The Great Helium Debate – Putting Things into Perspective

Helium Shortage
Ask most people what helium is used for and they will probably say balloons. The reason is simply that balloons are very visual and used in so many celebrations as decorations and as releases for promotion and numerous charity events. However the use of helium in balloons represents only a small fraction of the total use. People are generally not aware that the gas has any other use.

Helium Production
Helium is the second most abundant gas in the universe; the first being hydrogen. Unfortunately it is also the second lightest meaning that it cannot be contained within the earth's atmosphere in any great quantity. This makes it commercially impossible to extract helium by fractionally distilling normal air. It is therefore extracted along with natural gas from wells predominately in areas of the USA and Russia.
The crude mix of gases is processed to recover the helium in a liquefied state and this is then purified to give helium of purity in excess of 99%. Helium of this grade is suitable for medical and industrial applications.

Uses of Helium
Helium has a number of key properties which make it a commercially valuable gas:

1. It is inert so it is therefore non-combustible and non-reactive;
2. It is lighter than air so useful for lifting applications;
3. It has a very low boiling point making it suitable for intense cooling;
4. It has a very small molecular size which makes it suitable for leak testing (but this also allows it to leak out of latex balloons).

About 24% of helium is used in cryogenic applications including MRI scanners where is it used to keep the coils of the electromagnets at a low enough temperature to maintain superconductivity and hence produce an intense magnetic field. As it cools the magnets some of the helium evaporates into the atmosphere and is lost.

About 20% is used in the space industry. Being non-reactive, the gas is used to expel the liquid rocket fuel into the combustion chamber. Once again it is lost into the atmosphere and into space.

About 18% is used for welding. Once again the non-reactive property of helium means that it will not combine with the metal and prevents contamination of the weld by oxygen and other components of the air.

About 16% is used for controlled atmospheres used for example in the electronics industry for growing crystals etc.

Approximately 6% is used for leak detection owing to its small molecular size and about 3% for breathing mixtures.

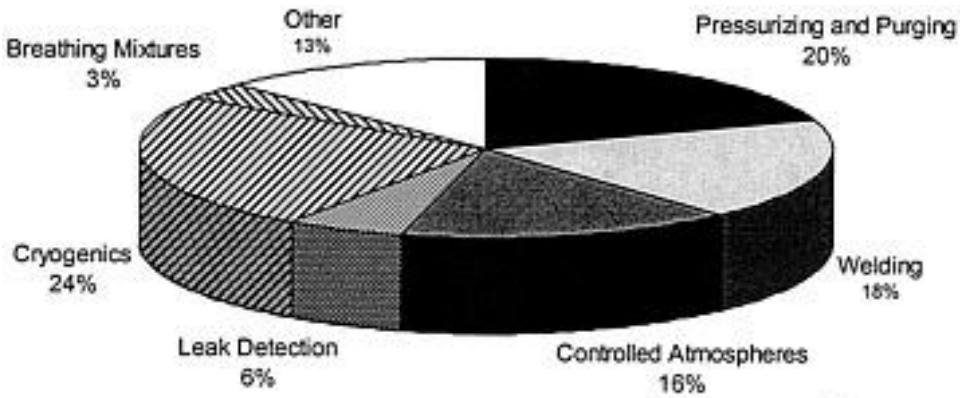
This leaves a very small amount (about 16%) for other uses; about half of which is used for balloons and airships of all type including meteorological experiment and military reconnaissance. A reasonable estimate is that latex “party” balloons and their foil equivalent account for between 5% and 7% of the total helium usage.

So let us put this into perspective. If the entire balloon industry gave up using helium tomorrow, the extra helium would contribute about 1-2% to MRI scanners and a similar amount to the space industry.

A typical MRI scanner uses about 10000 litres of liquid helium. The gas laws dictate that liquid helium at a temperature of -268 degrees Celsius expands by approximately 300 times at room temperature so the equivalent volume of gas would be some 3000,000 litres. This is equivalent to about 105944 cubic feet. A 12 inch latex balloon uses about 0.5 cubic feet so this is equivalent to about **211888 balloons** worth of helium. Moreover the process of shutting down an MRI scanner; a process known as quenching results in an extremely rapid (near explosive) expansion of the liquid helium and this must be vented into the atmosphere to prevent contamination of the treatment area. Once again this helium is lost.

The Hadron Collider used to study particle collisions required about 96 tonnes of helium. At room temperature this is equivalent to 537815126 litres or about **38 million** balloons (12-inch).

The record-breaking free-fall skydive by Felix Baumgartner was performed on 14 October 2012 from a helium filled balloon required 30 million cubic feet of helium (redbull.co.uk); enough for 60 million 12-inch balloons.



The Estimated Total Helium Used is
71.9 million cubic meters

Balloon Gas

It is important to make a distinction between the helium used for balloons and other lifting uses and that used for medical and cryogenic applications. Both originate from the same sources but balloon-gas is unrefined containing about 2% other gases. Both are non-flammable and non-toxic but balloon gas is quite unsuitable for more scientific applications owing to these impurities.

One might wonder why balloon-gas is not purified to the same level of purity as for these other medical and scientific applications. The answer is one of economics. Separation of gases which have different boiling points is referred to as fractional distillation and can be a costly process as can other forms of purification. It is not deemed necessary to separate out

such impurities just for the purpose of filling balloons. Hence a small amount of air (mostly nitrogen) is permitted although it should be noted that this is not deliberately added to the helium but is a natural constituent of the crude helium.

It is therefore quite possible to make use to helium which contains contaminates as part of its use for the purpose of filling balloons and thus there appears to be a ready market for recycled helium from scientific research and cryogenics. This is preferable to more costly purification to restore the helium to its former A-grade (99.8%) and certainly preferable to venting the 'unwanted' gas into the atmosphere.

Supply Difficulties

It is important to make the distinction between a helium shortage and a difficulty in supply. Back in the 1970s there were difficulties in the UK in supplying electricity to both the domestic and industrial market. However this was not due to a shortage of electricity itself, but rather to an era of troubled industrial relations. Similarly with the supply of helium and natural gas much of the difficult is down to the recession, the culture of reducing the demand for energy and issues of maintenance at one of the major helium processing plants. The result is one of instability in the supply and demand curves with a corresponding hike in prices.

In 2006, two of the 21 privately owned domestic crude helium plants did not produce or extract helium at all, according to the US Geological Survey. In 2007, a new plant in Algeria ramped up production later than expected and at half the expected capacity, a plant in Qatar came online slower than expected, and problems at the ExxonMobil Corp. plant in Shute Creek, Wyo., the world's largest source of commercial helium, left it operating below capacity. These issues have had a serious effect on the supply of helium but curiously have reduced the total amount of helium extracted from the earth.

Conserving Helium

We should all try to conserve helium and the balloon industry is making grade progress in this are through a greater emphasis on air-filled décor and the use of 60/40 helium/air inflators. However we must not be alone in this. It is easy to use emotive language such as 'helium is being squandered' and that it is 'being used at an unprecedented rate'.

Unprecedented simply mean more than before. Well of course things are unprecedented. There are more MRI scanners and more cryogenic applications than there have ever been.

The party industry is both a commercial and a leisure activity and as such is entitled to use resources as with any other industry. The book industry uses paper; the automotive industry uses oil and the entertainment industry uses electricity from fossil fuels all of which are non-renewable. The answer is to use such resources wisely. This is a challenge facing the balloon industry and one which it is happy to take on.