Ethanol – notes from a surveyor's forum:

Ethanol is also hydroscopic, capable of absorbing 100 percent of its weight in water. This adds a new concern not only to the fuel retailer, but also the boat owner who needs to pay closer attention to the fuel/water separator, he says.

When ethanol is mixed with MTBE formulations, gunk builds up, so boaters need to run the tank down before filling it with an ethanol blend. BoatU.S. says it has learned of more than 50 cases of fiberglass gas tanks that produced an engine-killing sludge or began leaking after being filled with E10 gasoline. Many of those tanks were manufactured before the mid-1980s, Boat U.S. says. BoatU.S. theorizes the sludge could be the product of a chemical reaction between the resin and ethanol. A preliminary investigation revealed hard, black deposits on the intake valves of engines, resulting in bent push rods, pistons and valves, ultimately destroying the engine.

The other issue is performance and driveability. Ethanol absorbs water readily and as little as .5% water will cause a phase separation. A water/ethanol mixture, being heavier than gas, will sink to the bottom of the gas tank, leaving a lower octane gas on top. This low octane gas can cause performance issues with 4-stroke engines, but can cause damage with 2-strokes due to a lean condition. In addition, 2-stroke engines can be damaged if a quantity of water/ethanol is ingested since the proper lubricating oil won't be present. Keeping water out of the tank is obviously important.

Everyone can be affected by the first problem, which is water dissolved in the mixture. Water is practically insoluble in gasoline. Even if the gas you get from your marina is completely dry when pumped into your boat, water will get into your fuel. There's likely a buildup of water at the bottom of your fuel tanks right now. That water comes from condensation that forms on the inside surfaces of the tanks with the normal fluctuations of humidity and temperature. Since the water can't dissolve into the gas and is heavier than the gas, it sinks to the bottom of your tank and sits there. As long as the level of water remains below your fuel pickup tube, it never affects your engine. However, water is soluble in ethanol. This means that the water in your tank will dissolve into an ethanol-gas mixture and be carried along to your engine where it will degrade performance, corrode engine surfaces and can prevent your engine from running at all.

Ethanol is a wonderful solvent. It's so good that when you put it in a fuel system that's not new, it dissolves the varnish and other gunk that has collected in there over the years. The newly dissolved gunk travels with the ethanol into the engine where it clogs fuel filters, carburetor jets and injectors. This isn't fatal to your engine, but can lead to engine failure while running (which can be fatal to your boat) and at the very least to costly repairs.

Ethanol has higher octane and thus retards burning. Uses more compression and hotter spark to ignite.

Conventional gasoline, depending on its aromatics content, can dissolve up to 150 parts per million (ppm) water at 21°C (70°F). The situation is different for gasoline oxygenated

with 10 volume % ethanol. The gasoline-alcohol blend can dissolve more water (6000–7000 ppm at 21°C/70°F). When this blend is cooled, both the water and some of the ethanol become insoluble. Contacting the blend with more water also draws ethanol from the blend. The result, in both cases, is two layers of liquid: an upper ethanol-deficient gasoline layer and a lower ethanol-rich (up to 75% ethanol) water layer. The process is called phase separation and it occurs because ethanol is completely soluble in water but only marginally soluble in hydrocarbons. After phase separation, the gasoline layer will have a lower octane number and may knock in an engine. The fuel also is less volatile. The engine will not run on the water/ethanol layer. As the concentration of ethanol is decreased, the aromatics content of the gasoline is decreased, and as temperature is decreased, less water is required to cause a phase separation.

From Mercury Marine web site: If an engine is a 1990 or older model frequent inspections of all fuel-system components are advised 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.

From Crusader: The use of ethanol fuel in marine engines is complex and multi-faceted. While the use of fuels containing E-10 and less are acceptable for Crusader engines currently being produced, Crusader, as well as some other engine manufacturers, have not yet determined the long term effect on 1980's vintage engines. In regard to 1980's vintage engines, Crusader's position has always been that methanol should not be used in Crusader engines and that position still holds true today. Crusader's position regarding ethanol in 1980's vintage engines has been that we do not recommend its use and that continues to be our position at this time.

Octane isn't only a resistance to detonation, but a measure of burn rate.