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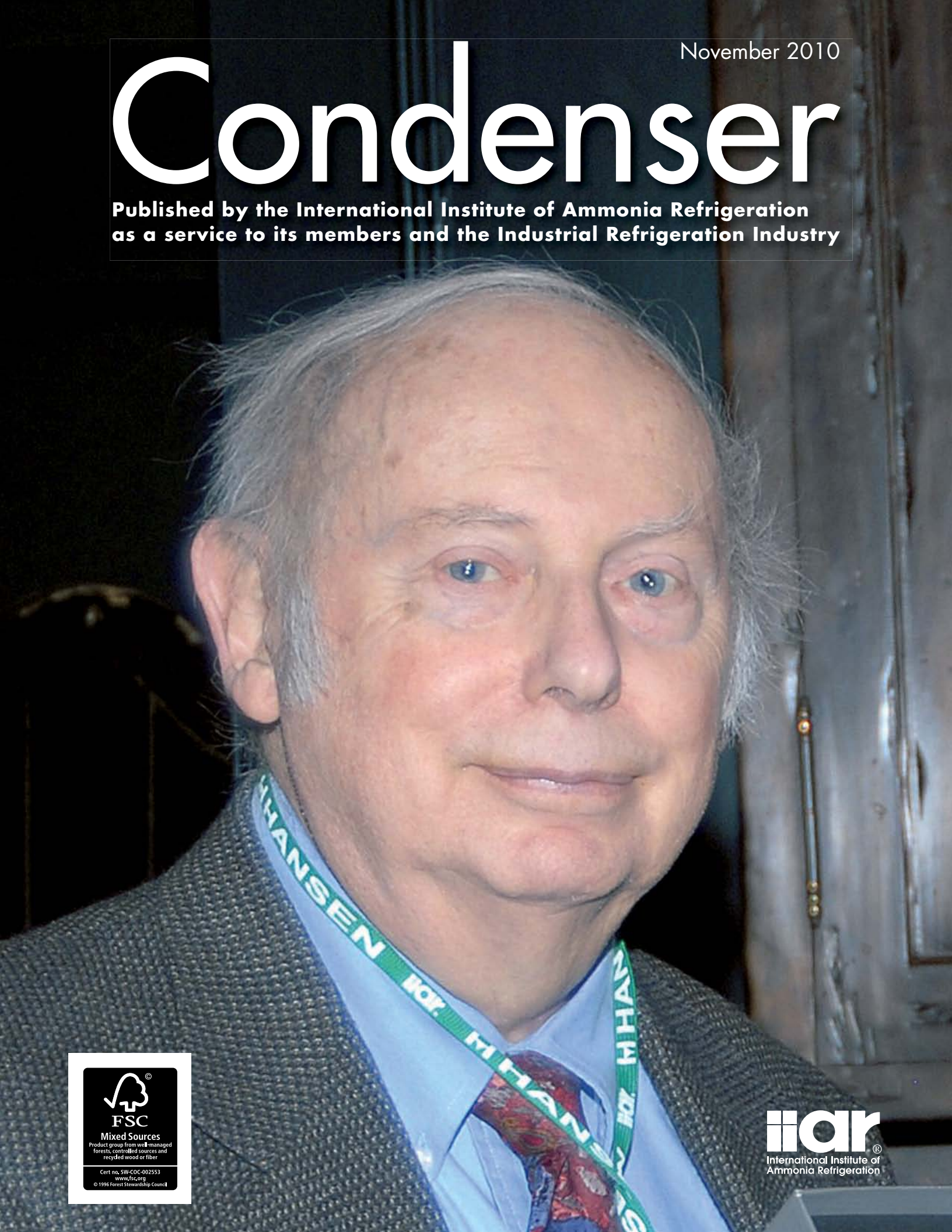

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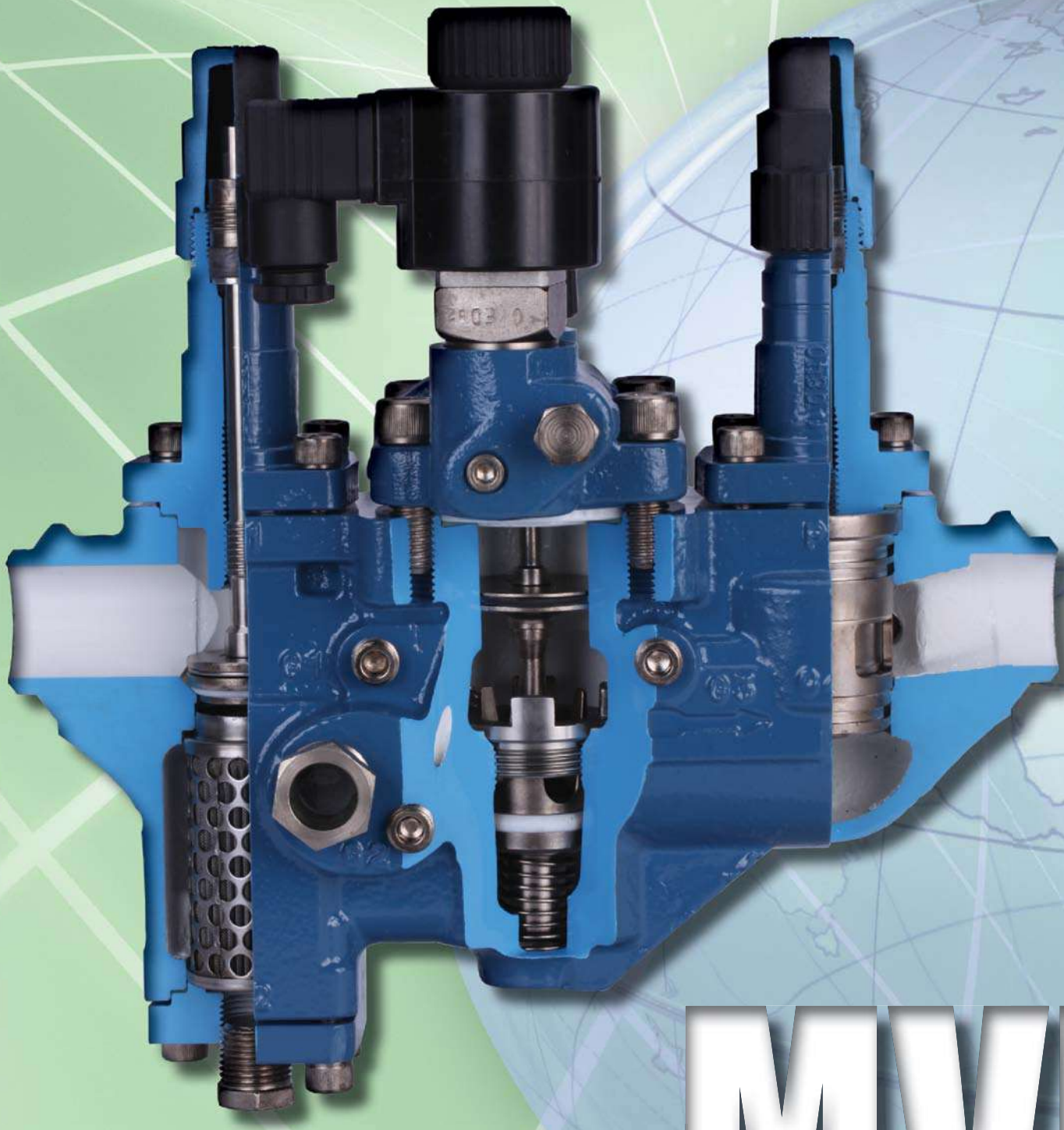

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Chairman's Message

The passing of Will Stoecker over the Labor Day weekend is a deeply felt loss, not only for his family, but also for all of us in this industry. His lifelong contributions and commitment to IIAR's mission are unlikely to ever be duplicated with such focus and enthusiasm. You can read a more complete article about Will on page 4 of this issue of the *Condenser*.

Prof. Stoecker was a visionary when it came to cultivating relationships with international colleagues within the ammonia refrigeration industry. Just last month while I was at the Chillventa Conference in Germany, I was reminded of how Will is recognized and how well remembered around the world he is wherever there is a gathering of professionals who know and understand ammonia refrigeration.

He was committed to the safe and efficient use of ammonia as a refrigerant. Will was a great believer in the tremendous potential for the use of ammonia as a refrigerant in non-traditional applications. In a technical paper presented at the 1989 IIAR Annual Meeting in Austin, Texas, Will talked about the potential growth in the use of ammonia as a refrigerant and the challenges we all face as an industry.

Will was one of the first to understand that a systems-wide approach to our field was the key to safety. Instead of just writing about the disparate components and technologies that make up our systems, he was thinking globally about whatever technologies were available throughout his long career and how to use them to optimize the performance of the entire industry.

In doing so, he uncovered many opportunities to improve not only efficiency, but also safety. The end result was that even the technical paper delivered in Austin, nearly twenty years ago, contains a message that is still every bit as relevant today as it was back then.

Will wrote, "Since safety is the major challenge facing potential applications of ammonia, this issue should receive top priority. Any fear held by the general public as well as by the engineering field in the more widespread application of ammonia must be dispelled by operating existing and new ammonia systems absolutely free of accidents."

The excerpt comes from just one of seven technical papers Will authored or co-authored and presented at the annual conference over the years. However, his extensive bibliography represents only a portion of his legacy with IIAR.

Will was chairman of the education committee for many years. He also served on the Research Committee; held the position of Scientific Advisor; and wrote a newsletter column entitled *Ask the Professor* during the 80s and 90s. In 1992, Will served as an industry spokesman in the IIAR video, *Refrigerant of the Future*. And, in the later-half of the 90s until the early years of the 21st Century, Will was responsible for the development and organization of the popular *Problem-Solution Session* at the annual conference. Throughout his career, he was a model volunteer and it was IIAR and the industrial refrigeration industry that were the beneficiaries of that dedication.

Long after his retirement, Will continued to be the most familiar face at IIAR annual meetings. He placed a high value on his role as mentor to so many new generations of engineers, sitting in on educational sessions and exchanging ideas with anyone who wanted to talk.

It was because of his enthusiasm that our organization has such a strong foundation for research and mentorship . . . an asset we have all made good use of. In order to continue to grow and innovate, we must continue to make contributions to the free-exchange of ideas and technical documentation on which we have come to depend. This is the legacy that Will has left, and we, as an organization, are committed to keeping it alive.

IIAR is the collective voice of an industry. Volunteerism has been at the very core of IIAR's success as a technological organization since it was founded almost 40 years ago.

Everything IIAR produces from bulletins to safety posters, from DVDs to the Piping Handbook has been the product of volunteerism, and many of the articles in this magazine are written by volunteers. The conference workshops, technical papers and panels are all prepared by volunteers. And, the IIAR Board of Directors are all volunteers. We encourage everyone who is a member of IIAR to contribute to the industry's collective knowledge by participating on a committee or task force.

The work goes on as our committees and task forces collaborate on conference calls, organize meetings, and generate relevant material with one goal in mind – to educate an industry and promote the safe and effective use of ammonia as a refrigerant. This was Will's passion. We can all honor his memory by continuing to devote ourselves to his lifelong mission.

Wilbert F. Stoecker

When it comes to ammonia, said Will Stoecker, "The fact that it stinks is one of the best things about it!"

With a quick wit and a serious commitment to safety and innovation, Prof. Stoecker led the ammonia refrigeration industry for four decades; shaping generations of new engineers over a career that spanned the most important years of formative change in the recent history of industrial refrigeration.

The International Institute of Ammonia Refrigeration, its Board of Directors, member companies and employees mourned the passing of Prof. Stoecker on Sept. 5, 2010, a man who dedicated his enthusiasm and professional leadership to IIAR and the advancement of his industry.

As those who knew Prof. Stoecker remember how he influenced their careers, a picture emerges of a life well spent in the service of two passions, teaching and engineering.

Will Stoecker accepts the 2008 Ammonia Refrigeration Foundation Philanthropist of the Year award from 2008 Foundation Chair David Grong

"We have lost an icon in our industry and in engineering education," said former colleague Ron Vallort, "Will Stoecker will be missed."

"Will stayed involved in ammonia refrigeration for his whole life," said Jeff Welch, a former IIAR chairman and current president of Freeze-Pro, Inc. "He was still coming to conventions long after he retired because he so enjoyed exchanging ideas with the new generation of engineers. He was very passionate about his work."

"Will's passing is a deeply felt loss, not only for his family, but also for all of us in this industry," said IIAR Chairman Peter Jordan. "His lifelong contributions and commitment to IIAR's mission are unlikely to ever be duplicated with such focus and enthusiasm."

As an honorary lifetime member of IIAR, Prof. Stoecker led the organization's industrial refrigeration workshop for forty-two years, teaching his most recent class in February of 2009. In 2008, Stoecker was named philanthropist of the year by the Ammonia Refrigeration Foundation for a generous financial contribution.

"Will was always very generous, not just in the sense of material things but also in sharing his knowledge and time," said Don Fenton, a professor and the head of the Department of Mechanical and Nuclear Engineering at Kansas State University.

Prof. Stoecker received his bachelor's degree from the Missouri School of Mines, a master's degree from the University of Illinois and his Ph.D. from Purdue University. He went on to be a professor of mechanical engineering at the University of Illinois, where he taught for 36 years until he retired in 1984. Stoecker also served IIAR as scientific advisor from the early 80's through the early 90's.

As an educator and advocate, Prof. Stoecker was above all else, a mentor, freely sharing his deep subject knowledge, his business vision and his willingness to lend support to industry friends and colleagues.

Perhaps best known as the author of the "Industrial Refrigeration Handbook," Stoecker's definitive volume remains the comprehensive guide to ammonia refrigeration; educating generations and becoming the most trusted reference for industry professionals.

Stoecker continued on page 6

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Stoecker continued from page 4

However, reminders of Stoecker's influence will reach far beyond the author's credit printed on the cover of his well-referenced handbook – evidence of his legacy can also be found in the work of several research organizations that continue to support the industry.

One such organization, The Air Conditioning and Refrigeration Center, was among the first to benefit from Prof. Stoecker's forward-looking approach to ammonia and refrigeration systems engineering.

Prof. Stoecker became the leading expert on ammonia engineering in a variety of national and international arenas, said Clark Bullard, Research Professor at the University of Illinois at Urbana-Champaign.

It was in the early 80's that Bullard began to work alongside Prof. Stoecker as a colleague at Urbana-Champaign, building interdisciplinary research centers for renewable energy technologies.

"As a student at the University of Illinois, I'd known Will and his work for many years, but when I came back to the University in 1980, I was plopped into an office right next to him," said Bullard. "I was the director of the campus office of energy research, working mainly on coal related technologies."

But then in 1987, satellite photos started showing a hole in the ozone layer, and Bullard began to think of setting up a research center to focus on developing a new generation of ozone safe and energy efficient air conditioning and refrigeration technologies.

"If it wasn't for the realization that a hole existed in the ozone layer, the industry would have just plodded along," said Bullard. "That problem led to the motivation for companies to redesign their equipment totally to get the most out of new refrigeration technologies and make the process more efficient at the same time… rather than just drop a new refrigerant into an old system."

A new era of environmental consciousness was beginning, and as usual, Prof. Stoecker was ahead of the curve.

"Will was thinking about ammonia as an alternative to damaging chemicals years before the hole in the ozone layer was identified," said Bullard. "He was thinking about alternatives years before the industry even had to start thinking about alternatives."

As Bullard established The Air Conditioning and Refrigeration Center at the University of Illinois with partner Roy Crawford, "Will was our mentor throughout the entire process."

"Those were the beginning years, and after Roy left, Will and I grew closer as he helped the Center grow," said Bullard. "He always knew that ammonia was one of the top candidates for commercial refrigeration when it came to ozone-safe refrigerants."

By 1992, Stoecker was one of the leading advocates for ammonia refrigeration, participating in IIAR industry promotional videos to help educate various audiences on ammonia's environmental benefits.

"As we look into our crystal ball to try to imagine what's going to happen to ammonia in the future, it's clear that it has certain advantages," said Stoecker. "In the first place, it does no damage to the ozone layer, and does not contribute to global warming. From an environmental standpoint, it has some great advantages as a very efficient refrigerant with exciting possibilities for expansion."

Prof. Stoecker was also ahead of his time when it came to developing an international presence for the U.S. ammonia refrigeration industry.

"Will's best piece of advice was to focus on international industry rather than just U.S. industry," said Bullard. "The government didn't like the idea of funding research that might go beyond the U.S. industry, and I knew that if I recruited international companies into the Center's research, the National Science Foundation would be unhappy."

However, the ammonia refrigeration industry, and competition within it, was growing on a global scale. Ignoring international technology developments could have proven limiting to U.S. industry.

"Will steered me through that minefield, encouraging me to get to know these companies and their technologies and as a result we involved them in every way we could, despite not allowing them to join the Center," said Bullard. "Will was able to see where the leading edge of the technology was going internationally, not just domestically. He brought a much richer dimension to the entire industry by helping to push our domestic leaders into the global arena."

"Since our competition was international, it was important to form those relationships and Will knew that," said Bullard. "Those companies that failed to look outward – into the international arena – are probably no longer with us today."

IIAR Chairman Peter Jordan agreed with Bullard that Prof. Stoecker was a visionary when it came to cultivating relationships with international colleagues within the ammonia refrigeration industry.

"Wherever I've traveled or given a presentation recently, the memory of Will Stoecker is not far behind," said Jordan. "Will is recognized and well remembered around the world wherever there is a gathering of professionals who know and understand ammonia refrigeration."

As a teacher, Prof. Stoecker was best known for his "Industrial Refrigeration Handbook," and focus on training and safety.

"There are many people coming into the industry now… and its going to be necessary that they be instructed in the codes and standards, for both design and installation, and that plant facilities that use ammonia have very strict operating procedures that are followed by the operating personnel," said Stoecker in an IIAR video."It is possible to manage ammonia safely and thereby use it very effectively in our refrigeration systems."

The key to that effective use and training, as it turned out, was Stoecker's textbook. "Will's Industrial Refrigeration Handbook became the bible for our industry," said Ron Vallort. "The book encompassed all aspects of the topic, and he continued to improve and refresh the content through the years."

"Will really did a service to the industry when he pulled together most of the modern thinking on ammonia refrigeration that was appearing in all of our technical papers," said Jeff Welch, former IIAR chair. "It became a definitive text when there really wasn't an engineering based technical text book that was directly targeted to our industry. He got into design concepts and details and the first principles of engineering as they applied to ammonia specifically."

As Prof. Stoecker wrote his handbook, he also became IIAR's scientific advisor. "Will was a chairman of the Education Committee at the time and was driven by the importance of educating people about our industry," said Hank Bonar, CEO of Bonar Engineering and Construction. "Each year he would have a training school, bringing in industry people like myself, and then of course, he used all this information to write his book."

Don Fenton, the current leader of those training schools said, "Will considered his industrial refrigeration workshop – started during his tenure as IIAR scientific advisor – to be the most successful thing he'd ever done."

"He said many times that was because it reached so many people. He got this connection going between the young ones coming in and the veterans really wanting to share what they know about good refrigeration work."

Prof. Stoecker may be gone, but his legacy will live on as his friends and colleagues continue to build the knowledge base of the industry by keeping many of his efforts alive, said Fenton. "I'm hoping to pass on this tradition of training to the next group of engineers, just like Will passed that tradition to me."

However, as the industry mourns the loss of such an enthusiastic leader, that transition may take awhile.

"Will was never afraid to ask about things," said Hank Bonar. "It is one thing to learn something, but it's another thing to learn how to learn, and he did that on behalf of our industry. It's hard to see anyone on our horizon who can transcend that."

IIAR Technical Papers Authored/ Co-authored by Will Stoecker

Ammonia/Carbon Dioxide Hybrid Systems: Advantages and Disadvantages
Author: Will Stoecker

Ammonia Sensors for Refrigeration Applications
Author: Horacio Perez-Blanco and Wilbert F. Stoecker

Concentrations of Ammonia in the Vicinity of Vapor Releases
Author: W. F. Stoecker

Dischare of Ammonia Vapor into the Atmosphere
Author: Wilbert F. Stoecker

Programmable Controllers for Industrial Refrigeration Plants
Author: W. F. Stoecker

Growing Opportunities for Ammonia Users
Author: W.F. Stoecker

Interfacing Computer Control with the Refrigeration System
Author: Wilbert Stoecker, Derek Lunn, Dr. John Hench, David G. Frackelton, and Jacob P. Persem

Will Stoecker is survived by his wife, Patricia (Tenting) Stoecker; a son, Paul, of Fort Collins, Colo.; a daughter, Janet Kiener, her husband Steve and their two children, Annie and Scott, all of Cincinnati, Ohio; and a daughter, Anita Edge, her husband Ben and their two children, Matthew and Kyle, of Clemson, S.C.

A memorial service will be held at Grace Lutheran Church, Champaign, on Dec. 19, 2010, at a time to be announced later.

Memorials may be made to Grace Lutheran Church, 313 S. Prospect Ave., Champaign, IL 61820-4779, or to the University of Illinois Foundation (Wilbert F. Stoecker Scholarship Fund), 1305 W. Green St., Urbana, IL 68101. ear

IIAR Code Advocacy Update

By Jeffrey M. Shapiro, PE., FSFPE

"Grandfathering" Application of Codes to Existing Facilities

If you operate a place of business, do you fear "*the inspector?*" Lurking in the minds of many business owners is a lingering worry that "the inspector" will walk in one day and wreak havoc on their operation by requiring expensive upgrades to the facility, equipment or operations.

The most obvious way to manage this fear is to ensure that your facility is safely operated and well maintained. Nevertheless, because codes are voluminous, complex and ever-changing and because inspectors vary in their level of knowledge, training and experience, there is always a possibility that the outcome of a compliance inspection won't go as well as one might hope.

When it comes to dealing with local code enforcement inspections related to fire or building safety, I can offer you three particularly beneficial pieces of advice: 1. Get it in writing, 2. Know the code, and 3. Know your rights.

1. **Get it in writing:** Fire and building safety field inspectors do not write laws. Their role is to interpret and enforce them, and some will do a better job than others. When a code compliance issue can be easily remediated, such as unblocking a path of egress or fixing a broken or inoperable safety device, deal with this issue quickly and cooperatively and you may be able to get an inspection notice that shows "no violations found." When compliance questions or issues are more complex or expensive to remediate, be sure to request that the inspector provide you with a written notice, and more importantly that the notice to cite the code section that serves as the basis of the applicable requirement. Without knowledge of the specific code section being applied, you may spend many hours playing "what if" games researching the code trying to find the relevant requirement.

2. **Know the Code:** Assuming that you were successful in getting the inspector to cite a particular section of the code associated with a violation notice, you'll need to get a copy of the code to review and research. These days, that task has become somewhat easier, as most codes and many standards are now available on-line (www.nfpa.org provides access to National Fire Protection Association documents, and www.iccsafe.org provides access to the International codes). In many cases, these documents can be viewed on-line for free.

Model code organizations, such as NFPA and ICC, also publish a variety of handbooks and commentaries on their codes and standards to assist users in understanding the background and intended application of these documents. However, don't regard these support documents as gospel, as they typically represent the opinion of the author and lack a formal peer review process. The information may be incomplete or even incorrect.

As a general rule, some degree of "grandfathering" is permitted by all major codes and standards. The concept of grandfathering basically allows an existing business to continue operating under the rules that were in effect at the time of initial occupancy rather than requiring compliance with the latest codes and standards. However, there are exceptions to the general rule, which are typically spelled out in code sections governing retroactivity (e.g. International Fire Code, Section 102).

Such exceptions may include new code requirements that are administrative, operational or maintenance related. These are often treated as retroactively applicable to existing occupancies because they do not change an existing "condition," such as building construction or equipment. For example, an updated code requirement to maintain records or reports or to store combustible materials a specified distance from sources of ignition might be enforced in existing occupancies, versus deferring to an old, outdated code requirement that previously applied.

Another exception may include code requirements that specifically state that they are retroactive to existing buildings and occupancies. Such requirements often involve basic safety requirements that certain buildings and occupancies should meet in all cases, such as minimum

Code Update continued on page 10

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provisions for safe egress. In the case of the International Fire Code, specifically retroactive requirements were scattered about the code based on the specified topic. Beginning with the 2009 edition, all of these requirements were gathered into a single location, the new Chapter 46.

The International Code Council also publishes a separate code called the International Existing Buildings Code (IEBC), which specifies minimum requirements that are retroactive to existing buildings and occupancies, and the National Fire Protection Association publishes a code called NFPA 101 – Life Safety Code that includes separate chapters that are retroactive to existing occupancies. Although these codes are not as widely adopted as the major fire and building codes, they do provide useful guidance even in cases where they are not specifically adopted.

If a notice of violation pertains to an area that has been altered or added since original occupancy, special code allowances may apply. The International Building Code contains a single chapter, Chapter 34 that provides some relief for additions, alterations or changes in use versus what would be required for new construction. The International Existing Buildings Code handles such situations more comprehensively. One or both of these sets of requirements may be adopted by a jurisdiction.

Except as noted above, existing occupancies and conditions are not typically required to comply with the latest code provisions. So if, for example, the latest code added a requirement to provide a fire protection system in a newly constructed refrigerated warehouse, that requirement would not ordinarily apply to an existing warehouse lacking such protection as long as the existing warehouse has remained complaint with the regulations that governed original occupancy.

On the other hand, if you are installing new equipment in an existing occupancy, expect that you'll be required to comply with the latest code requirements governing that equipment.

3. **Know your rights:** If you have a written notice of violation, have researched code applicability and have determined that you disagree with a field inspector's interpretation or application of the code, there are several options available for you to contest a field inspector's decision. First and foremost, discussing your disagreement with the inspector in a non-confrontational manner is often a good starting point. Writing a letter to the inspector explaining the basis of your position may be a good way to kick off that discussion, and if you've developed documentation to support your position based on researching handbooks or other authoritative sources, provide that documentation as an attachment to or citation in the letter.

If the letter proves ineffective, requesting a face-to-face meeting with the inspector at your facility is often a good next step, as may be requesting a meeting with the inspector's supervisor.

Bear in mind that a disagreement over code application shouldn't offend the inspector personally, but it nevertheless may. Be sure to thoroughly document all of your exchanges so that you'll have evidence of what's taken place should things go South.

The next step in resolving a code compliance disagreement is typically a hearing by a "Board of Appeals." These boards are established in most jurisdictions to resolve disputes between code enforcers and those who have been cited. Members of such boards are often practicing professionals involved in the local construction or business communities, and they are empowered, as a group, to overrule decisions by local officials, provided that their rulings are not allowed to constitute an outright waiver of a code requirement.

Next stop if the disagreement continues is the court house. If you get to that point, you'll need more than this article to guide you!

Finally, bear in mind that negligence of the law is not an excuse for non-compliance. If an inspector comes to your facility and notices a violation to a code provision that you weren't even aware of, you'll still be required to comply with applicable regulations, even if the violation has existed for many years and even if it's been missed by countless inspectors in the past. For example, if you made some alterations to your facility without a required permit or performed work that was not in compliance with the code provisions that were applicable at the time, local officials have full authority to require that such work be upgraded to comply with the latest code.

Parker Hannifin Announces **Recall**

Parker Hannifin has announced a recall of certain Sporlan/Refrigeration Specialties MA17 solenoid valves. Standard Machine & Manufacturing Co. manufactures MA17 solenoid valves for Sporlan and Refrigeration Specialties, both divisions of Parker Hannifin Corporation.

Standard Machine and Parker have been made aware of a small number of fractures of the tube portion of the MA17 solenoid valve where ammonia refrigerant has escaped as a result of the fracture. MA17 solenoid valves are utilized on ammonia refrigeration compressors to cool oil in the compressor.

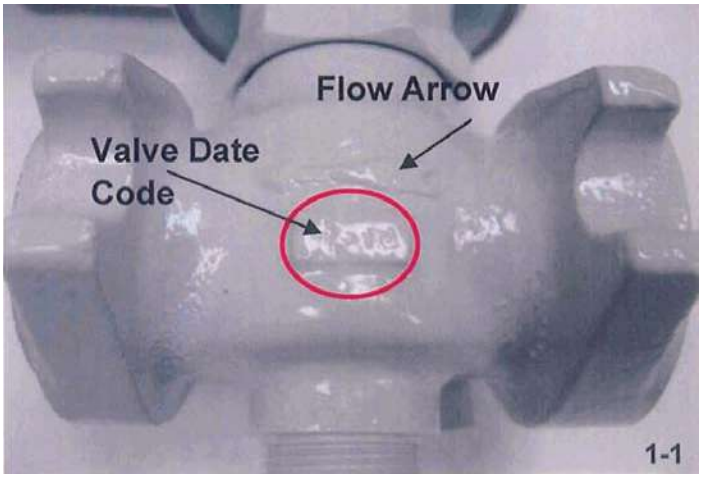
Standard and Parker have recalled MA17 solenoid valves that meet any of the following criteria:

- MA17 valves with a date code of January, 2008 and after;
- MA17 valves installed during that time period (January 1, 2008 to present); and
- Any unused MA17 valves or unused MA17 part kits.

According to a Parker Hannifin announcement, a free replacement Refrigeration Specialties solenoid valve, strainer and coil will be provided. The announcement advises customers to consult the material safety data sheet(s) at your facility which pertain to ammonia, as well as safety documents pertaining to the refrigeration system and/or the facility. Information regarding the hazards of ammonia is referenced in certain government documents, such as the following: http://www.osha.gov/SLTC/ammoniarefrigeration/index.html; *www.epa.gov/oem/docs/chem/ammonia.pdf*.

Identification of the recalled valves and kits can be determined through the following procedure:

1. Locate the flow arrow cast into the valve body approximately 1 " below the tube locknut. See photo 1-1.



2. Below the flow arrow is a cast, upraised boss where the valve date code is stamped. See photo 1-1, date code boss is highlighted with red circle. This boss may be located behind a flange through bolt. See photo 1-2.

3. Please note that the date code was designated by month (i.e., 1 through 12) prior to October 2008. Thereafter, the date code was designated by week (i.e., 1 through 52). The date code will appear as the following:
   a. **Manufacture Date Prior to October 2008:** Month (One or Two digits)–Year (Two Digits). For example a 7–08 stamping indicates July 2008.
   b. **Manufacture Date of October 2008 to present:** Week (One or Two digits)–Year (Two Digits). For example a 7–09 stamping indicates week 7 of January 2009.
4. If date code is illegible due to epoxy paint, the paint can be removed using 180-220 grit sandpaper. *Lightly* sand date code boss to remove paint layer. Care must be given such that excess material is not removed. Date code may be rendered illegible if too much material is removed from casting. See photo 1-3 below.

Contact Karina Villarreal at Parker by calling **1-877-499-6217** or send an Email to rsd_ma17@parker.com to obtain the appropriate replacement valve. **nar**

IIAR Government Affairs

By Lowell Randel, IIAR Government Affairs Director

2010 has been a busy year for IIAR Government Affairs activities dealing with issues ranging from Occupational Safety and Health Administration (OSHA) regulations and Alliances, to chemical facility security policies. In the wake of the November mid-term elections, and as 2010 begins to wind down, we thought it would be a good time to provide an update on some key issues impacting IIAR and its members.

OSHA/GCCA Alliance

As was reported in the last edition of The Condenser, IIAR, in partnership with the Global Cold Chain Alliance (GCCA) has formed an Alliance with OSHA to promote safety in our industry. An Implementation Team has been formed and they are busy working to advance the goals of the Alliance. The Implementation Team held its initial meeting immediately after the signing ceremony at OSHA on July 30th. The first meeting consisted primarily of an orientation from OSHA about the operational details of the Alliance Program and outlining potentials activities of the Alliance.

The team has held three conference calls since the signing to discuss next steps of the Alliance, including the identification of compliance assistance products to be developed and potential success stories to pursue. The team has begun work on its first compliance assistance product, a poster addressing general ammonia safety awareness for employees. A work group has been established to also examine the issue of personal protective equipment (PPE) in ammonia refrigeration facilities.

The team also decided to pursue two success stories relative to experiences companies have had with OSHA Cooperative Programs. One example will come from a refrigerated warehouse with a recent positive experience with the OSHA On-Site Consultation Program. The other success story being developed will reflect the experiences of a cold storage construction company and their work with OSHA on a number of cooperative programs.

Another component of the Alliance is GCCA participation in OSHA Safety and Health Topics Editorial Boards and eTools. The OSHA website features a Safety and Health Topics page and an eTool, both of which specifically address ammonia refrigeration. By virtue of the new Alliance, GCCA has been given the opportunity to provide technical expertise to these sites. Alliance Implementation Team and IIAR member Jim Marrella has been selected as the GCCA representative to the Ammonia Refrigeration editorial board to work with OSHA on the ammonia refrigeration safety and health page and eTool.

In addition to these activities, IIAR President Bruce Badger and IIAR Government Affairs Director Lowell Randel met with OSHA representatives at the Region 1 office in Boston. Bruce and Lowell discussed the formation of the new Alliance, as well as the National Emphasis Program on Chemical Facilities. OSHA representatives were very interested in the types of resources available through IIAR and suggested that training programs covering ammonia refrigeration would be beneficial for OSHA inspectors in Region 1. IIAR and the Alliance Implementation Team are currently considering options to provide this type of training in Region 1.

More information about the GCCA/OSHA Alliance can be found at the following website: http://63.234.227.130/dcsp/alliances/gcca/gcca.html.

GCCA Comments on Changes to OSHA Consultation Procedures

On September 3, 2010, OSHA published a notice in the Federal Register proposing changes to the On-Site Consultation Program that would give the agency more flexibility to inspect facilities going through the consultation process and those that have achieved SHARP status. OSHA has proposed adding a category to the three current circumstances under which enforcement action can be taken against sites of employers participating in OSHA Consultation's Safety and Health Achievement Recognition Program (SHARP). In addition to imminent danger investigations, fatality/catastrophe investigations, and complaint investigations; "other critical inspections as determined by the Assistant Secretary" would allow SHARP sites to be inspected. OSHA has also proposed to add referrals as a reason for which a consultation can be terminated. Finally, the OSHA proposal would limit the exemption from programmed inspections for SHARP participants to one year. Under the current system, some SHARP participants have been exempted from programmed inspections for longer than one year. The OSHA proposal is now subject to a public comment period that ended November 2, 2010. IIAR/GCCA Government Affairs Director, Lowell Randel drafted formal comments that were submitted to OSHA regarding the proposed rule.

OSHA National Emphasis Program on Chemical Facilities

The OSHA National Emphasis Program pilot on chemical facilities was originally slated to expire at the end of July 2010. The pilot has since been extended twice. First, the pilot was extended to the end of the 2010 fiscal year. And now, the pilot has been

Government Affairs continued on page 26

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Conference & Heavy Equipment Show

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Orlando's Caribe Royal Resort Hosts IIAR in 2011

This spring, the IIAR Industrial Refrigeration Conference & Heavy Equipment Show escapes the cold in balmy Orlando, Florida. IIAR is gearing up to host the world's largest meeting dedicated exclusively to industrial refrigeration at the Caribe Royale All-Suite Hotel and Convention Center. The Heavy Equipment Show is the best place to preview the industry's leading technology and concepts developed and produced by manufacturers, contractors and service providers.

Resting across more than 53 acres of tropical gardens and pool areas, the Caribe Royale is an all-suite property with spacious, newly renovated one-bedroom suites and two-bedroom lakeside villas. IIAR has negotiated a favorable basic room-rate of $189 per night for conference attendees. In addition to its expansive meeting and event spaces, this location offers unmatched hospitality and guest service as well as a variety of top-shelf dining options and hotel amenities designed to appeal to both families and business professionals.

Located just minutes away from popular Florida theme parks and local attractions, the Caribe Royale offers transportation and shuttle service for its guests, making it easy to take a advantage of everything the area has to offer either before or after the conference for a family vacation. Hotel reservations and conference registration are now open for the March 27–30, 2011 IIAR Industrial Refrigeration Conference & Heavy Equipment Show. Register online at IIAR.org to lock in the best early-bird registration rates and reserve your room today.

IIAR Delivers the Best in Education and Networking

Mike McClendon

Mark Blanchard

Registration is now open for the 2011 IIAR Industrial Refrigeration Conference & Heavy Equipment Show. It is the "must attend" event of the year for industrial refrigeration professionals.

The technical program, includes workshops, technical paper presentations and topical panels designed to give the most thorough update on operations and maintenance procedures that promote refrigeration system safety, efficiency and energy conservation. This year, IIAR's program focuses on industry-leading strategies that drive down operating cost by boosting energy efficiency.

Keynote speakers Mike McClendon and Mark Blanchard will be on-hand to share their extensive experience with domestic and international supply chains and provide a valuable perspective on the promising future of new technologies within the industrial refrigeration industry.

In addition to a well-rounded educational program, the conference agenda also includes a Code/Regulatory Update Breakfast Tuesday morning. The session will feature presentations from IIAR Code Consultant Jeff Shapiro and Government Affairs Advocate Lowell Randell.

A special closing session on Wednesday morning will focus on valuable updates to the IIAR Process Safety Management and Risk Management Program guidelines. The session will summarize fifteen years of experience in the field that serve as the basis of an update of one of IIAR's most popular publications that will be published in 2011.

IIAR's Industrial Refrigeration Conference & Heavy Equipment Show is the best forum in the world for industrial refrigeration professionals who want to stay educated on the issues they face in their day-to-day business environment while also broadening the scope of the industry by fostering a valuable exchange of ideas and knowledge.

A Magical Day of Golf – ARF 2011 Golf Tournament

The Ammonia Refrigeration Foundation (ARF) 2011Golf Tournament will be held Saturday, March 26, 2011 in conjunction with the IIAR 2011 Industrial Refrigeration Conference & Heavy Equipment Show in Orlando, Florida.

"Make your plans now to arrive in Orlando a day early and enjoy playing one of the most wonderful golf courses in the country," said Foundation Chairman Don Stroud. "The ARF Golf Tournament is an excellent opportunity to play a round of golf with colleagues before the busy conference agenda kicks off, and lend your support to the future of ammonia refrigeration by participating in ARF's Golf Tournament."

The golf fees and sponsorship revenue help to underwrite the work done by the Foundation. This year, purchasing a foursome will give you the opportunity to gain your customer's undivided attention as you play Disney's scenic Osprey Ridge Golf Course. From tee to green, your group will be challenged by the masterfully designed course, offering rolling fairways and large greens for every skill level. With one of *Golf Digest*'s highest ratings and spectacular personal service, Osprey Ridge has earned a place on the playlists of the pros.

"We'll be playing at one of the most beautiful and challenging golf courses in the country. Orlando has a reputation for hospitality and wonderful year-round weather," said ARF Golf Chairman John Hendrickson. "We're very excited to offer this venue, and we're looking forward to our most successful tournament yet."

The Osprey Ridge Golf Course is a challenging Par 72 course, and one of Florida's favorite fairways. Designed by world renowned golf architect Tom Fazio, the course combines native tropical wilderness and nature preserve landscapes with immaculately groomed greens.

Rated as one of the "Top 100 Resorts" by *Golf Digest* magazine, Osprey Ridge is not just visually pleasing; it's also certified by Audubon International as a Cooperative Wildlife Sanctuary.

Centrally located at the Disney Resort, the course is just minutes from IIAR's conference venue at the Caribe Royale Resort Hotel in Orlando. To learn more about the Osprey Ridge Golf Course, visit www.disneyworldgolf.com.

"We can't wait to get on the course," said Hendrickson. "Not only is this tournament important to the future of our industry, it's also the place we catch up with old friends and look forward to meeting new people."

The format for this year's outing differs from the typical *scramble* playing style, allowing all participants a chance to play their own ball throughout the match. A unique scoring system for the event will challenge the avid golfers to compete for the prize of individual champion. At the same time, the more casual golfers have a chance to enjoy the fun while helping their foursome compete for team prizes.

Your participation in ARF's golf tournament benefits the entire ammonia refrigeration industry. The Ammonia Refrigeration Foundation is a non-profit research and education foundation organized to promote educational and scientific projects related to industrial refrigeration and the use of ammonia as well as other natural refrigerants.

All ARF research projects are focused on finding solutions to practical problems that industry professionals face in their day-to-day business.

Join us to support the industrial refrigeration industry. We'll see you there!

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ENERGY $AVING OPPORTUNITIE$

Through the Intelligent Application of Refrigeration Evaporators

Dennis R. Carroll, P.E., Manager – AcuAir Application Engineering, Frick by Johnson Controls

More than before, people are looking for ways to economize their refrigeration operations. The energy required to operate a refrigeration system can be the single most expensive cost for a cold storage logistics operation or for a food processor. We are the perceived experts in the field. We will be asked to help evaluate current and future systems and design energy efficient systems.

One area I find which does not get the attention it deserves in the drive to economize refrigeration systems is evaporator operation. Here are four things YOU can do (for your customer) to save energy and YOUR (their) money, and possibly, win a few points for yourself.

The four things you can do are:1.Budget Fan Horsepower, 2. Utilize VFD's, 3. Defrost Smarter, and 4. Be Energy-Wise.

Budget Fan Horsepower

You or your customer should budget fan horsepower. Budgeting fan horsepower, like budgeting in other areas of life, forces discipline and ultimately wiser choices. When you exercise this discipline, however difficult, it demonstrates you care about the well being of your customer.

Consider your choices of fan motors. The scatter chart in Figure 1 shows the fan motors combinations which could be selected for a series of three fan evaporators. The evaporators illustrated are all ceiling hung evaporators, galvanized coils with a fin spacing of 4 fins per inch. The evaporators in this example range in size from 16.5 TR to 53.5 TR.

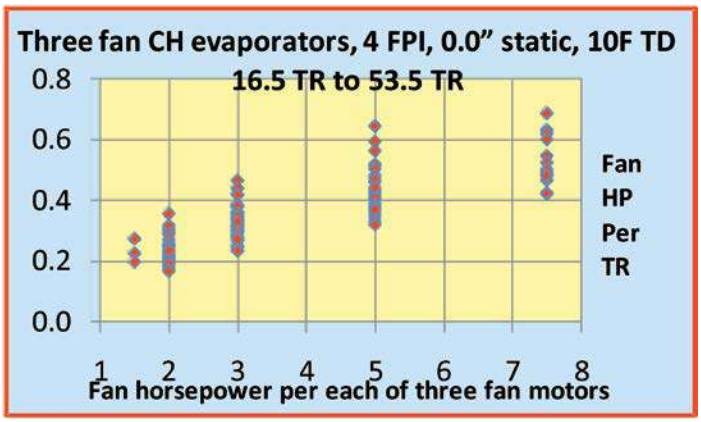

Figure 1

You have many fan HP to coil paring possibilities and combinations. The important thing to note is the number of choices available and their impact on the fan HP to delivered cooling ratio. Weight your choices carefully. The economic considerations are substantial.

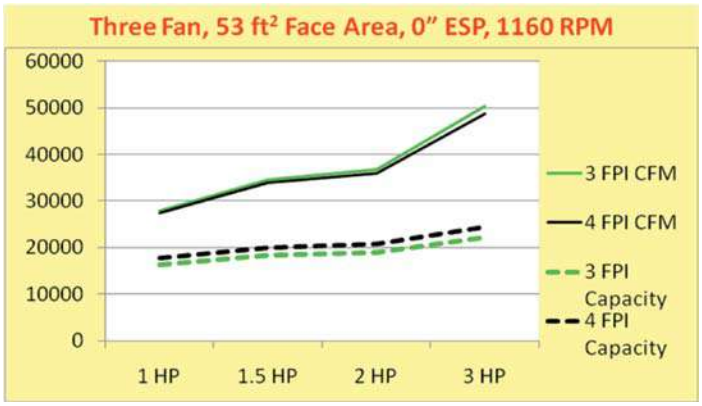

Figure 2

As a further consideration, Figure 2 shows for a typical evaporator the impact of increasing the fan HP. Certainly increasing the fan HP and the air flow volume through the evaporator will allow the evaporator coil to perform at a higher level. But at what cost? For this evaporator the increase in fan HP, and the corresponding increase in air flow, increases the capacity of the evaporator about 37%. From fan motors of 1 HP to 1.5 and 2 HP the increase in evaporator capacity roughly tracks the increase in airflow through the evaporator unit.

The change in air flow volume and fan HP significantly diverge as the fan HP increases to 3 HP. The increase in power consumed from 2 HP to 3 HP is 50%. The increase in capacity is 17%. Who would wish to defend to a customer the idea of paying 50% more in power for a capacity increase of 17% as being a good investment?

Some may argue that the 1 HP increase in fan energy is insignificant. If the increase was limited to 1 HP, the argument might be valid. But adding 1 fan HP has an impact on the entire refrigeration system and the operating cost borne by the operator.

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Energy Savings continued from page 18

What does this "1 HP" cost Your Operation?

Assume $0.08 per KW- HR.

1 HP * (0.7457 KW/HP ÷ 0.88 efficient) = 0.8474 KW

0.08 $/KW- HR * 0.8474 KW * 20 HR/D = $1.35 per day

Yearly cost is $494.87 per 1 Fan HP

Plus the work added to the Compressor Room

Figure 3

Figure 3 illustrates a cost analysis of the cost of 1 HP at an evaporator. And this does not include any "downstream" costs.

So what are the "downstream" costs? Where does this "1" horsepower go? How does it manifest itself within a refrigeration system? We know the answer though we may not wish to acknowledge it. The fan exerts work on the air within the refrigerated facility and heat is added to the air. Fan motor heat is removed by the refrigeration system.

The path of the fan motor heat is known: It is absorbed by the refrigerant, the refrigerant is compressed by the booster compressor (assuming a two-stage system), the heat travels thru an intercooling vessel, the refrigerant vapor is compressed by the high stage compressors, and the vapor finally loses the evaporator fan motor heat to the atmosphere via the evaporative condenser.

A conservative calculation will show that one (1) fan HP adds +/- 0.6 HP to the work required by the entire refrigeration system. And this calculation does not include any losses incurred by the refrigeration system resulting from pressure losses in the piping network, added refrigerant pumping or delivery costs.

Let's look at an example. Consider the case of a 60,000 square feet freezer which is 30 feet in height. For this example we will assume the loading is 425 ft2/TR. (This is a reasonably conservative value for estimating a cooling load). If the cooling requirement assumption is accepted, the resulting refrigeration load could be projected to be 141 TR at a -20°F SST. The assumption will also assume four (4) 35 TR evaporators are required. We will further assume the evaporators will have a fin spacing of 3 FPI, designed to operate at a 10F° TD and these evaporators will have a static pressure requirement of 0.25".

A blind selection by a third party resulted in the following six evaporator selection. The only requirement stated for the blind selection was one selection to be the most inexpensive evaporator unit offered in his product line which fit the criteria and one had to "appear" to be the most energy efficient offering. The selections offered are shown in Table 1. The selections are listed no particular order.

Six Evaporators meet the Capacity Requirements

	Actual Rating - TR	Number of Evaporators	Fans	HP	Fan Speed	CFM @ 0.25"	HP/TR
Evaporator #1	35.0	4	3	3	900	51,943	0.257
Evaporator #2	36.0	4	3	3	1200	54,253	0.250
Evaporator #3	36.3	4	3	5	1200	67,687	0.413
Evaporator #4	35.6	4	3	7.5	1200	74,514	0.632
Evaporator #5	36.0	4	4	1	1090	38,323	0.111
Evaporator #6	37.1	4	3	5	1160	53,413	0.404

Table 1

The units ranged in size from 35.0 TR to 37.1 TR. Airflows varied significantly, from 38,323 CFM to 74,514 CFM. (The discussion of how much air is needed will be reserved for another day)! For each evaporator the HP/TR ratio was calculated. The ratio ranged from a low of 0.111 to a high of 0.632.

Table 2 shows the total connected fan HP of the individual evaporators and their cost of operation. The values used in the calculation are those shown in Figure 3. For this, and subsequent calculations, Evaporator #1 was the base against which all evaporators were compared.

Operational Cost Imposed on the "Compressor Room"

	Actual Rating - TR	Number of Evaporators	Fans	HP	HP Total	CR HP CF	Compressor Room Loading - HP	Cost Imposed on CR Power / Year	Imposed Cost on CR Power above Base / Year
Evaporator #1	35.0	4	3	3	36	0.6	21.60	$ 10,689.19	
Evaporator #2	36.0	4	3	3	36	0.6	21.60	$ 10,689.19	
Evaporator #3	36.3	4	3	5	60	0.6	36.00	$ 17,815.32	$ 7,126.13
Evaporator #4	35.6	4	3	7.5	90	0.6	54.00	$ 26,722.98	$ 16,033.79
Evaporator #5	36.0	4	4	1	16	0.6	9.60	$ 4,750.75	$ (5,938.44)
Evaporator #6	37.1	4	3	5	60	0.6	36.00	$ 17,815.32	$ 7,126.13

Table 2

As expected, the higher HP fan motors cost more to operate. Table 3 shows the costs imposed on the refrigeration system when the fan motor heat is included in the calculation.

Operational Cost Imposed on the "Compressor Room"

	Actual Rating - TR	Number of Evaporators	Fans	HP	HP Total	CR HP CF	Compressor Room Loading - HP	Cost Imposed on CR Power / Year	Imposed Cost on CR Power above Base / Year
Evaporator #1	35.0	4	3	3	36	0.6	21.60	$ 10,689.19	
Evaporator #2	36.0	4	3	3	36	0.6	21.60	$ 10,689.19	
Evaporator #3	36.3	4	3	5	60	0.6	36.00	$ 17,815.32	$ 7,126.13
Evaporator #4	35.6	4	3	7.5	90	0.6	54.00	$ 26,722.98	$ 16,033.79
Evaporator #5	36.0	4	4	1	16	0.6	9.60	$ 4,750.75	$ (5,938.44)
Evaporator #6	37.1	4	3	5	60	0.6	36.00	$ 17,815.32	$ 7,126.13

Table 3

Total Operational Cost of these Evaporators above "Base"

	Cost of Fan Power above Base / Year	Imposed Cost on CR Power above Base / Year	Total Cost of Power above Base / Year
Evaporator #1			
Evaporator #2			
Evaporator #3	$ 11,876.88	$ 7,126.13	$ 19,003.01
Evaporator #4	$ 26,722.98	$ 16,033.79	$ 42,756.77
Evaporator #5	$ (9,897.40)	$ (5,938.44)	$ (15,835.84)
Evaporator #6	$ 11,876.88	$ 7,126.13	$ 19,003.01

Table 4

Table 4 shows the cumulative costs of operation for one year when the cost of operating the compressor room is included, as it should be.

Total Operational Cost of these Evaporators above "Base" including Purchase					
	Cost of Evaporators	Purchase price above Base	Total Cost of Power above Base / Year	First Year's Cost above base	First Five Year's Cost above base
Evaporator #1	$ 91,484.00		$ -		
Evaporator #2	$ 86,932.00	$ (4,552.00)	$ -	$ (4,552.00)	$ (4,552.00)
Evaporator #3	$ 82,020.00	$ (9,464.00)	$ 19,003.01	$ 9,539.01	$ 85,551.04
Evaporator #4	$ 78,496.00	$ (12,988.00)	$ 42,756.77	$ 29,768.77	$ 200,795.84
Evaporator #5	$ 130,760.00	$ 39,276.00	$ (15,835.84)	$ 23,440.16	$ (39,903.20)
Evaporator #6	$ 145,924.00	$ 54,440.00	$ 19,003.01	$ 73,443.01	$ 149,455.04

Table 5

Table 5 shows the results of the analysis. Shown in the table is: the fair market value of the six evaporators (what a user/owner might pay), their price compared to the "base" evaporator; the yearly power cost above the base unit; the first years operation above base evaporator; and finally, the cost of operation after five years above the base evaporator.

The results are staggering. Evaporators #2 and #5 were the least cost evaporators to operate. They had a HP/TR ratio of 0.25 and 0.111, respectively. The "least expensive evaporators", #3 and #4, are fantastically expensive to operate. They had a HP/TR ratio of 0.413 and 0.632, respectively. Note the second most expensive evaporators would pay for themselves in just over 3 years.

Obviously, not all fan brake horsepower ends up being whole integers. In truth, the horsepower consumed by evaporator fan motors can vary from the nameplate rating, both up and down. A proper analysis for you and your customer would require you obtain this information. But the central truth remains: fan horsepower does add load to a refrigeration system and it is significant.

Truth #1: Budgeting fan horsepower will add to your first cost, but it will save you (significant) money over time.

Truth #2: If you do not budget your fan horsepower someone else will! And they will not be as concerned about your cost of operation as you are.

Consider your fan horsepower carefully. Certainly, as a start, consider targeting 0.4 HP/TR or less for your evaporators. (This suggested value is based on evaporators expected to operate at a 10F° TD).

Utilize VFD's

Utilize VFD's, and/or consider re-powering existing evaporators. Properly controlled, the VFD's allow the fan motors to respond to the refrigeration requirements of the conditioned space. Refrigerated facilities do not operate at full load 100% of the day. Why purchase energy to remove heat that is not there?

One concern in using VFD is the diminished rate of air change within the cooled area when the VFD is operating the fan motor at reduced speeds. One study of which I have knowledge looked at cooler evaporators fitted with VFD's. The study found the forklift traffic in the coolers had a significant beneficial impact on the "stirring" of the cooler air. The forklift induced stirring working in conjunction with the cooler fans operating at very low speeds was quite sufficient. The coolers maintained the proper air temperatures.

On the west coast, one operator looking to save operating cost explored the option of rewinding his existing fan motors. The basic idea was a fan motors rotating at a slower speed had a reduced power input. In their "test" facility, freezer evaporator fan motors were rewound. The operating speeds were changed from 1200 RPM to 600 RPM. Their test indicated an air temperature increase of only about 0.5 F° to 0.75 F° over a distance of 300 feet. The only thing lost as a result of the rewinding was a drain on the company treasury! Temperatures were satisfactory and the refrigeration load was diminished. The operator estimated they saved $750,000.00 per year. And this was several years ago when power rates were lower.

Chart 1

Chart 1 illustrates the reason for their success. Operating a fan at 50% speed requires only 12.5% of the power the fan motor would consume at 100%.

Another control scheme would be to operate evaporators (and their fan motors) for only half a day. The idea is to operate outside of the peak power rate times. Is this a viable strategy? This is, one owner stated, the proper way to save energy and operating costs. I suggested that operating with VFD's was a far more energy efficient approach.

His system in a particular room held four (4) evaporators each fitted with (2) 5 HP fan motors. He manually limited the run time of his evaporators to 12 hours. Consider the math:

Time of day cycling:
4 units x 2 fans x 5 HP/fan x 12 hours/day = 480 HP-Hours

To "equalize" the comparison, I "locked" VFD's at 50% fan speed:
4 units x 2 fans x 5 HP/fan x 24 hours/day x 12.5% = 120 HP-Hours

Energy Savings continued on page 25

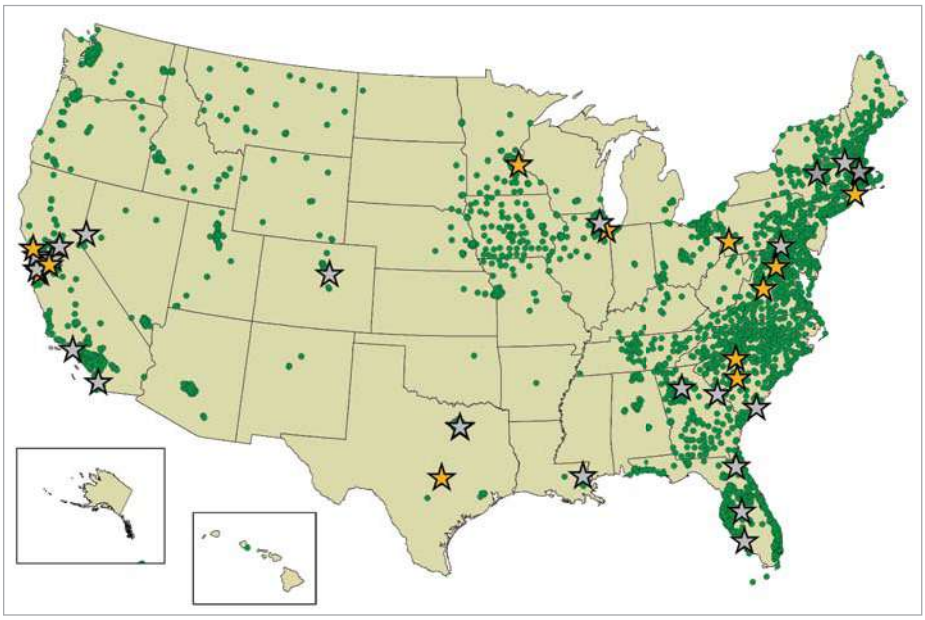
IIAR Participates in GreenChill Webinar

by Eric Smith, P.E., LEED AP, IIAR Technical Director

Recently, the IIAR participated in the presentation of a webinar in association with the EPA's GreenChill Partnership. The focus of the webinar was to examine the use of ammonia in combination with CO_2 for use in supermarket refrigeration systems. Ammonia's low Global Warming Potential (GWP=0) and low Ozone Depletion Potential (ODP=0) along with the similar characteristics of CO_2 make them an attractive alternatives to synthetic refrigerants. As described below, interest in the application of these systems in the United States is building. Discussion in the Webinar surrounded potential energy savings, construction of the systems, and potential hurdles that must be overcome for this application of natural refrigerants to gain acceptance.

EPA's GreenChill Partnership

GreenChill is an EPA Partnership Program with supermarkets to reduce refrigerant emissions and decrease their impact on the ozone layer and climate change. GreenChill was founded in November 2007 with just six supermarket partners. To date, forty supermarket companies with close to 5,500 stores nationwide have become GreenChill partners.



GreenChill partner stores (green dots) and certified stores (stars) as of June 2010

The goals of the GreenChill Partnership are to provide the supermarket industry with information and assistance to lower refrigerant charge sizes and eliminate refrigerant leaks; transition to environmentally friendlier refrigerants; and adopt green refrigeration technologies, strategies, and practices.

GreenChill has three main programs to achieve those goals: the Corporate Emissions Reduction Program, the Store Certification program, and the Advanced Refrigeration Program.

The GreenChill Corporate Emissions Reduction Program

GreenChill partners make a commitment to EPA that they will measure their corporate-wide aggregate refrigerant emissions annually and set an emissions reduction goal for each year. A Partner's first emissions report is the company's baseline year. EPA then measures the partner's progress in reducing emissions vs. that baseline year and the progress from year-to-year.

In 2009, the latest reporting year, GreenChill partners had an average corporate refrigerant emissions rate of 12%, which is much lower than EPA's estimated industry average annual emissions rate of 25%. If every supermarket in the nation had an emissions rate equal to the GreenChill average, they could prevent the annual emissions equal to about 22,000,000 metric tons of carbon dioxide. Reducing refrigerant leaks is not just good for the environment. It is good for supermarkets' bottom lines. The industry would also save over $100,000,000 on refrigerant used to replace leaks.

The GreenChill Store Certification Program

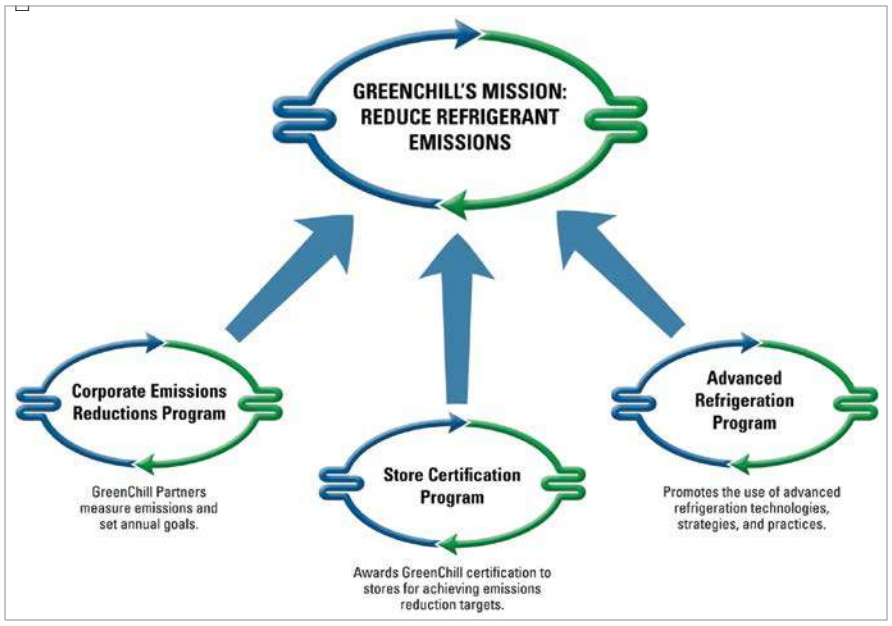
Reducing refrigerant emissions corporate-wide requires a lot of hard work on an individual store level. There are several certification programs that offer incentives for food retail stores to increase their energy efficiency and tackle other environmental goals; however in 2008, when GreenChill launched its store certification program, there weren't any other programs that provided recognition to companies that committed to and invested in commercial systems that lowered refrigerant charge size and leak rates.

With refrigerant emissions accounting for 20-30% of a supermarket's carbon footprint, there was a need to encourage these types of investments.

GreenChill has three certification levels available: platinum, gold, and silver. There are only two stores in the nation that have achieved GreenChill platinum, the Price Chopper Colonie store in New York and the Chestnut Hill Star Market in the Boston area. Both of these stores achieved impressive emissions reduction vs. a typical supermarket with a centralized direct expansion system. Both stores will emit less than 25 pounds of refrigerant annually, vs. an EPA estimated 1000 pounds emitted by a typical supermarket.

GreenChill does not mandate any particular technology be used by stores seeking certification. Any store that meets the program's refrigerant charge reduction and leak reduction standards can qualify.

It is not easy to achieve these standards. As of October 2010, there were only 39 certified stores in the nation. Some supermarket companies, such as Sprouts Farmers Market, have targeted achieving GreenChill certification for every new store they open. These companies often build the GreenChill certification requirements right into their new store specs. Their store designers, equipment manufacturers, and service technicians all work to meet the GreenChill standards. Sprouts currently has the most certified stores of any GreenChill partner.



GreenChill's three programs

Though no stores have met the challenge yet, GreenChill offers a special route to platinum certification for stores that only use refrigerants with global warming potentials of less than 350.

The GreenChill Advanced Refrigeration Program

GreenChill's Advanced Refrigeration Program provides information to the supermarket industry on green refrigeration

GreenChill continued on page 27

The IIAR Ammonia Refrigeration Management (ARM) Program

Developed for the industry by the industry

- A comprehensive safety management tool
- A streamlined regulatory documentation solution
- A guide for facilities with less than 10,000 pounds of ammonia

As the leading authority on ammonia refrigeration, the International Institute of Ammonia Refrigeration developed the **Ammonia Refrigeration Management (ARM) Program** to help small facilities improve safety, enhance system reliability and assist with regulatory compliance. ARM is intended to assist facilities with a charge of less than 10,000 lbs. of ammonia that are subject to inspection under the General Duty Clause.

ARM is a comprehensive safety management tool. It draws from the best ideas contained in Process Safety Management and Risk Management, simplifies the application of these concepts and streamlines the documentation process.

Order your copy of the ARM Program today!

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Energy Savings continued from page 21

In fact, the VFD "equipped" system could operate at 79.3% fan speed and not exceed the energy consumed by the time of day cycling.

VFD's applied to evaporator fan motors have the potential to conserve large amounts of energy. And this saving is multiplied when you consider unnecessary heat is never allowed to enter the refrigeration system.

Defrost Smarter

Do you defrost the way your Grandfather, or someone else's grandfather, did? Are you defrosting the same way you did 20 or 30 (or more) years ago? Welcome to the 21st Century! We have better and smarter ways to defrost evaporators. One of those ways is to utilize Liquid Drainers.

Table 6 lists many of the advantages of utilizing Liquid Drainers for defrosting. Three of the biggest benefits are:

1. The ability to allow condensing pressures to fall as low as the 120 PSIG range while maintaining quality defrosting, and
2. The fact the liquid defrost drainer passes virtually no high pressure vapor (a.k.a. hot gas) into the "lowside" of the refrigeration system thereby preventing the adding of non-useful work to the refrigeration system, and
3. When defrosting is complete the liquid drainer is self terminating and stops draining, i.e. no "artificial" gas load is imposed on the refrigeration system due to a timer not being satisfied.

When a liquid drainer style of defrost is chosen, the defrost piping network pressure can be set to operate at 75 to 100 PSIG with most evaporators. This "frees" the system from changes in vapor flow rates due to condensing pressure fluctuations.

Liquid drainer style defrosting relies on the latent energy required to condense vapor, not the sensible heat of large volumes of vapor passing (and condensing) through an evaporator. And, since liquid drainers are designed to drain and transfer liquid refrigerant, a liquid drainer style of defrost can be forgiving if the evaporator is not completely evacuated prior to the beginning of the defrost period.

Use Liquid Drainers for Defrosting

Advantages

- Simple
- Suitable for all temperatures
- Suitable for all refrigerants
- Quick
- Self terminating
- Little defrost vapor escapes
- Very "Green"
- Returns "usable" liquid to system
- Somewhat immune to changes in discharge pressure

The most efficient form of hot gas defrost as virtually all defrost vapor bypass compressors and condensers

Table 6

Liquid drainer defrosting has been advocated since the early 1980's as a proven technology. I know from personal experience liquid drainer defrosting works and works quite well.

Photograph 1

In Photograph 1, the drainer is shown beneath an evaporator. A liquid drainer's location is not limited to a gravity drain position beneath the evaporator. There are many liquid drainers located above evaporators at the valve stations on the roof above. There is a small penalty to be paid as there is the requirement to "push" the condensed refrigerant uphill. However, the advantages of the low vapor supply pressure and the self-terminating defrost considerably outweigh the pressure penalty.

Be Energy-Wise

Consider equipping your evaporators with defrost hoods. A defrost hood fitted to a penthouse style evaporator is shown in Photograph 2. A defrost hood benefits your evaporator in several ways.

First it contains the heat resulting from the defrost cycle. The defrost heat is "captured" as it cannot rise and disperse within the refrigerated space. Defrosting time is improved as the defrost heat is held in close proximity of the evaporator's coil. A larger amount of the defrost heat does useful work. A reduced amount of high pressure vapor flow is required. The "non-useful" high pressure vapor load imposed on the cooling system is reduced.

Secondly, a defrost hood minimizes the potential for moisture, resulting from the defrosting cycle, transferring from one evaporator to another. And trapping the moisture within the defrost hood also prevents this moisture from freezing to the structure, walls and roof of the refrigerated enclosure.

Energy Savings continued on page 27

Energy Savings continued from page 25

Photograph 2

Lastly: Clean your evaporators! This is probably the easiest thing to do and the least done. No one would install an evaporator with dirt and grime attached to the tubes and fins. And we can all agree a clean evaporator is more efficient in heat transfer and moves more (or the proper amount of) air. Why then do we tolerate dirty evaporators?

A private test at a grocery distribution facility indicated the following after a "good" cleaning of dock evaporators: Air leaving the evaporator decreased by 6.5F°; Air velocity increased by 64%; The evaporator's capacity increased by +/–30%.

I cannot substantiate the values above. I do not know firsthand the condition of the evaporators prior to the cleaning. I can tell you simple mechanical common sense would indicate a clean coil does more cooling than a dirty coil. I do know the owner was so pleased with the results the other evaporators were cleaned.

Cleaning an evaporator may not be exciting work, but the benefits cannot be denied. Most facilities have a maintenance staff or a scheduled third party maintenance service. Put "clean evaporators" on the list of maintenance procedures. Real benefits can be derived from a small investment in time.

Conclusion

Evaporators do not operate in a vacuum (no pun, or a rewriting of the thermophysical laws, is intended). Like every other mechanical device in the system, their application and their maintenance can either add to cost of operation or reduce the cost of operation. You can make the decision as whether to add or reduce the operating cost of your, or your customers' refrigeration system.

Reducing the cost of evaporator operation really is not difficult. But, like all the other components within a refrigeration system, an evaporator's operation simply requires the attention it is rightfully due. ear

Government Affairs continued from page 12

extended for an unspecified amount of time to allow OSHA to finish its evaluation of the pilot and determine the future of the program. It is anticipated that the agency will issue a new directive regarding the program in the coming weeks. While the agency has not made any formal announcements on the direction of the Chemical NEP, it is expected that OSHA will expand the program outside the original regions implicated in the pilot. IIAR President Bruce Badger and Lowell Randel have met with OSHA representatives in Washington and in regional offices on a number of occasions to provide feedback and input on the implementation of the NEP. IIAR will continue to engage with OSHA as it determines the future of the NEP and keep IIAR members informed.

IIAR Leadership Meets with New Jersey Department of Environmental Protection

Peter Jordan, IIAR Chairman of the Board of Directors, along with Past Chairman Larry Basil and Lawrence Cuomo of Dean Foods, IIAR President Bruce Badger, and Lowell Randel met with representatives of the New Jersey Department of Environmental Protection (NJDEP). The purpose of the meeting was to initiate a dialogue on state policies regarding ammonia and highlight challenges facing current and prospective industrial refrigeration facilities in New Jersey. The group discussed current NJDEP policies and how they are making it difficult for companies in the industrial refrigeration business to work in New Jersey. The group also discussed the availability of IIAR technical resources and how they could benefit NJDEP, including potential training of inspectors. The meeting was seen as a successful first step to build relationships in the state with the most restrictive policies towards ammonia.

Chemical Facility Security

The Chemical Facilities Anti-Terrorism Standards (CFATS) program continues to operate under a one year extension of authority which will expire in October 2010. The House passed legislation in 2009 to reauthorize the program, which included provisions of concern such as requirements for Inherently Safer Technology (IST). In July 2010, the Senate Committee on Homeland Security and Government Affairs moved to consider CFATS reauthorization. Ahead of Senate committee action, IIAR Government Affairs issued an action alert to IIAR members urging them to contact Senators to support legislation offered by Sen. Collins that would reauthorize the program without IST requirements. The committee ultimately passed a slightly revised version of the Collins bill that does not include IST. Timing for action by the full Senate is uncertain, and even if the Senate passes their version before the CFATS authority expires. The House and Senate versions were not reconciled before the mid-term elections in November which means that another one year extension of the current CFATS program is a likely outcome. ear

GreenChill continued from page 23

technologies, strategies, and practices. GreenChill has a monthly webinar series with expert speakers on commercial refrigeration topics of interest, a LinkedIn Group to promote information sharing, a website with GreenChill best practices guidelines and other information, quarterly partner meetings and, in future, monthly partner roundtable discussions.

GreenChill and Natural Refrigerants

As GreenChill approaches its third year, commercial refrigeration technologies using carbon dioxide and ammonia are gaining the interest of supermarket refrigeration engineers in the United States. GreenChill partners have five carbon dioxide cascade systems in use now in the United States, three of which are GreenChill-certified. Carbon dioxide is used as a secondary fluid in an increasing number of low-temperature secondary loop commercial systems in supermarkets. There are, as of yet, no ammonia commercial refrigeration systems in U.S. supermarkets, but the interest is there. GreenChill's July and August webinars were on carbon dioxide and ammonia commercial refrigeration systems for supermarkets. Finally, discussions on GreenChill's LinkedIn Group often feature an exchange of information on natural refrigerants.

Natural refrigerant use in industrial refrigeration systems is widespread in the U.S. Natural refrigerant use in supermarket commercial systems in Europe, Japan, and Australia is widespread. So why aren't more natural refrigerants used in supermarket commercial systems in the U.S.? The answer, according to GreenChill, is a combination of real and perceived hurdles particular to the U.S. supermarket industry. The perceived hurdles can be overcome with information. The real hurdles can be overcome if the will is there. And it seems that the will may finally be there if GreenChill is any indication.

Natural Refrigerant Hurdles in U.S. Supermarkets

The number one hurdle is probably the confusing regulatory landscape in the U.S. Supermarkets must understand and observe the differing state and local regulations and codes for each and every store location, plus of course understanding and observing federal law. Much of this issue is perception. U.S. supermarkets are used to the laws and regulations that pertain to HCFC and HFC refrigerants. No one is eager to jump into a whole new can of worms. The benefits of "new" refrigerants would have to be measurable and worth it for supermarkets to voluntarily wade in there. Some of the issue is a real hurdle. Carbon dioxide was only recently found acceptable by EPA's Significant New Alternative Policy Program (SNAP) for use as a primary refrigerant in commercial refrigeration. The SNAP Program found ammonia use as a primary refrigerant in supermarket secondary loop systems to be acceptable back in the mid nineties.

There are no major deterring regulations for the use of ammonia in supermarkets; however its classification as a B2 refrigerant restricts it from being used in occupied spaces. This can be bypassed however through the installation of a rooftop ammonia chiller, allowing any leaks to be safely directed to the atmosphere. In addition ammonia would not be subject to the OSHA and EPA's Safety Management Plan which is only required for refrigerants over 10,000 pounds (whereas supermarkets would utilize only around 200 pounds of ammonia). Also, isolating the system to an outdoor unit allows the system to be classified as "low probability" by the International Mechanical Code (IMC), thereby exempting it from IMC ammonia restrictions.

Another hurdle is higher system costs. This hurdle must not be underestimated in an industry with very low profit margins. Because a lot of the equipment for commercial systems that use natural refrigerants must be imported from overseas, costs can be high for the first supermarkets to try these systems. Once the use of natural refrigerant equipment becomes more mainstream, the prices would be expected to fall. In addition, installation costs can be higher at first due to the need for commercial refrigeration service technicians to become used to working with new systems. Some believe that stores may be able to save in other areas, such as energy costs and lower maintenance costs, with these systems, but until hard data is available to prove that, such arguments are unpersuasive to many.

Training and education are always factors to be considered with new refrigerants and new refrigeration technologies. The lack of training can be a catch-22 situation. The lack of trained service technicians for a new technology is seen as a reason to avoid that technology; yet until stores exist with a new technology, there are few opportunities to receive the necessary training. Many HVACR professionals are familiar with ammonia, but their knowledge is limited to industrial systems. With adequate training this can be overcome, but first the demand for this knowledge must be there. Commercial refrigeration service technicians tend to fear the high operating pressures of CO_2 systems. The only way to overcome this hurdle is through direct experience with these systems.

Finally, there is definitely a fear of increased corporate liability with ammonia and CO_2 systems. Liability concerns are present with respect to shoppers and employees. An ammonia system where the ammonia is confined to rooftop units, with only glycol or CO_2 circulating through the sales area should take care of the fear of liability for harm from ammonia to shoppers. Ammonia's strong odor should minimize the danger of employees being overcome by ammonia fumes, as the odor is detectable well below the level deemed toxic. Further, safety standards developed for the industrial sector would be implemented to minimize risks.

With some will and work, the use of ammonia in supermarkets could develop into a common practice. This would be good not only for the environment and end user's bottom lines, but it would also help the entire spectrum of the ammonia and CO_2 refrigeration industry become more widely and easily accepted. **iar**

From the Technical Director

by Eric Smith, P.E., LEED AP, IIAR Technical Director

Consultants have called the IIAR headquarters a few times recently with the following question: "I have an owner who has a building with two ammonia refrigeration systems. The systems are independent of each other. Both systems have charges of less than 10,000 lbs. of ammonia, but if the charges were added, the total inventory would meet or exceed the 10,000 lb. threshold limit established by federal OSHA Process Safety Management (PSM) and EPA Risk Management (RM) program requirements. Should a PSM and RM program be developed for this facility?"

The short answer is probably, but not necessarily.

The OSHA PSM standard requires a facility to develop a PSM program if the facility contains "A process which involves a chemical at or above the specified threshold quantities listed in Appendix A…" The threshold level for ammonia listed in Appendix A is 10,000 pounds. The OSHA PSM standard provides the following definition for a process:

> "Process" means any activity involving a highly hazardous chemical including any use, storage, manufacturing, handling, or the on-site movement of such chemicals, or combination of these activities. For purposes of this definition, any group of vessels which are interconnected and separate vessels which are located such that a highly hazardous chemical could be involved in a potential release shall be considered a single process.

EPA's definition of process is identical to the definition of process under the OSHA PSM standard.

Understanding the definition of process is important in determining whether you are covered by the PSM Standard and the RM Program regulation. What this means for end users is that:

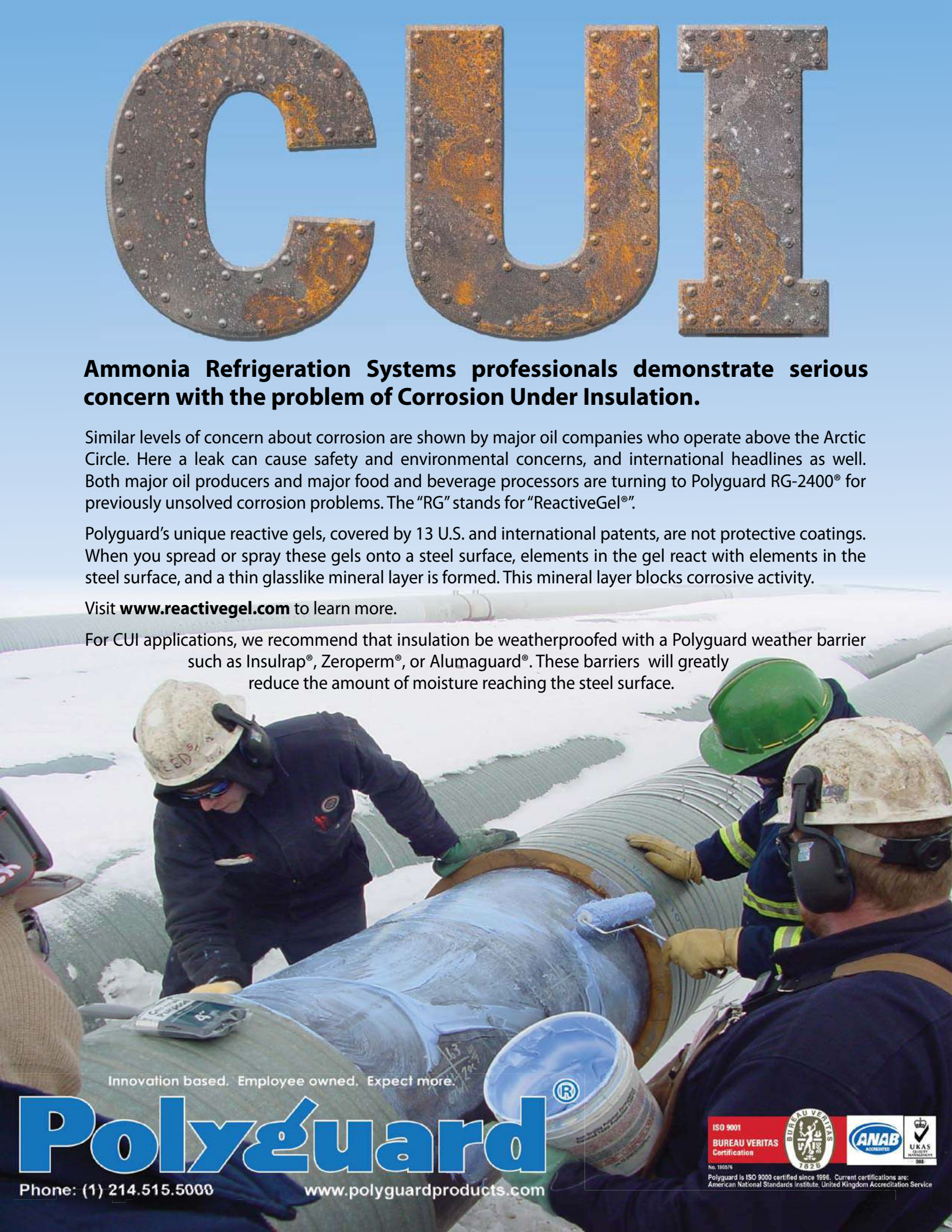
1. If you have a single ammonia refrigeration system in the United States and this system contains 10,000 pounds or more of anhydrous ammonia that system is covered by federal PSM and RM Program requirements.

2. If you have two (or more) separate ammonia refrigeration systems which are interconnected the separate systems should be considered a single "process". If the combined ammonia inventory is above 10,000 pounds the separate systems are covered by federal PSM and RM Program requirements. The connections between the systems need not be permanent. Even if two or more vessels are connected occasionally, they are considered a single process for the purposes of determining whether a threshold quantity is present.

3. If you have two (or more) unconnected ammonia refrigeration systems, you will have to determine whether the systems need to be considered "co-located". The key question is whether the systems are located such that they could be involved in a single release. For example, could a release from one of the systems lead to a release from the other system? Alternatively could a single event (such as a fire, explosion, or collapse of a building) have the potential to release ammonia from multiple ammonia refrigeration systems? You must determine if there is a credible scenario that could lead to an ammonia release of 10,000 pounds or more from the multiple systems.

   A release from one ammonia refrigeration system will not normally lead to a release from a different system unless a vessel or pipe catastrophically fails sending metal fragments into the other system. Co-located ammonia refrigeration systems could, however, be involved in a release caused by a fire or explosion from another source, for example a fire which affects the entire building or a roof collapse. You should not dismiss the possibility of fire spreading based on the assumption that the Fire Department or your sprinkler system will prevent any spreading. You should ask yourself how far the fire would spread if the worst happens – the Fire Department decides to let the fire burn our or water is not available. Thus if you have separate systems which could be affected by the same accident (i.e. the systems are considered co-located) and the combined ammonia inventory is above 10,000 pounds the separate systems are covered by federal PSM and RM Program requirements.

4. If you have two (or more) ammonia refrigeration systems which are not interconnected and are not co-located and the anhydrous ammonia inventory of each system is below 10,000 pounds, you will not have to comply with the federal PSM standard or the RM program regulation. You may, however, still have to comply with state regulatory requirements. In addition, the IIAR suggests that you voluntarily comply with Ammonia Refrigeration Management (ARM) program. The ARM program is a voluntary program developed by the IIAR designed to help facilities manage their ammonia refrigeration system in a safe and responsible manner.



Ammonia Refrigeration Systems professionals demonstrate serious concern with the problem of Corrosion Under Insulation.

Similar levels of concern about corrosion are shown by major oil companies who operate above the Arctic Circle. Here a leak can cause safety and environmental concerns, and international headlines as well. Both major oil producers and major food and beverage processors are turning to Polyguard RG-2400® for previously unsolved corrosion problems. The "RG" stands for "ReactiveGel®".

Polyguard's unique reactive gels, covered by 13 U.S. and international patents, are not protective coatings. When you spread or spray these gels onto a steel surface, elements in the gel react with elements in the steel surface, and a thin glasslike mineral layer is formed. This mineral layer blocks corrosive activity.

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