiar to them based on their background and past experience," Reindl said.

Jeff Carter, global technical services director for General Mills and IIAR board member, said properly trained OSHA inspectors result in better and more accurate facility inspections. "Most inspectors are trained on industrial oil and gas systems, which are very different than ammonia systems. This training provides foundational knowledge of ammonia systems," he said.

Schrift said when OSHA compliance officers are better educated on the details of ammonia refrigeration, including IIAR standards and guidelines, it is more likely they will use those interpretations when deciding if there is an actual issue at a site.

About 200 hundred OSHA personnel have taken the course. "The course has been very well received, and OSHA has appreciated the collaboration. IIAR has also created a 'government portal' that allows regulators to access and view IIAR's latest standards," Reindl said.

Carter said the training demonstrates IIAR's leadership and commitment to education, including regulators. "Specifically, the safe operation of ammonia systems," he said. "Ammonia is the safest, most cost-effective, and efficient natural refrigerant available to industry, but without training and education, people could have a false or misleading understanding of ammonia. IIAR is recognized as the organization that writes design and operational standards for industrial ammonia refrigeration and education is a natural part of IIAR's mission."

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IIAR's Annual Conference to Feature a Deep Dive on the Ammonia Piping Handbook

During the 2021 Natural Refrigeration Conference and Expo, IIAR will offer a four-hour training on the IIAR Refrigeration Piping Handbook.

"It will examine all the parts of the handbook and provide an overview of the content," said Eileen McKeown, vice president for marketing and sales for IIAR.

The educational session, Ammonia Piping Handbook Education Program: Exploring an Essential Tool for Designers, Contractors, and Operators, will take place on Thursday, June 24 at 11:00 a.m. Eastern time. "This type of session was typically presented on a Sunday, but it has moved from a Sunday to a Thursday in our virtual format," McKeown said.

The four-hour course will examine all the parts of the IIAR Refrigeration Piping Handbook and will provide an overview of the content, including spreadsheet calculators provided to those who purchase the handbook, and detailed explanations of the art and engineering methods that are presented in the handbook.

During the event, Bruce Nelson, director of innovation for Colmac Coil Manufacturing Inc. and past chairman of IIAR, will present Part 1, which will cover pressure drop engineering equations, vertical suction riser flow theory, and the use of computer programs and nomographs. Nelson is also the current chairman of the Ammonia Refrigeration Foundation.

"I'm just really pleased with the way that recent Ammonia Refrigeration Foundation-funded research has produced really high-value deliverables that have contributed directly to the re-write and the revision of the Piping Handbook," Nelson said. "In particular, Chapter 1, which I get to present to the membership at our education session."

Nelson said the chapter incorporates results from at least three different research projects. "We've incorporated the results from an ammonia suction riser project funded by ARF. The result is a sizing method that allows engineers to properly size these suction risers. The other updated our economic pipe sizing," he said. "Both of those projects introduced some new software tools."

> "I'm just really pleased with the way that recent Ammonia Refrigeration Foundation-funded research has produced really high-value deliverables that have contributed directly to the re-write and the revision of the Piping Handbook."
>
> —Bruce Nelson, director of innovation for Colmac Coil Manufacturing Inc. and past chairman of IIAR

During the session, Part 2, which will be presented by Gordon Struder, director, advanced engineering at Evapco, will cover evaporator and condenser piping methods. Struder is a member of the IIAR board of directors and is the chairman of the IIAR Piping Committee. He was also involved with the re-write of chapter one and the entire handbook. He was a long-time chairman of ASHRAE's Refrigeration Piping Committee.

Part 3, which will be presented by Doug Stricker, refrigeration engineering manager for Gray Architects and Engineers, will cover several important topics found within the handbook, including plant layout, machinery room layout, welding requirements, schematics, and relief piping. Stricker is a member of an IIAR Standards Consensus Body, the IIAR Piping Committee, and has contributed to the review and editing of the handbook content.

Jim Young, a cold insulation specialist engineer with Johns Manville, will present Part 4, which will address insulation systems for piping and equipment. Insulation systems reduce energy consumption, enhance workplace safety, and increase the mechanical integrity of piping and vessels. Young will provide the overview of insulation guidance found within the handbook. He is a long-term member of IIAR's piping committee and was instrumental in executing IIAR's recently published Insulation Installation Guideline and other insulation research. Young is also a long-term member of ASHRAE's piping and insulation technical committees.

The IIAR Refrigeration Piping Handbook Education Program is presented as an adjunct technical program to the annual conference technical program. Registrants will be provided the opportunity to purchase a new piping handbook, which provides access to computer design programs, for a 40 percent discount.

Technical Papers and Workshops at a Glance

RAGAGEP: Historical Variants and the Importance of IIAR Standards

Recognized and Generally Accepted Good Engineering Practices (RAGAGEP) are written documents intended for use in the design, installation, operation, and maintenance of process equipment. There has been a move in the ammonia refrigeration industry towards standardization, yet there are historical variants which often cause confusion. This session will examine RAGAGEP variants and discuss the importance of adhering to IIAR standards. We'll also look at tools for keeping RMP/PSM programs on-track and ensuring that a process adheres to RAGAGEP standards.

Uriah Donaldson, Resource Compliance

Fallacies in Using P&IDs for Construction Drawings

Although P&IDs can be helpful in showing individual equipment components and operation, using them in place of system drawings can fall short in accurately conveying two-phase flow throughout an ammonia refrigeration system. And while P&IDs are shown in a two-dimensional drawing, two-phase flow requires a three-dimensional understanding of the movement of liquid and gas throughout a refrigeration system. This session is intended to show some of the common fallacies in using P&IDs to represent complete refrigeration piping systems, sometimes with catastrophic results.

Henry Bonar, PE, Bonar Engineering Inc.

Implementing Risk Based Inspections for the Ammonia Refrigeration Industry

OSHA's PSM program and the EPA's RMP rule rely on mechanical integrity to achieve the desired results. When it comes to mechanical integrity of piping and vessels, IIAR 6 allows facilities the option of either frequency-based or risk-based inspections. Making a transition from the IIAR B-110 frequency-based inspection program to a risk-based inspection protocol, however, requires a fair amount of planning and preparation. The transition from frequency to a risk-based inspection model requires some historical information be obtained first, but for many facilities this switch is a worthwhile effort.

Ric Hartung, Process & Safety Solutions LLC

Operating Experiences with Large Scale, Two-Stage, Three-Temperature, Ammonia DX Low-Temperature Refrigeration System

This session will describe the design, installation and operating experiences associated with a large scale, dual stage, three temperature, centralized low charge NH_3 refrigeration plant. The total system design refrigeration capacity is approximately 1.7 MW (484 TR). Dry expansion refrigerant feed is employed throughout; there are no refrigerant pumps. We'll touch on some of the design challenges encountered during the concept stage, and we'll focus in detail on construction and commissioning experiences as well as recorded energy performances since May 2020.

Finn Dresen, Kältetechnik Dresen + Bremen, GmbH

The Case for HAZOP

Should hazard and operability (HAZOP) methodology be standard for Hazard Reviews (HRs) and Process Hazard Analyses (PHA)s. While there are advocates and opponents of the HAZOP methodology, this paper will argue that the benefits generally outweigh the costs. Opponents argue that HAZOP takes more time, and at a higher cost, than methodologies such as the What-If and/or Checklist methodologies. However, the additional effort yields a more exhaustive study identifying specific vulnerabilities throughout a potentially complex system. If the industry is aiming to enhance safety culture, shouldn't it be embracing a deeper and more meaningful methodology to address vulnerabilities before failures occur?

Stephanie Smith, PE, Risk Management Professionals, Inc.

2021 iiar ONLINE CONFERENCE & VIRTUAL EXPOSITION

Technical Papers and Workshops at a Glance

Sustainable Use Cases for Ammonia as a Refrigerant in Residential/Light-Commercial HVAC

Significant research and development has gone into the deployment of ammonia as a refrigerant in air-conditioning and heat pump systems, going back to the first half of the 20th century. This session will offer an overview of the basic thermodynamic cycles currently in application/development/consideration, as well as the accompanying hardware systems in various stages of maturation. We'll also discusses the pros and cons of using this earliest of refrigerants that continues to provide some of the most promising performance - both in terms of all-round environmental impact and energy (resource) consumption.

Vikas Patnaik, PhD, MBA, PoleStar Consulting, LLC

CFD Analysis of Pipework Fracture Due to Hydraulic Shock in an Ammonia Refrigeration System

Condensation induced hydraulic shock (CIHS) is a safety issue requiring accurate prediction of the risk of pipe rupture due to formation of a hydraulic shock. This session will describe a computerized fluid dynamics (CFD) that has been validated against experimental data. Its application to a real accident scenario produced accurate predictions and demonstrated capability to address safety and design issues in industrial scale refrigeration systems. We'll also discuss the potential benefits of CFD analysis of generic valve group designs in locations where hydraulic shock most frequently occurs.

Chidambaram (Chidu) Narayanan, DSc, AFRY, AG; **Lane Loyko,** PLA Corp.; and **Bent Wiencke,** Nestle USA (retired)

Considerations in Designing Industrial Refrigeration Systems for Full Vacuum

This session will examine considerations regarding modes of test and operation that place ammonia refrigeration systems in a vacuum. We'll present results for ASME BPVC calculations across a range of typical pressure vessels constructed from A516 carbon steel and show why full vacuum should not be applied to vessels that exceed a specified length to diameter ratio (L/D) unless the vessel nameplate indicates it has been designed for full vacuum.

Martin L. Timm, PE, CSP, Linde PLC (Retired)

Análisis de los ciclos de refrigeración con amoniaco/Analysis of Ammonia Refrigeration Cycles (delivered in Spanish)

Descripción de los ciclos aplicables de refrigeración con amoniaco de vapor por compresión para aplicaciones industriales con diferentes rangos de temperatura incluyendo procesos de ultra baja temperatura, baja temperatura, temperatura media y alta temperatura con explicación didáctica de aplicaciones de plantas frigoríficas con amoniaco para cubrir todas las necesidades industriales desde procesos de congelación, refrigeración hasta acondicionamiento de aire en fabricas de procesos de la industria de alimentos y otras donde se tengan necesidades de refrigeración en sus procesos de manufactura.

Silvio Toro, Froztec International, Inc.

Identifying and Quantifying Fugitive Emissions from Industrial Refrigeration Systems

Numerous facilities have experienced situations where a component in a refrigeration system intermittently leaks. Inherent in their intermittency is the difficulty of pinpointing the leak source. And when the source cannot be identified, continued refrigerant emission is the obvious result. This session will provide examples of fugitive emissions in industrial ammonia refrigeration systems and methods that can be used to locate and quantify the rate of loss.

Marc Claas, Industrial Refrigeration Consortium

Evaporadores para Areas de Procesamiento de Alimentos/Evaporators for Food Processing Areas (delivered in Spanish)

El control de patógenos en instalaciones de procesamiento de alimentos juega una parte importante en garantizarla seguridad de nuestros suministros de alimentos. Entre otros requerimientos, la USDA exige que el equipo sea limpiado cuidadosamente para remover manchas y después sanitizado para desinfectar las superficies. Con frecuencia estos dos procesos involucran

químicos, los cuales, si no son seleccionados y aplicados adecuadamente, tienen el potencial de corroer y dañar las superficies de metal de los evaporadores. Este material discute las fuentes de corrosión, la resistencia a la corrosión de varios metales usados en evaporadores y hace recomendaciones de acuerdo con la selección de la construcción del serpentín y acompañamiento apropiado de desinfectantes y limpiadores químicos para el ambiente en operación.

Gabriel Gutierrez, Colmac Coil Manufacturing, Inc.

Válvulas Motorizadas. Cómo tomar ventaja completa?/Motorized Valves. How to Take Full Advantage? (delivered in Spanish)

Los ingenieros que pueden ser reacios a las nuevas tecnologías o componentes electrónicos y aquellos que no tienen el conocimiento suficiente sobre esta tecnología y sus beneficios, pueden obtener información detallada y soporte sobre las aplicaciones, características, consideraciones de cálculo y beneficios de las válvulas motorizadas para mejorar la forma en que diseñan y controlan sus sistemas de refrigeración industrial.

Roberto Badillo, Danfoss Mexico

Procedimiento LOTO para Sistemas de Refrigeración/LOTO Procedure for Refrigeration Systems (delivered in Spanish)

Las energías peligrosas son la causa raíz de muchos accidentes laborales incapacitantes y fatales, este documento contiene información para controlar dichas energías través del procedimiento de bloqueo etiquetado (LOTO) para evitar accidentes. En este documento puede encontrar descripción de las energías peligrosas, procedimientos para realizar un bloqueo etiquetado sencillo o múltiple, actividades en las que se requiere el procedimiento, los tipos de dispositivo que se pueden usar en cada aplicación, pasos para retirar el dispositivo, para hacer cambios de turno laboral y las consecuencias de no cumplir estos requisitos.

Juan Carlos Zeledón, Cargill, Nicaragua

CO_2 Aplicados en Centros de Distribución: caso de Exito/CO_2 Applied in Distribution Centers: A Case Study (delivered in Spanish)

A la hora de asegurar la calidad de los alimentos, es fundamental tener absoluto control en la cadena de frio. Los centros de distribución refrigerados son fundamentales en este aspecto, y su evolución tanto en su uso como en su ubicación hace que la tecnología de Refrigerante usado sea clave en su implementación. El uso de CO_2 como refrigerante en los centros de distribución proporciona todas las ventajas desde el punto de vista de sutentabilidad, y a su vez permite construir centros logísticos flexibles, con una arquitecturaque se adapta a lugares cerca a la poblacion, multiambiente, con mejores proceso en conservación de alimentos, y aumento la calidad en sus procesos.

Mauricio Baena, Hillphoenix, Columbia

2021 Workshops

From Dry to Hybrid: A 360 Degree View of Cooling Technologies

A variety of fundamentally different dry cooling technologies are available for cooling water/glycol mixtures. The decision for or against one of these technologies during the planning stage of a project has an impact not only directly on the investment sum but also on the subsequent operating costs of the plant as a whole – across the entire life cycle. This is one of the reasons why it is important to know the applications of the technologies, as well as their specific advantages and disadvantages, and to evaluate them accordingly.

Michael Freiherr and **Miguel Garrido,** Güntner, U.S.

Defrosting Finned Air Cooling Heat Exchangers - An Optimization Based on Practical Experiences and Theoretical Research

Typical methods for defrosting air coolers are by hot discharge gas, electrical heating rods, water or warm glycol. This session will discuss methods of controlling the defrost to avoid excessive steam formation from the defrost process. A control logic and strategy is presented to secure a safe, reliable and efficient defrost. The focus will be on hot gas, electrical and glycol defrost. The target is to present a best-practice for controlling the defrost. The second part will look at maximizing efficiency and reliability by preventing the escape of heat and moisture from the unit cooler.

Felix Weber, thermofin GmBH

Determining Leak Rates in Ammonia Refrigeration Piping

Bent Wiencke, Nestle USA (retired)

2021 Panels

Panel 1: IIAR Research Panel
Information and discussion on current ARF funded IIAR research projects and results.

Panel 2: Code and Regulatory Panel
Updates from Code and Regulatory experts.

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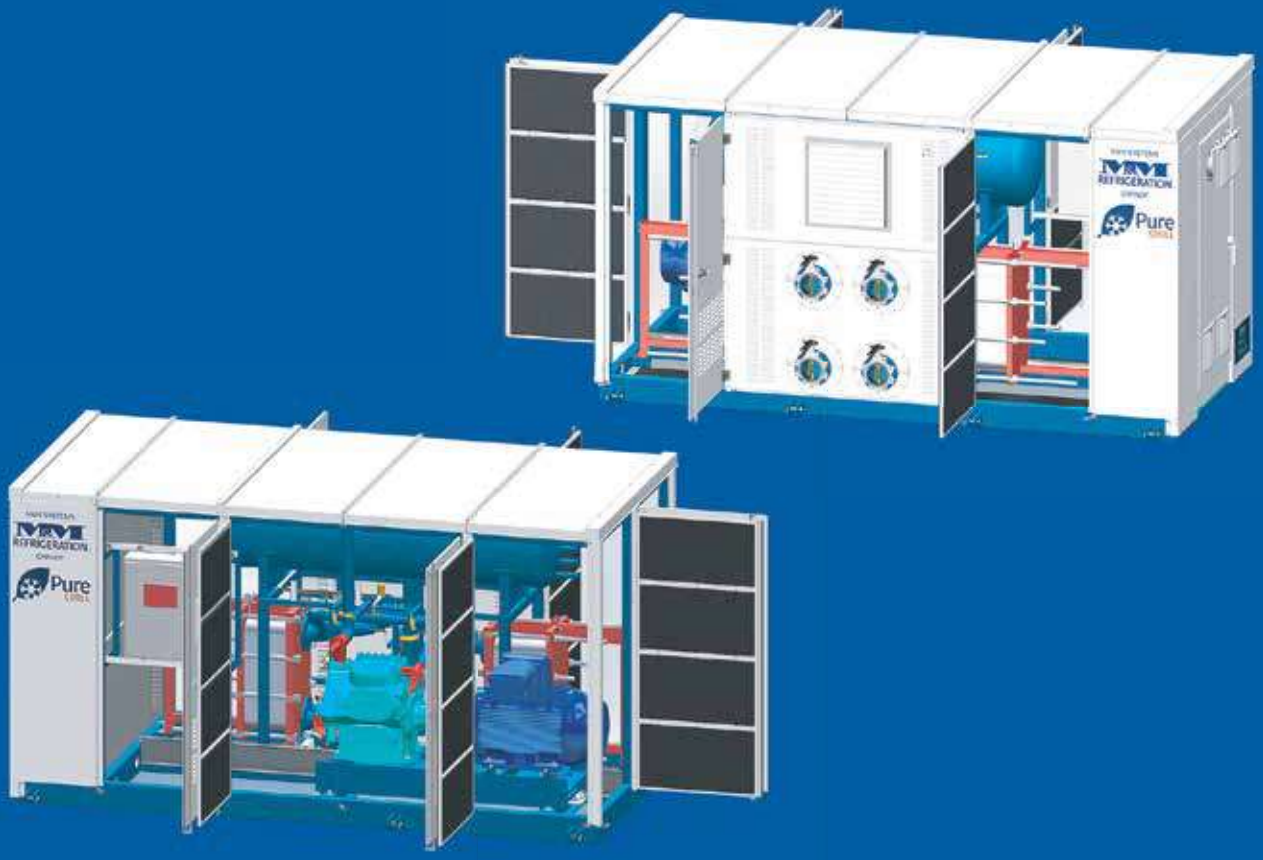

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The Industry at Rest: How SEC Benchmarking will Create New Momentum in the Refrigeration Sector for Mixed-Use Refrigerated Warehousing.

DR. MICHAEL RIESE, PH.D. – COLD LOGIC P/L

Newton's first law in part states that an object at rest will remain at rest unless acted upon by an external force. And this is where we are at the moment. Our industry, specifically in the mixed-use refrigerated warehouse sector is at rest. Or differently expressed, at a standstill when it comes to ongoing improvements, new ideas, and implementation of new technology that has the potential to make systems and plants more energy-efficient and creates ongoing savings for our clients.

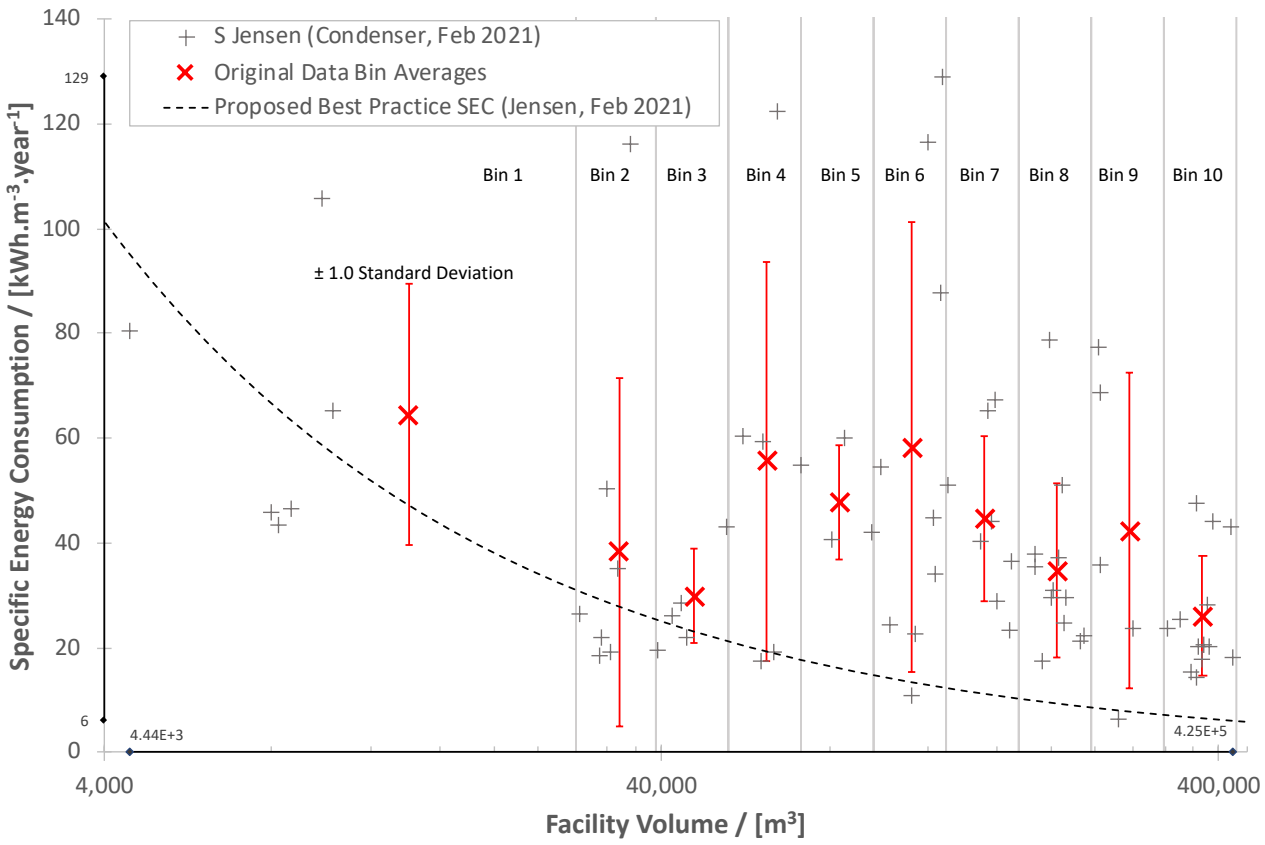
The current approach of liquid overfeed systems has been well established over the last 30 plus years and is well understood concerning design requirements and methodologies. However, with very few exemptions, design changes are relegated to the periphery and the fundamental underlying principles are not challenged. Essentially, the prevailing dogma appears to be the question of why change a good thing that our industry has going right now?

And the answer will be, that change will be coming. It will either be on our terms or external terms. Moving back to the analogy from the beginning, it is clear that it will be much easier for external forces, such as financial, political, or environmental change to pressure us into a new direction in which we have little control and little input in the means of implementing these changes.

This leaves us, as designers, consultants, contractors, maintainers, and operators with the challenge to create change from within; to create an internal force that overcomes the resistance to change. While the possibilities are endless, the argument can be made that using the concept of energy benchmarking to foster change and advocate for new first cost funding models that

Figure 1: Reproduction and averaging of SEC data provided by S Jensen in Condenser Feb 2021.

Bin 2 through 10 are split into equal logarithmic intervals. SEC averages for each bin are plotted in the center of each bi and are not indicative of the average facility size in the respective bin.



consider ongoing savings during the lifetime of the plant is the low-hanging fruit right in front of our eyes.

In the November 2020 and February 2021 editions of Condenser, Stefan Jensen of Scantec Refrigeration in Australia introduced the argument for the use of specific energy consumption (SEC) benchmarking to compare the performance of mixed-use refrigerated warehouse facilities. His writings center around the comparison of best practice values for specific energy consumptions and currently published and established SEC values from different industrial installations and reference literature. His arguments detail the benefits of reducing the SEC and flow on effects of operational expenses for a given facility. He shows a reduction in energy consumption up to 74 percent in a like for like comparison between two nearly identical sized and used facilities but with different refrigeration plant design principles.

This improvement in energy efficiency is clearly an indication of the low-hanging fruit that can be realized by our industry. And while the use of best practice SEC values is a lofty aim to strive for (Mr. Jensen offers some suggestions on how this can be achieved), the reality of establishing benchmarks based on current industry practice and then advocating and challenging contractors and designers to improve on those values can be considered a relevant approach.

To examine the reality of creating a moving benchmark and considering the impact of individual improved SEC values on the installed plant SEC average, the energy performance data presented in Figure 2 of the Feb 2021 edition of Condenser is reproduced in Figure 1 with permission from the author and will be further examined as part of this article.

The data provide by Mr. Jensen has been re-examined for underlying patterns and as shown in Figure 1 have been grouped into 10 different bins using logarithmic sorting and separation. Using this approach and in direct comparison with Figure 2 of Mr. Jensen's article in February 2021, several different results are immediately visible. Firstly, when using a logarithmic X-axis display it is evident that there is a significant void of data in the facility size between 10,500 m^3 and 28,000 m^3, which hence has led to a first bin size that is different from the remaining 9 bins. Those remaining 9 bins are all split into equal sizes when considering the exponential range of the overall available data. Hence secondly, when averaging the SEC for each bin (2 through 10), it can be seen that the average SEC for bins 2 and 3 are significantly influenced by the data provided from low-charge, centralized DX plants and specifically in bin 3 leading to a very low standard deviation of the data.

Lastly, when considering bins 4 through 10 alone, it appears that there is a linearized relationship between the individual bin average SEC values, but sometimes with a significant spread of the data's standard deviation and also significantly higher values when compared to Mr. Jensen's proposed best practice SEC values.

Figure 1 Reproduction and averaging of SEC data provided by S Jensen in Condenser Feb 2021. Bin 2 through 10 are split into equal logarithmic intervals. SEC averages for each bin are plotted in the center of each bi and are not indicative of the average facility size in the respective bin.

Assuming that there is agreement amongst the readership that the chosen method of data segregation is valid, it is now worth examining the potential impact of achieving and accounting for better than average facility SEC values and their impact on changing the benchmark values for each bin. For this purpose and as shown in Figure 2, the worst SEC in each bin has been replaced by a single data point in each bin that is more energy-efficient than the respective average SEC. Mr. Jensen has already demonstrated that SEC improvements over 50% can easily be achieved and hence a moderately low improvement target of 20% is used here. For the data bins 2 and 3 very little change in the average SEC is evident as a result of the data set modification because the plants captured in those data bins are already exhibiting a very low SEC when compared with the other data provided. The largest changes are evident in bins that show a large range distribution and hence standard deviation of the source data.

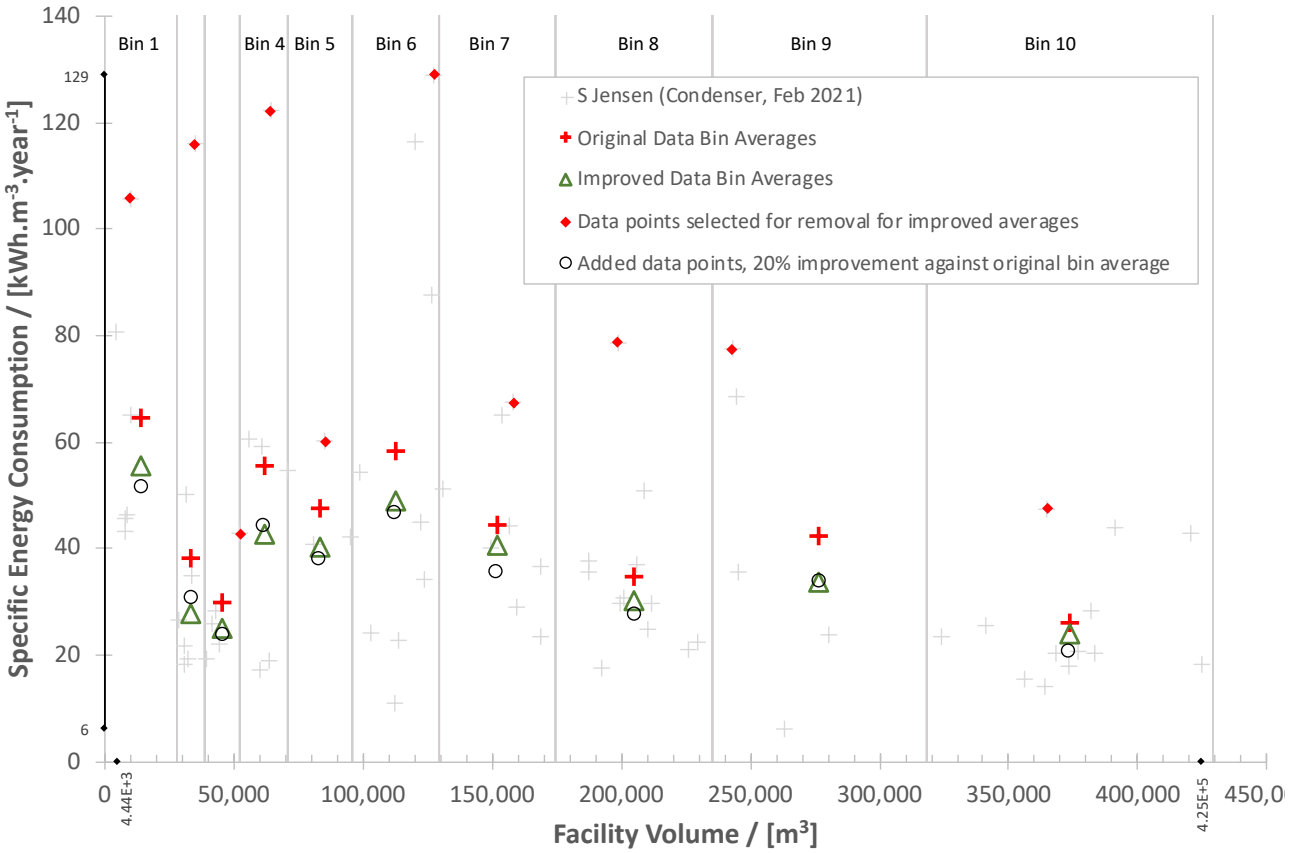
Figure 2 shows a demonstration of the influence of the removal of the single worst data point from each bin and replacing it with a new SEC value 20% lower than the original bin average.

Figure 3 shows the before and after averages for each data bin. Visual guidelines have been added for easier comprehension and they are solely used as a visual aids, not as a fitted trendlines. Overall though it is evident that a small change in data can have a significant impact on the overall average SEC for each bin. And while it appears that bin 10 is relatively unaffected by the improvement of SEC, it shows that larger improvements are possible in bins 1 through 9. Focusing on the bottom guideline that essentially connects the improved average SEC for bins 2 and 3 with bin 10, it shows that it should be possible to achieve a performance average and SEC that is significantly better than what is currently the case. While it is not even close to the proposed best practice SEC, it is a more readily achievable target for our industry. Utilizing a moving average approach, this benchmarking system provides the opportunity for designers and contractors to gradually improve the plant designs, control systems, and energy efficiency.

Figure 3 Application of indicative linear trendlines to the old and new bin averages for clarity. Bin averages in Bins 2 & 3 are not taken into account for the red and green dotted lines.

If the data described above is now considered holistically, it has been clearly shown that based on existing, published data, SEC trends and benchmarks can be established. While there are good

Figure 2: Demonstration of the influence of the removal of the single worst data point from each bin and replacing it with a new SEC value 20% lower than the original bin average.

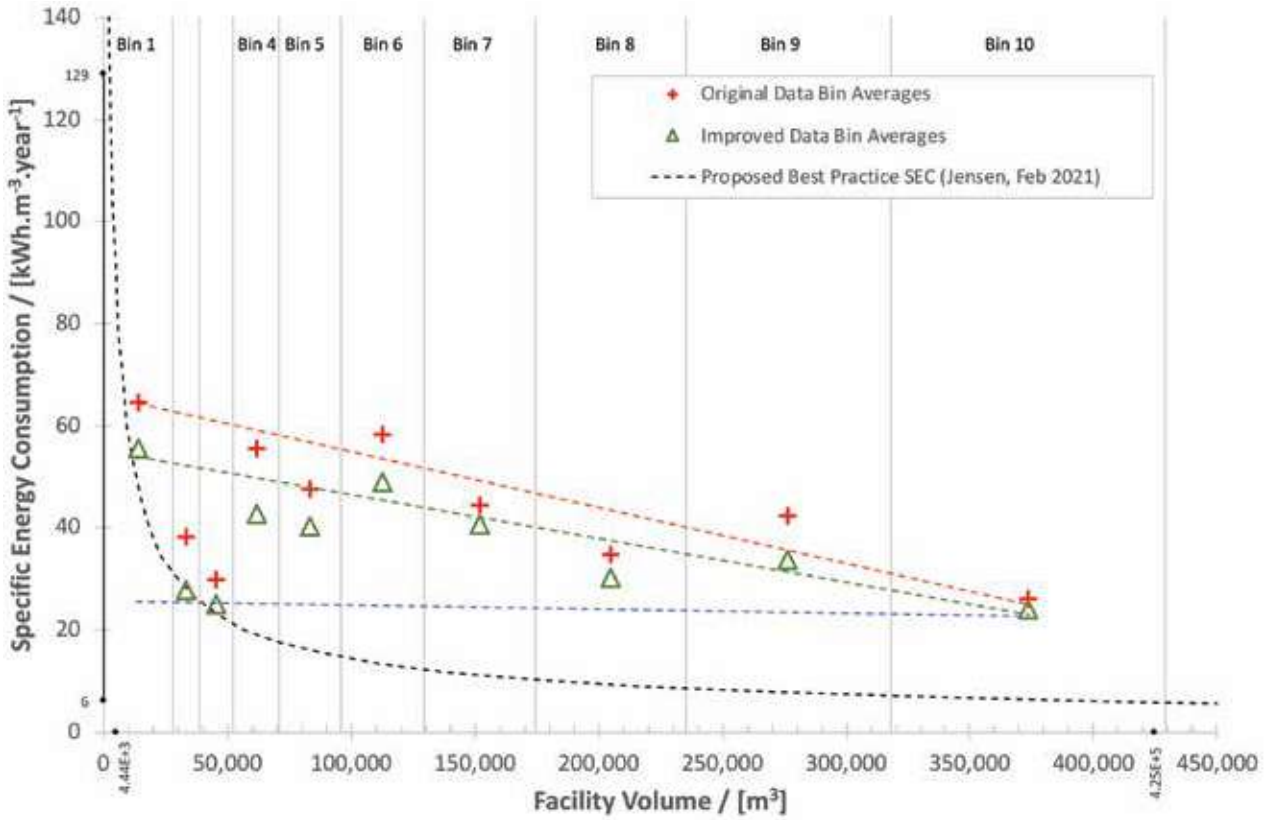


arguments that ultimately a best practice benchmark is the final goal to aim for, it may not be the best approach at this time for the refrigerated warehousing industry as a whole. Mr. Jensen has shown that significant improvements to the SEC can be made by moving away from traditional liquid overfeed systems and further development of centralized, low-charge DX plants will lead to significant improvements in energy consumption and operational expenditure for the owner. However, this requires research, education, and significant changes to established thinking in the ammonia refrigeration industry.

It is expected that there will be significant resistance to such approaches and hence at this point, the course of creating moving average benchmarks will lead to small step improvements and a gradual drive in the industry to become more energy-efficient. The published data show that plants that are more efficient than the respective bin average SEC benchmark have been constructed using established design approaches and only require specific changes in operation and design to achieve above-par performance.

In conclusion, it must be recognized that change to our industry will be coming. It is up to us to decide how to approach this change and how active a role we want to play. Only if we create change from within us, strive to overcome the resistance that keeps us at rest and maintains the status quo, are we able to freely decide our way forward. If we do nothing, change will be imposed on us by other interest groups and entities that make decisions based on their interests and are potentially directly contradicting what best practice can look like. Mr. Jensen in his articles has clearly shown where our industry can potentially go when considering the SEC for mixed-use refrigerated warehouses. These lofty ambitions have to be recognized for what they are: Potentially long-term ambitions that require large-scale change on all levels, from designers and contractors through to operators and maintainers. However, large-scale change also brings with it increased risk and as such will be an unattractive aspiration for many. Alternatively, and as demonstrated in this article, small step change that requires small amounts of efforts with limited risk increase are a more suitable way to harvest the low hanging fruit that is SEC benchmarking. Gradual change and adaptive SEC benchmarks, over time, will foster best practice, and a better understanding of performance by interest groups inside and outside of our industry. It will foster the promotion of competition and reward the best performers. This change will allow our industry at all levels to create a drive that will propel us from the resting position that we have occupied for so long and allow us to determine our future.

Figure 3: Application of indicative linear trendlines to the old and new bin averages for clarity. Bin averages in Bins 2 & 3 are not taken into account for the red and green dotted lines.



Rising Rates: Strategies for Managing Bond Risks

Federal Reserve monetary policies can affect the entire fixed-income market, and the prospect of rising interest rates is a major concern for bond investors. Regardless of the rate environment, however, bonds are a mainstay of investors who want to generate income or dampen the effects of stock market volatility on their portfolios.

Now that the Fed is raising rates toward more typical historical levels, you may have questions about how higher rates might affect your fixed-income investments and what you can do to help mitigate the effect on your portfolio.

Rate sensitivity

When interest rates rise, the value of existing bonds typically falls, because investors would prefer to buy new bonds with higher yields. Bonds with longer maturity dates are generally more sensitive to rate changes than shorter-dated bonds. In a rising rate environment, investors may be hesitant to tie up funds for a long period. Thus, one way to address interest rate sensitivity in your portfolio is to focus on short- and medium-term bonds. However, keep in mind that, although these bonds may be less sensitive to rate changes, they will generally offer a lower yield than longer-term bonds.

A more specific measure of interest rate sensitivity is called duration. A bond's duration is derived from a complex calculation that includes the maturity date, the present value of principal and interest to be received in the future, and other factors. If there are two bonds with a particular maturity, the bond with the higher yield will typically have a shorter duration.

For this reason, U.S. Treasuries tend to be more rate sensitive than corporate bonds of similar maturities. Treasury securities, which are backed by the federal government as to the timely payment of principal and interest, are considered lower risk and thus can pay lower rates of interest than corporate bonds. A corporation could default on payments (though this is relatively rare), so corporate bonds typically offer higher yields in compensation for the higher risk. A five-year Treasury bond has a duration of fewer than five years, reflecting income payments that are received before maturity. However, a five-year corporate bond with a higher yield has an even shorter duration.

When a bond is held to maturity, the bond owner would receive the face value and interest, unless the issuer defaults. However, bonds redeemed before maturity may be worth more or less than their original value. Thus, rising interest rates should not affect the return on a bond you hold to maturity, but may affect the price of a bond you want to sell on the secondary market before it reaches maturity.

To estimate the impact of a rate change on a bond investment, multiply the duration by the expected percentage change in interest rates. For example, if interest rates rise by 1%, a bond or bond fund with a three-year duration might be expected to lose roughly 3% in value; one with a seven-year duration might fall by about 7%.

BOND LADDERS

Owning a diversified mix of bond types and maturities can help reduce the level of risk in the fixed-income portion of your portfolio. Another way to manage interest rate risk is to construct a bond ladder, a portfolio of bonds with maturities that are spaced at regular intervals over a certain number of years. For example, a five-year ladder might have 20% of the bonds mature each year.

Bond ladders may vary in size and structure and could include different types of bonds depending on an investor's time horizon, risk tolerance, and goals. When short-term bonds from the lowest rung of the ladder mature, the funds are often reinvested at the long end of the ladder. By doing so, investors may be able to increase their cash flow by capturing higher yields on new issues. A ladder might also be part of a withdrawal strategy in which the returned principal from maturing bonds provides retirement income.

Building a ladder with individual bonds provides certainty as long as the bonds are held to maturity, but it can be expensive. Individual bonds typically require a minimum purchase of at least $5,000 in face value, so creating a bond ladder with a sufficient level of diversification might require a sizable investment. Diversification is a method used to help manage investment risk; it does not guarantee a profit or protect against investment loss.

A similar option involves laddering with bond exchange-traded bond funds (ETFs) that have defined maturity dates. Such ETFs typically hold many bonds that mature in the same year the ETF will liquidate and return proceeds to shareholders. Bond ETFs may enhance diversification and provide liquidity, but unlike individual bonds, the income payments and final distribution rate are not fully predictable.

Another option is to purchase unit investment trusts (UITs) with staggered termination dates. Bond-based UITs typically hold a varied portfolio of bonds with maturity dates that coincide with the trust termination date, at which point you could reinvest the proceeds as you wish. The UIT sponsor may offer investors the opportunity to roll over the proceeds to a new UIT, which typically incurs an additional sales charge.

BOND FUNDS

Bond funds — mutual funds and ETFs composed mostly of bonds and other debt instruments — are subject to the same inflation, interest rate, and credit risks associated with their underlying bonds. Thus, falling bond prices due to rising rates can adversely affect a bond fund's performance. Because longer-term bonds are generally more sensitive to rising rates, funds that hold short- or medium-term bonds may be more stable as rates increase.

Bond funds do not have set maturity dates (except for the ETFs discussed above), because they typically hold

bonds with varying maturities, and they can buy and sell bonds before they mature. So you might consider the fund's duration, which takes into account the durations of the underlying bonds. The longer the duration, the more sensitive a fund is to changes in interest rates. You can usually find duration with other information about a bond fund. Although helpful as a general guideline, duration is best used when comparing funds with similar types of underlying bonds.

A fund's sensitivity to interest rates is only one aspect of its value — fund performance can be driven by a variety of dynamics in the market and the broader economy. Moreover, as underlying bonds mature and are replaced by higher-yielding bonds within a rising interest rate environment, the fund's yield and/or share value could potentially increase over the long term. Even in the short term, interest paid by the fund could help moderate any losses in share value.

It's also important to remember that fund managers, who typically have some latitude, might respond differently if falling bond prices adversely affect a fund's performance. Some might try to preserve the fund's asset value at the expense of its yield by reducing interest payments. Others might emphasize preserving a fund's yield at the expense of its asset value by investing in bonds of longer duration or lower credit quality that pay higher interest but carry greater risk. Information on a fund's management, objectives, and flexibility in meeting those objectives is spelled out in the prospectus and also may be available with other fund information online.

Floating rates

Adding a floating-rate component to a bond portfolio may also provide some protection against interest rate risk. These investments (long offered by U.S. corporations) have interest payments that typically adjust based on prevailing short-term rates.

The U.S. Treasury started issuing floating-rate notes with two-year maturities in January 2014. Investors receive interest payments on a quarterly basis. Rates are tied to the most recent 13-week Treasury bill auction and reset weekly, so investors are paid more as interest rates rise and less as rates fall.

Keep in mind that the path and pace of interest rate changes may be difficult if not impossible to predict. So you should focus more broadly on the degree of risk you are willing to accept in your bond portfolio and the important role that fixed-income investments play in your overall financial strategy.

The return and principal value of individual bonds, UIT units, and mutual fund and ETF shares fluctuate with changes in market conditions. Fund shares and UIT units, when sold, and bonds redeemed prior to maturity may be worth more or less than their original cost. Supply and demand for ETF shares may cause them to trade at a premium or a discount relative to the value of the underlying shares. UITs may carry additional risks, including the potential for a downturn in the financial condition of the issuers of the underlying securities. Mutual funds, ETFs, and UITs are sold by prospectus. Please consider the investment objectives, risks, charges, and expenses carefully before investing. The prospectus, which contains this and other information about the investment company, can be obtained from your financial professional. Be sure to read the prospectus carefully before deciding whether to invest.

The IIAR and ARF reserve investment funds are currently managed by Stifel Financial Services under the investment policy established by their respective board of directors. Members of IIAR may use the 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.

OSHA Ramps Up COVID Enforcement

iiar government RELATIONS

BY LOWELL RANDEL, IIAR GOVERNMENT RELATIONS DIRECTOR

Responding to the COVID-19 pandemic continues to be a high priority for the Biden Administration. Despite increases in vaccinations and lower cases in many parts of the country, President Biden is calling on the Occupational Safety and Health Administration (OSHA) to ramp up its enforcement efforts to regulate workplaces. Biden was critical of OSHA during the Trump Administration for not being aggressive enough in protecting workers from COVID-19.

The Department of Labor's Office of Inspector General (OIG) recently issued a report on OSHA's COVID enforcement in 2020 that supports Biden's contentions about OSHA enforcement in 2020. The report found that onsite inspection and travel restrictions led to a dramatic decrease in inspections. Comparing inspections over an eight-month period in 2019 and 2020, OIG found that OSHA conducted more than 26,000 compared with approximately 13,000 inspections in 2020. The OIG report also noted that OSHA received 15 percent more complaints in 2020 but performed 50 percent fewer inspections. The OIG concluded that these factors led to "an increased risk that OSHA has not been providing the level of protection that workers need at various job sites." Among the OIG's recommendations was for OSHA to issue an Emergency Temporary Standard (ETS) to establish enforceable requirements.

Comparing inspections over an eight-month period in 2019 and 2020, OIG found that OSHA conducted more than 26,000 compared with approximately 13,000 inspections in 2020. The OIG report also noted that OSHA received 15 percent more complaints in 2020 but performed 50 percent fewer inspections.

UPDATED OSHA COVID-19 GUIDANCE

Shortly after taking office, the Biden Administration initiated a series of actions to increase its COVID-19 policies and enforcement. One of the first steps taken was to update OSHA's COVID-19 guidance to employers. While not an enforceable standard on its own, the guidance sets the agency's expectations for how employers address COVID-19 hazards. The updated guidance emphasizes the importance of the implementation of COVID-19 Prevention Programs. Key elements of prevention programs include:

- Assignment of a workplace coordinator
- Identification of where and how workers might be exposed to COVID-19 at work
- Identification of a combination of measures that will limit the spread of COVID-19 in the workplace, in line with the principles of the hierarchy of controls
- Consideration of protections for workers at higher risk for severe illness through supportive policies and practices
- Establishment of a system for communicating effectively with workers and in a language they understand
- Educate and train workers on your COVID-19 policies and procedures using accessible formats and in a language they understand.
- Instruct workers who are infected or potentially infected to stay home and isolate or quarantine
- Minimize the negative impact of quarantine and isolation on workers
- Isolating workers who show symptoms at work
- Performing enhanced cleaning and disinfection after people with suspected or confirmed COVID-19 cases have been in the facility

COVID NATIONAL EMPHASIS PROGRAM

In addition to updating COVID-19 guidance, OSHA has also implemented a National Emphasis Program (NEP) to focus enforcement activities related to the pandemic. The goal of this NEP is to significantly reduce or eliminate worker exposures to COVID-19 by targeting industries and worksites where employees may have a high frequency of close contact exposures and therefore, controlling the health hazards associ-

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ated with such exposures. This goal will be accomplished by a combination of inspection targeting, outreach to employers, and compliance assistance. The NEP augments OSHA's unprogrammed COVID-19 inspections by adding a component targeting specific high-hazard industries or activities where the disease hazard is prevalent. The NEP targets establishments that have workers with increased potential exposure to this hazard and includes provisions to ensure that workers are protected from retaliation related to COVID-19 issues.

The NEP will be implemented by OSHA Area Offices and equivalent programs will be administered by state plan states. OSHA is expected to continue prioritizing COVID-19 fatalities, complaints, and referrals through unprogrammed inspections. However, the NEP adds programmed inspections to the agency's pandemic-related activities. The NEP includes lists of targeted industries that OSHA has identified as being higher risk for workplace transmission of COVID-19. The identified targeted industries include several categories in which IIAR members may fall such as meat and poultry processing, supermarkets and grocery stores, and warehousing and storage.

Programmed inspections can be conducted either on-site or a combination of on-site and remote methods. IIAR members with multiple facilities should be aware that OSHA will provide a letter to the corporate entities regarding the COVID-19 inspection. It is important that any identified deficiencies during an inspection also be addressed in other facilities within the company. Failure to abate known hazards in another facility could result in a repeat or willful citation.

EMERGENCY TEMPORARY STANDARD

As of the writing of this article, the Biden Administration was nearing the issuance of an Emergency Temporary Standard (ETS) specific to COVID-19 in the workplace. Biden directed OSHA to make a determination on whether to issue an ETS by March 15, 2021. However, the process was delayed as newly confirmed Labor Secretary Marty Walsh requested an additional review of the data and science related to the pandemic before moving forward. The ETS was finally transmitted to the White House Office of Information and Regulatory Affairs (OIRA) on April 26, 2020. OIRA review generally takes around two weeks. It is expected that the ETS will become effective immediately after issuance and will be in place for 6 months. OSHA may also move forward with a rulemaking to establish a permanent infectious disease standard.

It is likely that the ETS will face legal challenges as critics of issuing a standard will cite the increasing number of vaccinated people and decreasing COVID-19 caseloads. But, even without an ETS, the COVID-19 NEP gives clear indications that OSHA will be accelerating its pandemic-related inspections. Regardless of the status of the ETS, IIAR members are strongly encouraged to review the current OSHA and CDC guidance and their own protocols and be prepared for increased OSHA enforcement activity.

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Different Views on Regulations in Europe and the USA

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refrigerants delivered by mother nature

BY MONIKA WITT, MANAGING DIRECTOR OF TH. WITT GMBH, GERMANY, EURAMMON BOARD MEMBER

In my February 2019 article, I examined the need for sprinkler systems in machinery rooms in the USA and their prohibition in Europe. Afterward, I was contacted by Jeff Shapiro who indicated that Anders Lindborg, an honorary life member of IIAR and expert on ammonia releases, had changed his mind just before he passed away and was no longer arguing against sprinkler systems in machinery rooms. Jeff also provided his article from 2011 that laid out the different perspectives of experts from each side. It is evident that this has been a long-running discussion and has caused some confusion within the industry. This article serves to present both perspectives and illuminate that there are different approaches to refrigeration system and building construction depending on where in the world the system is located.

The reason for examining the differences in regulations concerning the safe operation of refrigeration systems was prompted by an IIAR member and owner of many food-processing plants. The desire was to identify the different requirements for the same refrigeration system in different locations of the world. How can the very same installation be regarded safe in the USA and not being permitted elsewhere? This notion has prompted an effort by the IIAR International committee to identify major differences in regulations to be able to inform such multinational companies of the variances.

In Europe, as in the USA, the operation of a refrigeration system can be subject to different inspectors depending on the area you live in. In Europe, operation is purely a national responsibility and there is no uniform regulation or code of conduct. In Europe EN 378 is the most important regulation for refrigeration. Part 2 is harmonized with all European regulations concerning free trade and addresses the design and installation of refrigeration systems. But other parts, particularly part 4, dealing with the operation, are only recommendations and each country may have additional requirements that need to be considered.

In Europe, as in the USA, the operation of a refrigeration system can be subject to different inspectors depending on the area you live in. In Europe, operation is purely a national responsibility and there is no uniform regulation or code of conduct.

Coming back to the sprinklers, Bernhard Schrempf, chairman of EN378 in Germany, argues that any flammable material in the machinery room is not permitted, and sparks to initiate a fire would not be possible because electrical equipment in the room would automatically be disconnected (except for the explosion-protected ventilation systems) once a sensor indicates more than 30,000 ppm ammonia. Before this, at 500 ppm, the ventilation system kicks in to vent any ammonia that may have collected in the machinery room for whatever reason and a warning must be sent to the permanently occupied control center of the plant. Thus any low ammonia levels from minor leakage would be checked by the maintenance staff before a major incident can occur.

Given the facts that: 1) machinery room walls are built in a fire-resistant way to withstand at least 90 minutes of fire with all openings being sealed with fire-retardant sealant, 2) a ventilation system is in place that is activated by sensors to avoid a flammable concentration is accumulating, and 3) entrance is allowed only for authorized and trained personnel, Bernhard Schrempf concluded that a fire could not develop inside a machinery room and water would do more harm than good.

The European point of view is that in the event of a leak, the ammonia should be confined to the machinery room without introducing unnecessary energy which would cause ammonia liquid to evaporate, making the additional gas volume much more difficult to handle compared to the liquid. Adding water to liquid ammonia would increase the volume (about 170 times) which would increase the risk to people by spreading the ammonia vapor over much larger distances. Keeping the ammonia in its liquid form minimizes the risk. But this presumes that sprinklers would activate simultaneous to a liquid ammonia release, i.e. by rupturing pipework due to fire affecting the support structure.

From the US perspective, because sprinklers are not activated by ammonia, but rather by the heat from a significant fire, an ammonia release would be a secondary concern. Considering that vessels and associated piping are equipped with pressure relief devices, and the evaporation of refrigerant inside the system creates a cooling effect, there is little chance that a fire would cause a

liquid release. Further, sprinklers would work to extinguish the fire and simultaneously cool the refrigeration equipment.

Jeff Shapiro explained that the issue of sprinklers is more a function of the overall building/occupancy risk versus the isolated risk of a machinery room itself. In the US, sprinklers tend to be installed in a much higher percentage of buildings than in most other countries because of the US building safety scheme. Much of that is associated with incentives, by which owners are allowed reductions in fire-resistance ratings for walls/floors/structures when sprinklers are installed (the assumption being that sprinklers will slow the growth of or extinguish a fire, reducing the level of dependence on fire-resistive building elements). These construction cost incentives can go a long way to offset the cost of installing sprinklers, and with insurance discounts and higher assurance of business continuity after a fire within sprinklered properties, the economics and business considerations can be complex. Concerning U.S. machinery rooms, the U.S. codes significantly reduce required fire resistance for walls enclosing machinery rooms, and this extends to ratings for door openings, mechanical ventilation openings, sealing of penetrations in the enclosure walls with expensive fire-rated materials rather than simple "plugging" material, etc. when sprinklers are provided. That stated, there is not a specific requirement for sprinklers in an ammonia machinery room simply because there is ammonia refrigeration equipment within it. The requirement to have sprinklers or not is driven entirely by the building code and the owner's choice of investment. But as stated before, when sprinklers are provided in a machinery room, fire-rated separation is not required.

Jeff assumed correctly that Europe relies on fire-resistive building elements and less on "active" systems, such as sprinklers. In many European countries, water supply infrastructure is not required by any building codes and is simply not available. Instead of prolific sprinkler requirements, Germany, for example, has sophisticated strategies of fire prevention relying on fire-resistant walls, prohibition of flammable materials, and includes isolating sections of the building with special automatic doors, ventilation systems, and evacuation routes (that can sometimes slow down projects like what occurred at the Berlin airport). I agree with Jeff's opinion that there is little reason to further debate or initiate further action on the topic. The risk of a liquid ammonia spill occurring while sprinkler heads are active is very low, as is the risk of a fire occurring in a well-designed and well-maintained machinery room. However, this shows clearly that requirements to install a refrigeration system are sometimes driven less by good refrigeration knowledge than by looking at the overall picture, including an examination of building codes.

A good risk analysis is therefore the key to installing a safe refrigeration system and the risks may be considered differently depending on where the refrigeration system is located based on local habits.

I am pretty sure that other differences will come up for the very same reason on other occasions and that we will discover there are good reasons for them.

Scholarships Provide Multiple Learning Opportunities for Recipients

The Ammonia Refrigeration Foundation, which supports research and education programs benefiting the industrial refrigeration industry, is currently accepting applications for IIAR's Founders Scholarship.

The scholarship is awarded annually to collegiate juniors exhibiting exceptional character and interest in pursuing an engineering or related technical degree leading to a career in the refrigeration field. Awards provide $4,000 to students during their junior year and $9,000 in their senior year for those who attended IIAR's Annual Natural Refrigeration Conference and Expo during the spring of their junior year. Students who cannot attend the annual conference receive $4,000 during their senior year.

"In addition to financially rewarding academic performance, IIAR's scholarship program serves to expose applicants and their network of friends to a richly rewarding opportunity to work in an industry that is having a real impact on the future of our environment," said Mark Stencel, director of business development for Bassett Mechanical and chairman of the IIAR education committee. "There are not too many scholarships that feature the opportunity to engage with a broad array of opportunities with an expense-paid participation in a national trade conference."

Stencel said the scholarship program provides a unique opportunity for students to learn about a technical field, immerse themselves in IIAR's national conference, be financially rewarded, and contribute to the health of the world, which will help attract very high caliber future leaders into our industry.

The industrial refrigeration industry is a multi-disciplinary field that offers exciting job opportunities in virtually all engineering fields of study. Engineers working in the industrial refrigeration industry have the opportunity to help address the urgent issue of climate change and reducing greenhouse gas emissions by applying environmentally friendly natural refrigerants in energy-efficient refrigeration and heat pump systems.

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"It has been widely noted that students today don't just want a job upon graduation. They want to have a positive impact on the world. They want to make a difference," Stencel said. "The natural refrigeration field is one in which they can replace refrigerants that are contributing to global warming with ones of zero or very minimal global warming potential."

Those entering the refrigeration industry can help conserve energy, protect the environment and reduce the carbon footprint of businesses. "Not ten years down the road, but in natural refrigeration, these results can be achieved by interns and recent graduates," Stencel said, adding that the industry is looking for future leaders with solid technical skills as demonstrated by academic performance. "Additionally, we are seeking those who can envision a more sustainable future through the use of natural refrigerants and can articulate those ideals through the application process."

Gary Schrift, president of IIAR, said students may be unaware of the opportunities that exist within the natural refrigerant industry. "Compared to HVAC as a whole, this is a small niche group, relatively unknown to new students and people in general. Thus, it is difficult to get students looking into the new world to get interested in ammonia refrigeration because they do not know about it, and it is not 'sexy,'" he said. "However, with the HFC phase-down, the increasing knowledge and talk of global warming, and the idea that we can help with that through expanded use of natural refrigerants, we can get students interested."

Stencel said great professional and career opportunities are revealed in times of change. "The truly 'green' future has already begun to embrace natural refrigerants and the engineering and design of natural refrigeration systems are already changing supermarkets, air conditioning, home refrigerators, and food and beverage production," he said.

The Ammonia Refrigeration Foundation is a non-profit research and education foundation that was originally organized by members of the International Institute of Ammonia Refrigeration to promote educational and scientific projects related to industrial refrigeration and the use of ammonia and other natural refrigerants.

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IIAR Standards: A Look Back

Bob Czarnecki can't remember exactly when he started as chairman of IIAR's Standards Committee, but he thinks it was 10 to 12 years ago.

"The former chair had some medical issues, and I was filling in for him. So, I'm blurred as to when I started," Czarnecki said. "When I first started, the mandate was to develop, maintain and interpret standards. At the time, we had two standards that were ANSI approved. Since then, we have developed eight other standards that have gotten ANSI approval."

Gary Schrift, president of IIAR, said Czarnecki's work has been apparent in his well-organized and executed committee meetings, continual communications, and updates to committee members and IIAR staff, and the vast amount of projects he managed. During Czarnecki's tenure, IIAR's standards have been recognized by the many code bodies, the Environmental Protection Agency, and the Occupational Safety and Health Administration.

"Bob has brought all of our standards along through the years to make sure they are current and, especially, adopted by code bodies," Schrift said.

Bruce Nelson, director of innovation for Colmac Coil Manufacturing Inc. and past chairman of IIAR, has worked closely with Czarnecki and the Standards Committee over the years. "I can only express my profound gratitude to Bob Czarnecki for his leadership and transformation of the Standards Committee—how it is organized, how the work is divided, and accelerating the pace of the work. Bob did all of those things," said Nelson. "It is a team effort, but it was his leadership that has produced amazing and great results."

The committee has been tasked with creating new standards as well as updating existing standards every five years. "We maintain them, and every time we do the updates, they get improved," Czarnecki said, adding that the committee tracks any updates that come in during the five-year period. "We tally them up, and when it comes time for the re-write, we address them all."

The committee has also focused on writing new standards, which Czarnecki said takes a long time. "The updates are easier, but when you're starting from scratch, things are harder," he said.

Once standards are created, the first step is getting them ANSI approved, a somewhat rigorous process. "The next step is to get the various code bodies to refer to the standards. The last step is to get the code bodies and others in the standards business, such as ASHRAE, to remove ammonia from their documents and defer to IIAR standards for anything ammonia related," Czarnecki said, adding that to date, all codes except the International Fire Code (IFC) and ASHRAE 15 defer to IIAR standards for ammonia.

Currently, IIAR is working with the International Fire Code, trying to get the organization to defer to IIAR's standards, Czarnecki said. The committee is also working with the Academy of Natural Refrigerants, which puts out education courses on IIAR's standards. "We check course content for accuracy," he said.

Additionally, the Standards Committee is currently working on a hydrocarbon standard. "One thing I was able to do while [I was] chairman was to employ a task force to examine a need for and guide the decision to move forward with the hydrocarbon safety standard. It seemed like a bit of a crazy idea department at the time," Nelson said.

Hydrocarbons can provide a solution for smaller commercial equipment that is dominated by synthetics, Nelson said. "It is difficult to apply ammonia in some of those commercial rooftop packaged types of machines, but hydrocarbons fit those applications beautifully," he explained.

For the past 12 months, Nelson supported Dave Schaefer, IIAR's chair, but has stepped down as an IIAR and Ammonia Refrigeration Foundation (ARF) officer. "Bruce is extremely well organized. He makes plans and follows up to execute them," Schrift said. "In my year at IIAR, with him as IIAR chair, and then the last 12 months as ARF chair, I can see how much has been produced."

Nelson has worked to get the ARF bylaws updated with some needed changes in the past months, supported the ARF annual report, initiated written procedures for the ARF scholarship process and the ARF research process, Schrift said.

What makes all of the work within IIAR so remarkable is that everybody working on the committees is a volunteer. "You take what everybody can give. Fortunately, the membership on the committee was very willing to work hard," Czarnecki said, adding that the membership has grown over the years, particularly on the Standards Committee. "When I first got on the Standards Committee, there were maybe 12 people on it. When I stepped down as chair, there were 120. I think people saw what we were doing and wanted to get involved."

Schrift said the volunteer efforts are improving the environment and advancing the refrigeration industry. "The foresight and past work of so many will greatly support the national and international efforts underway in regards to HFC reduction," he said. "Natural refrigerants are safe for the environment, and having ANSI standards developed for these natural refrigerants will allow for safe, sustainable, and expanded use of these refrigerants in the coming years."

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> **—Bob Czarnecki, chairman of IIAR's Standards Committee**

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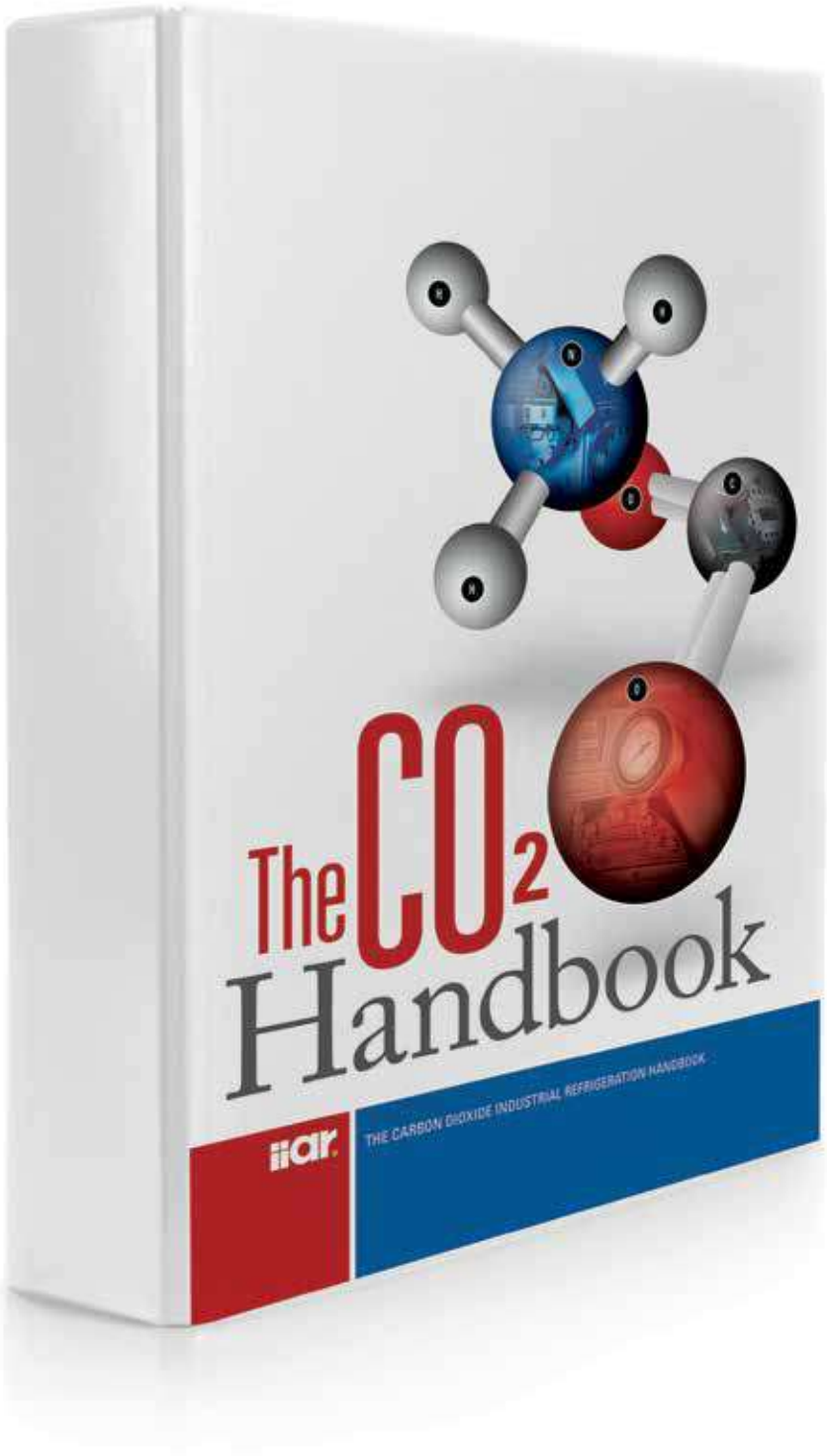

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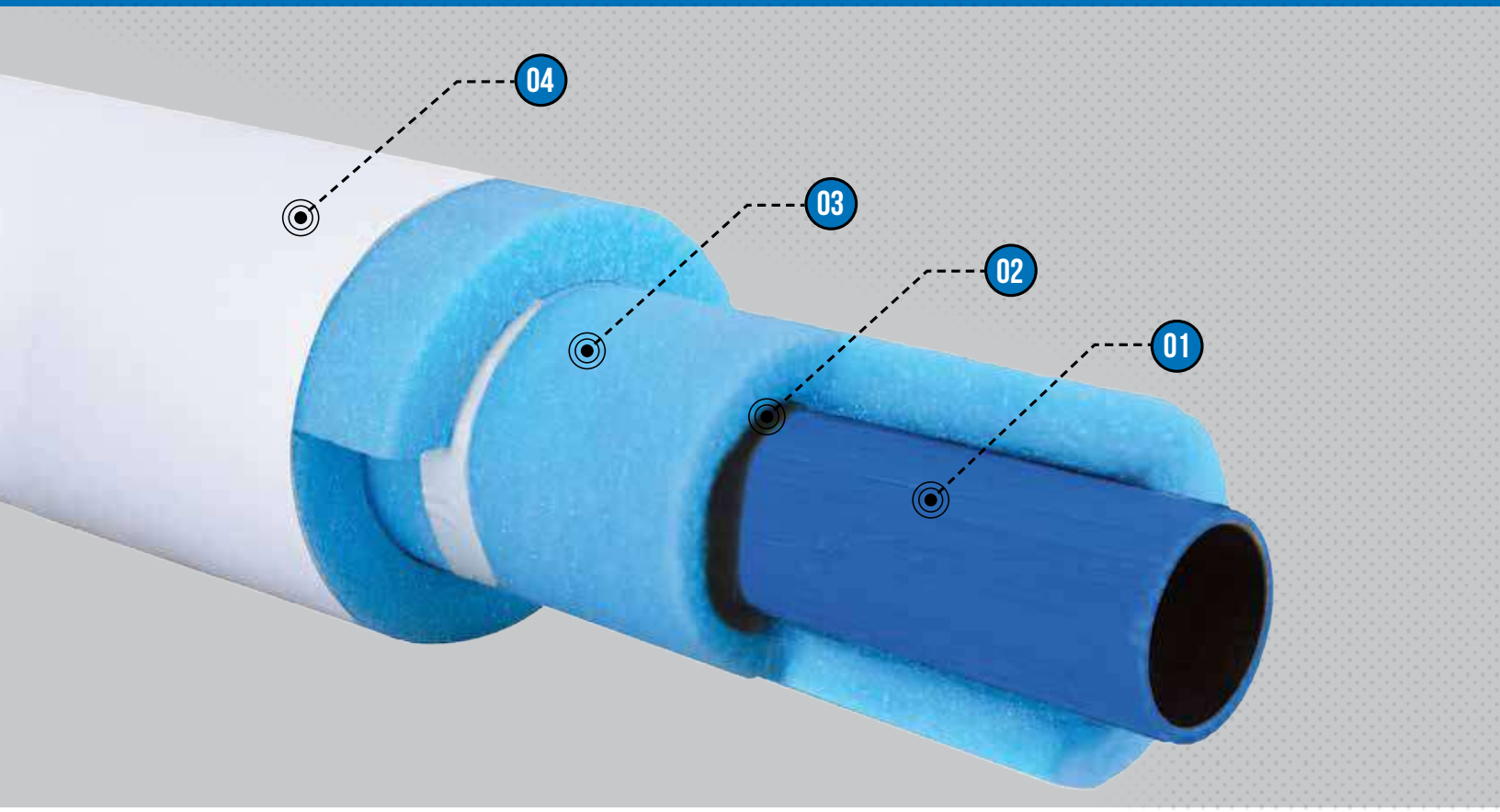

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