When it comes to the impact of refrigerants on the environment, you can find lots of data but much is used out of context. Here are some of the facts put in perspective.

**NATURAL... OR NOT?**

Hydrocarbons, such as Isobutane ($\text{C}_4\text{H}_{10}$) and Propane ($\text{C}_3\text{H}_8$), ammonia ($\text{NH}_3$), and carbon dioxide ($\text{CO}_2$) are sometimes referred to as “natural refrigerants.” Although they can be found in nature, the gases used are industrial gases, just like HFCs & HFOs, and are produced in refineries or other industrial facilities.

End-of-Life products of HCs, NH$_3$, CO$_2$, HFC and HFO refrigerants occur abundantly in nature. Refrigerant selection should be based upon technical performance and resource efficiency, safety in use, energy efficiency and the lowest GWP compatible with the application, and not an arbitrary and misleading ‘natural’ label.

**COMPARING ACTUAL EMISSIONS**

<table>
<thead>
<tr>
<th>Gas</th>
<th>2011 (million tons)</th>
<th>2013 (million tons)</th>
<th>2015 (million tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO$_2$</td>
<td>3640.61</td>
<td>6.92</td>
<td>3.59</td>
</tr>
<tr>
<td>NH$_3$</td>
<td></td>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td>HCs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HFCs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With more than 69000 x more CO$_2$ emitted than HFCs;

Emissions of HFOs are much lower than for HFCs.

**THE ENVIRONMENTAL IMPACTS OF “NATURAL REFRIGERANT” GASES**

- **HCs are Volatile Organic Compounds** that cause photochemical smog while breaking down to CO$_2$ and other compounds.

- **NH$_3$ emissions can lead to changes in soil and water quality** and contribute to the formation of particulate aerosols in the atmosphere.

- CO$_2$ emissions are the primary cause of global warming and persist in the atmosphere for hundreds of years. CO$_2$ is also a major cause of acidification of the oceans.

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1. Note 1 Total emissions from all sectors including industry and agriculture, reported by Eurostat or EEA. 97.4% of ammonia emissions are from agriculture in 2010 (EEA). HFOs emissions are currently much lower than HFCs. 20% of HFCs emissions are for 2015, HCs for 2011, and NH$_3$ for 2013.

2. Note 2 Hydrocarbons (HCs) are non-methane volatile organic compounds controlled under the Convention on Long Range Transboundary Air Pollution (LRTAP). Some 80% of the emissions arise from commercial, household and industrial applications (2011 EEA).
All of the final breakdown products of fluorocarbon refrigerants, already occur in nature in very large quantities and so HFCs & HFOs have little impact.

**WHAT ARE THEY?**

- Fluoride, carbon dioxide and for some refrigerants, TFA or formic acid.

**DO THESE OCCUR NATURALLY?**

- Yes. Formic acid occurs naturally in the atmosphere. Fluoride is found all over the globe and is naturally transported by winds.

**WHAT ABOUT TFA?**

- Over 200 million tonnes of TFA are present naturally in both coastal and deep-ocean seawater. HFCs and HFOs will add only 0.1% to the amounts already naturally present.

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**REFRIGERANT PRODUCTION**

Manufacturing all refrigerant gases requires energy due to their production processes.

### COMPARING PRODUCTION

<table>
<thead>
<tr>
<th>Refrigerants</th>
<th>Embedded Energy (GJ/t)</th>
<th>Total EU Production (million t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFC134a</td>
<td>65-105</td>
<td>3</td>
</tr>
<tr>
<td>NH₃</td>
<td>37</td>
<td>15</td>
</tr>
<tr>
<td>HCs</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>CO₂</td>
<td>10</td>
<td>3</td>
</tr>
</tbody>
</table>

**Other uses**

- Globally most CO₂ is used for Enhanced Oil Recovery (EOR, fracking) mainly in the USA (Global CCS Institute). Other main applications are beverage carbonisation and food industry usage.
- HCs (LPG) are used mainly as fuel and also as aerosol propellants and for foam blowing.
- NH₃ is mainly used in industrial production of other chemicals including fertilizers.
- HFCs are used as propellant in MDIs for asthma treatment and for foam blowing.
- HFOs are used for foam blowing and technical aerosols.

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*CO₂ values for Western Europe in 2015, captured from emission streams, fermentation, and natural gas processing plants. Estimated EU refinery production of LPG (2013). Other LPG is produced from natural gas. NH₃ EU production capacity in 2014 (Centre of European Policy Studies).