IN CONFERENCE

ULSFO: The View from Orim Energy

This issue's "In Conference" is based on a presentation by Marc Harskamp of Orim Energy at World Fuel Oil Summit IX in Athens on May 20, 2016. Mr. Harskamp manages Orim's activities in the ULSFO market.

This issue's "In Conference" assesses the introduction of 0.1%S ultra low sulfur fuel oil (ULSFO) in the bunker market. An abbreviated review of environmental regulations pertaining to international waters is provided. After this, an overview of ULSFO is provided and the role of Orim/Interchem in the ULSFO market is explored.

International Environmental Regulations

The control of pollution (in the sea and air) from ships in international waters falls under the purview of the International Maritime Organization, a specialized agency of the United Nations. IMO's ship pollution rules are contained in the International Convention on the Prevention of Pollution from ships known as Marpol (short for marine pollution). The Marpol convention of 1973 (as modified in 1978) was amended by a 1997 protocol which contains Annex VI (Regulations for the Prevention of Air Pollution from Ships). Annex VI sets limits on SOx and NOx emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances.

Two sets of emission and fuel quality requirements are defined by Annex VI: global and more stringent requirements applicable to ships in special emissions areas. The global SOx emissions limit was 4.5%S until 2012 when it dropped to 3.5%S. A much more severe decline will occur when the global cap falls to 0.5%S as early as 2020. Depending on the results of a review of the bunker situation by 2018, the 0.5%S cap may be postponed until 2025.

An Emissions Control Area (originally known as a SOx Emissions Control Area) can be designated for SOx (as well as particulate matter and NOx). The first ECAs covered the Baltic Sea and the North Sea/English Channel, effective May 2005 and November 2007, respectively. Another ECA covers the coastal areas of North America (the US and Canada), effective January 2012. In terms of sulfur, the ECAs were first capped at 1.5%S. The ECA cap became 1.0%S in July 2010 and 0.1%S in January 2015.

The IMO places no barriers to the use of heavy fuel oil to meet applicable sulfur limits (whether ECA or global). There is no IMO requirement to use distillate fuels. Alternative measures (such as shipborne scrubbers) to meet sulfur limits are allowed in ECAs as well as globally. Ships are free to select any effective exhaust gas cleaning system.

The 1%S ECA market, which ended on December 31, 2014, ran an estimated 1.2 million mt per month. In Europe, the demand for 1%S bunker fuel ran roughly 900 kt a month, with the ARA and the rest of Europe each accounting for about 450 kt a month. The 1%S demand in the North American ECA ran about 200 kt a month. The rest of the world's demand ran some 100 kt a month as some ships took on 1%S bunkers prior to entering ECAs.

ULSFO Overview

In the face of the 0.1%S ECA cap, it was generally believed that the answer was to burn 0.1%S gasoil. Many shipowners took the necessary steps to enable their ships to operate on 0.1%S DMA gasoil. The huge drop in oil prices in second-half 2014 provided little motivation to consider a fuel oil alternative to DMA.

Under these circumstances, demand for ULSFO started slowly. In early 2015, ULSFO demand in the ARA was not more than 100 kt a month. ULSFO's big price advantage against DMA served, however, to gain the attention of at least some shipowners, with the ULSFO to MGO differential in first-half 2015 running $25-$60 per mt. By mid-2016, the ARA's demand for ULSFO had increased to around 170 kt a month compared to 0.1%S MGO demand of around 325 kt per month. While most ULSFO is

sold on a term basis, some of the material is sold on a spot basis.

Initially, many shipowners were concerned about the quality of ULSFO. These concerns, however, were generally undeserved given that ULSFO does not derive cracked fuel oil. The vast bulk of ULSFO bunker fuel oil is based on either straight run fuel oil or VGO. The straight run usually derives from sweet West African crudes. By contrast to LSSR, cracked fuel oil tends to have have high viscosity and high density. As such, slurries and other cutterstocks may be needed to bring the cracked fuel oil into compliance with ISO bunker specifications. This is no easy task when it comes to the sulfur and aluminum/silicon contained in cracked fuel oil.

For now ULSFO remains a niche market dominated to a large degree by the major international companies, such as BP, Exxon, and Shell. BP and Shell have a blending operation based on LSSR from West Africa. This LSSR is combined with product from the majors' ARA refining. Exxon produces a VGO-related 0.1%S bunker fuel at its Antwerp refinery.

One problem associated with the use of straight run fuel and VGO from sweet crudes is that the products often have a high pour point. Pour point is not a problem when burned but can present challenges for transport via barges and/or pipelines that are not well insulated. ULSFOs on the market have wide-ranging viscosity, ranging from 2 cSt-110 cSt at 50 °C. Higher viscosity ULSFO is a plus for seagoing vessels shifting from RMG 380 (and high viscosity RMK) to ULSFO when they enter ECAs.

Much of the ULSFO on the market is characterized by very low viscosity. One ULSFO seller, who faced difficulty making a higher visc ULSFO, offered customers RMD 80, with a maximum viscosity of 80 cSt at 50 °C. Subsequently, the RMD 80 grade took on a life of its own and became the standard ULSFO grade while RMG ULSFO has come to be seen as off-spec despite the fact that ships usually sail on RMG or RMK.

Probably the biggest problem associated with ULSFO is its limited availability in ports around the world. Efforts to develop ULSFO bunker fuel oil in Algeciras, for example, have so far been unfruitful. Local suppliers say there is a lack of demand for ULSFO. But this may be a chicken and egg issue.

Handling ULSFO presents challenges. Heated tanks (and associated pipelines), such as typically used for HSFO, are needed for ULSFO. Contamination with a small amount of HSFO can make the ULSFO exceed the 0.1%S cap and therefore be off-spec for use in ECAs.

Leaving the lack of heating aside, gasoil systems (including tanks and pipelines) are not suitable for ULSFO. The use of ULSFO would serve to blacken any gas oil system. This would be the same problem with barge transportation. It is necessary to use barges dedicated to ULSFO or barges with a completely separate ULSFO system on board.

ULSFO from Orim Energy

ULSFO is produced and offered in the ARA by a joint venture of Interchem and Orim. Singapore-headquartered, Interchem has office in six Asian, three European, and two Western Hemisphere countries. The company started in 1976 as a trader of chemicals, followed soon thereafter as a producer and blender of gasoline and gasoline-related products. Founded in September 2014, Orim Energy aimed to be in position to meet the 2015 ECA sulfur standard by producing, blending, and supplying 0.1%S ULSFO. Headquartered in Malta, Orim also has an office in the Netherlands.

Orim produces around 80 kt per month of ULFSO in Rotterdam at the Odjfjell storage terminal. Of this quantity, about 60 kt a month is derived from processing West African crude oil (such as Doba) in an Odjfjell distillation unit. (Doba crude arrives at the the Odjfjell terminal in Suezmax vessels.) Near the distillation unit at Odjfjell Interchem/Orim has storage and blending facilities.

Orim produces another 20 kt a month of ULSFO via blending in Antwerp. The Antwerp barrels meet ISO 8217 RMD specifications. Interchem/Orim can also blend on demand at Antwerp to produce a desired custom grade of ULSFO.

Orim sells some of its ULSFO production to others, which, in turn, sell the material both in and outside the ARA. Orim's share of the ARA ULSFO market share is estimated at 40 percent. The biggest customers of Orim are the same major oil companies that make

their own ULSFO. These companies are aware that the Orim product tends to be stable and very low in sulfur.

Orim's ULSFO from the Odjfjell terminal is considered to be of high quality, perhaps the highest quality ULSFO available in the market. The material is 80 cSt at 50 °C, with a typical density of 0.9055. As to metals, the Orim material has typical vanadium of 1 ppm, aluminum and silicon less than 10 ppm, and typical calcium of 138 ppm. The accompanying table shows RMG 380 versus Orim's Rotterdam ULSFO.

COMPARATIVE BUNKER FUEL SPECIFICATIONS, RMG 380 AND ORIM'S ROTTERDAM ULSFO

		RMG 380	Oriim's ULSFO
Viscosity at 50 °C	max	380 cSt	80 cSt
Density at 15 °C	max	0.9910	0.9055
CCAI	max	870	785
Sulfur	max	0.10	0.0838
Flash Point	min	60 °C	62 °C
Hydrogen Sulfide	max	2.00	<1
TAN	max	2.50	2.17
TSA	max	0.10	<0.10
MCR	max	18	5.12
Pour Point	max	30	24
Water	max	0.50	<0.10
Ash	max	0.10	0.05
Vanadium	max	350	1
Sodium	max	100	8
Alu+Si	max	60	<10
Calcium		30	138
Zinc		15	1
Phosphorus		15	1

Orim's Rotterdam ULSFO is based on a stable straight run fuel oil which can be blended with other fuel components. Higher in viscosity than MGO, the Orim ULSFO does not present technical problems for ships entering or leaving ECAs. The actual viscosity of Orim's ULSFO when injected into a ship's engine is about the same as for HSFO. The quality of Orim's ULSFO stays fairly steady.

At 130-140 ppm, the calcium content of Orim's Rotterdam ULSFO is relatively high versus most other fuel oils. Calcium deposits remain in the engine and needs to be periodically removed. This can be accomplished during regular engine maintenance. Calcium, it should be noted, does not have same negative impact on engine performance as other metals such as aluminum.

Questions about the relatively high calcium content have been raised by shipowners. Shipowners may point to the ISO 8217 specification which sets limits on calcium, zinc, and phosphorus. But ISO's aim in setting these limits is to keep used lubricating oil out of bunker blends. To accomplish this aim, ISO states that two of the three elements must exceed certain limits for the bunker fuel to be deemed to contain uses lubes. In the case of Orim, the calcium derives from the crude oil used to make the fuel oil, not the blending of used lubes. As such, Orim meets ISO specs since only of one of the three elements (namely, calcium) exceeds ISO limits. The typical content of zinc and phosphorus in Orim's Rotterdam ULSFO is 1 ppm for each.

Orim has been supplying ULSFO based on Odjfjell distillation since April 2015. Over 500 kt of this Rotterdam product was sold in the year ending March 2016. Over this period, no claims have been received by Orim.

Conclusion

By year-end 2016, sales of ULSFO in the ARA are expected to rise from about 170 kt a month to some 200 kt a month. The share of 0.1%S gasoil will gradually rise from about a third to about half of the 0.1%S bunker market in the ARA. While remaining a niche market, ULFSO sales in the ARA may reach 250-300 kt per month by mid-2017.

Looking further ahead, the IMO's 0.5%S cap on bunker fuel on the high seas will likely begin in 2020 (though it could be started as late as 2025). Reminicent of the passivity in the face of the coming 0.1%S cap, the indus-try is marked by passivity. It is quite clear that there is not enough 0.5%S max fuel oil pro-duced by the world refining industry and that refiners are reluctant to invest in resid desulphurization capacity.

That said, there are many more crudes in the world which yield fuel oil with sulfur of less than 0.5%S than 0.1%S. Together with distillates and ULSFO, most of the cracked fuel oil of 1.5-2.0%S can be blended to meet the 0.5%S cap. Shipborne scrubbers and alternative fuels (such as LNG) will also play roles in helping the world cope with the forthcoming 0.5%S cap.

What remains unclear is the disposal of those high sulfur fuel oils which cannot be blended into the 0.5%S pool. ■