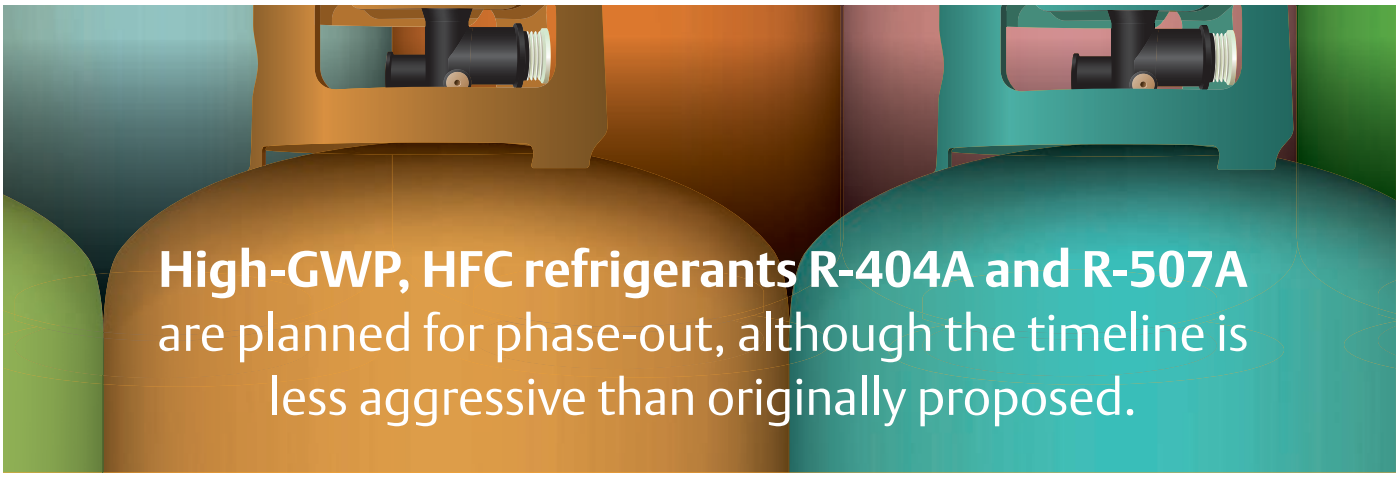
Delist, Delay, Decipher

Coming to terms with the EPA's refrigerant rulings

Dr. Rajan Rajendran, Vice President of System Innovation Center and Sustainability for Emerson Climate Technologies, is one of the most respected, global authorities on refrigerants, particularly in commercial refrigeration applications. In this article, he explores the implications of the EPA's final rule on refrigerant delisting and discusses likely replacement alternatives.



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If you're in the commercial refrigeration business, you've witnessed a turbulent regulatory environment over the last few years. Some, me included, have even referred to it as a perfect storm. The Environmental Protection Agency's (EPA) recent Significant New Alternatives Policy (SNAP) refrigerant delisting rule (Federal Register Vol. 80 No. 138, July 20, 2015, 42870-42959) is fresh in our minds, but it comes within a broader context of other significant rulings.

At the eye of the storm you'll find two primary issues: refrigerants and energy efficiency. Competing for our undivided attention are the EPA's recent SNAP rulings and the Department of Energy's (DOE) energy efficiency mandates — all of which have major implications to our industry.

The EPA's moves are just the most recent steps the agency has made under the authority of the Clean Air Act (CAA), a law enacted by Congress in 1970 to limit air pollutants. Public awareness of environmental concerns grew in the 1990s when scientific evidence of ozone depletion brought the dangers associated with aerosols and refrigerants to light.

The ozone depletion potential (ODP) of these substances became the subject of the Montreal Protocol, an international treaty proposed in the 1990s to phase out and ultimately ban refrigerants based on chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) compounds. ODP also became one of the EPA's criterion used to evaluate a refrigerant's potential risk to the environment.

Today, as environmental focus has grown to include global warming concerns, the EPA has also added global warming potential (GWP) as another important environmental indicator.

There are many sources of chemicals and pollutants that could lead to climate change, but hydrofluorocarbon (HFC) refrigerants have the greatest impact on our industry. High-GWP HFCs like R-404A have been the target of regulations all around the globe; here in the U.S., the EPA has spearheaded the effort to reduce the use of these HFCs.

It's Official: The SNAP Refrigerant Delisting Is Final

Let's start with a closer look at the EPA's recent SNAP delisting ruling and explore what it means to our industry. When the original proposal was published on August 6, 2014, it created quite a stir in commercial refrigeration. Among other things, it proposed changing the status of three of the most commonly used refrigerants: R-404A, R-507A and HFC-134a, all typically found in stand-alone, reach-in and walk-in units, as well as traditional rack refrigeration systems.

The industry as a whole responded with resounding calls for caution via the EPA's NOPR (Notice of Public Rulemaking) commenting process. In addition to numerous private companies like Emerson Climate Technologies, industry associations such as the American Heating and Refrigeration Institute (AHRI) and the North American Association of Food Service Manufacturers (NAFEM) submitted comments to the public record.

Earlier this summer, AHRI (with me as a delegate) was invited to discuss the potential ramifications of this ruling with the Office of Management and Budget (OMB) of the White House. They were well-informed on the complexity of the issues at hand and listened intently to our concerns. In addition, Emerson Climate Technologies and other industry constituents participated in many EPA meetings leading up to this ruling, and have had many conversations with policy makers to voice our concerns and opinions.

Based on the nature of the final ruling, it's clear the industry's collective caution contributed to a less severe delisting timeline than what was originally proposed.

High-GWP, HFC refrigerants R-404A and R-507A are planned for phase-out in certain end uses, although the timeline is less aggressive than originally proposed. For example, in supermarket racks, the R-404A/R-507A ban was pushed from 2016 to 2017. It's important to note that the EPA addresses new and retrofit systems differently, so be sure to familiarize yourself with that distinction (see Table 1).

An important distinction of the EPA's final rule regarding service of existing systems is worth noting: "existing systems may continue to be serviced and maintained for the useful life of that equipment using the original refrigerant." This is a very good thing.

Stand-alone applications — which include low- and medium-temperature, reach-in and walk-in units — now have some wiggle room to comply, but aren't without complications. In low-temperature, stand-alone systems, several new (and natural) refrigerants are approved for use, including: R-448A, R-449A, R-290 and R-744 (CO_2). HFC-134a is still allowable in low-temperature systems, although new refrigerant blends R-450A and R-513A represent viable alternatives. Some of these refrigerants have high compressor discharge temperature issues; others have low capacity problems.

It is also worth noting that R-448A and R-449A, while recently SNAP-approved in most commercial refrigeration applications, were not approved for medium-temperature, stand-alone applications. Medium-temperature, stand-alone systems face the challenge of having to design with low-capacity refrigerant blends or move to hydrocarbons (or hydrocarbon blends), which are charge-limited flammable gases.

The EPA's final delisting ruling also calls for bans on foam-blowing agents, such as those commonly used in insulation for commercial reach-in refrigeration units. Among the plastic-based foams listed include rigid polyurethane and rigid polystyrene with a delisting date of 2020. Please see Table 8 on page 55 of the EPA's final rule for a complete listing of all the changes.

New Approved Refrigerant Substitutes

While the SNAP delisting rule is grabbing all the headlines, the EPA has also finalized three other SNAP rulings in the past year that approve new refrigerant substitutes

Emerson Perspective: EPA FINAL RULE ON DELISTING—Phase-out Candidates*, Likely Alternatives* and Dates

EMERSON Climate Technologies

Phase-out Refrigerant	Supermarket New[1]	Supermarket Retrofit[2]	Remote CDU New	Remote CDU Retrofit[2]	Stand-alone			
					MT <2,200 BTU/hr. and not contain flooded evap. New	MT ≥2,200 BTU/hr. with or without flooded evap. New	LT New	LT and MT Retrofit[2]
R-404A/507A	**Jan. 1, 2017**	**July 20, 2016**	**Jan. 1, 2018**	**July 20, 2016**	**Jan. 1, 2019**	**Jan. 1, 2020**	**Jan. 1, 2020**	**July 20, 2016**
R-410A	OK	–	OK	–	**Jan. 1, 2019**	**Jan. 1, 2020**	**Jan. 1, 2020**	–
R-407A/C/F	OK	OK	OK	OK	**Jan. 1, 2019**	**Jan. 1, 2020**	**Jan. 1, 2020**	OK
HFC-134a	OK	OK	OK	OK	**Jan. 1, 2019**	**Jan. 1, 2020**	OK	OK
Likely Alternatives								
R-448A/449A	OK	OK	OK	OK	**Neither SNAP-approved, nor banned**	**Neither SNAP-approved, nor banned**	OK	OK for LT only
R-450A/513A	OK	OK	OK	OK	OK	OK	OK	OK
R-290	–	–	–	–	OK	OK	OK	–
R-744	OK	–	OK	–	OK	OK	OK	–
R-717	OK (in primary loop of secondary CO_2 system)	–	OK (in primary loop of secondary CO_2 system)	–	–	–	–	–

* Abbreviated; see EPA final rule for complete listing.

[1] The EPA defines the term "new" as follows: "The date upon which the refrigeration circuit is complete, the system can function, the system holds a full refrigerant charge, and the system is ready for its intended purpose."

[2] The EPA defines the term "retrofit" as follows: "The use of a refrigerant in an appliance (such as a supermarket) that was designed for and operated using a different refrigerant." Further, the term retrofit "does not apply to upgrades to existing equipment where the refrigerant is not changed."

Table 1: *The EPA's much-anticipated SNAP ruling on refrigerant delisting is now final. While the nature of the ruling has moderated from the original proposal, the change of listing status will take place between the 2017–2020 time frame — a schedule that still presents significant challenges for the commercial refrigeration industry.*

Emerson Perspective:
SNAP-APPROVED REFRIGERANT REPLACEMENTS

EMERSON Climate Technologies

New Refrigerant	Class	Replaces	Application
R-170 (ethane)	A3	n/a	Very low-temp refrigeration
R-600A (isobutane)	A3	HFC-134a	Reach-ins, walk-ins, freezers
R-290 (propane)	A3	n/a	Reach-ins, walk-ins, freezers, vending machines
R-441A (hydrocarbon blend)	A1	HFC-134a	Reach-ins, walk-ins, freezers
R-448A (HFC/HFO)	A1	R-404A	Supermarket (racks), reach-ins, walk-ins (low-temp)
R-449A (HFC/HFO)	A1	R-404A	Supermarket (racks), reach-ins, walk-ins (low-temp)
R-513A (HFC/HFO)	A1	HFC-134a	Supermarket (racks), walk-ins, reach-in units
R-450A (HFC/HFO)	A1	HFC-134a	Supermarket (racks), walk-ins, reach-in units

Table 2: *The EPA has approved several new low-GWP refrigerants through its recent SNAP rulings, including natural alternatives and new refrigerant blends. Their intent was to replace recently delisted R-404A and HFC-134a in specific applications. Note that the natural options are classified as A3 (flammable), while the blends are class A1 (non-toxic, non-flammable).*

in commercial refrigeration (see Table 2). The first two rulings cleared the way for several approved alternatives having a GWP ranging from 3 to 675 and include: R-170 (ethane), R-600A (isobutane), R-290 (propane), R-441A (hydrocarbon blend) and R-450A (HFC/HFO blend). The first three in this list are considered "natural" refrigerants with very low GWP/ODP, but are also class A3 (flammable).

A third ruling, which was recently approved this summer, introduced additional class A1 (non-flammable) refrigerants to the mix: R-448A, R-449A and R-513A. R-448A and R-449A are blends of HFC/HFO, and are considered a suitable replacement in several applications that traditionally used R-404A and R-507A. Prior to this announcement, Emerson Climate Technologies successfully performed research, development and testing to prepare our Copeland Scroll™ and Copeland Discus™ compressors for use with R-448A and R-449A. These units are now ready for market.

With a GWP of less than 600, R-513A and R-450A are HFC/HFO blends designed to potentially replace HFC-134a. While HFC-134a is an effective refrigerant in medium-temperature applications, it has a lower capacity than R-404A and operates below atmospheric pressure under most low-temperature conditions—the reduced capacity results in equipment size increases up to ~35 percent, and the lower pressure leads to a greater potential for refrigerant leak-related issues.

It's important to note that none of these new refrigerant alternatives are "drop-in" substitutes for retrofitting. Equipment must be specifically designed, evaluated and tested for use with these new refrigerants. We recommend that you check with the equipment and component manufacturers before any retrofit to ensure that all proper guidelines are being followed.

How the DOE and EPA Rulings Interact

Energy efficiency and refrigerant choice are highly dependent variables in a refrigeration system. One of the biggest challenges the industry has grappled with is the close timing between the EPA's SNAP rulings and the DOE's energy reduction mandates on stand-alone commercial refrigeration systems (see Table 3). Not only must we concern ourselves with which refrigerants to use, we also have to comply with the DOE's efficiency requirements.

For example, a medium-temperature, stand-alone case using R-404A will be subject to compliance with the DOE's energy reduction rule by March 27, 2017. The same case will also have to transition to an EPA SNAP-approved refrigerant by Jan. 1, 2019 (see Table 2).

As an industry, there are several important questions we need to consider to approach this challenge. First, how will we meet the DOE's energy efficiency requirements using this new class of approved refrigerants? To qualify as a suitable alternative in new self-contained systems, refrigerants will need to comply with energy efficiency requirements and be capable of production on a mass level.

Second, and more importantly, how can we combine our product evaluation and qualification efforts to satisfy both sets of requirements in one step? The last thing we want is to develop solutions and systems that meet DOE compliance today, and then

repeat that exercise in 2 to 3 years for the EPA. This scenario would result in unnecessary costs and duplication of efforts.

Finally, are there enough resources at the component suppliers, equipment manufacturers and test laboratories to handle the increased workload of the qualification process? Let us not forget that this process is linear. We first need the refrigerants to be made available and components to become widely produced — only then can equipment manufacturers begin to test, approve and place new equipment into production. To the extent possible, our objective should be to pursue refrigeration technologies that achieve both DOE and EPA regulatory compliance at once. This will be no small task.

Continued Stewardship Is Needed

If there's a silver lining to the dark clouds of this regulatory storm, it's been the opportunity for the industry to make its many voices heard. I mentioned our discussions with the OMB earlier this summer. It was our second visit, the first of which took place last September when the 2014 SNAP ruling on delisting was in the NOPR phase.

The meetings we've been a part of were well attended by EPA and DOE leaders, Congress and Senate members, refrigeration industry associations (such as NAFEM and AHRI) and a select number of representatives from other private companies.

At the September 2014 meeting, the White House asked us to develop a list of action items to demonstrate our commitment to their environmental and energy efficiency initiatives. Among these was the development of a new innovation center and continued research in CO_2-based refrigeration systems. We will present our progress to them this October when Emerson Climate Technologies Executive Vice President Bob Sharp and I attend the next White House meeting.

As we navigate the next few years, ongoing industry participation in regulatory decisions will continue to be critical — not only here in the U.S., but in Canada, the E.U. and the Middle East. Our industry has many decisions to make in the next few years about which refrigeration system technologies will take us into the future. In this increasingly global marketplace, we all must play an active role in shaping refrigeration strategies that meet our environmental, economic and energy efficiency objectives.

Emerson Perspective:
EPA'S FINAL RULE AND DOE ENERGY REGULATION TIMING

EMERSON Climate Technologies

Phase-out Refrigerant	Super-market New	Super-market Retrofit	Remote CDU New	Remote CDU Retrofit	Stand-alone			
					MT <2,200 BTU/hr. and not contain flooded evap. New	MT ≥2,200 BTU/hr. with or without flooded evap. New	LT New	LT and MT Retrofit
R-404A/507A	Jan. 1, 2017	July 20, 2016	Jan. 1, 2018	July 20, 2016	Jan. 1, 2019	Jan. 1, 2020	Jan. 1, 2020	July 20, 2016
R-410A	OK	–	OK	–	Jan. 1, 2019	Jan. 1, 2020	Jan. 1, 2020	–
R-407A/C/F	OK	OK	OK	OK	Jan. 1, 2019	Jan. 1, 2020	Jan. 1, 2020	OK
HFC-134a	OK	OK	OK	OK	Jan. 1, 2019	Jan. 1, 2020	OK	OK
DOE Energy Reduction Compliance			**Jan. 1, 2020 (Walk-in)**		**March 27, 2017**	**March 27, 2017**	**March 27, 2017**	

Table 3: *Both DOE and EPA rulings take effect in the 2017–2020 time frame. But, the effective dates of respective rulings don't necessarily correspond. To avoid a duplication of efforts, OEMs should attempt to satisfy both requirements in one product development cycle.*