

BOATOWNERS WARNED:

E10 Fuel Presents An **Unacceptable Risk**

According to the outboard industry, the popularity of ethanol blended fuels could be a disaster for the boating industry - especially if used innocently by boatowners unaware of the potential risks involved. As Gary Fooks* reports in this special feature on E10, the solution is simple: don't use in your outboard; leave it to use in your very late model car - and save the planet that way.

Owners of old and new boats are going to suffer some serious problems if they start using the cheaper ethanol blended petrol available in several states, and this situation will only get worse as governments around Australia push ethanol mandates on the oil companies.

There are no real savings from E10 (10% ethanol blend) at current pump prices, and the potential damage bill could be high. Boats more than a few years old, and even new boats with fibreglass fuel tanks, are most at risk.

Even one tank of E10 could mean an expensive trip to the workshop.

While ethanol is fine in about 60% of cars, some boat owners are about to experience melted fuel tanks, leaks and damaged engines.

That's why all of the four oil companies we called, recommended that we didn't use ethanol in any boat.

David Heyes, of BRP Evinrude and Chairman of the Outboard Engine Distributors Association (OEDA) recently stated that his members were alarmed. He explained that while most modern outboards will at least tolerate E10, the outboard industry was very concerned with the potential damage to fuel systems, and especially for the safety of boat owners.

The risks for boat owners come from three key characteristics of ethanol. It's a powerful solvent, it doesn't stay mixed with petrol, and it has a very short shelf life. Specifically:

- **The solvent nature of ethanol means that it dissolves some of the components of fibreglass fuel tanks, as well as many elastomer (rubber like) materials found in fuel systems. The inevitable leaks are a fire risk, and if you're lucky enough to avoid a spark there will be a powerful solvent attack to the bilge surfaces.**

- **Ethanol and petrol will separate under normal boating conditions. Feeding two separated fuels into an outboard definitely risks engine damage through misfiring and fuel management issues.**

- **Ethanol has higher volatility than most elements of petrol, meaning it evaporates off first ie a short shelf life.**

While most state governments are pushing ethanol, much of the boat building industry has missed the warning signs.

So far, ethanol fuel is distributed in Queensland, Tasmania, NT and

NSW/ACT and mostly around the capital cities. Serious planning and discussions are taking place in Victoria, SA, and WA, where a major plant is under consideration.

E10 – A Money Saver? Hardly . .

The E10 attraction to most motorists is the lower price of E10 blended fuel, but it's not that simple – especially for boatowners. For them, it can be argued there are few dollars saved by using E10 at today's prices.

Ethanol has a heating value of 23.5 MJ/L, which is 32% percent less than petrol. Even conservative studies say that a 10% mix (E10) will lose about 3% in the engine's fuel economy.

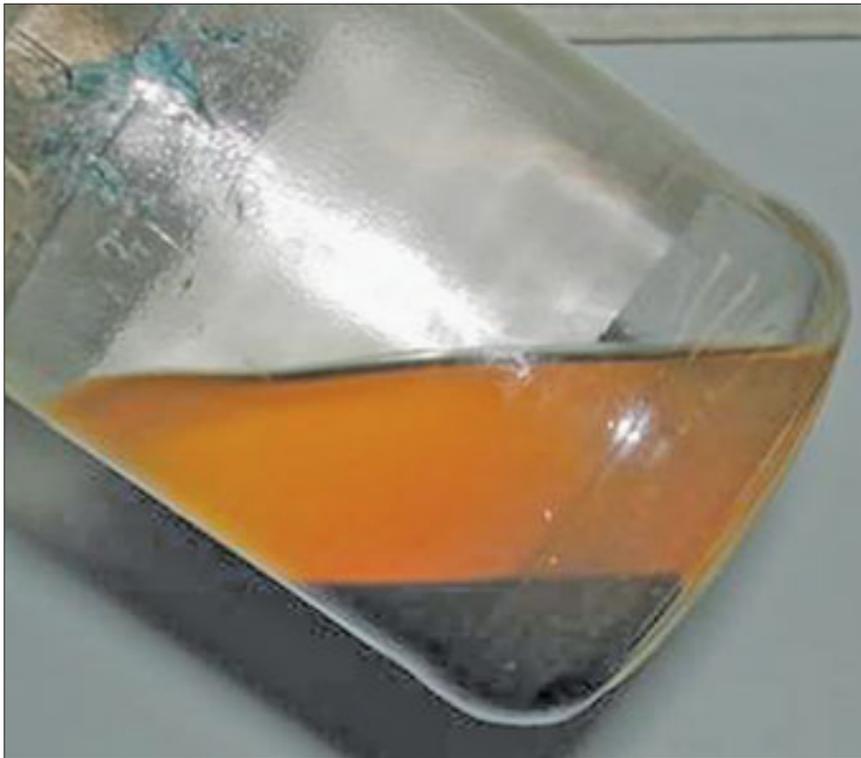
So if unleaded fuel is \$1.70 per litre, E10 has to be under \$1.65 just for the buyer to break even.

At press time (July 2008) the price difference is closer to 3 cents - hardly a bargain.

So if you want to do the right thing, and support a renewable biofuel, then I take my hat off to you. Just realise that you will be paying more - and keep it for your car and not the boat.

Ethanol – The Super Solvent

As Paul Dawson of Evinrude puts it, ethanol is going to liberate dirt and residue in your fuel system that you



This is what all the fuss is about - and example of “phase separation” in petrol - that ‘sludge’ on the bottom is not good news for engines.

never knew existed.

In 2007 Shell had to shut down its ethanol sales for a period because the new fuel in old tanks just kept releasing sediments and blocking up filters.

Boat owners are likely to experience the same blocked filters. So if you end up using ethanol, plan for a filter change after the first tank, and carry a spare.

Even the best filters won't block some potential hazards. Some chemicals become completely dissolved and readily pass through the filters before ending up re-deposited inside the engine.

Boats with fibreglass tanks are most at risk from the solvent properties of ethanol. GRP (stands for “glass reinforced plastic”) (fibreglass) tanks are soon attacked by ethanol, dissolving the resins, eventually weakening the structure and inviting leaks.

That also means any fuel spills around the filler cap could cause some permanent damage to gel coat or paint finishes. An ethanol spill is one you need to wash off immediately.

Boat USA conducted tests on two older boats that had suffered suspected ethanol damage. The 1967 and 1970 Bertram's both showed signs of engine

and fuel system damage.

They found black material on an intake valve which indicated esters, ketones and polyester. In other words the fibreglass fuel tanks and perhaps fuel lines were dissolving and these chemicals were passing straight through the filters before being deposited inside the engines.

The fuel in the tanks showed styrene, a component of polyester resin. The tanks were also tested and showed to have “aggressive degradation” and had lost 40% of their strength.

There is no easy solution for this. Fibreglass tanks will have to be replaced before they can be used with any ethanol blend.

Some boat builders are on the ball and have been planning for this day. Greg Haines, of Haines Signature, told us that their fibreglass boats sold today all have appropriate roto-moulded, polypropylene tanks.

But not all boat builders are as forward thinking as Haines Signature. A quick survey at last month's Melbourne Boat show revealed that six out of ten boats were not ready for ethanol. Mostly smaller brands.

Aluminium tanks are reported to be at risk of corrosion, too. E10 should be okay, but if there is chloride (from salt water) or copper (e.g. brass

Who Wants Ethanol?

There is such a tide of groups who want ethanol that we will inevitably be obliged to use more.

Environmentalists want it because it is “green” fuel made from renewable crops. E10 also lowers engine emissions, but there is a cost. Grain used to make fuel pushes up the demand for crops and in turn cattle feed and food prices. That also means less excess food available for donations to famished nations and to support natural disasters.

Growing crops is not pollution free either. Just think of all the tractors, diesel, trucks and pesticides.

Some farmers certainly want us to all use ethanol - they get a better base price for their crops. So when the Queensland Labor government announced mandatory 5% ethanol by 2010, the opposition yelled “*Not soon enough*”.

So it's a vote winner for both sides of politics.

The Ethanol 2007 conference was sponsored by six organizations: all of them were farmer associations.

Other farmers aren't so happy. Dougal Gordon of the Australian Feedlotters Association complains that grain diverted to ethanol production is taking away feed grade grain from animals.

And finally there are the oil pundits who say we are running out of oil, and we had better use ethanol and any other means to stretch out our limited world supplies of oil.

fittings) present in the mix then chemical reactions could mean accelerated corrosion.

Ethanol makes petrol more electrically conductive, and this may also be a cause of some cathodic corrosion. Whatever the cause, the NMAA in the USA is clear that aluminium tanks and ethanol are not a good combination.

The bottom line is that only approved plastic and quality stainless

tanks will meet future requirements.

What we need urgently, is a review of boat builder's fuel tank standards. The USA introduced fuel tank standards to meet the challenge of ethanol years ago, but there are no signs that Australia is considering a similar standard.

Potential leaks can come from any part of the fuel system. Hoses and gaskets may not be compatible and any part that is old or suffered UV damage is certainly at risk of leaking.

If your boat is more than six years old, or has been left outside and exposed to the UV, start budgeting for a complete fuel system refit.

Separation of Fuels

Ethanol is "hygroscopic" and absorbs moisture just like brake fluid and diesel fuel. Up to 0.5% absorption is not a problem, but beyond that, the saturated ethanol sinks to the bottom of the tank in a process called Phase Separation.

No amount of stirring or shaking will mix the ethanol back with the petrol, and there are no proven additives that will fix the problem. So that leaves us with some undesirable side effects.

Time Out: There are several additives

we've found that claim to cure phase separation, water absorption, etc. Mostly made in the USA or Europe, we are keen to test them out and read the scientific reports – but already we've discovered it is very hard to get objective, believable science on the subject, as distinct from anecdotal evidence. Nevertheless, F&B is getting involved in a test program that will attempt to test two of the brands nominated by several very well informed readers keen to share their research experience on fuel issues – thank you, folks - with their fellow boatowners. When we have something concrete to offer, we'll publish the results – PW, Ed.

After phase separation, straight petrol is floating at the top of the tank. That sounds great, until you realize that the missing ethanol was our octane booster.

So the first sign of separated fuel may be pre-ignition or "pinging" as the octane in our remaining fuel drops about 3 points from say 91 RON to 88 RON.

As the phase-separated ethanol builds up at the bottom of the tank, it eventually reaches the fuel pickup tube. At this moment, we get a 100% dose of ethanol through a fuel system and engine designed to cope with no more than 10%.

This is moment we get to see how strong a solvent pure ethanol can be. The result is some real damage to engines and fittings, and a high risk of fuel leaks.

The moisture that causes separation will always collect in fuel tanks. Humid air is drawn in though the tank breather and as night cools, condenses on the

Left: "Startron" is one of several products claiming to have beaten the E10 issues of 'phase separation' and water absorption - let alone the maintenance of the octane rating. Given the WORLD's pre-occupation with the problems of using ethanol in fuels, it's hard to understand why NONE of the oil companies, governments, private labs (etc) HAVEN'T embraced these additives which so ardently claim to have solved ALL the problems. Something doesn't add up, does it ?

What Is Ethanol?

Basically ethanol is a form of alcohol and made in much the same way, by fermenting crops.

In the USA it's made from corn, in Europe from sugar beet and wheat stalks. In Australia, it's mostly sourced from sugar cane, wheat, and some other grains. In Victoria, there is even a suggestion to make fuel from excess wine production!

Ethanol is used in petrol for a number of reasons.

First it stretches out the available petrol which is a good thing with rising fuel costs and the fear that oil will run out.

It also oxygenates the fuel, making for cleaner burning and lower emissions.

The Octane rating of ethanol is over 120, and so added to petrol it enhances the octane and with less environmental damage than MTBE currently used, or the lead we used to use.

walls of the tank, runs down the walls, and is immediately attracted to the ethanol.

Light aircraft pilots know this phenomenon well. Their pre-flight check includes draining a small amount of fuel from a nipple on the bottom of each tank. There is hardly a morning when pilots don't collect at least a few drops of water.

The traditional solution to condensation in planes or boats is to keep the tank full overnight, leaving little space for moist air. But ethanol also has a very short shelf life, so leaving a full tank when you won't use the boat for a month is going to produce a new set of problems.

Once phase separation occurs, the only cure is to completely empty the tank, and clean out any fuel, ethanol or water in the bottom. That means opening up the tank, not just pumping it empty through the fuel pickup.

Disposing of the tank residue is a real problem. We called a few local authorities and got some different answers.

Brisbane Council, for instance, will accept up to twenty litres, but only at specific collection points, and then only four times a year. The coastal Redland Shire Council will accept only



five litres, also just one day each quarter.

It will pay to check the policy with your local council. We had a few strange responses from Council officers before we got onto the right person.

Some incorrectly advised that fuel was not accepted, when it was.

One even suggested that we leave the fuel can open until it all evaporated: which is not only creates a severe fire risk, as well as being about as environmentally friendly as pouring it down the drain.

Short Shelf Life

The third shortcoming of ethanol is its short shelf life. Normal petrol has a shelf life of between 4-13 weeks depending on which expert you consult. BP explains that even regular fuel that has had two weeks at 30C is suspect.

The reason is simple enough to understand. Petrol is not one chemical but a range of compounds from heavy to light. Some of the lighter elements like butane (yes, the one used in cigarette lighters and cheap boat stoves) are the first to evaporate. As the weeks go by all the light elements evaporate off, and all you are left with are the thicker elements.

Ethanol is very volatile, meaning it converts from liquid to vapour readily. So it doesn't take long for too much of the 10% ethanol to just evaporate away.

Again – that will leave you with low octane petrol and the resulting engine problems.

What's worse, the thicker 'gums' left behind in the tank can still find their way into your engine, and well ... they are called "gums" for a reason!

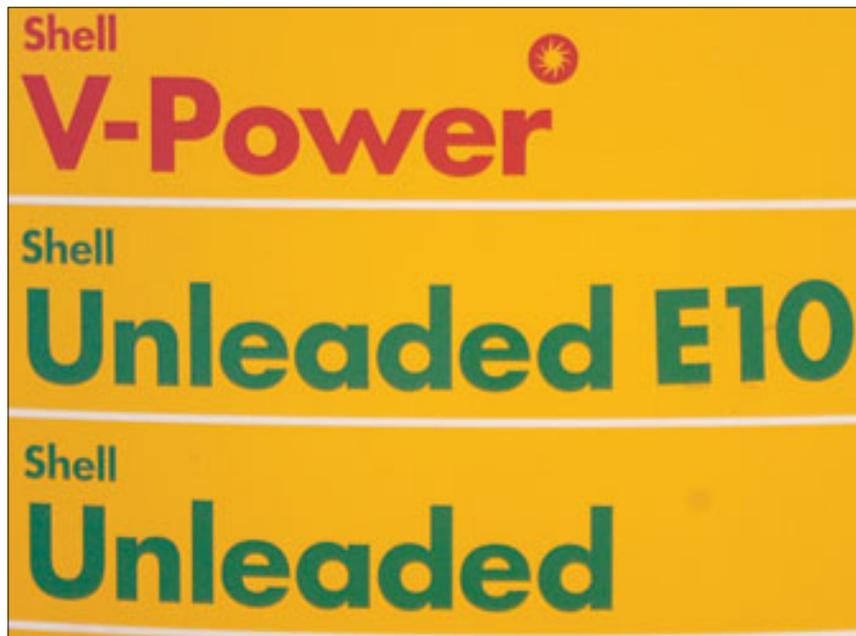
An outboard mechanic friend in warm north Queensland told us that he could stay in business just from the repairs he does to engines gummed up with old fuel.

What the Oil Companies Say

We contacted BP, Shell and Caltex during research and they all advised that boat owners should not use ethanol mix fuels in boats. Full stop.

They each told us that their warning was mostly because ethanol has a dramatically shorter life expectancy, especially in a marine environment.

To reduce moisture accumulation in fuel tanks the remedy is to keep them



What The Outboard Manufacturers Say

Overall modern outboards are fine with fresh ethanol up to E10, but they warn about fuel system risks.

Evinrude: Evinrude motors can tolerate up to 10% alcohol in fuels, (which is the maximum currently sold in Australia)

Honda: Honda engines are designed for good performance and efficient operation using petrol containing from 0 to 10% ethanol.

Mercury: Mercury engines will withstand up to 10 percent ethanol in gasoline

Suzuki: Recommends the use of pure petrol without alcohol, but can use up to 10% alcohol if necessary.

Tohatsu: Recommends use of fuel up to only 10% ethanol. Voids the warranty for all alcohol-fuel related malfunctions.

Yamaha: All 2008 and later models are suitable for use with Ethanol E10 blended fuel. **Models prior to 2008 are not suitable for Ethanol blended fuels.**

full, so there is less space for moist air and less condensation. On the other hand ethanol blended fuel should be kept for no longer than two weeks. Keep the tank full yet regularly turned over, is the catch for many boat owners.

Time Out: If you have been reading closely you will realize that we have just

proven that you must go out in the boat for a long trip at least every week. If you need a letter to the boss saying you have to go fishing every weekend, I'm sure our editor will oblige. Another solution is that the same legislation mandating ethanol also makes it compulsory to take the boat out every week. So far the politicians haven't grabbed this idea, but we'll keep lobbying! (Continued over)



Seriously, it is a real Catch 22. Keep the tank full but don't let it get more than two weeks old. For commercial operators and the fortunate few who can go out every week that won't be an issue, but the majority of boaties are going to have a problem.

There are additives available, fuel stabilizers, which claim to keep ordinary gasoline fresh. Again, the jury is out.

The best advice from boat builders and oil companies has been to completely remove all fuel from the system at the end of each trip, unless you are certain that the boat will be used again within a week or two.

That's going to mean a lot of boat owners siphoning out fuel at the tired end of a weekend and transfer it to the car. That's a basket of safety problems we don't need to see.

Political Matters

Politicians have committed to grow ethanol sales in Australia. The Federal Government has set a target for the use of 350 megalitres of biofuels a year by 2010. NSW mandated 2% of all sales will be ethanol in 2007 and the Queensland Government recently announced a 5% mandate by 2010 or sooner.

E10 fuel (or 10% ethanol) is already available at every petrol station at 3cpl cheaper than regular unleaded.

Despite this discount it's still less than 2% of total fuel sales.

The Queensland Government's confirmation of its 5% ethanol mandate by 2010 seems to have forgotten that ethanol and boats don't mix. Still, we have to give some credit. Bureaucrats were quick to pick up the ball when we gave them a call. They even offered an exclusive statement from the Minister. The key points are:

"The main reason the Queensland Government has not mandated ethanol

sooner is the importance of education to car and other vehicle owners and to give the industry time to prepare for production and distribution.

"This is highlighted by some issues raised within the boating industry regarding the suitability of ethanol blended fuels for some engines and fuel tanks.

"Most motor vehicle manufacturers provide advice about suitability for use with ethanol blended fuels and I would encourage other engine manufacturers, if they haven't already done so, to make this information available as well.

"Under the Queensland mandate, consumers will still be able to purchase regular unleaded fuels.

Ethanol blended fuels have been used in the USA for some years and the risk to boats is well documented. There is a large volume of well documented research peaking in 2006 and even the conservative US Coast Guard issued advice in its bulletin of March 2007.

Time For Action

For most new boats, the use of E10 fuels won't be a problem, except for slightly reduced range, but if your boat is a few years old, or has a fibreglass tank, then you are up for an expensive refit and a new fuel tank if you use ethanol.

Don't expect any government to change these E10 plans. It's a vote



****Gary Fooks, 50, is a Brisbane based academic, fishing enthusiast, and consultant to industry and government (Federal and States) on a wide range of subjects. A research specialist, he has been largely responsible for establishing the VELS 'Star' Rating emission scheme for OEDA and the boating public.**

Only in America. . .

In June, a California law firm filed a class action lawsuit in U.S. District Court in Los Angeles, alleging oil companies failed to inform boat owners that ethanol causes damage to fibreglass fuel tanks.

The suit seeks to represent a class comprising all owners of boats with fibreglass fuel tanks who filled their tanks with ethanol-blended gasoline from a California retailer. The suit also seeks to represent all persons in California who own boats with fibreglass fuel tanks that had to be replaced because of damage caused by ethanol-blended gasoline bought from a California retailer.

The lawsuit, filed by Kabateck Brown Kellner, LLP, names major oil companies, including Chevron and Exxon Mobil Corp., as defendants.

Source: Boat USA

winner for both sides of politics.

The idea of a special 'boats only' fuel available through marinas was dismissed. It will be far too expensive and inconvenient for most of us.

What we need to get started is a review of boat building standards so consumers can be safe no matter what fuel they use.

The immediate needed is for a serious information program to educate and warn the boating public of the potential pitfalls of the E10 mandates, and their effects in the marine environment.

Of deep concern, is the impact of the E10 fuels on existing boat fuel tanks, fuel fittings and fuel lines by 95% Australia's 600,000 boatowners who know nothing of the problems and risks involved in using this widely promoted 'green' fuel (E10) solution to 'doing their bit' to save the planet from increased global warming.

Our marine industry is about to be caught asleep at the wheel, when the USA had fuel tank standards nearly a decade ago.

Special thanks to Ken Evans of Mercury and Paul Dawson of BRP-Evinrude for their advice.

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