ARCTIC CONTAINER SHIPPING

THE RISKS OF HEAVY FUEL OIL

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Arctic shipping is possible for longer periods of the year as climate change unveils new, previously inaccessible routes connecting Asia, Europe, and North America. Ice-free navigation enables more, and larger, ships to transit the Arctic, including containerships. Globally, and in the Arctic, most containerships use heavy fuel oil (HFO), the world's dirtiest transportation fuel. HFO poses serious environmental and economic risks, especially in ecologically sensitive areas like the Arctic. When spilled, HFO breaks down slowly, particularly in cold water. Unlike other fuels, which float on the surface when spilled, HFO emulsifies in sea water, making it nearly impossible to clean up, especially if it sticks to sea ice.

Using HFO is risky not only because of its spill potential, but also because burning it produces harmful air and climate pollutants including black carbon (BC), a small dark particle that settles on Arctic snow and ice, absorbs sunlight, accelerates melting, and contributes to Arctic and global warming. Containerships use and carry HFO in the Arctic today and larger containerships are expected as countries exploit Arctic shortcuts. In this article, I describe the prevalence of HFO-fueled containerships in the Arctic, with a focus on those burning and carrying the greatest quantities of this dangerous fuel.

HFO IN THE ARCTIC

For ships, Arctic waters are defined in the International Maritime Organization's (IMO) Polar Code and exclude the less icy waters around Scandinavia (Figure 1) which we call the IMO Arctic. Under the Polar Code, ships plying polar waters are subject to additional environmental and safety rules and, at the South Pole, ships operating in Antarctic waters (south of 60° S latitude) are prohibited from using or carrying HFO onboard as a means of protecting the polar environment. The Polar Code recommends that ships not use or carry HFO in the Arctic, but it is not mandatory. As such, ships operating in the IMO Arctic, including containerships, are free to use and carry HFO.

In 2015, 2,086 ships operated in the IMO Arctic, according to ongoing research by the ICCT. The most common ships were fishing vessels, which tend to operate on cleaner marine distillate fuels; however, many cargo ships, and more than a few fishing vessels, operated on HFO. About 42% (889 of 2,086) of ships operating in the IMO Arctic in 2015 were HFO-fueled. While less than half of ships operating in the Arctic burned HFO, HFO represented 57% of fuel used by weight, 76% of fuel carried by weight, and 56% of distance-weighted fuel carried (calculated as the fuel onboard the ship times the distance the ship traveled). Additionally, 68% of the 193 tonnes of BC Arctic ships emitted in 2015 resulted from burning HFO.

A	B	C	D	E	F	G
60°00'.0N 056°37'.1W	58°00'.0N 042°00'.0W	64°37'.0N 035°27'.0W	67°03'.9N 026°33'.4W	(Sørkapp, Jan Mayen) 70°49'.56N; 08°59'.61W	(by the Island of Bjørnøya) 73°31'.6N; 019°01'.0E	(Cap Kanin Nos) 68°38'.29N; 043°23'.08E

Source: International Council on Clean Transportation

Figure 1. The Arctic as defined in the Polar Code (the "IMO Arctic").

CONTAINERSHIPS IN THE ARCTIC

Forty-three containerships sailed the IMO Arctic in 2015 and all of them used and carried HFO as their primary fuel. Of those 43, only a handful of them operated for significant amounts of time in the IMO Arctic. Seven ships stand out, each operating in the IMO Arctic for more than 1,000 hours in 2015: five Danish-owned and flagged ships operated by the Danish government's Royal Arctic Line, and two Russian-owned and flagged ships operated by Russian companies Trident Trust Group and FESCO. For comparison, the other 36 containerships each spent 60 hours or less operating in the Arctic in 2015, meaning that they didn't transit the Arctic. However, several ships that are technically classified as 'general cargo' ships, which can carry all sorts of cargo but can also carry containers, have transited the Arctic in recent years, including China's HFO-fueled Yong Sheng, which first transited the Northern Sea Route in 2013, with return voyages in 2015 and 2016. The Yong Sheng can carry up to 19,150 tonnes of cargo, including up to 1,226 twenty-foot equivalent unit (TEU) containers. Thus, trans-Arctic container shipping has already come to the Arctic.

Focusing on dedicated container shipping (i.e. ships classified as containerships), it's no surprise that the most active container ships are owned and operated by Danish and Russian companies, as both Denmark and Russia are prominent Arctic nations. The Arctic state of Greenland is an autonomous country under the Kingdom of Denmark, and Russia controls the majority of the Arctic coastline. Together, these seven Danish and Russian ships are capable of carrying 3,870 TEU. These ships are small compared to the 20,000+ TEU behemoths launched in recent years, but as Arctic sea ice dwindles, we expect to see more, and larger, containerships taking advantage of trans-Arctic routes, which can be up to 50% shorter in length than transiting the Suez Canal.

Among the seven most active containerships in the Arctic, the 24-year-old, 424-TEU Irena Arctica was the most active. The Irena Arctica serves the various towns that dot Greenland's southern coastline, with typical calls on the Greenlandic ports of Nuuk, Paamuit, Narsaq, and Ilulissat, among others. The ship has ice-breaking capabilities; in fact, it's rated by the DNV classification society as ice class ICE-1A*, which means that it can usually operate in heavy ice conditions without the assistance of an icebreaker. Even so, operating in heavy ice conditions while carrying HFO onboard is risky business.

From a spill perspective, the risks of using HFO in the Arctic are related to the amount of HFO carried in ships' fuel tanks, any hull

and tank protections, and the distance HFO-fueled ships sail in Arctic waters. From a climate perspective, the risks of using HFO are related to the amount of HFO consumed, as burning HFO emits climate warming pollutants, including carbon dioxide (CO^2) and BC. The Irena Arctica sailed nearly 51,000 nautical miles within the IMO Arctic in 2015 and she typically carries over 500 tonnes of HFO in her fuel tanks at any given time, resulting in distance-weighted HFO carriage of over 26 million tonne-nautical miles. Over the course of the year, the Irena Arctica burned more than 3,500 tonnes of HFO (~22,500 barrels), emitting 2 tonnes of BC, approximately equivalent to the annual BC emissions from 800 heavy-duty trucks.

Interestingly, the Irena Arctica didn't always operate on HFO. In 2010, she switched from using cleaner, but more expensive, distillate fuel to exclusively using HFO. According to DNV, Royal Arctic Lines would prefer to operate its fleet on distillate fuels because it lengthens the maintenance interval for ship engine and fuel systems, but it's significantly cheaper to use HFO. As ships continue to use HFO in the Arctic, the spill risks and climate risks will persist.

THE FUTURE OF HFO IN ARCTIC SHIPPING

As long as HFO continues to be the cheapest maritime transportation fuel, it's hard to imagine ships capable of burning HFO using anything else. And with Arctic ice receding, it won't be long before more, and larger, containerships take advantage of trans-Arctic routes. Indeed, we're already seeing large general cargo ships, with containers onboard, regularly transiting the Arctic. As more HFO-fueled ships take advantage of Arctic shortcuts, the risks of an HFO spill and the damaging impact of BC emissions will grow.

Upcoming regulations mean that, beginning in 2020, the maximum allowable sulfur content of marine fuels will drop from 35,000 parts per million (ppm) to 5,000 ppm. According to the IMO, the average sulfur content of HFO is about 26,000 ppm and the average for distillate fuels is approximately 800 ppm. At first glance, the regulation appears to prohibit the use of high-sulfur HFO, including in the Arctic. However, it's possible to blend HFO with low-sulfur distillate fuels to make a fuel that is cheaper than distillate, but still contains HFO, and complies with the 5,000 ppm sulfur requirement. Additionally, ships can comply by installing exhaust gas cleaning systems (more commonly known as "scrubbers") that allow the ship to continue to use high-sulfur HFO because the scrubber removes sulfur from the exhaust stream, thereby achieving "equivalent" compliance. DNV reports that more than 350 ships have or will have scrubbers installed by 2020, with cruise ships making up the biggest market, but with containerships accounting for 10% of installations. Thus, even in 2020 and beyond, there's no guarantee that HFO will be eliminated in the Arctic under current regulations.

To ensure the Arctic receives the same protections as its polar sister (Antarctica), a group of environmental NGOs called the Clean Arctic Alliance have campaigned to ban the use and carriage of HFO for ships sailing Arctic waters. (HFO cargo, as opposed to the fuel in the ships' fuel tanks, would be exempt from the ban.) Their efforts have gained traction. In April, the IMO agreed to develop a ban on the use and carriage of HFO as fuel in Arctic waters, subject to an impact assessment to ensure that Arctic communities are protected from potential undue economic consequences of a ban. While others, namely Russia, have proposed other options, including navigational measures, infrastructure development, emergency preparedness, and crew training, banning HFO in the Arctic is the simplest and most effective way to protect this unique and pristine environment. Using distillate marine fuels is the obvious replacement for HFO, but other fuels such as LNG, hydrogen, batteries, and fuel cells are possible alternatives as well. Early next year, the IMO's Pollution Prevention and Response subcommittee will begin its work, to develop a ban on the use of HFO in the Arctic. When a ban might enter into force is anyone's guess; it's easy to stall in the international environmental policy realm. Until then, you can expect HFO to continue to be used in the Arctic, in some form, for several years to come.

ABOUT THE AUTHOR

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ABOUT THE ORGANIZATION

The International Council on Clean Transportation is an independent nonprofit organization founded to provide first-rate, unbiased research and technical and scientific analysis to environmental regulators. Its mission is to improve the environmental performance and energy efficiency of road, marine, and air transportation, in order to benefit public health and mitigate climate change.

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