GLOBAL WARMING POTENTIAL (GWP)

What is it and why is it important?
A major part of the innovation of spray foam products over the last 25 years has been the evolution of blowing agents. Blowing agents are the gases used to expand the cells of foam plastic and give it additional insulating properties. Unfortunately, over time, blowing agents will migrate out of the cells and ultimately end up in the atmosphere.

Closed cell foams typically use synthetic compounds as blowing agents because:

- they offer improved insulation performance
- their longer molecular structure migrates out of cell more slowly
- the closed structure of closed cell foam restricts gas loss best

Environmental critics point to two issues that blowing agent gases can contribute to—ozone depletion and climate change—as reasons for considering their use more closely. Early blowing agents such as CFC’s and HCFC’s had a high Ozone Depletion Potential (ODP) and there was a great concern that their use was causing a widening hole in the earth’s protective Ozone Layer. Today’s blowing agents have an ODP of zero, but the progress has been slower on the climate change issue.

Global Warming Potential Defined
Global Warming Potential is a measure of how much a given mass of a gas contributes to global warming over a given period of time compared to the same mass of Carbon Dioxide. By definition, Carbon Dioxide has a GWP of 1. The table below lists the GWP of various gases in comparison to Carbon Dioxide.

<table>
<thead>
<tr>
<th>Gas</th>
<th>Uses</th>
<th>GWP¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide</td>
<td>Various</td>
<td>1</td>
</tr>
<tr>
<td>Methane</td>
<td>Natural gas</td>
<td>25</td>
</tr>
<tr>
<td>CFC-11</td>
<td>1st gen. SPF Blowing Agent</td>
<td>4,750</td>
</tr>
<tr>
<td>HCFC-141b</td>
<td>2nd gen. SPF Blowing Agent</td>
<td>725</td>
</tr>
<tr>
<td>HFC 134a</td>
<td>2nd gen. Rigid Board Blowing Agent</td>
<td>1430</td>
</tr>
<tr>
<td>HFC-245fa</td>
<td>3rd gen. SPF Blowing Agent</td>
<td>1030</td>
</tr>
<tr>
<td>HFC-365mfc</td>
<td>3rd gen. SPF Blowing Agent</td>
<td>794</td>
</tr>
</tbody>
</table>

When CFC’s were the blowing agents in common use, blowing agents typically had a GWP in the range of 5,000, meaning they were 5,000 times more powerful agents of climate change than Carbon Dioxide. Today’s third generation blowing agents, HFC-245fa and HFC-365mfc, have a GWP of 700 to 1000. It’s significantly better than the original blowing agents that were in common use years ago but the progress is not as significant as it was on Ozone Depletion issue.

The so-called “fourth generation” blowing agents have GWP’s in the range of 5 to 15. They are not in common usage yet, so it is unclear which ones will prove most popular. What is clear is that the focus on innovation in this area is very important to the manufacturers of foam products.

1. Intergovernmental Panel on Climate Change, 4th assessment report, 2007
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**Water Blown Technology**

Icynene has long been known as one of the pioneers of water blown foams for spray insulation. The water in the mixture reacts during the application process to release Carbon Dioxide and heat. The combination of carbon dioxide and water vapor expand and create the three dimensional structure of the insulation.

Water blown technology was first developed for use with open cell foams. Because water reacts and creates Carbon Dioxide, the GWP of the blowing agent is that of Carbon Dioxide. As previously indicated, Carbon Dioxide has a GWP of 1.

Water blown light density spray foams, such as Icynene Classic™ and Icynene Classic Max™, are a popular design choice because, as well as having an R-value comparable to most fibrous insulation products, they also add air barrier performance and they are vapor permeable (allowing bi-directional drying). They also are the products that offer the lowest GWP of any foam insulation product - a GWP of 1.

However, there are applications where a higher R-value per inch and Class II vapor retarder performance are also required. In these cases, designers used to have to specify medium density closed cell spray foam with a high GWP blowing agent to get the required performance. Recently, Icynene introduced Icynene ProSeal Eco™, a 100% water blown medium density closed cell foam. With Icynene ProSeal Eco™, there is no need to sacrifice GWP performance to get a higher R-value per inch and vapor retarder performance. Because it is 100% water blown, it too offers the lowest GWP of any foam insulation product - a GWP of 1.

**Global Warming Averted with Energy Savings**

The GWP of blowing agents is important but it also must be recognized that the use of spray foam saves energy (and avoids greenhouse gas emissions that result in climate change) by insulating and air sealing. Because spray foam is a leading technology for saving energy, a large volume of Carbon Dioxide emissions is avoided during the time SPF insulation is in service.

Many experts suggest that the proper way of assessing greenhouse gas impact on climate change is a Life Cycle Analysis (LCA). It is a much more complicated analysis including climatic conditions, energy inputs to manufacturing, transportation and other variables. However, the analysis shows water blown spray foams also produce better LCA performance than blowing agent foams.

A recent study by the Spray Polyurethane Foam Alliance (SPFA)² suggests that for many parts of the US, water blown spray foams have a payback (greenhouse gas produced versus greenhouse gas avoided) in less than a year whereas blowing agent foams typically took two to three times longer to pay back.

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² Life Cycle Assessment of Spray Polyurethane Foam Insulation, based on research by PE International Inc., 2012