
"SAFER" REFRIGERANTS REVISITED

Leak detection and safe handling practices are as important with alternative refrigerants as with the refrigerants they are replacing.

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On Tuesday, October 17, 2017, three people died due to an ammonia leak at an ice rink in Fernie, British Columbia, Canada. While the Fernie investigation¹ was still ongoing there were calls to replace all ice rink ammonia refrigeration systems in Canada with "safer" alternatives.

Since the Fernie incident, there have been several additional fatal accidents involving ammonia refrigeration systems, including the Lineage Logistics incident in Statesville, NC, U.S. in January 2020, and the Arctic Glacier incident in Kamloops, British Columbia, Canada, on May 26, 2022. These continuing incidents only serve to increase the calls for "safer" refrigerants.

Several articles found on the internet point to Freon refrigerants as a safer alternative. But, what the articles fail to point out is that not only are these refrigerants being phased out, but that they too have their own inherent risks.

Chlorofluorocarbon refrigerants are being phased out as part of the 1987 Montreal Protocol due to their tendency to deplete the ozone layer. Hydrofluorocarbons, or HFCs, are being phased out due to their "Global Warming Potential," or GWP, as part of the Kyoto Protocol.

Safety Applies to All Gases

Ozone depletion and global warming are broad, long term, risks, however, refrigerants continue to pose more immediate risks. While not caustic like ammonia, CFCs and HFCs will, like ammonia, cause frostbite on bare skin. When exposed to high temperatures, CFCs and HFCs will decompose into toxic byproducts, including halogen acids such as hydrofluoric acid.

While the exposure limits for these refrigerants are significantly higher than ammonia, they will displace oxygen with no warning outside of specialized sensors. There have been documented cases of deaths due to asphyxia from entering a space where a CFC or HFC refrigerant leak was occurring.² This is perhaps the most critical safety concern with these types of refrigerants.

Some of the newer refrigerants taking the place of CFCs and HFCs have odors to indicate a leak, but the majority of them are moderately to highly flammable even at low airborne concentrations. This makes leak detection and mitigation all the more critical. Carbon dioxide, while not toxic or flammable, also displaces oxygen and is undetectable without sensors. Carbon dioxide systems also operate at much higher pressures than other refrigerant systems, which can lead to other hazards, such as catastrophic ruptures, if improperly maintained.

Many of the new Hydro-Fluoro-Olefin (HFO) and Hydro-Chloro-Fluoro-Olefin (HCFO) refrigerants are both moderately flammable and have possible long term environmental and health effects. The HCFO and HFO refrigerants decompose rapidly in the atmosphere, resulting in little to no buildup in the atmosphere, thus having a substantially lower ozone depletion potential than traditional CFC and HCFC refrigerants. However, some of the chemicals that these new refrigerants break down into, such as trifluoroacetic acid (TFA), are toxic to aquatic life; and its effects on humans has yet to be fully understood. It is also important to note that TFA is classified as a "forever" chemical by some agencies in the same class as PFAS (Per- and Polyfluoroalkyl Substances). The long-term health effects of

PFAS exposure are only now being publicly recognized after 50 years.

Responsible Stewardship a Safeguard

Regardless of the refrigerant used, there will always be hazards associated with their use. The only true safeguards are proper system design and installation, allocation of sufficient resources for proper operation and maintenance of the system, and proper training in safe system operation, system maintenance and leak response. This includes proper training in a facility's emergency action plan, not only for employees, but also for visitors.

In an industrial setting, facilities always try to educate their visitors on the emergency action plan. What about non-industrial facilities? Do these facilities explain to visitors what the facility alarms are and what to do when they go off, or is the expectation that they will read the sign next to the alarm (if there is one) and do what it says? When training is insufficient to the point that someone gets burned trying to siphon an ammonia-water mixture by mouth,³ one has to wonder if training will be sufficient such that no injuries or fatalities will occur with these "safer" refrigerants. 🐼

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¹ Fernie-Investigation-Report-TSBC.pdf.

² <https://bit.ly/3WwbBcV>; <https://bit.ly/refrigaccident>

³ <https://bit.ly/ammoniaincidents>