

# HFOs: What You Need to Know

## What are HFO refrigerants?

HFOs (short for hydrofluoroolefins) are new-generation refrigerants developed to replace older refrigerants (like HCFCs and HFCs) with high global warming potential (GWP) and ozone depletion potential (ODP). HFOs feature a drastically lower GWP versus legacy refrigerants and zero ODP.

Global warming potential (GWP) is a measure of how much energy the emissions of one ton of a particular gas will absorb over a given period, relative to the emissions of one ton of carbon dioxide (CO<sub>2</sub>). The word “potential” is used because GWP only becomes a factor if a leak occurs. HFO refrigerants are not meant for release into the environment.



All Opteon™ refrigerants are HFOs or HFO/HFC blends.

## What makes HFOs superior?

HFO refrigerants have many attributes that make them preferable to industrial gases, often marketed as “natural” refrigerants. These include:



**Performance:** HFOs perform as well or better than both legacy refrigerants and industrial gases such as CO<sub>2</sub> in the most demanding cooling applications.<sup>1</sup>



**Safety:** HFOs are A1 or A2L refrigerants. They have a low flammability risk, low toxicity, and comparable operating pressures to the refrigerants they replace. When handled correctly, HFOs do not pose a risk to human health or the environment at any point during their lifecycle.<sup>2</sup>



**System compatibility:** HFOs use commonly available materials and require no special high-pressure components.



**Efficiency:** HFOs are in many cases more energy efficient compared to industrial gases, which gives them lower lifetime total emissions.<sup>3</sup>



**Sustainability:** HFOs have a low to ultra-low GWP (reduced scope 1 emissions), and their energy efficiency (reduced scope 2 emissions) further bolsters their environmental benefits.



**Cost:** HFOs require no special equipment, installation practices, or advanced mitigation technologies, and competent service technicians should be widely available at competitive rates, so their total cost of ownership tends to be lower compared to industrial gases.

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## HFOs vs. Industrial Gases aka “Naturals”

“Naturals,” sometimes referred to as “F-gas alternatives,” are so named because these substances, which include ammonia, propane, carbon dioxide, can be found in crude form in the natural environment. To describe them as “naturals” is misleading. They are all made using industrial processes, often at a significant cost to the environment in terms of energy consumption and emissions.

Industrial gases were in widespread use prior to their rebranding as “naturals.” Beginning in the 1930s, they were largely displaced by F-gases, which had superior performance and operating characteristics. Recently, interest in industrial gases has been revived as the world strives to meet new climate targets. However, these solutions are based on outdated technology and often require complex, expensive systems along with specially trained technicians to service them.



### Other concerns with “naturals” include:



Toxicity



High flammability/  
explosiveness



High operating  
pressures



When their relative inefficiency and poor thermal characteristics are factored in, the long-term emissions of “naturals” are in many cases higher than those of HFOs.<sup>4</sup>

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Here is how Opteon™ HFO refrigerants stack up against some of the most common industrial gases on several performance and safety criteria:

	HFOs	CO <sub>2</sub>	Ammonia	Hydrocarbons
Energy Efficiency	<b>Excellent</b>	Poor (esp. in high ambient temperatures)	Excellent	High
Operating Pressure	<b>Moderate</b> (On par with traditional systems)	High	Moderate	Moderate
System Leaks	<b>Low</b> (With proper refrigerant management programs)	Higher (Due to high working pressures)	Potentially deadly (Due to toxicity)	Moderate (Deliberate venting during service and EOL)
Toxicity	<b>Low</b>	Low	High	Low
Flammability	<b>None to Mild</b> (Opteon™ XP/Opteon™ XL)	Nonflammable	Mild	High (Explosive)
Installation Cost	<b>Moderate</b> (On par with traditional systems)	High (Due to components suitable for high working pressures)	High (Due to specialized components)	High (Self-contained applications)
Lifetime Cost	<b>Moderate</b> (On par with traditional systems)	High (Due to higher system cost and poor efficiency)	High (Monitoring and maintenance requirements)	Moderate
Service and Maintenance Costs	<b>Moderate</b> (On par with traditional systems)	High (Limited technician pool and higher component cost)	High (Due to specialized components and hazards)	High



**HFOs**  
REFRIGERANTS  
OF CHOICE

★★★★★

Opteon XL40  
Refrigerant (R-454A)

Thanks to their safety, efficiency, compatibility, operating characteristics, and favorable lifetime costs, low GWP HFO refrigerants are the solutions of choice for today's cooling applications.

<sup>1</sup> "The Path to Reducing Climate Change Emissions from Commercial Refrigeration Applications," pg. 19, [https://www.opteon.com/en/-/media/files/opteon/opteon\\_the\\_path\\_to\\_reducing\\_climate\\_change\\_emissions\\_v9](https://www.opteon.com/en/-/media/files/opteon/opteon_the_path_to_reducing_climate_change_emissions_v9), accessed December 2, 2022.

<sup>2</sup> "Safety of Opteon™ XL Refrigerants," pg. 2, <https://www.opteon.com/es/-/media/files/opteon/safety-of-opteon-xl-en.pdf?rev=70f86c93c1014ba1924df0423aee0cf6>, accessed December 2, 2022.

<sup>3</sup> "System Efficiency Is More Important Than GWP: Efficiency," GlobalFACT, <https://globalfact.org/update/system-efficiency-is-more-important-than-gwp-efficiency/>, accessed December 2, 2022.

<sup>4</sup> "The Cold Truth," GlobalFACT, [https://www.globalfact.org/wp-content/uploads/2020/01/GlobalFACT\\_MythvFact\\_FINAL\\_4.pdf](https://www.globalfact.org/wp-content/uploads/2020/01/GlobalFACT_MythvFact_FINAL_4.pdf), accessed December 2, 2022.