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REFRIGERATION ENGINEERING NEWS *from* **emanuelson-podas** | Q1.24

The Switch to A2L Refrigerants: How It Impacts You

You've probably heard some buzz about A2Ls. These nontoxic, mildly flammable refrigerants are increasingly viewed as a climate friendly alternative to hydrofluorocarbon refrigerants. HFCs are among the most detrimental and longest lasting greenhouse gases.

Efforts to slow climate change have led governments around the world to curb the use of HFCs: In 2021, the U.S. Environmental Protection Agency issued regulations aimed at achieving an 85% nationwide phasedown in HFC refrigerants by 2036. Businesses whose operations rely on refrigeration — from grocery stores to ice rinks, manufacturers to medical facilities — may want to know what's required to comply with the mandates.

EP refrigeration expert Kevin Galbraith has been watching the situation unfold and fielding questions from clients. We recently asked him for some answers to common questions.

What are A2Ls?

ASHRAE classifies refrigerants by both toxicity (A, B) and flammability (1, 2, 2L, 3). A is non-toxic while B is toxic. 1 is least flammable and 3 the most flammable. A1 refrigerants have long been the gold standard in cold storage, because of their low toxicity and flammability, but growing concerns about the environmental impact of A1 refrigerants have piqued interest in alternatives. A2Ls are considered the next best thing in refrigeration, with a slight increase in flammability, but no increase in toxicity and lower global warming potential (GWP). As a category, A2Ls include hydrofluoroolefins (HFOs) and hydrocarbons.

Are A2Ls really better than A1s?

From a climate point of view, A2Ls definitely outperform A1s. In some cases (take R134A, for example), A2L refrigerants may reduce GWP by up to 99%.

Depending on the application, some A2L refrigerants also have higher cooling efficiency, which may translate into significant cost savings. Like A1s, A2Ls are considered safe and easy to use for most refrigeration applications.

What about flammability concerns?

A2L refrigerants have a low flame speed and a low heat of combustion. PPE and proper training are, of course, recommended for anyone involved in maintenance and installation.

	Lower Toxicity	Higher Toxicity
No Flame Propogation	**A1**: CFC, HCFC, most HFCs	**B1**: Seldom used
Lower Flammability	**A2L**: Most HFOs, R32	**B2L**: Ammonia
Flammable	**A2**: R152	**B2**: Seldom used
Higher Flammability	**A3**: Hydrocarbons	**B3**: No refrigerants

Refrigerant classification per ASHRAE 34

Do I need to make immediate changes to existing systems?

No immediate changes are required. Low GWP refrigerants are required for new systems and significantly remodeled systems beginning in 2026 (or 2027 for supermarkets). Significant remodels are defined as replacement of 75% or more of existing systems evaporators or adding load to an existing system. If you're thinking about investing in new equipment or upgrades, A2Ls will be an option. The GWP maximum for air conditioning is 700, however for refrigeration the maximum is 300 for low charge systems less than 200 pounds and for the high temperature side of cascade systems. For refrigeration systems exceeding 200 pounds of charge, the GWP maximum is 150. This significantly limits the available refrigerants for a typical supermarket or cold storage rack system.

What should I think about going forward?

Switching to A2Ls will involve changes in equipment designs, changes to machine room ventilation, pipe building and testing, and leak alarming. The suitability of your replacement will depend on the application, safety considerations, federal and local regulatory requirements and other factors. To minimize disruption to your businesses and customers, consult a refrigeration engineer with knowledge on the latest developments in refrigerant regulations and technologies. Research and development in this area is ongoing and changing rapidly.

Got a question about A2Ls? Email EP refrigeration engineer Kevin Galbraith at kgalbraith@epinc.com.

COMMONLY USED A2Ls

R32: Significantly lower GWP compared to R-410A and, in many applications, a relatively straightforward replacement for R-410A for air conditioning.

R1234yf: This HFO has a GWP of 1. Single component. No glide.

HFO/HFC Blends: These manufactured blends perform similarly to traditional refrigerants but have lower environmental impact.

R454A: Blend of R32 (68.9%) and R1234yf (31.1%) with a GWP of 238, which is lower than the threshold required for low charge refrigeration (less than 200 pounds). Comparable to or better than R404A for efficiency and capacity. Has approximately 9 degrees of glide.

R455A: Blend of R32, R1234yf, and CO2 (3%). Able to be used for low and medium temperature refrigeration. Ultra Low GWP at 146 allows consideration for large charge refrigeration systems. Similar to R404A for low temperature refrigeration, however it does have very high glide at 20+ degrees.

R516A: Blend of R1234yf, R-134A, R-152a. Ultra Low GWP of 131. Is an Azeotropic and has zero glide. Temperature and pressure fits well for medium temperature use.

Engineers + Manufacturers = Project Success

When a new refrigeration system operates correctly, it means three things have come together in perfect balance: the client's needs, the design engineer's expertise, and the manufacturer's knowledge. Collaboration is key to developing a system that functions properly in every way. If the client, designer, and manufacturer aren't in sync, what gets built will likely not meet your expectations.

Our process for designing refrigeration systems begins and ends with the client, of course. Initially, we assess our clients' goals, technical requirements, maintenance capabilities, and existing systems. Once those parameters are established, however, we quickly pivot to a conversation about manufacturers and with manufacturers.

The commercial refrigeration sector is dominated by roughly half a dozen players, and each manufacturer brings particular features and experience to the table. EP's refrigeration design team has worked closely with representatives from every manufacturer, equipping us with a level of knowledge that allows us to select and tailor a system that meets each client's specific needs.

Close collaboration between your refrigeration design team and equipment representative provides numerous benefits:

- **Technical Expertise:** Refrigeration design engineers possess specialized knowledge and expertise in designing refrigeration systems, including understanding thermodynamics, heat transfer, and refrigeration principles. Our expertise ensures that the equipment vendor's products are integrated effectively into the overall system design.
- **System Optimization:** Refrigeration design engineers can optimize the selection and configuration of the equipment vendor's products within the refrigeration system to maximize performance, efficiency, and reliability. This optimization enhances the overall system's functionality and ensures it meets the specific needs of the customer.
- **Customization:** Working with an engineer allows equipment vendors to tailor their products to meet the unique requirements of individual projects. This customization can include adapting equipment specifications, configurations, or controls to ensure compatibility with the overall system design and customer preferences.

- **Problem Solving:** Design engineers are skilled at troubleshooting and resolving technical challenges that may arise during the design and implementation of systems. Our involvement can help equipment vendors anticipate and address potential issues early in the process, minimizing delays and ensuring customer satisfaction.

This three-way conversation between owner, engineer, and manufacturer results in a system that is ultimately right for the client and the client's needs.

Early Project Considerations:

- Budget
- Load, Refrigerant, Defrost, Ambient Conditions
- Size and location
- Control systems
- Project delivery schedules
- Maintenance

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