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ECAs – Is there another option?

The introduction of tighter ECA requirements in 2015 could lead to an increase in loss of propulsion incidents. What are the risks – and what other options are available?

Captain Jeff Cowan with Claes Jakobsson

In 2010, the International Convention for the Prevention of Pollution from Ships (MARPOL) designated specific portions US, Canadian and European waters, including the English Channel, the Baltic Sea and the North Sea, as Emission Control Areas (ECAs). Since August 2012, ships operating in these areas have had to burn fuel oil not exceeding 1.0% sulphur. In January 2015, the limit falls to 0.1% sulphur, effectively making the use of distillate fuel mandatory within the ECA.

The US has already had some experience of the effects of this legislation, as California has required ships to use distillate fuel within 24 miles of the coast since 2009. While this requirement was intended to reduce emissions and improve air quality, it has also created some difficulties, most notably an increase in Loss of Propulsion (LOP) incidents that could have caused a collision, allision or grounding. The state has come close to a more serious incident several times but thankfully none have actually occurred so far.

LOPs – the risks

There are five different types of LOPs experienced in California:

1. Increase in Failure to Start scenarios. Typically, these result from the difference in British Thermal Units (BTU) of the distillate fuel versus the Heavy Fuel Oil (HFO). The fuel rack requires adjustment to ensure positive starts. Other issues include the lack of ability to maintain RPMs at slow engine speeds from BTU issue and Masters continuing to order engine starts without engine calibration to offset the lack of BTUs.
2. Heat incompatibility issues when switching from HFO to distillate fuel. To get HFO to flow through the fuel lines it must be heated to 150°C or 302°F. Distillate fuel flows at ambient temperature and loses its limited viscosity if fuel lines and components are above ambient temperature.
3. Fuel system leakage. 'O' rings on engines adapted to run on HFO with the extra heat do not do well with the solvent qualities of distillate fuel, causing extraordinary leakage at times.
4. Clogged strainers and/or fuel filters. The solvent quality of distillate releases asphaltenes from the fuel components. These collect in the filters and strainers, causing shutdowns from clogged fuel lines.
5. Distillate is less viscous and has less lubricity. Close tolerance parts, even if worn, do well with the viscosity and lubricity associated with the heated HFO. Distillate has shown to be less tolerant of any wear in the fuel injectors/pumps, causing close tolerance fuel components to hang up either open or closed.

Risk levels

As the ECA standards evolved, several regulatory agencies, including the US Environmental Protection Agency and the US Coast Guard, were asked if they had carried out any risk assessments with regard to mandatory fuel switching. The answer: No. Yet there clearly are risks involved.

Prior to 2009, California averaged 23 LOP incidents per year. This shot up by almost 200% when regulations requiring the use of distillate fuel were introduced. Even more alarming is the potential number of LOP incidents in the Gulf of Mexico. There are 4,000 shallow water oil rigs, 800 manned oil rigs and 94 deep water oil rigs in the Gulf of Mexico. Having been in the Gulf and noted the proximity of the rigs to shipping lanes, this fact carries great weight with this mariner. Given some ships may become dead in the water and at the mercy of the elements, could an allision with a drilling rig be in the future? Very possibly.

The problem extends well beyond the US. Ships headed for Northern Europe will have no choice but to transit the English Channel. Their fuel switchover position is a line between Land's End and the Brest Peninsula in the south. According to the UK Maritime & Coastguard Agency, there were 35,581 transits of the South West Bound Lane in the English Channel in 2013. In the same period, the Northeast Bound Lane saw 36,297 transits, according to the Prefecture Maritime de la Manche et de la Mer du Nord. If LOPs occur in the same proportion as in California, the maritime industry could see 646 LOP events annually in the crowded English Channel.

To the north, the ECA extends southwards of latitude 62° North and eastwards of longitude 4° West, an area that encompasses most of the North Sea. The North Sea plays host to 570 oil rigs, 152 of which are staffed. Unlike arrival into the US, where ships will be surrounded by open ocean after the switchover, these Channel and North Sea bound ships will be in close proximity to France, England and oil rigs and very close to potential dangers if problems should occur. Given the potential for LOP events in the area, 2015 could prove to be an anxiety-ridden year

Weather

Weather may also be a factor. Historically, weather in the North Atlantic and North Pacific during the winter months causes a consistent 20-40% chance of seas over 12 feet or 4 metres. Typically this means the wind is blowing over 26 knots. Why would this be significant? It does not take much more wind for the seas to build over 4 metres and hamper the progress of a ship. Engine loads increase in sizeable seas, forcing the Master/Chief Engineer to reduce load on the engine (reducing fuel) and slowing the ship even more. If the Chief Engineer hesitates to reduce load, extra wear will appear on the engine components, enhancing the possibility of a LOP. This likelihood of suffering a LOP incident is increased many times over where distillate fuel is used. Imagine the potential of a ship running aground and a major oil spill in the North Sea!

Routeing

Once the 2015 ECA comes into effect, ships will try to minimise their use of the more expensive fuel with its assorted running issues by changing routeing to avoid the areas affected as far as possible. For example, Masters coming to the US will use a great circle course (intersects each line of longitude at a different angle) until the ship is directly east or west of its destination, then proceed into that port using a rhumbline (intersects each line of longitude at same angle) or straight line.

Collectively taking all of the ship arrivals into the United States on a yearly basis and using the assumption that Masters will opt to change routes, ships will add approximately 1.1 million miles to their voyages. In other words they will be burning the less desirable fuel (HFO) for over 1 million extra miles in total. The point of using low sulphur distillate is to reduce emissions, but in this scenario, the net benefit might be zero when offset against the operational changes.

Scrubbers

Companies wishing to avoid the higher fuel bills and mechanical issues associated with fuel switching have the option of installing stack gas scrubbers. These cost $5-10 million to install upon existing ships for the main propulsion engine(s) and auxiliary generators. They are capable of reducing sulphur oxide emissions (SOx) to ECA-compliant levels while burning the less costly HFO but at what real cost? It has been estimated that scrubbers will increase fuel consumption by 1.5% to 5%. Take a ship that burns 100 tons per day of HFO. When the scrubber is in use, consumption will increase from 1 to 5 tons.

One of the chemicals typically used in this scrubbing technology is caustic soda. Consumption can be over 20 tons per week while in the ECA, so it is vital that crews are trained on how to handle this hazardous substance without sustaining injury. The typical operation will also consume approximately one ton of fresh water if the system is a closed loop scrubber. Ships will need exceptional evaporators to handle the extra demand for fresh water in this scenario. Any hazardous effluent leftover must be disposed of, and only two options exist: bring it to port or release it into the ocean. In an open loop scrubber system, the free copper effluent also needs disposal. If disposal ashore is not feasible due to shoreside facility restrictions or other impediments, then the only option is to release it into the ocean. Meanwhile, industry has not completed a life cycle analysis of the scrubber system, meaning that the length of service and viability of a scrubber system is unknown, placing the ship at risk and liable in the event of equipment failure.

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From the beginning scrubber technology has been reported as the panacea for air emissions. It becomes clear that this option is not without drawbacks. However, with the upcoming regulations requiring the use of 0.5 % sulphur fuel worldwide from 2020, it might be a dead heat when looking at the total impact on the environment.

Another alternative?

When data for the original ECAs was compiled, ‘hull speed’ (design speed) was used as the benchmark for consumption and emissions. Aboard my former ship, consumption at hull speed was around 150 tons of HFO per day. With the price of fuel increasing so quickly over the last five years, ship operators have been conducting experiments with slow speed steaming. What typically was a five ship service was increased to a six ship service, meaning that at the slower speed, six ships provide the same scheduled service as five.

Using the C-Energy Emission Compensation Model (CEECM), a European ECA study reports that it is possible to reduce daily consumption of HFO by one-third, just by proceeding at 2-3 knots less than hull speed. More importantly, emissions decreased along with the reduction in speed. In a study of the health risks associated with nitrous oxide emissions, acidification and eutrophication (the process by which a body of water becomes enriched in dissolved nutrients that stimulate the growth of aquatic plant life, usually resulting in the depletion of dissolved oxygen) were reduced in comparison to a ship proceeding at design speed on distillate, while health risks associated with particulate matter were equal.

Then there is cost. Using low sulphur heavy fuel oil is less expensive than distillate, not to mention the cost of installing a scrubber or exhaust gas recirculation apparatus. Let’s not forget the more forgiving nature of HFO versus distillate; ships will have fewer LOPs which could result in a catastrophic allision, collision or grounding.

Until slow steaming is accepted in IMO as an alternative to fuel switching, however, Masters and Chief Engineers must remain alert to the possibilities of an LOP.