



Big Changes Are Coming to the Marine Fuel Industry

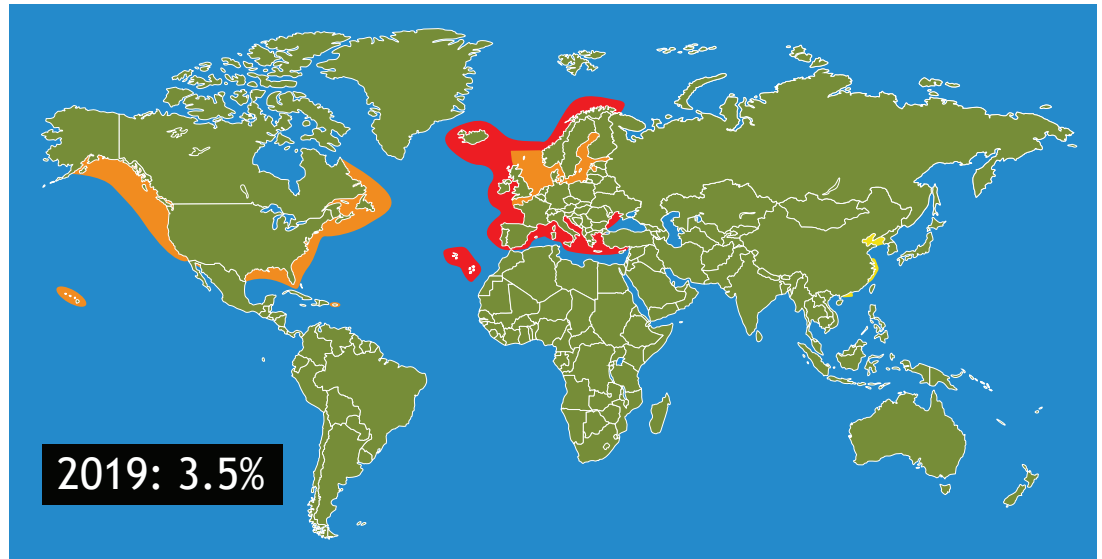
MARPOL 2020, became effective January 1st. The new measure limits the sulfur content in marine fuel. This will drastically change the market with a massive demand for low sulfur fuels.

PAC offers a wide range of ISO-conforming solutions to support the compliance of IMO 2020 and help mitigate the risk of using unreliable marine oils.



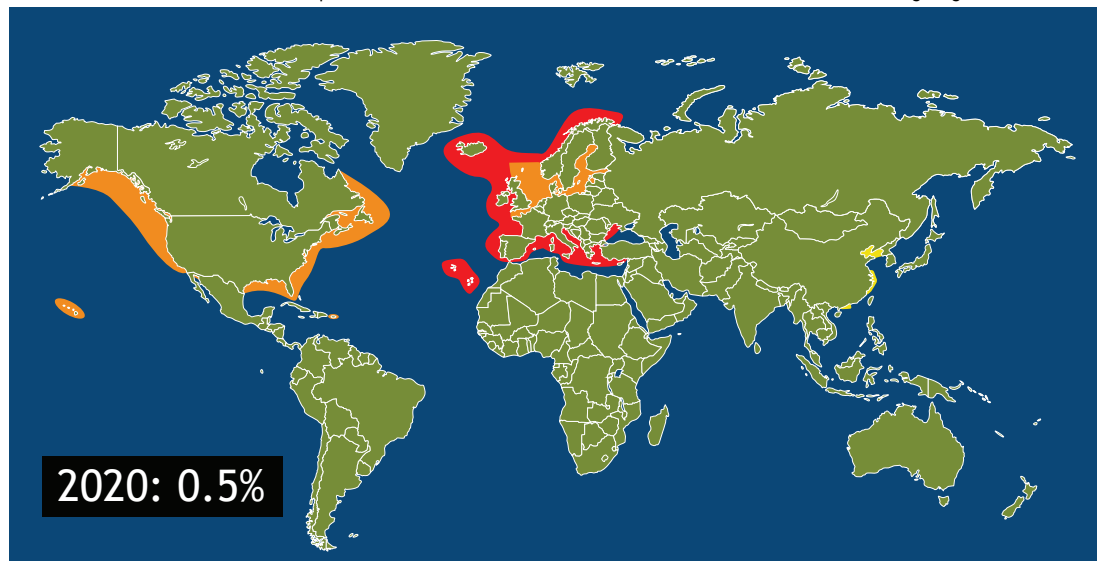
Reducing Sulfur Emissions in 2020

The International Marine Organization's (IMO) regulations limit the sulfur content in fuel oil used on ships operating outside designated emission control areas. The limit has been reduced from 3.50% m/m to 0.50% m/m worldwide according to the International Convention for the Prevention of Pollution from ships (known as the MARPOL Convention).



Who will be affected?

Vessel owners, ports and contract labs will be some of the most affected.



Source: BP MARPOL 2020 and Beyond

Fuel options available

Marine gas oil (MGO) is a light distillate fuel that is already used by many shipping vessels in Emission Control Areas (ECAs) while sailing or berthing near certain coastal regions in Europe, North America, and Asia. Because shippers already have experience using MGO, and ships can already use this type of fuel without major modifications, this is the solution with the fewest barriers to implementation.

Despite being the easiest and most feasible solution, there will be challenges with the transition to using marine gas oil as the primary fuel. Operational issues

are to be expected. For example, vessels using MGO can experience cold flow issues in frigid waters, which can lead to increased clogged fuel lines and operational disruptions, or even loss of propulsion.

Other fuel options are:

- HSFO: High Sulphur Fuel Oil, for use on ships fitted with scrubbers, which have a high cost and long installation time.
- VLSFO: Very Low Sulphur Fuel Oil, with a max sulphur content of 0.50% mass.
- LNG: Liquefied natural gas, requires a special vessel, engine design and crew.

Parameters to measure

Switching to MGO and blending bunkers from different suppliers can result in fuel instability and incompatibility. These are some properties that will need to be monitored to stay in compliance.

Sulfur Content

IMO 2020 is focused on the reduction of sulfur. While most sulfur streams are already low, testing and verifying may be required to achieve compliance.

Viscosity

ISO 8217:2017, requires that MGO operate at a minimum of $2\text{mm}^2/\text{s}$ at $+40^\circ\text{C}$. Because engine rooms can be warmer than 40°C , a fuel that just meets spec can quickly become out of spec when heated to warmer temperatures. Shippers need a technology that will let them know at what temperature the fuel will reach $2\text{mm}^2/\text{s}$.

Flash Point

MGO has a higher minimum flash point limit (-60°C) than road diesels, so it is considered safer and it conforms with the minimum flashpoint limit stipulated in SOLAS and MARPOL Annex VI.

Pour Point

A standard cold flow spec for marine fuel oil. Because MGO is seldom heated during storage or even during

use, it is susceptible to wax buildup in cold weather. Because of this, ISO 8217 was modified to include cloud point and CFPP requirements, as well as pour point measurement.

Cloud Point/CFPP

When MGO is exposed to cold weather, it can clog fuel lines and filters. Cloud point and CFPP offer a more proactive measure of potential cold-flow issues, which provides extra time to take preventative action.

Density

The density value provides assurance that the fuel being used reflects the correct weight-to-volume ratio and associated energy density.

FAME

The use of renewable FAME in concentrations of up to 7% is permitted in MGO to address global environmental and decarbonization initiatives. Monitoring of FAME is necessary, as there have been sealing, dirt, water, and microbial issues when the concentrations become too high.

Carbon Residue

The amount of carbon residue offers an estimate of the tendency of MGO to form deposits, which, in turn, can affect engine performance.

PAC Solutions

Phase MFA 70Xi

Viscosity at 40°C (mm^2/s)

Density at 15°C (kg/m^3)

Pour Point in Winter and Summer

Cloud Point in Winter and Summer

Phase Technology's MFA-70Xi is the only analyzer that is specifically designed to test four critical properties of marine fuel—viscosity (at $+40^\circ\text{C}$), density, cloud point, and pour point. All in 20 minutes or less!

Simple and easy to use, the MFA-70Xi performs all four tests with the single push of a button.

Sample is automatically loaded, without the need of a pipette. An optional 48-position autosampler offers greater throughput and improved automation if desired. The MFA-70Xi is completely self-cleaning; no solvent is required.

MFA-70Xi was developed to meet the growing needs of the marine fuel industry as they test MGO distillate fuels. This includes DMX, DMA, DMZ, and DMB (also known as DFA, DFZ, DFB).



PAC Solutions

OptiFPP

A cold filter plugging point analyzer, OptiFPP accurately and reliably measures CFPP at ultra-low temperatures (down to -70°C) to control cold flow.



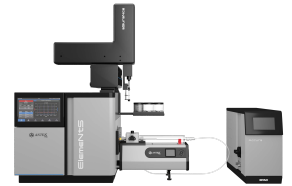
OptiFlash SS

Only requires a small amount of sample (2 mL compared to typically $> 50\text{ mL}$ in traditional test methods), which reduces fuel exposure to the user and eases fuel handling and disposal. With an optional built-in fire extinguisher, the instrument is designed to reduce the risk of an incorrectly set flash point.



MCRT160

With the benefit of automatically determining the carbon residue, MCRT160 delivers results that are equivalent to the more time-consuming and operator-intensive Conradson Test D189.



ElementS

Quantitative analysis of Nitrogen and Sulfur in one run: Gasoline, Diesel, Biodiesel, LPG's, Aromatics, Jet Fuels, Heavy Oils, water.

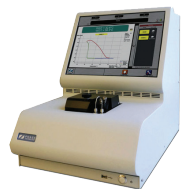
OptiFuel

A robust FTIR-based fuel analyzer, OptiFuel determines FAME content. It offers a very fast, two-minute analysis to measure sulphur.



WAT 70Xi

Compatibility of different waxing profiles is measured in 20 to 40 minutes even with the most opaque samples and with a precision of 1.0°C .



ABOUT PAC

PAC is the leading manufacturer of advanced analytical instruments for gas chromatography, elemental analysis, physical properties, and fuels composition. Our portfolio includes the world's most respected brands of lab and process analyzers: AC Analytical Controls, Advanced Sensors, Alcor, Antek, Cambridge Viscosity, Herzog, ISL, PetroSpec and Phase Technology.

PAC complies with ISO 9001-2015 and 17025-2017 standards, which reaffirms our commitment to quality and customer support.

PAC is a unit of Roper Technologies, a diversified technology company and a constituent of S&P 500, Fortune 1000, and Russell 1000 indices.

AFTER SALES SUPPORT

We are committed to delivering superior and local customer service worldwide with 14 office locations and a network of over 50 distributors.

We offer field services for preventative maintenance, calibration, installation, as well as emergency site visits. Our service programs help our customers ensure maximum quality and repeatability, while complying with standards and regulatory requirements.

PAC has Service Repair Centers located around the world. They are all ISO-9001 accredited. All work is performed by our factory trained and certified technicians who use only approved spare parts to guarantee your instrument performance.