



EPA 2006

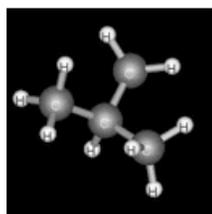
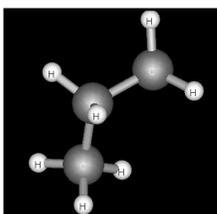
EPA this... EPA that....

Text by Michel Garneau

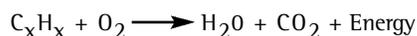
It seems that one cannot read any snowmobile-related literature these days without it somehow making reference to the EPA and the new exhaust emissions standards that are coming into effect this year. Many of you are surely wondering what these standards are all about? How will it affect me? If these questions have been running through your mind, fear not for you are not alone. In this month's Atelier column, we aim to shed light on this mysterious topic.

Chemistry 101 : the ABC's of combustion

All matter is composed of molecules which are, in turn, made up of atoms. Gasoline and other petroleum products are no different, with their molecules made up exclusively of carbon and hydrogen atoms, hence their being referred to as hydrocarbons. The H and C atoms assemble themselves in all different lengths of chains (molecules) which give each specific product its own unique characteristics (eg. Boiling point, specific energy,...). In the case of gasoline, it is a cocktail composed of a large variety of hydrocarbons. The same can be said for petroleum oil although, compared to gasoline for example, oil's added viscosity comes from the fact that the hydrogen and carbon chains present are, on the whole, longer and heavier.



We all know that internal combustion engines generate energy and motion from burning gasoline or some other fuel. So, let's have a look to see exactly what happens when fuel is burned:



In the above equation, C_xH_x is the hydrocarbon, O_2 is oxygen gas, H_2O is water vapour and CO_2 is carbon dioxide. In other words, combustion is a chemical reaction in which a hydrocarbon combines with oxygen gas to produce water vapour, carbon dioxide and energy. This is true for ANY hydrocarbon. Now, this simplistic model does not take into account any of the numerous additives used

in modern oils and gasoline, not does it consider incomplete combustion, or the fact that air is not pure oxygen (in fact, air is approx. 21% oxygen and 78% nitrogen). So, as you can see, the presence of numerous other compounds in the combustion chamber at the time of ignition can and does have an effect on what products come out the exhaust pipe.

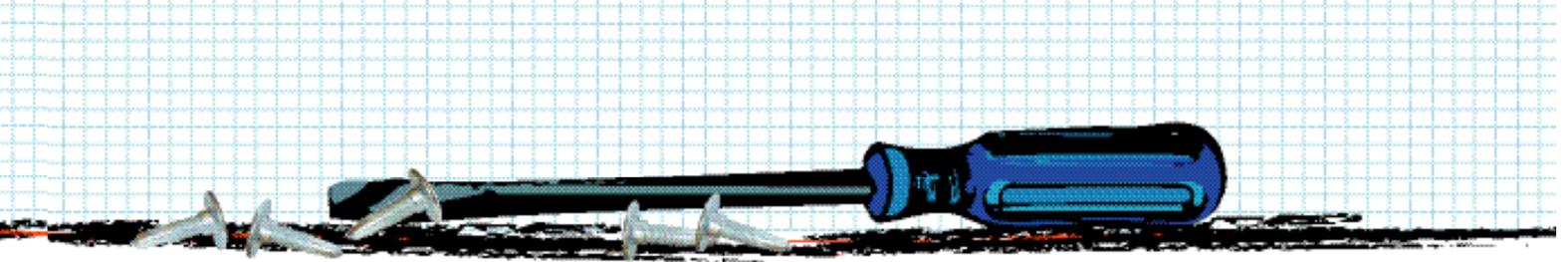
The EPA

Many of you have heard of the EPA yet may not be aware exactly of what it is and what it does. To begin with, the EPA (Environmental Protection Agency) is an agency of the United States government whose mandate is to set, monitor and enforce standards in all matters related to the environment and how it affects public health. Their jurisdiction is very broad and covers such diverse issues as drinking water quality, industrial waste and vehicle emissions to name but a few.

In response to growing public awareness and concern over air quality, the EPA decided some years ago to design an all-encompassing set of regulations for all internal combustion engines. While other vehicles such as automobiles and (road-going) motorcycles have been forced to comply with various standards for some years now, the implementation of regulations for non-road-going vehicles is fairly new.

Why are standards necessary?

Air quality is becoming an increasingly important issue in our society. Research is indicating more and more the close relationship between deteriorating air quality and the increase in certain diseases resulting from long-term exposure. Of course, the rapid growth in the number of vehicles circulating on our roadways (estimated to be in excess of 300 million cars in the US alone!) has only helped to compound the problem.



Regulations

Many opponents of snowmobiling would have you believe that our industry invented practically pollution. Well friends, that is just not so and, in fact, a close examination of the actual contributions made by snowmobiles in the overall picture clearly indicates that ours is negligible at best. For example, the US EPA estimated that percentage contributions made by snowmobiling to the overall output in the US for the year 2001 is as follows:

- HC (unburned hydrocarbons): 1.2%
- CO (carbon monoxide): 0.5%
- NOx (oxides of nitrogen): 0.007%
- PM (particulate matter): 0.07%

So, as you can see, snowmobiles play a very minor role in polluting the skies over the US (with the results being very similar for Canada).

In light of these facts, the EPA had initially no intentions of regulating snowmobiles deeming it to be not worth the effort. However, sensing the change in public mood, along with the mounting attacks against our activity by radical environmental groups (armed with mounds of disinformation), the four major manufacturers approached the EPA to have standards created. The end result of that work is the launching of new standards beginning in model year 2006.

Please note that the standards affect only the exhaust gas emissions and not sound emissions (as this area is overseen by the SSCC, or Snowmobile Safety and Certification Committee).

What is being measured?

As we had explained earlier, what leaves the exhaust of your vehicle is the product of the combustion that takes place in the combustion chambers of your engine. The four main (emissions) areas of concern are the following:

- 1) HC : As the name implies (above), this refers to unburned fuel escaping into the atmosphere, usually in the form of vapour.
- 2) CO: the product of incomplete combustion.
- 3) NOx: Oxides of nitrogen are formed when nitrogen atoms (from nitrogen gas in air) join with oxygen atoms in high temperature and pressure environments. It is one of the main components of smog and ground-level ozone.
- 4) PM: Particulate matter refers to soot and other heavier products released into the atmosphere.

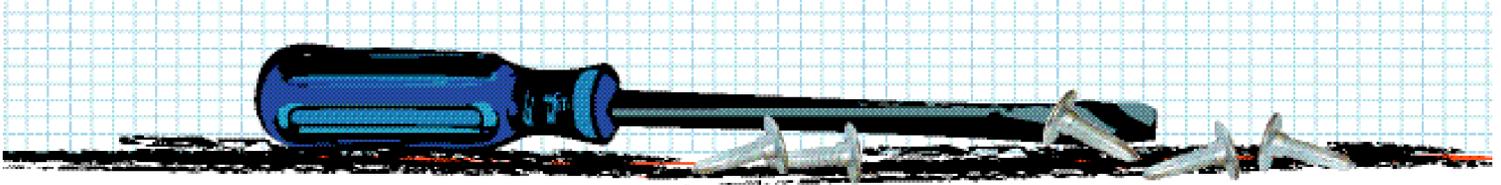
In the case of snowmobiles, the EPA has chosen to target two main areas specifically: HC and CO. The reasons for this are quite simple. To begin with, NOx compounds are mostly a concern in the summer when high temperatures act as a catalyst for the creation of smog. This, typically, is not an issue in the winter. Secondly, CO tends to be a greater concern in the winter due to the large number of heating systems (wood, gas and oil) being used. This tends to create high atmospheric levels of this dangerous gas. Finally, PM is more of an issue for diesel engines. So, given that snowmobiles operate exclusively in the winter months, the EPA chose to target those emissions which are of most concern at this time of year.

Development process

Developing accurate tests and effective standards requires that one first assess the method or context of use for the vehicle. In this case, some opponents of snowmobiling were promoting a study carried out years ago which proved, they claimed, that snowmobiles were abhorrently dirty and had to be barred from many areas if not outright pulled off the market. The problem lies in the fact that the test used was designed for a lawnmower and was executed on twelve year-old sleds! It is any wonder the results were skewed.



To counter this practice, the manufacturers contracted Southwest Research Institute, a pre-eminent US-based firm with vast experience in developing testing methods, to have them develop accurate “use” cycles to be used as better models of evaluation based on a more realistic use pattern. Once this process was completed (and accepted by the EPA), a review of the initial findings indicated some rather serious areas of concern. For example, the results obtained using the lawnmower-type test were found to be overestimated by 76% for HC, 77% for CO, 45% for NOx, and 66% for PM. Interesting, don't you think? Unfortunately, despite this latest research, the “radical greens” are still promoting the old test results with an almost religious fervor.



Once the testing cycles were approved, testing began to be carried out in order to develop an industry “baseline” which would paint a true picture of the areas of concern and serve as the basis upon which to base the new standards.

The standards: 2006 and beyond

Prior to 2006, snowmobiles were under no regulatory framework in terms of exhaust emissions requirements. Model year 2006, then, is the first time that standards will come into effect in the snowmobile industry. Here then, is how the standards will evolve for future years:

• PHASE 1 : 2006-2009

- standards to be met: 100 g/kW-hr HC, and 275 g/kW-hr for CO (represents 30% decrease over industry baseline)
- standards do not apply to individual snowmobiles but rather to the entire fleet with the use of fleet averaging (similar to what is used for automobiles). This provides manufacturers with added flexibility in creating their product mixes. Please note that the regulations make absolutely no mention of how the manufacturers are to abide by the regulations. For example, they do not stipulate that four-stroke engines only may be used.
- measurements are taken on a dynamometer using a 5 modes cycle which replicates typical field usage



- model year 2006
 - only 50% of the fleet must meet the standards (models selected are at the discretion of the manufacturer)
 - represents a phasing in of standards
- model years 2007-2009
 - 100% of fleet must meet standards (again with the use of fleet averaging)

We should note as well that 2008 marks the beginning of the implementation of permeation requirements for vehicle fuel containers and lines. Fuel tanks will be allowed a rate of evaporation of 1.5g/m²/day (deterioration factor to be included) whereas fuel lines will be permitted 15g/m²/day (no deterioration factor). This will likely lead to new gas tank materials being introduced as the now-common plastic tanks will be unable to meet these standards.

• PHASE 2 : 2010-2011

- standards to be met: 75 g/kW-hr HC, and 275 g/kW-hr for CO (25% reduction in HC, CO remains unchanged)
- fleet averaging applies once again

• PHASE 3 : 2012 and beyond

- unfortunately, 2012 standards have yet to be announced or implemented as a result of law-suits filed by radical green groups (such as the Bluewater Network) against the EPA asking to have the regulations nullified
- one possibility being considered, apparently, is the introduction of individual model caps (as opposed to fleet averaging)

Credits

One of the hoped-for goals of the new regulations was to encourage manufacturers to develop and introduce cleaner engines as quickly as possible, in advance, in fact, of the 2006 model year. To accomplish this, the EPA created a system whereby manufacturers introducing sleds between 2003 and 2005 could accumulate credits to be used during Phase 1. These could be banked, sold (to competitors) or utilized in averaging (as a buffer while newer engine designs are being readied). Fortunately, all manufacturers quickly seized on this opportunity and the net result was that we have had cleaner engines on the market now since 2002. A listing of all sleds approved prior to 2006 is available at the following Web site:

www.epa.gov/otaq/certdata.htm

We should inform you, as well, that, as the unit used to measure the HC and CO is g/kW-hr, there is a disproportionate amount of benefit to be had from cleaning up higher horsepower engines. In other words, it is more advantageous for a manufacturer to reduce emissions on a high-horsepower engine than a low-hp model.

Certification procedure

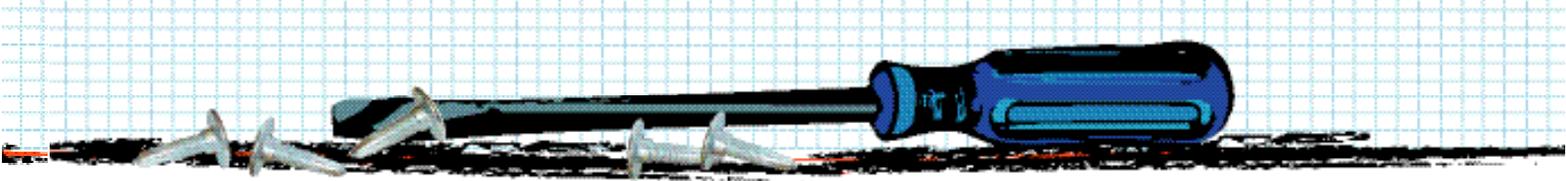
As one would expect, the actual certification procedure is a complex and complicated affair so we will try to provide you with a basic understanding of how things are done. To begin with, actual certification is attributed to an engine family. These must meet certain criteria and be clearly identified by a specific code. The formula for certification, then, is as follows:

$$FEL = OTR + DF + PT$$

FEL: Family Emissions Level (final number used to determine compliance)

OTR: Official Test Result (result of testing conducted by the manufacturer, there are enormous fines for supplying false information)

DF: Deterioration factor (following their initial testing, engines are re-tested after 400 hours or 8,000 km to see how they hold up over time)



PT: Production Tolerance (some provision is made for production tolerances given that these are mass-produced items)

Once all of this information has been quantified, the actual FEL is calculated and will appear on the engine's exhaust emissions label.



In order to ensure that manufacturers do not try to circumvent the process with the introduction of revised packages mid-way through the year, at least two production engines must be tested in each model year. Finally, a snowmobile whose engine meets the standards will be delivered to the dealer with a "hang tag" which identifies the vehicle's Normalized Emissions Rate and this is not to be removed prior to sale.



Exceptions

The EPA, in formulating the new standards, recognized that the burden of meeting all of these regulations and the testing expenses that go with them could create a substantial, if not fatal, drain on the resources of smaller manufacturers. For this reason, they created an exception in the law for small manufacturers whose annual production does not exceed 600 units.

Transports Canada

All of the information provided to date, in strict terms, applies only to those snowmobiles sold in the US. Why then are we making such a fuss about it on this side of the border? For two good reasons, the first being that the North American snowmobile retail market is relatively small which would tend to make two separate production runs (one for Canada, one for the US) unfeasible. In other words, we all get the same basic sleds regardless of where in North America it is purchased. The second reason is that while these standards are not officially in force in Canada yet, discussions are under way with Transport Canada which will likely see these norms (with some very slight changes, for example to the credit system) officially implemented in 2007.

How will it affect me?

In the end, the introduction of exhaust emissions controls on snowmobiles will surely bring about dramatic changes in snowmobile engine technology in the coming years. Expect to see the introduction of direct-injection

Truth and lies

Snowmobiles have and continue to cause serious air quality issues at West Yellowstone National Park in the US.

We have all seen them, the famous pictures of the Park wardens wearing gas masks to protect themselves from the supposed snowmobile pollution. What you are dealing with is simply some doctored photos prepared by enemies of our activity. The facts are that there has never been a documented case of a violation of clean air standards at Yellowstone Park. Ever.

One snowmobile emits 225 times the CO and 1000 times more HC than a car.

Here is a dramatic statement (and other closely related ones) that has been appearing increasingly in media reports. To set the record straight, there has never been a specific study undertaken on the subject. Furthermore, differences in testing standards make it impossible to draw comparisons. Realistically, the only way to possibly do such a comparison would be to make a series of assumptions and move on from there. Unfortunately, the very nature of these assumptions would skew the results to the point of uselessness.

Snowmobiles deposit HC pollution into the snowpack which then pollutes our waterways.

Some research has been carried out on this very topic and the results do not support this premise. To begin with, almost all of the exhaust emanations which escape are in the vapour phase (most volatile organic compounds) and so tend to evaporate within five minutes. Only a very small percentage of HC emissions (unburned fuel and oil) get stored in snowpack and studies conducted on water runoff indicates that the effect of the HC is negligible.

* source: ISMA, www.snowmobile.org

Next month:

Join us as Kevin Cameron gives us a technical overview of both two-stroke and four-stroke engine types. Find out all about each design's inherent properties, as well as their strengths and weaknesses. The latest technological developments will be discussed and numerous myths de-bunked. You don't want to miss this one!

two-strokes along with more four-strokes on the trails. The snowmobile of the future will be cleaner, more energy efficient and costlier to purchase. While the latter is an unfortunate result, it is the price of "doing our share".