AMEC
Australia Marine Engine Council Inc.... *toward sustainable boating*

Outdoor Power Equipment Association

Blue Sky Alliance

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The Project Manager – Queensland biofuel mandate
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Dear Mr. Bonnick

Response to: Towards a clean energy economy: achieving a biofuel mandate for Queensland

Thank you for the opportunity to comment on the proposed ethanol mandate for Queensland.

Background

The Blue Sky Alliance is a collaboration between two peak bodies representing non road engines. Formed expressly to further the environmental goals of our two industry sectors, in particular the introduction of non-road spark ignition engine emissions standards for Australia. (NRSIEE)

Together, the two peak bodies' account for annual sales of over one million non-road spark ignition (petrol) engines. In terms of unit sales, we are on a par with the Automobile sector.

The Australian Marine Engine Council represents importers of marine engines: outboards, and personal watercraft.

The Outdoor Power Equipment Association is the peak body representing manufacturers and importers of petrol powered equipment from lawn mowers to chainsaws, and from generators to log splitters.

The Blue Sky Alliance actively promotes to the public the benefits and availability of low emission engines. We have consistently recommended to government emissions standards and have worked closely with the Australian Environment Ministers toward emission standards since 2006. We hope to hear a final decision from the next Environment Minister's meeting scheduled for July 2015.

If that decision is made then legislation and regulations could take a year to implement. If Australia meets the current USA EPA standard in 2016 we would be seventeen years behind the USA in legislating standards. In fact we lag the EU, Canada, Japan, Switzerland and Turkey. We are years behind India and by 2016 will be five years behind China.

The discussion above is to point out that we are actively supportive of practical ways to reduce engine emissions in Australia. Further, we point out that to date there are no standards whatsoever for non-road engines, including any suitability of E10.

Queensland accounts for a disproportionally high percentage of the 1.04m non-road spark ignition (petrol) engine purchased by Australians. One assessment based on audited warehouse shipments calculates that Queensland accounts for 34% of national sales of non-road engines or 367,000 units p.a. This is consistent with the fact that Queensland has more boats registered than any other state or territory, and we mow more laws p.a. due to climate. Industry estimates that each Queensland household owns 2.04 pieces of non-road spark ignition equipment.

Of course these are not just household items. Small machinery is vital to commerce and especially the agricultural sector. Equipment such as chainsaws, water pumps, brush cutters, portable sawmills and post hole diggers are all vital to rural industry.

The Discussion Paper

The debates to date have been myopic in that they have focussed only on the automotive use of ethanol. As the discussion paper writes:

> *This is important as approximately 15 per cent of Queensland's 2.5 million vehicles are incompatible with E10 fuel.*

However this fails to consider that approximately 100% of Queensland's 4.0 million non-road spark ignition (petrol) engines (NRSIE) are incompatible with E10 fuel to varying degrees.

There are a range of reasons that E10 is incompatible with NRSIE. These are well documented and these have resulted in:

- Safety warnings from Maritime Safety NSW
- Warnings and cautions from BP, in the form of advisories and stickers on every fuel pump
- E10 concerns for marine use, in a cautionary tale from the Department of Tourism Regional Development and Industry in 2009 ("E10 and the Marine Industry" (2009, appended)

E10 is unsuitable for NRSIE for a number or reasons which fall into two distinct categories, vis:

- The chemical nature of ethanol
- The way in which NRSIE are used, and how that differs from automobiles.

Proposed NRSIE Emissions Standards

Use of E10 in NRSIE could potentially be in conflict with the proposed national emissions standards for NRSIE. Those standards are based on test engines meeting a standard and using a reference fuel, close to regular petrol. Modification of the engine would be an offence under the proposed legislation we have cooperated in drafting. The use of fuel outside of the manufacturer's recommendations would similarly be an offence under the proposed legislation. The use of fuels other than regular fuel, including perhaps E10 has been shown to lower certain emissions but may increase emissions of CO, HC or NOx that are to be limited by legislation, and so the use of E10 could put the owner in breach of emissions standards. Further research needs to be undertaken.

Ethanol is a powerful solvent

Ethanol is a powerful solvent. It is known to dissolve fibreglass fuel tanks, corrode aluminium fuel tanks, and perish some plastic fuel tanks, fuel lines and fittings. These components will eventually leak, risking a fuel fire. But before they leak, the dissolved fibreglass and plastics pass through the best filters, because they are dissolved in solution. These chemicals are deposited inside the engine, causing catastrophic failure.

An engine failure of a car or a lawn mower is a nuisance. An engine failure in an offshore boat is potentially life threatening.

According to the manufacturers, all modern outboards can cope with E10: but they cannot cope with a diet of dissolved plastics. So while the E10 engine testing conducted in several Australian studies, (notably by the Orbital Engine Company) showed that in short term testing engines mostly cope with E10, the research ignored the wider issue of fuel systems in common use and their compatibility with E10, and the subsequent engine damage.

Ethanol is chemically attracted to water.

In a moist marine environment, in a boat used once a month or less, or a chainsaw left in a damp shed for weeks, the ethanol bonds with the water and, in a process called Phase Separation, sinks to the bottom of the fuel tank. No amount of mixing or expensive additives will fix this problem. (see Appendix C)

As the Queensland Government document explains (2009) that the only remedy is to completely drain remove and dispose of perhaps fifty or more litres of petrol, completely clean the tank and start all over

again. That's a nuisance and an environmental hazard for a mower or a chainsaw. For most boats, with built in fuel tanks this is as difficult and expensive as if it were a car. The problem is that with E10 in the same boat, used in the same conditions, the same problem will re occur every month.

If the Phase Separated fuel is not removed, the layer of ethanol builds up sufficiently, and gets picked up by the fuel feed, sending near 100% ethanol load into a fuel system and engine that can at best cope with a 10% blend. Engines fail, hoses leak and we have both environmental and safety problems that are obvious.

E10 Shelf Life

According to BP and other sources, E10 has a much shorter shelf life than regular fuel. In a car that is driven daily, this matters little. In a boat used perhaps one weekend a month, this stale fuel can cause engine failure at sea, with obvious safety implications.

Repairing a gummed up engine is an expensive process for an outboard and perhaps makes a chain saw beyond economic repair. That is an enormous and hidden cost that needs to be considered.

Value for Money

Ethanol has 39% less calorific value than petrol: that is, 30% less energy per litre. (32MJ/L vs 19.6MJ/L) So E10 has 3.9% less energy and so 3.9% less range per fuel tank, reducing safety margins for boats, and value for money for all Queenslanders.

E10 is priced at the pump at 3cpl less than regular fuel, but as it has 4% less energy it is overpriced. When petrol is $1.40 / litre, E10 needs to be more that 5.4cpl cheaper to be value for money. In energy terms all Queenslanders are being overcharged 2.4 cents per litre every time they buy E10. In practical terms, we are getting much fewer klm per tankful. Boat owners get les range and less safety.

Where mandates have required all regular petrol to be replaced with E10, NRSIE owners have been forced to pay an extra 11cpl to buy premium unleaded petrol (PULP), just to avoid ethanol damage. PULP offers no other benefits for NRSIE engines, thus the mandate is an unfair and unreasonable "tax" on ownership.

The same would be true for the 375,000 car owners in Queensland who cannot use E10.

To illustrate this point: following the mandate in NSW sales of premium fuel grew from 21.6% to 37.5% of the market as consumers paid a premium to avoid ethanol.

Based on the Cost Benefit Analysis conducted for the Federal Department of Environment (MMA 2008) NRSIE account for more 17million litres of fuel purchases p.a. in Queensland alone. The impost of buying more expensive premium fuel, just to avoid ethanol is a cost of around $2m p.a.

Of course it is a much greater number for the 15% of car owners. If they all used an average of 50 litres of fuel a week, these Queenslanders would be paying $107m p.a. penalty just to avoid E10.

Environmental Benefits

As explained above, the Blue Sky Alliance is proactively seeking environmental improvements for NRSIE.

The environmental benefits of E10 are unclear. The incremental improvement in urban air quality needs to be balanced against the energy, fertilizer, pesticides and chemicals used in production of the extra crops, and the run off from these chemicals is a risk to our waterways, including the Great Barrier Reef. There are also arguments that land production for fuel takes away from food production, increasing the price of food.

Economic Issues

While Ethanol has benefits for some farmers and ethanol producers, it comes at a high cost to the economy and consumers. As such it is taking money from many and giving to a few. That is what should happen to help the needy, but not what we should be doing to benefit one industry sector.

Ethanol has been subsidized for years, at an opportunity cost to other sectors of the Queensland Economy. The infant industry argument has lapsed: subsidies and mandates can protect a new industry, however other sectors should not be disadvantaged, to ensure a level playing field. There comes a time for the infant to stand on its own two feet.

We defer to the Productivity Council for a more rigorous analysis on the economic and environmental issues.

Availability of Regular Fuel (ULP)

All the above can be overcome with universal availability of ULP. The arguments put forward by government showing how the 2% mandate will ensure universal availability of ULP are specious.

Retail petrol sites have a fixed number of tanks and hoses. To add E10 they must drop one product from the range. Business dictates it will be the product with the lowest margin that is dropped i.e. Regular unleaded. Premium fuels and Diesel have less price competition and enjoy higher margins. So any E10 mandate is at the expense of the distribution of ULP.

The lack of availability of ULP will force all NRSIE owners and 15% of car owners to use PULP, for no benefit to their engines but just to avoid E10. This increases sales of the higher margin premium fuels, and so again, the petrol retailer has a strong incentive, under a mandate, to drop ULP from their product range rather than any other type of fuel. And so they will.

Transport logistics will dictate that to minimize costs, E10 distribution will be concentrated in certain areas and not spread evenly across the state, making regular unleaded unavailable in certain areas. The Department's assumption that E10 will be evenly distributed across the state seems to ignore the fact

that such a broad distribution pattern is a high and avoidable cost for the Oil Industry. We have seen this rational behavior under previous mandates and can confidently predict it will be the future pattern.

The proposed legislation would be unable to enforce a broad distribution of E10 across the state. To do so would also require a cooperation / collusion between competing companies to ensure some ULP in every suburb and town, and the ACCC would likely have concerns were this to occur.

So while, for now, a 2% E10 mandate is proposed, in reality this will make E10 a 100% mandate in certain regions. Thus validating all of our concerns above, albeit in regions and perhaps not state-wide.

A 6% mandate has proven to be unworkable in NSW. A 10% mandate or in practice a 10% regional mandate, would turn millions of boats, mowers and cars into scrap. Or more likely, continue to be used, with high risk of fuel leaks, fires, engine failure at sea and personal injury.

A Solution

Our Alliance would like to see the core benefits of renewable biofuels: lower emissions, less reliance on oil, fewer imports and secondary markets to support farming communities. However ethanol is not the answer.

We are encouraged by the progress made with Biobutanol, a second generation bio fuel. Biobutanol is also a product of the fermentation of crops. However it is a longer, four link molecule, making it closer to petrol, and avoiding the disadvantages of ethanol. Biobutanol is a proven concept and Australia should be investing in this fuel now:

- DuPont and BP have formed a Joint venture under the brand name “Butamax” and have commissioned a production facility in Hull, UK.
    - It can be produced by retrofitting existing ethanol plants
    - Can be mixed with petrol is higher proportions than ethanol
    - Is not as powerful a solvent
    - Does not separate in contact with moisture
    - It can be used in all engines, cars and fuel tanks
- In the USA, one of our members is already demonstrating Biobutanol powered boats

Fuel	Energy density	Air-fuel ratio	Specific energy	Heat of vaporization	RON
Petrol	32 MJ/L	14.7	2.9 MJ/kg air	0.36 MJ/kg	91–99
Butanol	29.2 MJ/L	11.1	3.2 MJ/kg air	0.43 MJ/kg	96
Ethanol	19.6 MJ/L	9.0	3.0 MJ/kg air	0.92 MJ/kg	107

Conclusion

We are available to provide further information and to appear before committee should you so desire

Yours sincerely

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On behalf of

David Heyes
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ENCL.

E10 and the marine industry

What is ethanol?

Ethanol is an alcohol that is produced primarily from sugarcane and grain grown in Queensland. Ethanol is blended with unleaded fuel for use in motor fuels, and can decrease fuel costs and harmful carbon monoxide emissions while increasing fuel octane ratings.
In short, ethanol is a clean-burning, high-octane fuel.

The most common ethanol-blended fuel is:
E10 = 10 per cent ethanol
90 per cent unleaded fuel

Why use E10?

It has been projected that fossil fuel sources will be depleted within the next 50 years. Unlike fossil fuels which take thousands of years to form, ethanol is completely renewable and therefore a long term alternative.

E10 in Queensland

By 2010 it will be compulsory in Queensland that the equivalent of five per cent of the total regular unleaded fuel available contain ethanol. As it is expected that fuel companies will continue to blend 10 per cent ethanol, it is likely that non-blended regular unleaded petrol will still be available in the market place. The Queensland Government will not require premium unleaded petrol to be blended.

What are the benefits of E10 for Queensland's marine industry?

Better for the air and our waterways

- Ethanol is an oxygenate, which means it contains oxygen. This is why fuel blended with ethanol burns cleaner, more completely and more efficiently.
- Ethanol reduces particulate matter emissions.
- 10 per cent ethanol-blended fuel reduces carbon monoxide emissions by 30 - 40 per cent.
- Choosing a 10 per cent ethanol-blended fuel results in a three to five per cent reduction in greenhouse gas emissions on a whole of life cycle basis, when compared to conventional unleaded petrol.
- Both late model two-stroke and four-stroke engines will experience little or no decrease in performance with an E10-blended fuel.

Most major engine manufacturers have declared ethanol as safe for your motor and better for the waterways and the environment.

What are the potential risks of using E10 in boats?

Although E10 is a positive step towards creating a cleaner environment by reducing carbon emissions, boat owners need to be aware of some of the risks associated with using E10 in their engine. These are outlined below.

- Phase separation — Ethanol has the ability to attract and absorb water while safely burning through the engine. However, if ethanol becomes saturated with water – which can happen when it sits for long periods or in humid environments – the ethanol separates from the fuel, forming two separate layers. The ethanol layer sinks to the bottom of the fuel tank and cannot be re-mixed. When sufficient ethanol builds up in the bottom of the tank the pickup then carries a dose of near 100 per cent ethanol through the fuel system. This is a risk as the engine is designed to cope with no more than 10 per cent ethanol.
- Solvent nature of ethanol — Ethanol is a stronger solvent than fuel, which has the potential to loosen rust and debris that may lay undisturbed in your fuel system. Ethanol may also remove some plasticisers and resins, effectively dissolving and weakening fibre glass fuel tanks. These dissolved compounds pass through most filters and are known to cause engine damage.
- The solvent may damage paint and gel surfaces – Spills must be washed off with soapy water immediately.
- Ethanol is linked to increased corrosion of aluminium fuel tanks — Due to ethanol's capability to conduct electricity, it can also cause galvanic corrosion. The principal issue with the corrosive effect is the possible reduction in structural integrity of the tank. This could cause leaks to go un-noticed, particularly for those tanks below decks. Many late model tanks are compatible with the ethanol-blended fuels, however the manufacturer should be consulted to ensure that all components are safe.

The use of E10 in marine outboards is not mandatory.

Guidelines for effective use of E10 in boats

- Check for the presence of water in your fuel tank when switching over to an E10 fuel for the first time. If any water is present, dry the tank completely. Fill your tank as full as possible (95 per cent capacity or more) to limit the flow of air in and out of the vent. This reduces the chance of condensation occurring, which can add water to the tank. It is critical to minimise the amount of water in the tank, as too much water will cause phase separation and can lead to stalling and engine damage.
- Do not overfill as any spill or leak through the breather will damage paint surfaces. Wash off any spill with soap and water immediately.
- If phase separation occurs, it is necessary to completely remove all fuel from the system and replace the fuel before continuing operation. This involves opening the tank to remove any fuel at the bottom. Be aware that pumping fuel out of the pickup will still leave phase separated ethanol in the bottom of the tank.
- Inspect your fuel filter frequently. Ethanol is a clean fuel that acts like a solvent, which may loosen particles that commonly settle in fuel tanks and lines over time. When you first change to ethanol, you may need to change the filter after the first tank and more frequently until the old deposits are removed. Stock your boat with extra filters and place the old filter in a metal container to prevent any spillage on the deck. Know how to replace the filter in case it clogs while you are on the water. Replace the fuel filter regularly when burning the first several tanks of E10. A 10 micron filter is recommended.
- Frequently inspect the complete fuel system including hoses and connections. In boats older than 20 years, using E10 may be detrimental to plastic and rubber components.
- Most manufacturers of late model marine motors approve the use of E10 in their equipment without voiding the warranty.
- Follow proper engine maintenance guidelines for your boat.
- Check with your boat manufacturer if any additional precautions are required for E10 usage for your specific boat model.

Tips for extended storage

- Fuel distributors recommend that E10 be stored for no more than two weeks (less in warmer climates). When preparing to store your boat for extended periods of time (more than a month) it is recommended to completely remove all fuel from the tank.
- If it is difficult to remove the fuel, maintaining a full tank of fuel (at least 95 per cent) with a fuel stabiliser is recommended. A fuel stabiliser is essential when storing any fuel for an extended length of time as it acts as an antioxidant and extends the life of the fuel.

Boaters with fibreglass fuel tanks

- Owners of boats with fibreglass fuel tanks can experience significant difficulties with E10. This is due to the solvent characteristics of ethanol. Some early fibreglass fuel tanks were not built to withstand the effects of ethanol-enriched fuel. However, there are some fibreglass tanks that are able to withstand the characteristics of E10. It is recommended you consult your boat manufacturer prior to using E10.
- Avoid spills on fibreglass or painted surfaces. If E10 is spilt remove immediately.

Tips for marinas

- Manufacturers recommend that marina fuel tanks be less than 20 per cent full before adding the first load of E10. This is common practice in the oil and fuel industry as it minimises the reactions between fuel blends with different chemical content.

Where can I purchase E10?

A range of ethanol blended fuels under various brand names are available from many service stations in Queensland. Check with your preferred service station for their brand of E10.

You can also visit www.ethanol.qld.gov.au for a current list of retailers selling E10 fuels in your area.

NSW MARITIME

Media Release

Thursday, 29 January 2009

Ethanol fuel caution for boats

NSW Maritime advises all boat owners to check with a local dealer about the suitability of ethanol mix fuels for their marine petrol engine.

NSW Maritime General Manager Recreational Boating and Regional Services Brett Moore said there was growing concern among boat operators about using ethanol mix fuels in their boats.

A number of risks have been identified including:

- Ethanol can affect some fibreglass fuel tanks because of its potential to act as a solvent;
- Ethanol can affect older fuel lines, seals and gaskets; and
- The fuel can separate into the petrol and ethanol components if condensation forms in the tank or where the fuel is stored for extended periods.

“Use of an inappropriate fuel can result in damage to the engine and boat components that may require repair or replacement,” Mr Moore said.

“Fuels with ethanol can attack some fuel-system components, such as tanks and lines if they are not made from acceptable ethanol-acceptable materials.

“The ethanol can soften some fibreglass or rubber components or can leach resins from other materials from rubber components which can foul filters, carburettors or injectors.

“Whilst some boat owners have tried to do the right thing in their quest to reduce their carbon footprint by choosing the greener option, NSW Maritime advises boat owners to check with their engine and boat dealer about the appropriate fuel choice,” Mr Moore said.

Media contact: Penny Robins 0407 220 111

The Environment

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.

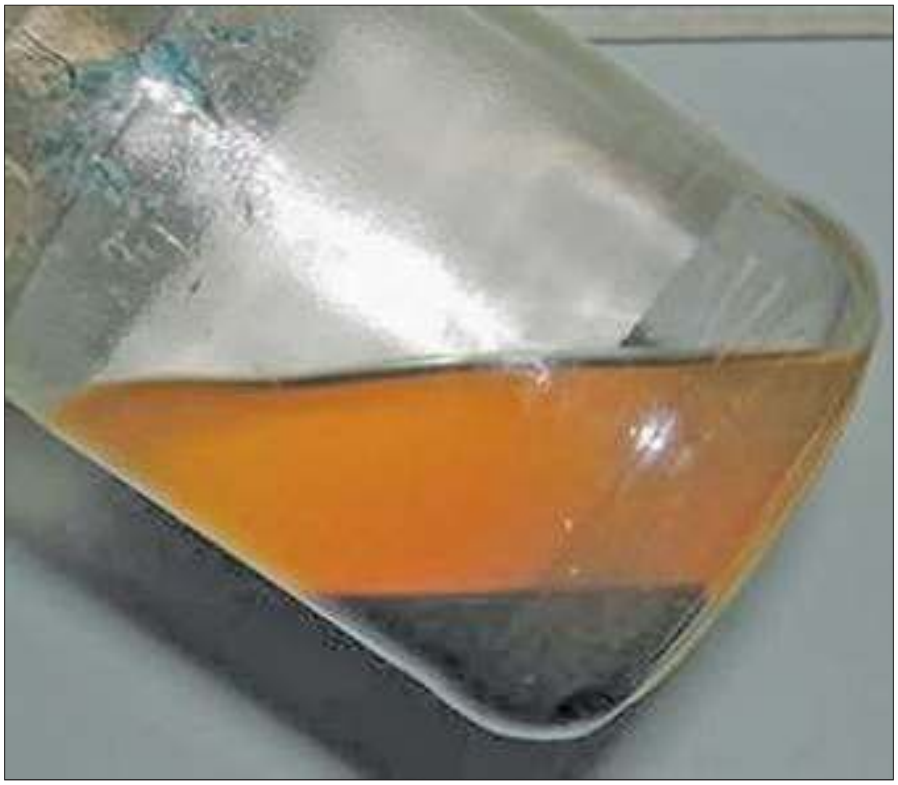
So if unleaded fuel is $1.70 per litre, E10 has to be under $1.65 just for the buyer to break even.

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 though 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, keytones 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, polypropene 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 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

Who Wants Ethanol?

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

Environmentalist 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.

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 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

Left: "Startron" is one of several products claiming to have beaten the E10 issues of 'phase separation' and water absorbtion - 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.

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 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)***

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.***

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 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.

F&B

***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

FUEL NEWS

BP UNLEADED WITH 10% ETHANOL IN OUTBOARD MOTORS

What about the fuel-system components on the boat?

It is important to follow boat manufacturers' recommendations when selecting fuels. Use of an inappropriate fuel can result in damage to the engine and boat components that may require repair or replacement. Fuels with ethanol can attack some fuel-system components, such as tanks and lines if they are not made from acceptable ethanol-compatible materials. The ethanol can soften some fibre glass or rubber components or can leach resins and other materials from rubber components, these can then foul filters, carburrettors or injectors.

Can ethanol-blended fuels affect the performance of two-stroke engines?

Refer to the manufacturers specifications , if the manufacturer specifies that the equipment can use petrol with an Ethanol content up to 10% then the engine will operate satisfactorily. When petrol containing ethanol is used for the first time after a fuel changeover from ordinary petrol, the tank must be completely dry prior to introduction of the ethanol blend. Otherwise, phase separation could occur that could cause filter plugging or damage to the engine. If the engine is one that can use an ethanol blend but is an older model it is advisable to frequently inspect all fuel-system components to identify any signs of leakage, softening, hardening, swelling or corrosion. If any sign of leakage or deterioration is observed, replacement of the affected components is required before further operation.

How does ethanol affect fiberglass fuel tanks?

Older fiberglass tanks manufactured may not be compatible with petrol containing ethanol. In the presence of ethanol, some resins may be drawn out of fiberglass and carried into the engine where they can clog filters and carburrettors or injection systems.

Are older fuel lines prone to failure? What about gaskets?

Older fuel lines can become brittle and hard with age, when exposed to ethanol they can soften, swell and distort and this can cause leakage. If the rubber components in a fuel system look old, hard or show signs of cracking or brittleness then they should be replaced with ethanol compatible components before using fuels containing ethanol.

What is phase separation, and how do I deal with it?

If significant amounts of water are present in a fuel tank with petrol that contains ethanol, the water will be drawn into the fuel until the saturation point is reached for the three-component mixture of water + gasoline + ethanol. Beyond this level of water, phase separation could cause most of the ethanol and water to separate from the bulk fuel and drop to the bottom of the tank, leaving petrol with a significantly reduced level of ethanol in the upper phase (see Figure 1 below). If the lower phase of water and ethanol is large enough to reach the fuel inlet, it could be pumped directly to the engine and cause problems. Even if the ethanol water phase at the bottom of the tank is not drawn into the fuel inlet, the reduced ethanol level of the fuel reduces the octane rating by as much as 3 octane numbers, which could result in engine problems.

The level at which phase separation can occur is determined by a number of variables, including the amount of ethanol, the composition of the fuel, the temperature of the environment and the presence of contaminants. It is very important (A) that the system is inspected for significant quantities of water in the tank before using gasoline with ethanol and (B) to limit exposure of the fuel tank to excess water. If phase separation has occurred, it is necessary to completely remove all free water from the system and replace the fuel before continuing operation. Otherwise, engine problems could occur.

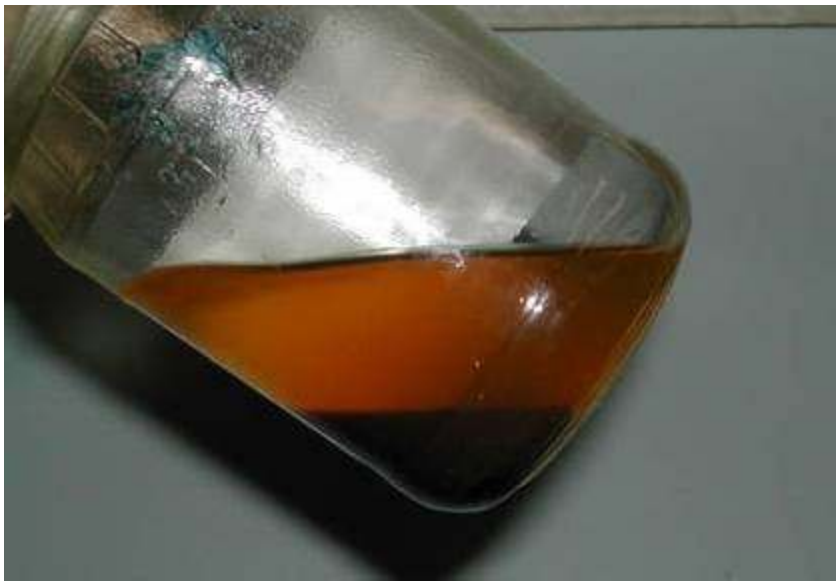


Figure 1: Sample of fuel from fuel tank in which phase separation has occurred. The upper phase is petrol with a reduced level of ethanol. The lower level is a mixture of ethanol and water.

Is an additive available that can prevent phase separation?

There is no practical additive that can prevent phase separation from occurring. The only practical solution is to keep water from accumulating in the tank in the first place.

Are there any additives that can allow the phase-separated mixture to remix when added to the fuel tank?

No, the only way to avoid further problems is to remove the water, dispose of the depleted fuel, clean the tank and start with a fresh, dry load of fuel.

Is there a simple solution to water condensation in the tank as a result of ethanol?

It is best to maintain a full tank of fuel when the engine is not in use. This will reduce the void space above the fuel and will reduce the flow of air in and out of the tank with changes in temperature. This will reduce condensation on the internal walls of the tank and will limit exposure of the ethanol in the fuel to humidity and condensation.

What should be done when storing boats with ethanol-blended fuels for extended periods?

When preparing to store a boat for extended periods of two months or more, it is best to completely remove all fuel from the tank. If it is difficult or not possible to remove the fuel, maintaining a full tank of fuel with a fuel stabilizer added to provide fuel stability and corrosion protection is recommended. A partially full tank is not recommended because the void space above the fuel allows air movement that can bring in water through condensation as the temperature cycles up and down. This condensation potentially becomes a problem.

For further information, please call the
BP Lubricants and Fuels Technical Helpline
1300 139 700
freecall