Title: The Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2021 **IA No:** DfT00422 **RPC Reference No:** RPC-DfT-4483(1) **Lead department or agency:** Department for Transport **Other departments or agencies:** Maritime and Coastguard Agency	**Impact Assessment (IA)** **Date: 20 December 2020** **Stage: Final** **Source of intervention:International** **Type of measure: Secondary Legislation** **Contact for enquiries:** maritime-environment@dft.gov.uk

Summary: Intervention and Options

RPC Opinion: GREEN

Cost of Preferred (or more likely) Option (in 2019 prices)			
Total Net Present Social Value	**Business Net Present Value**	**Net cost to business per year***	**Business Impact Target Status**
-£14m	-£14m	£118m	Non-qualifying provision

What is the problem under consideration? Why is government intervention necessary?

Sulphur oxides and nitrogen oxides emitted by shipping result in adverse human health effects and environmental damage. These costs are not reflected in the market prices of the fuels used by shipping, meaning that, in the absence of intervention, the shipping industry would underinvest in reducing these emissions. Therefore, in 2008 the International Maritime Organization (IMO) introduced regulations to limit these emissions. As there are currently some gaps in the UK's implementation of these regulations, government intervention is required to bring our existing domestic legislation into line with the international regulations.

What are the policy objectives and the intended effects?

The first objective is to bring UK law into line with latest international regulations. The intended effects of this are to comply with the UK's obligations as a Party to the International Convention for the Prevention of Pollution from Ships (MARPOL), reducing the risk of reputational damage to the UK and any knock-on implications for the trading conditions of UK ships; and to enable UK inspectors to enforce these regulations more effectively. The second objective is to avoid the risk of delays between future changes to the relevant MARPOL requirements and the transposition of these into UK law by introducing Ambulatory Referencing.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

Two options have been considered: a) Do Nothing; and b) Full Implementation of the latest international regulations and the introduction of ambulatory referencing (Option 1).

Do Nothing is not considered to be a viable option as it would not enable the UK to comply with its obligations as a Party to MARPOL. Under this scenario, the ability of UK inspectors to enforce the international regulations would be constrained. However, it is expected that UK ships operating internationally would still have to comply with the international regulations to avoid enforcement action and fines from other IMO states.

Option 1 is our preferred option as it would fully meet the policy objectives.

Given the need to ensure that UK law fully aligns with the international regulations, no alternatives to regulation have been identified.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 2025

Does implementation go beyond minimum EU requirements?		N/A		
Is this measure likely to impact on international trade and investment?		Yes		
Are any of these organisations in scope?	**Micro**Yes	**Small**	**Medium**	**Large**
What is the CO_2 equivalent change in greenhouse gas emissions?		**Traded:**	**Non-traded:**	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister: Date: **09:43, 26 May 2021**

Summary: Analysis & Evidence

Policy Option 1

Description: Full implementation of the latest international regulations and the introduction of ambulatory referencing

FULL ECONOMIC ASSESSMENT

Price Base Year 2020	PV Base Year 2020	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low: -£110m	**High:** -£2	**Best Estimate:** - £14m

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	£0	NA	£0.2m	**£2m**
High	£0		£13.6m	**£110m**
Best Estimate	£0		£1.8m	**£14m**

Description and scale of key monetised costs by 'main affected groups'

We expect that UK owned ships operating internationally will comply with the international regulations under the Do Nothing scenario to avoid enforcement action from other IMO states. Therefore, compared with the Do Nothing scenario, the costs to UK owned ships operating internationally of complying with Option 1 are considered to be neutral.

In contrast, under the Do Nothing scenario, the UK would not be able to effectively enforce the new requirements for UK owned ships that only operate on domestic voyages between UK ports. Therefore, for UK owned ships that only operate on domestic voyages between UK ports, we have attributed the costs of complying with the new requirements as costs of Option 1.

Accordingly, the monetised costs and net present value estimates for Option 1 reflect the estimated costs of complying with the new requirements for UK owned ships that only operate on domestic voyages between UK ports.

However, in order to illustrate the overall impact of the new international obligations on UK businesses, we have separately created a constructed counterfactual to estimate the overall costs to UK owned ships of complying with the international regulations that are not already incorporated in UK legislation, which has been used to estimate the direct impact on business shown below.

Hence, the direct impact on business and net cost to business per year estimates (note – these estimates are labelled with an asterisk '*') reflect the estimated costs of complying with the new requirements for both UK owned ships operating domestically and UK owned ships operating internationally.

Other key non-monetised costs by 'main affected groups'

Non-monetised compliance costs for UK ship owners: Given the limitations of the available evidence, it has not been possible to monetise all compliance costs for UK ship owners. For example, the data used in the analysis only covers ships on the UK Ship Register. So, none of the costs for UK owned ships registered on other flags are taken into account in any of the estimates.

Familiarisation costs to UK businesses: Under Option 1, any familiarisation costs are not expected to be significant.

Administration and enforcement costs to the Maritime and Coastguard Agency (MCA): Under Option 1, any additional costs to the MCA are expected to be minimal.

Impact on greenhouse gas emissions: It is expected that there will be a modest increase in the greenhouse gas emissions from UK domestic shipping due to the use of abatement technology.

Costs to business of ambulatory referencing: None of the costs of any future amendments to the international regulations, which will be introduced in UK law as a result of ambulatory referencing, are reflected in any of the estimates.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	£0	NA	£0	**£0**
High	£0		£0	**£0**
Best Estimate	£0		£0	**£0**

Description and scale of key monetised benefits by 'main affected groups'

Given the limitations of the available evidence, it has not been possible to monetise any of the benefits of Option 1 for the purpose of this impact assessment.

Other key non-monetised benefits by 'main affected groups'

Benefits from reduced emissions of air pollutants: For ships that only operate on domestic voyages between UK ports, the benefits of these ships complying with the new requirements should be treated as benefits of Option 1 in line with the approach taken for the monetised costs. In particular, it is expected that the new requirements will lead to a reduction in the emissions of nitrogen oxides (NOx) from UK domestic shipping.

In contrast, for UK owned ships operating internationally, we assume that the benefits associated with the new requirements would be fully realised under the Do Nothing scenario and hence that there would be no additional benefits under Option 1.

Avoiding the risks of not implementing the international regulations in UK law: Under Option 1, it is expected that the amendments to domestic legislation would reduce the risk of any reputational damage to the UK from not complying with our obligations as a Party to MARPOL and any knock-on implications for the trading conditions of UK owned ships.
Benefits of more effective enforcement: Under Option 1, UK inspectors would be able to enforce the international regulations more effectively.
Benefits of international regulations: It should be recognised that the international regulations also result in benefits for human health and to the environment, which are not reflected in the estimates of the direct impact on business shown below.

Key assumptions/sensitivities/risks	**Discount rate (%)**	3.5%

The estimated costs presented in the IA are very sensitive to the data sources that have been used in this analysis and the assumptions that have been made (e.g. about future fuel consumption, the price differential for lower sulphur fuel, the costs of emissions abatement technology, etc.). Therefore, these estimates should be interpreted as indicative estimates of the order of magnitude of these costs.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			**Score for Business Impact Target (qualifying provisions only) £m:** N/A
Costs*: £118m	**Benefits:** £0m	**Net*:** - £118m	

1 Policy background

1. Air pollution is the top environmental risk to human health in the UK, and the fourth greatest threat to public health after cancer, heart disease and obesity[1]. The UK Government is determined to reduce air pollution and improve the quality of the air[1]. To underline this commitment the Government published the DEFRA-led Clean Air Strategy in January 2019. The Government has additionally established the new government-led Clean Maritime Council (CMC) to bring together different parts of the maritime sector to drive uptake of cleaner technologies and greener fuels.

2. This instrument implements a series of pollution control measures agreed by the International Maritime Organization (IMO), designed to reduce emissions of sulphur oxides (SOx) and nitrogen oxides (NOx) from all ships[2]. The IMO regulates pollutant emissions from ships under Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL). The UK has played a leading role in negotiating international limits to pollutant emissions from shipping. These regulations are expected to have, and will continue to have, a positive impact on the reduction of both international and domestic shipping emissions in UK and international waters.

3. As part of those international negotiations in 2006-2007, the IMO established an informal Cross Government/Industry Scientific Group to study the effect of the different fuel options for reducing sulphur and to develop the NOx Technical Code[3]. The options in the Group's report for controlling SOx emission were considered at the 57th session of IMO's Marine Environment Protection Committee (MEPC 57). During the discussion, it became clear that none of the options presented in the report could be accepted by a sufficient number of delegates at MEPC 57. In the end, a separate 'compromise' solution was adopted the Parties at MEPC 57, which became the basis for the new pollutant limits incorporated into Annex VI.

4. Annex VI regulates emissions from shipping in two ways. Firstly, there are controls on emissions which apply globally to ships – such as the global 0.5% limit on the amount of sulphur contained in marine fuels that can be used, and the NOx Tier I and Tier II standards for new engines. Then there are regional controls which impose stricter SOx limits and the NOx Tier III standard on ships engines when operating in waters that are designated as emission control areas (ECAs). There are currently four such areas:

    - The North American ECA – extending 200 miles of the west and east coasts of the USA and Canada.
    - The US Caribbean ECA
    - The Baltic Sea ECA
    - The North Sea ECA (which includes the English Channel east of Falmouth)

5. Since 2015, ships operating in the North Sea ECA must either use either 0.1% sulphur fuel, an exhaust gas cleaning system (EGCS), or use an alternative fuel which meets an equivalent standard.

[1] Defra – Clean Air Strategy 2018 page 1. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf

[2] The main pollutants are sulphur dioxide (SO_2) and nitrogen dioxide (NO_2), but in the legislation (and for the sake of simplicity) they are commonly referred to as SOx and NOx.

[3] IMO Committee MEPC 57/4: "Report on the outcome of the comprehensive study undertaken by the informal cross government/industry scientific group of experts established to evaluate the effects of the different fuel options proposed under the revision of MARPOL Annex VI"

6. Furthermore, the IMO has agreed a 0.5% sulphur limit for global shipping from 1 January 2020 and the introduction of NOx emissions control areas for the North Sea and the Baltic Sea in 2021.

7. For SOx emissions, ship operators can either achieve the sulphur limits by using compliant 0.1% or 0.5% sulphur fuel, or by using of an exhaust gas cleaning system (EGCS) - which is an emissions abatement technology - or by using an alternative fuel which delivers an equivalent reduction in emissions. The sulphur limit for sea-going vessels is comparatively high compared with other transport sectors. The fuel used in the road transport sector, on inland waterways and for non-road mobile machinery (e.g. agricultural machinery) has a maximum sulphur content of 0.001%[4]. For NOx emissions, reductions will be achieved by restricting and prohibiting the type of engine which can be brought onto the market for new and refitted vessels. For the waters which are subject to the NOx Tier III emission standard, we expect that ships will either use a post combustion abatement technology (e.g. Selective Catalytic Reduction system or an exhaust gas recirculation system), or an alternative fuel (such as liquefied natural gas, batteries or a fuel cell technology).

8. These changes to the international regulations in MARPOL Annex VI are expected to deliver significant reductions in the emissions of air pollutants from shipping. In particular, the IMO expects that the 0.5% sulphur limit for global shipping will mean a 77% drop in overall SOx emissions from ships, equivalent to an annual reduction of approximately 8.5 million metric tons of SOx[5]. In addition, applying the Tier III standard in the North Sea and Baltic ECA will reduce the limits on NOx emissions from new ships operating in this area by around three-quarters[6].

9. Domestic legislation which controls air pollution from ships, is contained in the *Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008* (SI 2008/2924) ("the 2008 Regulations"). Most of the current SOx and NOx limits for ships were adopted in 2008, which saw a major revision to Annex VI. The 2008 Regulations implemented the NOx Tier I standard on diesel engines with a power output of 130kW, on ships constructed on or after 1 January 2000 wherever they operate. It also banned the use of fuel with a sulphur content exceeding 4.5% and banned the use of fuel with a sulphur content exceeding 1.5% for ships operating in an ECA, unless they were using an abatement technology. The 2008 Regulations were amended by the Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2010 (SI 2010/895), to implement EU provisions contained in Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels. These included a requirement for ships at berth in an EU port for more than two hours to switch to 0.1% sulphur fuel, and a requirement for regular passenger ships using EU ports not to use fuel which exceeds 1.5% sulphur. Neither of these EU measures are required under MARPOL Annex VI.

10. The 2008 Regulations were further amended by the Merchant Shipping (Prevention of Air Pollution from Ships) and Motor Fuel (Composition and Content) (Amendment) Regulations 2014 (SI 2014/3076). These regulations implemented Directive 2012/33/EU of 21 November 2012 amending Council Directive 1993/32/EC as regards the sulphur content of marine fuels (commonly referred to as 'the sulphur directive'), which reduced within EU waters[7] the maximum sulphur content of fuel used inside an ECA to 0.1%, and outside an ECA to 3.5% by mass with effect from 1 January 2015, and further reduced the latter to 0.5% with effect from 1 January 2020. The requirements in the sulphur directive were implemented into UK law by SI 2014/3076. With the exception of the IMO's

[4] Amendment to the Fuel Quality Directive (EU Directive 2009/30/EC) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0030&from=EN

[5] http://www.imo.org/en/MediaCentre/HotTopics/Pages/Sulphur-2020.aspx

[6] http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Nitrogen-oxides-(NOx)-%E2%80%93-Regulation-13.aspx

[7] Those waters which are currently controlled by the UK and EU / EEA States.

ban on the carriage of >0.5% sulphur which was adopted on 26 October 2018, our existing legislation applies all of the sulphur requirements under MARPOL Annex VI within EU waters (see Annex A).

11. The new statutory instrument - *The Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2020* ("The new Regulations") - will implement the changes to MARPOL Annex VI which are not included in our existing domestic legislation. Until the new Regulations come into force, UK Port State Control Officers from the UK's Maritime and Coastguard Agency (MCA) that inspect arriving ship for breaches in international law, have a limited number of sanctions they can apply to non-compliant foreign registered ships. They can record a deficiency and/or temporarily detain the vessel, or order the ship to debunker if the ship is using non-compliant fuel. But until the new Regulations come into force, they would not have the option of taking the shipowner, operator and / or Master of the vessel to Court to impose a fine. The new Regulations will enable UK inspectors to enforce the international pollutant limits and standards more effectively.

12. The main changes that the new Regulations make to UK law are to apply:

    a) The NOx Tier I standard on ships / engines of 5,000kW and over, constructed since 1 January 1990.

    b) A global ban on ships using (or carrying >0.5% sulphur fuel intended for use[8]) fuel oil which exceeds 0.5% sulphur by mass (note – a 0.1% or 0.5% limit on fuel use already applies to all ships in UK waters (implemented by SI 2014/3076), and to all ships in EU waters (as explained in paragraph 10).

    c) The global NOx Tier II standard for new ships / engines constructed since 1 January 2011.

    d) The NOx Tier III standard for ships / engines constructed since 1 January 2016) operating inside the North America and US Caribbean NOx ECA.

    e) The NOx Tier III standard for new ships / engines operating in the North Sea and Baltic ECA from 01 January 2021 onwards.

13. The new Regulations do not affect the existing 0.1% sulphur EU requirements for ships at berth in a UK port, implemented under (SI 2010/895), as these must be retained. However, obsolete references in the 2008 Regulations (SI 2008/2924) have been removed, most notably, references to a previous 1% sulphur limit for ships inside an ECA (which expired on 31 December 2014) and the EU requirement for passenger ships operating outside an ECA to use 1.5% sulphur fuel (which expired on 31 December 2019). More information on the measures listed in paragraph 12 can be found at **Annex A**.

2 Problem under consideration

14. The UK regulations are intended to bring UK law into line with latest international regulations. This will allow the UK to comply with its obligations as a Party to the International Convention for the Prevention of Pollution from Ships (MARPOL). Non-compliance would result in the risk of reputational damage to the UK and potential knock-on implications for the trading conditions of UK ships. Failing to transpose the outstanding amendments in the Convention would also mean UK inspectors would not be able to enforce these regulations effectively.

[8] The carriage of high sulphur fuel oil as cargo is still permitted.

15. The problem that MARPOL Annex VI is intended to address is the air pollution that results from shipping activity.

16. Poor air quality is a risk to human health and can shorten lives. It has been linked to cancer, asthma, stroke and heart disease, diabetes, obesity, and changes linked to dementia. The health problems resulting from exposure to air pollution have a high cost to people who suffer from illness and premature death, to our health services and to business.

17. Air pollution is also a risk to our natural environment, damaging our waterways and biodiversity. It has direct impacts on the natural environment, reducing crop yields, polluting oceans and in some instances can contribute to climate change. Cleaner air directly benefits animals and habitats as well as creating a better environment for everyone to live, work and thrive in[9].

18. Scientific data and numerous studies demonstrate that shipping is an important source of emissions of air pollutants. In 2017, domestic shipping (ships that start and end their journey in the UK) accounted for 12% of the UK's total domestic nitrogen oxide (NOx) emissions, 2% of primary small particulate matter (PM2.5) and 8% of sulphur oxides (SOx) emissions[10]. International shipping (ships in transit, or arriving from non-UK locations) also has a significant impact on air quality in the UK. Emissions from international shipping are not included in the total for domestic shipping nor are they included in the national totals for UK pollution emissions. Nevertheless, these emissions do have an impact on UK public health and the environment, and are estimated to be significantly higher than the total for domestic shipping. For example, analysis carried out by Imperial College estimated that NO_X emissions from UK international shipping, and ships not destined for a UK port but which transit UK waters, were three and six times higher respectively than for UK domestic shipping in 2016[11].

19. MARPOL Annex VI particularly targets the emissions of SOx and NOx from shipping.

20. SOx (particularly sulphur dioxide) is a corrosive, acidic gas produced from the combustion of solid and liquid fuels which contain sulphur. Asthma sufferers are particularly sensitive to SOx emissions, and the sulphur in coal played a contributory key role in the health impacts of the London smog in 1952, where estimates of the resulting mortality range between 8,000 and 12,000 deaths. Moreover, SOx emissions can also combine with water vapour in the atmosphere to produce acid rain which caused significant harm to forests and freshwater habitats in the Northern Hemisphere in the 1970s - 80s. The damage caused by SOx emissions has reduced markedly in recent years following restrictions on the sulphur content of liquid fuel as well as the shift away from the reliance on coal for energy generation[12].

21. NOx are a group of gases that are predominantly formed during the combustion of fossil fuels. The majority of NOx emitted as a result of combustion is in the form of nitric oxide (NO). When NO reacts with other gases present in the air it can form nitrogen dioxide (NO_2) which is harmful to health. Short-term exposure to concentrations of NOx (particularly $NO_{2)}$ can cause inflammation of the airways and increase susceptibility to respiratory infections and to allergens. It exacerbates the symptoms of those who are already suffering from lung or heart conditions, shortening their lives. [13]

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[9] Clean Air Strategy - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf

[10] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850280/env0301.ods

[11] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf - page 47.

[12] Clean Air Strategy 2019 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf

[13] Ibid.

3 Rationale for intervention

22. The rationale for intervention by government to introduce MARPOL Annex VI is discussed below.

23. As explained in the previous section, sulphur oxides (SOx) and nitrogen oxides (NOx) emitted by the shipping industry result in adverse human health effects, as well as environmental damage. These costs are not reflected in the market prices of the fuels used by the shipping industry, meaning that, in the absence of intervention by governments, the shipping industry would underinvest in reducing these emissions. Intervention by governments is therefore required to set appropriate limits on these emissions.

24. International shipping is one of the most global of industries, so it is logical that it should be regulated through international conventions. By applying international regulations, the shipping industry can be assured of the regulatory framework with which it must comply for several years. It also enables the owners and operators of vessels to plan a strategy to meet the requirements and reduces the risk that the policy may change or the goalposts may move. This offers an incentive for investment in the technologies that have been developed to meet the proposed emission standards. It should also lead to a more consistent and co-ordinated approach to enforcement, which should reduce the risk of distortions in competition from non-compliant ships.

25. As there are currently some gaps in the UK's implementation of the international regulations in MARPOL Annex VI, intervention by the UK Government is now required to bring our existing domestic legislation into line with these international regulations.

26. The new Regulations implement the outstanding gaps from MARPOL Annex VI and incorporates them into our domestic regime.

27. Whilst we expect that UK owned ships operating internationally will comply with the international regulations in the absence of the new Regulations to avoid enforcement action and fines from other IMO states (see Section 6.2 for further details), the new Regulations are required to comply with the UK's obligations as a Party to MARPOL. This will reduce the risk of reputational damage to the UK from not meeting our obligations and any knock-on implications for the trading conditions of UK ships (see Section 6.3.2.2 for further details). The new Regulations will also enable our Port State Control officers to more effectively inspect foreign registered vessels arriving at UK ports to ensure compliance (see Paragraph 11 and Section 6.3.1.4 for further details). The Regulations are also needed to ensure that domestic shipping operating exclusively in UK waters (and not subject to Port State Control inspection) also comply with the requirements in Annex VI,

28. The Regulations which implement the outstanding MARPOL Annex VI provisions do not go beyond what is strictly needed to align the UK with the international regime.

29. To ensure there is fair competition and a level playing field, consultation with the UK Chamber of Shipping has confirmed with the Department that it wants the new Regulations to come into force as soon as possible.

4 Policy objectives

30. The policy objectives that the Government wants to achieve are divided into two distinct areas: transposition of outstanding amendments to MARPOL Annex VI into UK law; and the introduction of ambulatory referencing (see Annex B for further details).

4.1 Transposition of outstanding amendments to MARPOL Annex VI into UK law

31. The first policy objective is to bring UK law into line with latest international regulations.

32. European air quality legislation for shipping is broadly aligned with international legislation for sulphur emissions, although it does not implement the global 0.5% sulphur cap outside of EU waters[14]. In the past the UK has prioritised the transposition of sulphur limits to meet the EU standards. European legislation does not impose any restrictions or controls on ships' NOx emissions, and as a consequence, there is a backlog in transposing and ensuring we can effectively enforce the NOx limits as laid down in Chapter III of Annex VI of the MARPOL Convention. However, if the UK did not put the new international regulations into UK law, UK ships operating internationally would still need to meet the new standards to avoid enforcement action outside the UK.

33. The intended effect of this objective is to comply with the UK's obligations as a Party to the International Convention for the Prevention of Pollution from Ships (MARPOL), avoiding the risk of reputational damage to the UK and any knock-on implications for the trading conditions of UK ships.

34. Equally, transposing the outstanding amendments in the IMO's will enable UK inspectors to enforce these regulations more effectively.

35. We have consulted the UK Chamber of Shipping on the new measure. The Chamber has indicated that its members are committed to a culture of continuous improvement, that would see a reduced impact on the environment and human health from air emissions from shipping. They confirm that they fully support the IMO global sulphur cap, and that the global cap should be effectively enforced to ensure a level playing field, ease administrative burdens and provide clarity. The UK Chamber also supports the stricter NOx Tier III controls in areas which have been designated as ECAs by the IMO.

36. The International Maritime Organization is planning to audit the UK's domestic legislation to ensure it is aligned with requirements in international conventions. The audit is scheduled to begin in February 2021, and it is important that all outstanding IMO legislation on pollutant air emissions is in place by then. The Regulations implement all the outstanding international requirements in relation to air pollutant emissions from ships.

4.2 Introduce ambulatory referencing

37. The second policy objective is to avoid the risk of lengthy delays between changes being made to the requirements in MARPOL Annex VI in the future and the transposition of these requirements into UK law by introducing Ambulatory Referencing (see section 5 and Annex B for further details).

38. Introducing ambulatory referencing to MARPOL Annex VI will directly fulfil the main request of industry from the Red Tape Challenge (see Paragraph 45 for more detail), which was to address the delay in transposition of international requirements. This also:

    a) provides the legal certainty sought by industry as domestic legislation will no-longer be out of step with international requirements;

[14] See Annex A - EU waters includes territorial and controlled waters belonging to the UK, EU and EEA States.

b) reduces the administrative burden for industry, as it can focus on the convention text in technical areas rather than also having to refer to national implementing legislation;

c) meets the industry desire for copy-out text, and reduce debates on whether a provision has been "gold-plated"; and

d) helps provide a level playing field between UK ships calling at foreign ports and foreign flagged ships calling at UK ports.

5 Options considered

39. Two options have been considered in this impact assessment.

- ***Do Nothing***

- ***Option 1 – Full Implementation of the latest international regulations and introduction of ambulatory referencing (the preferred option)***

40. Do Nothing is not considered to be a viable option as it would not enable the UK to comply with its obligations as a Party to MARPOL. Under this scenario, the ability of UK inspectors to enforce the international regulations would be constrained. However, as countries can enforce these requirements on all ships calling at their ports under the IMO's Port State Control regime, UK registered ships operating internationally would still need to demonstrate compliance when they call at ports in countries that are enforcing these requirements.

41. Option 1 will fully implement the outstanding requirements under MARPOL Annex VI into our domestic legislation and introduce ambulatory referencing to refer UK industry to the most up to date international legislation in MARPOL Annex VI.

42. Under Option 1, the provisions which will be implemented in UK law are:

- The NOx Tier I standard on ships / engines of 5,000kW and over, constructed since 1 January 1990.
- The global ban on ships using (or intending to use[15]) fuel oil which exceeds 0.5% sulphur by mass.
- The global NOx Tier II standard for new ships / engines constructed since 1 January 2011.
- The NOx Tier III standard for ships / engines constructed since 1 January 2016 operating inside the North America and US Caribbean NOx Emission Control Area (ECA).
- The NO Tier III standard for new ships / engines operating in the North Sea and Baltic ECA from 01 January 2021 onwards.

43. Under Option 1, Ambulatory Referencing will also be introduced. Ambulatory Referencing transposes international provisions without gold plating or adding any additional obligations (see Annex B for further details). This will result in future changes to MARPOL Annex VI being automatically incorporated into UK law.

44. Supporting documentation will be provided by the Maritime and Coastguard Agency (MCA) to add clarification and additional guidance, especially where the international text is open, as required e.g.

[15] The carriage of high sulphur fuel oil as cargo is still permitted.

where the Chapter states that an obligation must be performed "to the satisfaction of the administration", the MCA will specify what is required to meet this obligation.

45. During the Red Tape Challenge industry raised its concern over the lengthy delays between amendments to international Conventions coming into force globally and being transposed into UK law. These delays lead to legal uncertainty and disparity between national and international legislation.

> **Specifically the UK Chamber of Shipping's**[16] **response to the Red Tape Challenge was:** *"The UK shipping industry was very pleased to contribute to the Government's recent Red Tape Challenge initiative and proposed a number of basic principles which might help ensure 'better regulation' into the future.*
> *One of these involved the direct read-across through 'ambulatory references' of international conventions which have been accepted by Government into UK law without their provisions having to be rewritten in the national context.*
> *This would in particular help with keeping the national law up to date when amendments were agreed, of course again subject to their acceptance by Government.*
> *The international convention text would clearly remain subject to the same scrutiny as at present and could be supplemented by guidance in the UK as to interpretation as necessary.*
> *We believe that such a practice in the UK would substantially reduce the regulatory and legal process surrounding the adoption in this country of international regulations, which are an essential part of international shipping and without which the UK merchant fleet would not be able to operate."*

46. In response, DfT sought regulatory reform through the Deregulatory Act 2015. The Act introduced an additional power which allows for ambulatory referencing to be made to international instruments. Ambulatory Reference means a reference in legislation to an international instrument as modified from time to time (and not simply to the version of the instrument that exists at the time the secondary legislation is made).

47. It is worthwhile noting that whilst the UK Chamber of Shipping advocates 'ambulatory references', this does not negate the Government's principle of consultation. Amendments to international Conventions are developed and agreed at the IMO, where in addition to Member States, industry is well represented. Industry is therefore heavily involved with policy development and also in helping to shape the UK's negotiating position. Working in partnership UK officials and industry actively contributes to negotiations on new initiatives to ensure they are appropriate and proportionate measures.

48. Moreover, if the IMO were to consider changing the boundaries of existing ECA or creating a new ECA, this could only be achieved with the support of all the coastal States adjacent to these waters. A full cost benefit analysis confirming that the benefits outweighed the costs for the proposal, would also have to be submitted for consideration at the IMO before the waters or revised boundaries could be designated as an ECA.

49. Option 1 has the support of the UK shipping industry and fully meets our policy objectives, and is therefore the preferred option.

[16] The UK Chamber of Shipping is a trade association and considered to be voice for the UK shipping industry. It has around 150 members from across the maritime sector. Further information on the Chamber is available from: https://www.ukchamberofshipping.com/about-us/

50. We have discounted non-regulatory alternatives, as this would not be an effective means of controlling emissions from a global industry. Neither would it satisfy our obligation as a Party to MARPOL Annex VI to implement and enforce these international requirements.

51. We have not publicly consulted on the changes to these measures as amendments to International Conventions are developed and agreed at the IMO, where in addition to Member States, industry is well represented. Industry is therefore heavily involved with policy development and also in helping to shape the UK's negotiating position. Working in partnership, UK officials and industry actively contribute to negotiations on new initiatives to ensure there are appropriate and proportionate measures to improve standards. We have spoken to the UK Chamber of Shipping and the UK Petroleum Industry Association ahead of introducing the proposed changes.

6 Costs and Benefits

6.1 Approach

52. In this section, the costs and benefits of Option 1 (see Section 6.3 for further details) have been assessed relative to the Do Nothing scenario (see Section 6.2). This represents our assessment of the impact of the amendments to UK law under Option 1.

53. We expect that UK owned ships operating internationally will comply with the international regulations under the Do Nothing scenario to avoid enforcement action from other IMO states. Therefore, compared with the Do Nothing scenario, the impacts on UK owned ships operating internationally of complying with Option 1 are considered to be neutral.

54. In contrast, under the Do Nothing scenario, the UK would not be able to effectively enforce the new requirements for UK owned ships that only operate on domestic voyages between UK ports. Therefore, we have attributed the impacts on UK ships that only operate on domestic voyages between UK ports of complying with the new requirements as costs and benefits of Option 1.

55. Accordingly, the estimates in this section only reflect the impacts of UK owned ships operating domestically complying with the new requirements.

56. However, in Section 7, we have separately created a "constructed counterfactual" to estimate the overall costs to UK owned ships of complying with the new international regulations which is used to estimate the direct impact on business in line with the Business Impact Target reporting requirements.

57. Hence, the estimates in Section 7 reflect the impacts of complying with the new requirements for both UK owned ships operating domestically and UK owned ships operating internationally.

58. Furthermore, it should be noted that the estimates that are presented in the Impact Assessment are dependent on the data sources that have been used in this analysis and the assumptions that have been made. There are considerable uncertainties around some of these assumptions and therefore these estimates should be interpreted as indicative estimates of the order of magnitude of these costs and benefits.

6.2 Do Nothing scenario

59. Under the Do Nothing scenario, the UK would not transpose any remaining gaps in our domestic legislation to bring it into line with the international requirements for SOx and NOx reductions.

60. In summary, the following conditions would apply to UK vessels within scope under the Do Nothing scenario:

    a) The 0.5% SOx limit would apply from 1 January 2020 in European (non-ECA) waters and be enforced for all ships in EU waters in accordance with the existing requirement under the Merchant Shipping (Prevention of Air Pollution from Ships) and Motor Fuel (Composition and Content) (Amendment) Regulations 2014 (SI 2014/3076)[17]. However, in practice, enforcement action by UK port State control officers through the Courts, would normally only occur if there was evidence that an offence took place in UK territorial or controlled waters, rather than in other European waters. Other port States would be notified of the action, and it would be for them to consider if they want to bring a separate action for offences committed in their waters.

    b) UK flagged ships operating in ECAs[18] would need to comply with the 0.1% sulphur limit in accordance with the existing requirements under SI 2014/3076.

    c) Ships would be allowed to use emission abatement technologies and alternative fuels as a means of meeting the existing UK requirements (and the more demanding international requirements).

    d) UK legislation would not implement either the NOx Tier I (for engines in large vessels generating over 5,000kW power, which were constructed between 1 January 1990 and 31 December 1999)[19] or the NOx Tier II standard on vessels operating in UK waters, or for UK flagged vessels operating outside of UK waters. However, these international standards have been in place since 2008, and all ships with engines that are within scope of these standards have to be surveyed and certified as compliant every 5 years, otherwise they will not receive an International Energy Efficiency Certificate (IEE Certificate) for the vessel. In addition, we understand that there is little incentive not to comply, as neither the Tier I or Tier II standards are difficult to achieve or expensive for engine manufacturers to produce. Therefore, it is expected that vessels which operate outside UK waters are already complying with these measures in order to be certified, and avoid enforcement action and fines from other IMO states.

    e) UK legislation would not implement the NOx Tier III requirements on vessels which operate inside the North American and US Caribbean Sea ECAs. However, as these standards have been in place since 2016 and are actively being enforced by port State control officers, it is expected that vessels are already complying with these measures.

    f) UK legislation would not implement the NOx Tier III requirements on new vessels constructed after 1 January 2021, which operate inside the North Sea and Baltic Sea ECAs; or the global ban on ships using fuel oil which exceeds 0.5% sulphur by mass in non-European (non-ECA)

[17] These regulations implemented Directive 2012/33/EU of 21 November 2012 amending Council Directive 1993/32/EC as regards the sulphur content of marine fuels, which reduced within EU waters the maximum sulphur content of fuel used inside an ECA to 0.1%, and outside an ECA to 3.5% by mass with effect from 1 January 2015, and further reduced the latter to 0.5% with effect from 1 January 2020. Directives 1999/32/EC and 2012/33/EU were consolidated and repealed by Directive (EU) 2016/802 of 11 May 2016 relating to a reduction in the sulphur content of certain liquid fuels.

[18] ECAs included are: the North Sea ECA, the Baltic Sea ECA, the North American ECA and the US Caribbean ECA.

[19] NOx Tier I requirements are included in our 2008 Regulations (SI 2008/2924) for all vessels with a power output of over 130kW, which were constructed after I January 2000.

waters from 1 January 2020. However, it is expected that UK flagged ships would have to comply with these measures for international voyages to avoid enforcement action and fines from other IMO states.

g) There would be less pressure on new UK flagged ships which operate entirely on domestic voyages between UK ports to comply with the requirements on NOx emissions detailed in paragraphs d) and f) above. These vessels would not be subject to port State control inspections and we would have very limited enforcement and sanctions options available. Hence, the UK would not be able to effectively enforce these requirements for UK owned ships that only operate on domestic voyages between UK ports.

61. The IMO Conventions are transposed into UK law to give the UK the legal powers to enforce them upon UK registered vessels that are in scope, as well as foreign registered vessels in UK territory. Under the Do Nothing scenario, these vessels, however, will be required to meet the standards of the updated IMO convention whenever they visit another country that is a IMO member. There are currently 177 IMO member states, of these 97 (representing 96.75% of world tonnage) have implemented MARPOL Annex VI - including all the major maritime nations[20]. This is enforced through port state control, where a ship visiting port is required to meet all relevant standards by the maritime authorities in that country. Ships which are registered to a State which is not a Party to MARPOL Annex VI, or which has not implemented its provisions, will not receive any favourable treatment. Quite the opposite in fact, they are more likely to be inspected on the grounds that they could pose a greater risk. If the ship does not meet the necessary standards, it can be detained and the owners and/or the Master could face enforcement action**.**

62. If the UK did not put the legislation into UK law, ships using the UK flag would still need to meet the new standards to avoid enforcement action outside the UK. Other UK businesses own ships that do not use the UK flag. These businesses will face the same update in standards and regulations because of the IMO convention, and not because of UK legislation, which has no legal effect on non-UK registered vessels outside of UK waters.

63. Although the main responsibility for ensuring such compliance remains with the flag State, arguably the most effective means of ensuring that ships comply with international requirements is to have the ship inspected by a qualified Port State Control Officer, at the port of destination. The UK is a member of the Paris Memorandum of Understanding (Paris MoU), an organisation which has 27 participating maritime Administrations and covers the waters of the European coastal States and the North Atlantic basin from North America to Europe. A similar organisation – the Tokyo MoU – covers the waters of the Asia / Pacific region and has 21 full time participating maritime Administrations. The aim of these organisations is to eliminate the operation of sub-standard ships through a harmonized system of port State control. To achieve this, more than 17,000 inspections take place on board foreign ships in the Paris MoU ports, ensuring that these ships meet international safety, security and environmental standards, and that crew members have adequate living and working conditions.[21]

64. Given that IMO measures are enforced globally, we expect that UK owned ships operating internationally will comply with the international requirements for SOx and NOx reductions under the Do Nothing scenario to allow them the flexibility to operate globally and to avoid enforcement action and fines from other IMO states.

[20] List of ratifications to MARPOL Protocol 1997 (Annex VI) http://www.imo.org/en/About/Conventions/StatusOfConventions/Documents/StatusOfTreaties.pdf.

[21] https://www.parismou.org/about-us/organisation

65. In contrast, with respect to the requirements on NOx emissions detailed in paragraphs 60 d) and f) above, the UK would not be able to effectively enforce these requirements on ships that only operate on domestic voyages between UK ports under the Do Nothing Scenario. The situation for ships that only operate on domestic voyages between UK ports under the Do Nothing scenario is explained further in Box 2 below.

66. The 'Do Nothing' scenario also poses the risk of reputational damage to the UK, the cost of which is difficult to quantify. A poor performance, due to the lack of transposition into UK law, in the mandatory IMO audit scheme has the potential for the UK to lose the "low risk status", causing the frequency of inspection of UK registered ships at foreign ports to rise, increasing the costs of these inspections to UK industry. An IMO audit of UK transposition of international shipping legislation is planned to begin in February 2021.

67. Further detail on the enforcement of IMO measures globally is provided in Box 1 below.

Box 1 – Further detail on the enforcement of IMO measures globally

1. The Paris and Tokyo MOU areas are actively enforcing the new sulphur requirements which prohibit the use of non-compliant fuel from 1 January 2020 and the carriage of non-compliant fuel, for use on the ship, from 1 March 2020, unless the ship is fitted with an Exhaust Gas Cleaning System (EGCS). To raise awareness in advance of the implementation of the sulphur limits, both organisations have carried out a Concentrated Inspection Campaign (CIC) on MARPOL Annex VI between 1 September and 30 November 2018.[22]

2. Both organisations also issued a "Letter of Warning" to vessels at the beginning of 2019, to encourage timely compliance. The objective was to send a signal to the industry that port State control will take enforcement of the sulphur limits seriously from the outset. During this information campaign the awareness among ships' crew of the 0.5% sulphur limit on fuel use proved to be high, so most of the emphasis was placed on the requirement around the carriage of non-compliant fuel in fuel tanks, which entered into force on 1 March 2020. In instances where compliant fuel cannot be obtained a Fuel Oil Non-Availability Report (FONAR) must be submitted to the flag State and the Competent Authority in the next port of call[23].

3. The US authorities are actively enforcing MARPOL Annex VI requirements in the North American ECA. The US Environmental Protection Agency (EPA) website states that:

   "U.S. flagged vessels are subject to inspection for compliance with Annex VI. Non-U.S. flagged ships are subject to examination under Port State Control while operating in U.S. waters. The US Coast Guard (USCG) or EPA may bring an enforcement action for a violation."

   "The US EPA and US Coast Guard have a Memorandum of Understanding (MOU) to enforce Annex VI MARPOL. The Annex VI MOU provides that EPA and USCG will jointly and cooperatively enforce the provisions of Annex VI. Efforts to be conducted by USCG and EPA include inspections, investigations and enforcement actions if a violation is detected. The efforts to ensure compliance with Annex VI include oversight of marine fuelling facilities, on board compliance inspections, and record reviews." [24]

[22] https://www.parismou.org/sites/default/files/Joint%20press%20release%20Paris%20and%20Tokyo%20MoU%20-Prohibition%20on%20carriage%20of%20non-compliant%20fuel%20-%2020%20januari%202020.pdf

[23] Joint press release Paris and Tokyo MoU - Prohibition on carriage of non-compliant fuel (20.01.20)

[24] https://www.epa.gov/enforcement/marpol-annex-vi-and-act-prevent-pollution-ships-apps#resolutions

4. There have also been reports in the trade press about action taken against non-compliant ships.

5. In January 2020, a media report revealed that the Chinese authorities had fined three ships Yuan10,000 (£1,114) and Yuan100,000 (£11,140)[25] for using non-compliant fuel. Fuel sampling of fuel tanks were used and the results confirmed that the ships had used fuel with a sulphur content between 0.55%-0.68%. China implemented a 0.5% sulphur limit in its territorial waters on 1 January 2019, one year before the 0.5% global sulphur cap was introduced, and it is widely reported that non-compliance in these cases resulted from fuel contamination or the onboard blending of compliant and non-compliant fuels.

6. More recently, a container vessel owned by the Switzerland-based Mediterranean Shipping Company (MSC) - the MSC Joanna – was found to be carrying 700 million tonnes of HSFO in a sealed tank after the 1 March 2020 deadline. The ship was given a 1 year ban from all UAE ports, in violation of the IMO regulations that prohibits the carriage of HSFO on board ships that are not fitted with scrubber technology.[26]

7. On 16 April 2018, the European Commission published a report on the implementation and compliance with the sulphur standards set out in Directive (EU) 2016/802[27], relating to the reduction in the sulphur content of certain liquid fuels. Ships operating in the North Sea and Baltic ECAs have been limited to using 0.1% sulphur fuel since 1 January 2015. Based on entries made by port inspectors between 2015 to 2017, the report indicates that there were around 28,000 specific ship inspections (about 60 per cent carried out in the ECA waters), of which around 1,350 ships were found to be non-compliant. The report also found that over 93 per cent of ships inspected in the two ECAs were compliant with the stricter 0.10 per cent sulphur limit, and this has led to a significant reduction in sulphur dioxide emissions concentrations in regions bordering these waters. Despite the higher cost of 0.10 per cent fuel, the new limits did not result in any significant loss of marine traffic, or shift to other modes of transport. Nor were there any severe cases where compliant fuel was unavailable.

Box 2 – Ships that only operate on domestic voyages between UK ports

1. **Sulphur Regulations** – Under the Do Nothing scenario, UK domestic ships which currently operate exclusively in UK territorial and controlled waters[28] are subject to the sulphur limits and requirements which were implemented by SI 2014/3076[29]. Accordingly, as explained in Paragraph 10, a 0.1% or 0.5% sulphur limit on fuel use already applies to all ships in UK

[25] Lloyds list – *"Third Chinese port announces sulphur cap violation*" – 13 January 2020

[26] https://insurancemarinenews.com/insurance-marine-news/msc-looking-into-how-hsfo-was-left-on-board-msc-joanna/

[27] https://ec.europa.eu/environment/air/pdf/report_sulphur_directive.pdf

[28] Territorial waters are within 12 nautical miles of the UK coastline. Controlled waters are those specified by the Merchant Shipping (Prevention of Pollution) (Limits) Regulations 2014 as waters within which the jurisdiction and rights of the United Kingdom are exercisable in accordance with Part XII of the United Nations Convention on the Law of the Sea for the protection and preservation of the marine environment.

[29] Implemented by the Merchant Shipping (Prevention of Air Pollution from Ships) and Motor Fuel (Composition and Content) (Amendment) Regulations 2014 (SI 2014/3076)

waters (implemented by SI 2014/3076). Therefore, ships that only operate on domestic voyages between UK ports will already be complying with the 0.5% sulphur limit.

2. **NOx Regulations** – Under the Do Nothing scenario, ships which operate in UK waters with engines over 130kW power output which were constructed on or after 1 January 2000 are already subject to the NOx Tier I standard under existing UK legislation[30]. However, the requirements on NOx emissions detailed in paragraphs 60 d) and f) above would not be incorporated in UK law, and the UK would not be able to effectively enforce these requirements in UK territorial and controlled waters. Therefore, under the Do Nothing scenario, ships that only operate on domestic voyages between UK ports – although subject to the international standards - would not be compelled to comply with these requirements under UK law.

   Note: while there are circumstances where the UK could take action to enforce the NOx Tier II requirements on non-compliant ships operating in UK waters, we would not be able prosecute shipowners using the UK Courts.

   The requirements on NOx emissions detailed in paragraph 60 e) above are not relevant to ships that only operate on domestic voyages between UK ports, since they relate to the North American and US Caribbean Sea ECAs.

6.3 Costs and benefits of Option 1

6.3.1 Costs

6.3.1.1 Compliance costs to UK owned ships that only operate on domestic voyages between UK ports (Monetised)

68. For the reasons discussed in Box 2, under the Do Nothing scenario, ships that only operate on domestic voyages between UK ports would not be required to comply with the following requirements under UK law:

    a) The NOx Tier I standard on ships / engines of 5,000kW and over, constructed since 1 January 1990[31].

    b) The global NOx Tier II standard for new ships / engines with a power output of over 130kW constructed since 1 January 2011.

    c) The NOx Tier III standard for new ships / engines with a power output of over 130kW operating in the North Sea and Baltic ECA from 01 January 2021 onwards.

69. Therefore, the UK would not be able to effectively enforce these requirements for UK owned ships that only operate on domestic voyages between UK ports under the Do Nothing scenario.

70. Given this, for UK owned ships that only operate on domestic voyages between UK ports, we have attributed the costs of complying with these requirements as costs of Option 1.

[30] SI 2008/2924

[31] However, there would be no impact on these vessels / engines constructed after 31 December 1999, as the NOx Tier I requirements are included in our 2008 Regulations (SI 2008/2924) for all vessels with a power output of over 130kW, which were constructed after I January 2000.

71. NOx Tier III Standard – This standard will apply to all newbuild ships with an engine rating power greater than 130kW from 1 January 2021 operating in the North Sea and the Baltic Sea ECAs, including those that only operate on domestic voyages between UK ports.

72. In Section 7.5.1.2, we have estimated the total costs to UK businesses of complying with the NOx Tier III standards in respect to vessels operating in the North Sea and the Baltic Sea ECAs from 1 January 2021.

73. These estimates are shown in Table 11 and cover both vessels that only operate on domestic voyages between UK ports and vessels that operate on international voyages.

74. To enable the compliance costs to UK owned ships that only operate on domestic voyages between UK ports to be estimated, it is necessary to estimate the proportion of the total costs to UK businesses that relates to ships that only operate on domestic voyages between UK ports.

75. For the purposes of this analysis, this proportion is to assumed to be the same as the proportion of relevant ships that only operate on domestic voyages between UK ports, which has been estimated as follows:

    a) In Section 7.5.1.2, we have estimated that, in 2017, there were 244 trading and non-trading vessels over 400GT on the UK Flag with UK ownership that entered either the North Sea or the Baltic Sea ECAs.

    b) Analysis has been undertaken using port call data from the Consolidated European Reporting System (CERS) and Marine Traffic to identify which of these ships only operated on domestic voyages between UK ports.

    c) Based on this analysis we estimate that, in 2017, 56% of the relevant ships only operated on domestic voyages between UK ports (137 ships).

    d) For the reasons explained in Paragraph 137, it is assumed that this proportion will stay constant over the appraisal period.

76. Finally, in order to estimate the compliance costs to UK owned ships that only operate on domestic voyages between UK ports, the estimated total costs to UK businesses of complying with the NOx Tier III standards in respect to vessels operating in the North Sea and the Baltic Sea ECAs (shown in Table 11) are then multiplied by the proportion of relevant ships that only operate on domestic voyages between UK ports (56%).

Table 1: An overview of the estimated cost to UK owned ships that only operate on domestic voyages between UK ports of complying with NOx Tier III standards from 1 January 2021 (2020 – 2029, £m)[32]

Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total (Present Value)
Central	£0.0	£0.4	£0.8	£1.2	£1.6	£2.0	£2.4	£2.8	£3.1	£3.5	£14
Low	£0.0	£0.0	£0.1	£0.1	£0.2	£0.2	£0.3	£0.3	£0.4	£0.4	£2
High	£0.0	£3.0	£6.1	£9.1	£12.1	£15.1	£18.2	£21.2	£24.2	£27.2	£110

77. NOx Tier I and Tier II Standards - The ships affected by the NOx Tier I standards are UK flagged vessels with some element of UK ownership that have large engines (5,000kW and over) and came

[32] Note that Total Present Values have been rounded to the nearest million. Annual costs have been rounded to 1 decimal place.

into service after 1 January 1990[33]. In addition, the ships affected by NOx Tier II standards are UK flagged vessels with over 130kW power output with some element of UK ownership that came into service after 1 January 2011.

78. Based on discussions with equipment manufacturers, we understand that these standards are not particularly difficult to achieve (e.g. they should not require a post-combustion emissions abatement system to be installed)[34]. So, the costs of meeting these standards is expected to be significantly smaller than the costs we have monetised. However, we have not identified any quantitative evidence on the costs of meeting these standards. Therefore, it has not been possible to monetise these costs.

6.3.1.2 Compliance costs to UK owned ships that operate internationally (Non-Monetised)

79. For the reasons discussed in Section 6.2, it is assumed that the IMO regulations considered will already be implemented by UK owned ships which operate internationally and that any associated costs will already be incurred under the Do Nothing scenario in order for these ships to continue operating internationally. Therefore, compared to the Do Nothing scenario, the costs to UK owned ships which operate internationally of complying with Option 1 are considered to be neutral.

80. Sensitivity test: Although we expect UK owned ships operating internationally to comply with the IMO regulations in the absence of domestic legislation, we recognise that there is a risk of non-compliance under the Do Nothing scenario.

81. To reflect this risk, we have undertaken a purely illustrative sensitivity test to provide illustration of the scale of the additional costs in a situation where the introduction of the new UK legislation and associated enforcement powers under Option 1 leads to an increase in compliance with the international regulations compared with the Do Nothing scenario.

82. For the purposes of this sensitivity test only, we have made an arbitrary assumption that there is a 5 percentage point increase in compliance with the IMO regulations by UK owned ships operating internationally compared with the Do Nothing scenario.

83. To estimate the additional cost to UK owned ships operating internationally under this sensitivity test, we have multiplied the assumed percentage point increase in compliance (5%) by the total monetised costs to UK Businesses estimated in Section 7 (excluding the costs estimated for UK domestic ships in Section 6.3.1.1 above).

84. The estimated additional costs to UK owned ships operating internationally under this sensitivity test are presented in Table 2.

Table 2 – Estimated total additional costs to UK owned ships operating internationally under sensitivity test (Present Value, 2020 – 2029)[35]

Scenario	Cost (£m)
Central	£50m
Low	£10m
High	£90m

[33] However, there would be no impact on these vessels / engines constructed after 31 December 1999, as the NOx Tier I requirements are included in our 2008 Regulations (SI 2008/2924) for all vessels with a power output of over 130kW, which were constructed after I January 2000.

[34] Tier II standards are expected to be met by combustion process optimization. The parameters examined by engine manufacturers include fuel injection timing, pressure, and rate (rate shaping), fuel nozzle flow area, exhaust valve timing, and cylinder compression volume. http://www.marinewiki.org/index.php/Allowable_NOx_Emissions

[35] Note that values under £10 million have been rounded to the nearest million and values over £10 million have been rounded to the nearest £10 million

6.3.1.3 Familiarisation costs to UK businesses (Non-Monetised)

85. The familiarisation costs of understanding the legislation are not expected to be significant as this change in regulation has been communicated to industry and they have been expecting most of the changes to happen since 2008[36]. All four of the existing ECAs had been established by the end of 2011, with the NOx Tier III standard coming into force on 1 January 2016 for the North American and US Caribbean ECAs. Although the SOx limits applied to the North Sea and Baltic Sea ECAs from the outset, they were only designated as NOx ECAs from October 2017 – with the NOx Tier III standards for new ships operating in these waters coming into force from 1 January 2021. Nevertheless, industry has been aware of this for several years and the requirements are well known. Any familiarisation costs incurred were a result of IMO led change, rather than this UK regulation. It is expected that the UK regulations will have a negligible additional familiarisation cost. Given this, it has not been considered proportionate to seek to monetise these costs.

6.3.1.4 Administration and enforcement costs for the MCA (Non-Monetised)

86. These costs have not been monetised on proportionality grounds as they are expected to be minimal relative to the administration and enforcement costs of the current regulations that would be incurred under the Do Nothing scenario. Any costs incurred by the MCA for surveying and certification work is recovered from business through an existing fee charging regime[37]. The cost of Port State Control inspection of ships arriving at UK ports will be met through existing budget allocations. Therefore, they are out of scope for the Business Impact Target and we have chosen not to monetise them for our Net Present Value on proportionality grounds as mentioned above.

87. As part of its commitment to Port State Control, the Maritime and Coastguard Agency (MCA) inspects a proportion of ships calling at UK ports. Until now, UK enforcement of sulphur limits has focused on the 0.1% sulphur limit which applies to ships operating in the North Sea ECA region, as these ships have most to gain financially from using non-compliant fuel. This enforcement is now being widened to include UK ports on the west coast and Northern Ireland, such as Bristol, Liverpool and Belfast to ensure that ships arriving at these ports are complying with the 0.5% global sulphur limit. Of the 10,000 ships which arrive in UK ports annually, UK Port State control (PSC) officers inspect about 1050 ships, and take fuel samples from around 300 of these to test the sulphur content at a laboratory.[38] Minimum levels of ship inspections and fuel sampling to control emissions of air pollutants, are prescribed under Commission Implementing Decision (EU) 2015/253[39]. These limits have not been revised, but the distribution of PSC inspections is expected to change. Consequently, although the annual total for ship inspections and fuel samples should remain broadly similar to previous years, ships using non-ECA ports are now more likely to be checked for breaches in SOx limits.

88. Ships using SOx or NOx emission abatement systems must have, under international (and existing UK) legislation, certified 'tamper-proof' continuous emissions monitoring systems onboard. These

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[36] Since the revised version of Annex VI was adopted in 2008, Regulation 14.1.3 has stated that ships should not use fuel which exceed 0.50% from 1 January 2020, but with the option (under Regulation 14.10) to defer the application to 2025 if the IMO concludes that insufficient fuel would be available. In October 2016 – in accordance with the findings of its review - the IMO's Marine Environment Protection Committee (MEPC 70) confirmed the default position, that a global 0.5% sulphur cap would come into force on 1 January 2020.

[37] Merchant Shipping (Fees) Regulations 2018

[38] Based on data entered into the THETIS-EU database by Port State Control Officers.

[39] Commission Implementing Decision (EU)2015/253 of 16 February 2015 lays down the rules concerning the sampling and reporting under Council Directive 1999/32/EC as regards the sulphur content of marine fuels. Article 3 requires Member States to carry out inspections of the ship's documentation on at least 10% of the individual ships calling in their ports, and sample and analyse the sulphur content of the fuels of 20 to 40% of the inspected ships depending on whether the Member State is (partly) bordering an ECA or not. For the UK, the proportion sampled is 30% of ships inspected.

enable port inspectors to check compliance and also allow the ship's Master to monitor the emissions from his vessel to check that it is meeting the statutory requirements. We expect that this would already be happening under the 'Do Nothing' scenario therefore there will not be any additional costs.

89. There is provision for ships that cannot source compliant fuel. The IMO has developed a 'fuel non-availability report' (FONAR) which the ship's operator would need to complete and forward to the next port of call, for consideration by Port State Control officers. Ships which are found to be using non-compliant fuel can be detained and forced to debunker. These powers are available to PSC officers even without the new regulations. The new regulations do however, enable the owner, operator and Master of a non-compliant ship outside an ECA, to be liable to heavy fines if the case for is taken to Court.

6.3.1.5 Costs from increased greenhouse gas emissions (Non-Monetised)

90. For ships that only operate on domestic voyages between UK ports, any impacts on greenhouse gas emissions due to these ships complying with the new requirements should be treated as impacts of Option 1 (in line with the approach taken for the monetised costs in Section 6.3.1.1).

91. In contrast, for UK owned ships operating internationally, we assume that any impacts on greenhouse gas emissions associated with the new requirements would be fully realised under the Do Nothing scenario (in line with the approach taken in Section 6.3.1.2) and hence that there would be no additional impacts under Option 1.

92. As explained in Section 6.3.1.1, the new requirements that apply to ships that only operate on domestic voyages between UK ports relate solely to NOx emissions.

93. The available evidence[40] indicates that the use of some NOx abatement technologies results in slightly higher fuel consumption, which would lead to a modest increase in greenhouse gas emissions. So, it is expected that there will be a modest increase in the greenhouse gas emissions from UK domestic shipping under Option 1.

94. As the value of any increase in greenhouse gas emissions is expected to be much less significant than the monetised costs[41], it has not been considered to proportionate to seek to monetise the costs associated with this modest increase in greenhouse gas emissions.

6.3.2 Non-Monetised Benefits

6.3.2.1 Benefits from reduced emissions of air pollutants

95. For ships that only operate on domestic voyages between UK ports, the benefits from the reduction in emissions of air pollutants due to these ships complying with the new requirements are treated as benefits of Option 1 (in line with the approach taken for the monetised costs in Section 6.3.1.1).

96. In contrast, for UK owned ships operating internationally, we assume that the benefits from reduced emissions of air pollutants associated with the new requirements would be fully realised under the Do Nothing scenario (in line with the approach taken in Section 6.3.1.2) and hence that there would be no additional benefits under Option 1.

[40] For example, the Danish Ministry of the Environment IA states that "There is a minor increase in fuel consumption associated with the technology [EGR]" https://www2.mst.dk/Udgiv/publications/2012/06/978-87-92903-20-4.pdf

[41] For example, the Danish Ministry of the Environment IA states that "Fuel cost is only a minor cost component" of the costs of complying with the NOx Tier III Standard. https://www2.mst.dk/Udgiv/publications/2012/06/978-87-92903-20-4.pdf

97. As explained in Section 6.3.1.1, the new requirements that apply to ships that only operate on domestic voyages between UK ports are as follows:

    a) The NOx Tier I standard on ships / engines of 5,000kW and over, constructed since 1 January 1990[42].

    b) The global NOx Tier II standard for new ships / engines with a power output of over 130kW constructed since 1 January 2011.

    c) The NOx Tier III standard for new ships / engines with a power output of over 130kW operating in the North Sea and Baltic ECA from 01 January 2021 onwards.

98. Therefore, it is expected that the new requirements will lead to a reduction in the emissions of NOx from UK domestic shipping.

99. A study commissioned by BEIS found that future NOx emissions factors (emissions per tonne of fuel used) are expected to reduce over time. This is due in part to the continued turnover in the fleet resulting in a higher proportion of vessels with engines that meet stricter NOx emission standards (e.g. NOx Tier II), but also as a direct consequence of designating the North Sea as a NOx ECA and applying the NOx Tier III standard to new ships from 2021. The study assumed that these two effects will lead to a reduction in the average NOx emission factor of 4% per year from 2021, compared with its assumption of 0.7% reduction per year in the period to 2020.[43]

100. The results of this study indicate that, of the three requirements under consideration, it is the NOx Tier III standard for new ships that will lead to the largest reduction in the NOx emissions from UK domestic shipping. However, no existing analysis of this is available, and there is considerable uncertainty around the extent that new ships on domestic voyages between UK ports will operate within the NO_X ECAs in the future. So, it has not been possible to monetise this benefit in this impact assessment. Nonetheless, as the Tier III controls only apply to new ships and engines, it is expected that the impacts of NOx Tier III standards will increase over time as the number of new ships operating in these waters increases.

101. Given that it has not been possible to monetise these benefits, switching value analysis has been undertaken to estimate the scale of the reductions in NOx emissions that would be required for the monetised benefits to exceed the monetised costs that have been estimated in Section 6.3.1.1. This analysis is discussed in Section 6.3.2.3 below. Given the limitations of the available evidence, this switching value analysis does not take any other benefits or costs into account. These other benefits are discussed qualitatively in the next section.

6.3.2.2 Other benefits

102. There are other benefits from bringing UK regulations closer to international standards, which include avoiding reputational damage to the UK from not fulfilling the requirements of the MARPOL Convention relating to transposing relevant requirements into UK law, and providing legal clarity for operators by avoiding contradictory standards in UK and international regulations.

103. The risk of reputational damage to the UK by not implementing the new Regulations is real and imminent. The IMO is conducting an audit of the UK's implementation of international legislation which scheduled to begin in February 2021, and any legislation which has not been implemented will

[42] However, there would be no impact on these vessels / engines constructed after 31 December 1999, as the NOx Tier I requirements are included in our 2008 Regulations (SI 2008/2924) for all vessels with a power output of over 130kW, which were constructed after I January 2000.

[43] https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1712140936_ED61406_NAEI_shipping_report_12Dec2017.pdf

be highlighted in the IMO's report which will be published. Given the high priority which the Government places on environmental protection and control of emissions in particular, it would be very damaging to the UK's reputation if it became widely known that we had not implemented these international measures. Consequently, this could affect our participation in the sensitive and difficult ongoing negotiations at the IMO, to reduce greenhouse gas emissions from shipping.

104. It also gives the UK government the ability to support UK vessels in meeting relevant requirements and demonstrating that they have met the requirements that will be enforced in other countries through effective flag state inspections backed up by appropriate UK legislation. The UK Chamber of Shipping has also confirmed that they support the measures; that their members will comply with the requirements and that they want the UK (and other States) to apply an effective enforcement and sanctions regime to avoid distortions in competition.

105. The regulations will allow Port State Control Officers to bring the full range of enforcement measures against non-compliant foreign registered ships operating in UK waters. Currently, they may register a deficiency or detain the vessel if they are found to be non-compliant with MARPOL Annex VI requirement, but they cannot use the Courts to impose fines (which can be unlimited). Although using the Courts is rarely used, it is a necessary and useful deterrent to discourage repeat offenders. Moreover, the ban on the carriage of non-compliant fuel will be easier to enforce than having to prove that the ship was using non-compliant fuel – which will also act as a deterrent. Given the financial advantage of using non-compliant fuel, there is a benefit to the competitiveness of UK owned and registered ships if the UK can apply an effective enforcement and sanctions regime to foreign registered ships.

106. The proposed regulations could also improve trading conditions for UK flagged ships trading internationally by upholding the UK's flag state reputation. If the UK failed to implement its obligations under these international agreements this could result in UK flagged ships being challenged more frequently during port state control checks in foreign ports, leading to expensive delays and inconvenience for UK flagged ships trading internationally. Implementing the measures would avoid such a cost and improve trading conditions for UK flagged ships operating internationally.

107. However, the Department has not been able to identify any evidence that can be used to monetise these impacts.

6.3.2.3 Switching Value Analysis

108. The purpose of this switching value analysis is to estimate the reduction in the level of NOx emission required for the monetised benefits to exceed the additional costs associated with the UK regulations that have been estimated in Section 6.3.1.1. This illustrates the magnitude of benefits required to outweigh the monetised costs of Option 1.

109. The level of NOx emission savings required has been estimated as follows:

a) In Section 6.3.1.1 we have estimated the annual compliance cost to UK businesses of the amended domestic regulations under Option 1 in 2020 prices.

b) Defra's 'air quality appraisal: damage costs toolkit'[44]has been used to estimate the damage cost[45] per tonne of NOx emissions from shipping in 2029 (the final year of the appraisal period) in 2020 prices. The range of damage costs can be found in Table 3.

[44] https://www.gov.uk/government/publications/assess-the-impact-of-air-quality

[45] https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance#damage-costs - Damage costs are defined by Defra as a set of monetary impact values per tonne of emission

c) We have then divided the estimated annual costs of the domestic regulations in 2029 by the damage costs to obtain estimates of the level of NOx emissions savings required for the monetised benefits to equal the costs to business of Option 1 in 2029. The range of estimates of the required quantity of NOx emissions savings are presented in Table 4.

Table 3 - Damage Cost of NOx emissions from Ships in 2029 (£ per tonne) (2020 prices)

Year	**2029**
Central Damage Cost	£3,290
Low Damage Cost	£415
High Damage Cost	£11,629

Table 4 – Estimated annual quantity of NOx emissions savings required for the monetised benefits to exceed the estimated additional costs to UK businesses of Option 1 in 2029 (tonnes)[46]

Scenario	**2029**
Central	1,077
Low	38
High	65,695

110. To put this in context, in 2017, the NOx emissions from UK domestic shipping were estimated to be 100,800 tonnes[47]. The quantity of NOx emissions savings required for the monetised benefits to exceed the estimated costs to businesses of Option 1 in 2029 would be between 0.04% and 65.2% of the total NOx emissions from UK domestic shipping in 2017.

111. In addition, as noted above, a review commissioned by BEIS found that future NOx emissions factors (emissions per tonne of fuel used) are expected to reduce over time, and assumed that there will be a reduction in the average NOx emission factor of 4% per year from 2021, compared with its assumption of 0.7% reduction per year in the period to 2020.[48]

112. If it is assumed that NOx emissions from UK domestic shipping would reduce by 4% per year instead of a 0.7% reduction per year between 2021 and 2029, the additional annual NOx emissions reduction achieved in 2029 would be 24,300 tonnes[49] . Therefore, the estimated central annual quantity of NOx emission savings required for the monetised benefits to exceed the estimated costs of Option 1 in 2029, would be 4.4% of the estimated reductions that would be achieved from the changes in the average NOx emission factor.

113. Therefore, we expect that it is very likely that the air quality benefits associated with the domestic regulations would exceed the estimated annual costs of the domestic regulations in the central scenario and the low scenario. However, there is uncertainty around whether these benefits would exceed these costs in the high scenario.

6.3.3 Ambulatory Referencing

6.3.3.1 Non-monetised Costs of Ambulatory Referencing

[46] The high and low scenarios have been estimated as follows:
- High scenario – the high annual costs of the domestic regulations are divided by the low damage cost
- Low scenario – the low annual costs of the domestic regulations are divided by the high damage cost

[47] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850280/env0301.ods

[48] https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1712140936_ED61406_NAEI_shipping_report_12Dec2017.pdf

[49] This assumes that there is no change in UK domestic shipping activity or fuel consumption compared to 2017, and that there is a 0.7% reduction in the NOx emissions from UK domestic shipping per year between 2017 and 2021.

114. Future amendments to MARPOL Annex VI may lead to further costs to UK businesses, which through ambulatory referencing will automatically come into force. However, for the reasons discussed in Section 6.2, it is expected that any future amendments to MARPOL Annex VI will continue to be implemented by UK ship owners and that any associated costs will continue to be incurred under the Do Nothing scenario in order for them to continue operating internationally.

115. The cost associated with future amendments cannot be monetised at this stage as there is currently no indication of what form future amendments may take. These costs are therefore not reflected in this impact assessment. It is proposed that regular Post Implementation Reviews (PIR) will be undertaken to evaluate whether the use of ambulatory reference to MARPOL Annex VI has achieved its goal and is still valid, and to estimate the costs and benefits of all the technical amendments enacted since this assessment.

6.3.3.2 Non-monetised Benefits of Ambulatory Referencing

116. Compared to a scenario where future amendments to MARPOL Annex VI are implemented in UK law via new regulations, ambulatory Referencing would result in cost savings to industry as shipowners would only have to consult a single piece of legislation. Familiarisation costs resulting from future amendments to the MARPOL Annex VI will therefore be lower as they will not read separate international and domestic requirements – although the UK government will provide guidance and clarification of the international text in a Merchant Shipping Notice, where necessary.

7 Business Impact Target Calculations

7.1 Approach

117. Regulatory provisions that implement new or changed international commitments and obligations, where the UK does not “gold plate” and add additional requirements, are excluded from the Business Impact Target (BIT). Hence, these Regulations are excluded from the scope of the BIT.

118. Although these Regulations are excluded from the scope of the BIT, in this section, we have estimated the costs to UK business of complying with the IMO requirements, that are not already incorporated in UK legislation, to demonstrate the impact businesses will have faced from these international obligations. These figures are shown in the Equivalised Annual Net Direct Costs to Business (EANDCB).

119. A proportionate approach has been adopted to estimate the costs to UK businesses as they are from an International Maritime Organisation (IMO) convention of which the UK is a Party to. The IMO measures are enforced globally and we expect ships operating internationally to comply under the Do Nothing scenario (see Section 6.2 for further details).

120. The proportionate approach adopted has the following implications for the analysis carried out for the BIT calculations:

a) We have decided that it would not be proportionate to commission any new external research. Analysis carried out for this impact assessment has therefore been based on the existing available data and evidence.

b) We have focussed on monetising the requirements that are expected to give rise to the highest costs to UK businesses.

c) We have adopted a number of simplifying assumptions to make the analysis more manageable.

7.2 Constructed Counterfactual used for direct impact to business calculations

121. As this is an international obligation, if the UK did not transpose the legislation into UK law (i.e. 'do nothing'), ships using the UK flag would still need to meet the new standards to avoid enforcement action outside of the UK.

122. Under the Do Nothing scenario, it is therefore assumed that, due to these reasons, ships operating internationally will comply with IMO regulations in the absence of UK legislation. This baseline is used to assess the costs and benefits of the UK Regulations in Section 6.

123. However, in this section, a 'constructed counterfactual' has been adopted for the purposes of estimating the Equivalent Annual Net Direct Cost to Business (EANDCB) to UK owned ships of complying with the international regulations that are not already incorporated in UK legislation.

124. Under this 'constructed counterfactual', it is assumed that UK registered ships would operate as if the IMO requirements, that are not already incorporated in UK legislation, do not exist; and that the UK would not transpose any remaining gaps in our domestic legislation to bring it into line with the international requirements for SOx and NOx reductions.

125. It should be recognised that the 'constructed counterfactual' is not intended to represent what would happen in the absence of the UK Regulations and has only been developed in order to illustrate the impact of the international obligations on UK businesses.

126. An overview of the regulations that apply under the 'constructed counterfactual' and the changes under Option 1 compared with the 'constructed counterfactual' are shown in Table 5.

Table 5 – An Overview of the Constructed Counterfactual and changes under Option 1

Regulations that apply under the constructed counterfactual	
Sulphur regulations	• UK flagged ships operating outside of EU/ ECA waters must comply with the 3.5% sulphur limit for fuel oil. • UK flagged ships operating in (Non-ECA) European waters must comply with 0.5% sulphur limit on fuel oil. • UK flagged ships operating in the North Sea, Baltic Sea, North American and US Caribbean ECAs must comply with 0.1% sulphur limit.
NOx regulations	• UK flagged ships constructed on or after 1 January 2000 must comply with NOx Tier I standard. There are no NOx standards for ships constructed before 1 January 2000.
Changes under Option 1 compared with the constructed counterfactual	
Sulphur regulations	• UK flagged ships operating outside of European waters and ECAs must comply with global 0.5% sulphur cap from 1 January 2020. This prohibits ships from the using fuel oil which has more than 0.5% sulphur, unless the ship is using an exhaust gas

	cleaning system – in which case it may continue using high sulphur fuel oil. • From 1 March 2020 onwards there will be a global 0.5% sulphur limit on fuel oil carried in bunkers on board UK flagged ships. This prohibits ships from carrying high sulphur fuel oil (>0.5%) in any of their fuel tanks, unless they have an exhaust gas cleaning system.
NOx regulations	• UK flagged ships constructed between 1 January 1990 and 31 December 1999 with engines which have a power output of 5,000kW or more, must comply with NOx Tier I standards. • UK flagged ships operating on international journeys constructed on or after 1 January 2011 must comply with NOx Tier II standards. • UK flagged ships operating in the North American and US Caribbean ECAs which came into service from 1 January 2016 must comply with NOx Tier III standards. • From 1 January 2021, new UK flagged ships operating in the North Sea and Baltic Sea ECAs must comply with NOx Tier III standards.

7.3 Summary of the estimated costs of Option 1 compared with constructed counterfactual

127. A summary of the estimated total costs of Option 1 between 2020 and 2029 compared with constructed counterfactual in present value terms is shown in Table 6.

Table 6 – Summary of Monetised Costs and Benefits to UK Businesses, 2020 – 2029[50]

Cost Type	Scenario	Cost (£m, Present Value)
Cost to ship-owners of complying with the global sulphur limits from 2020	Central	£1,010m
	Low	£290m
	High	£1,600m
Cost to ship-owners of complying with the NOx Tier III standards in North Sea and Baltic Sea ECAs from 2021	Central	£30m
	Low	£3m
	High	£200m
Cost to ship-owners of complying with the NOx Tier III standards in North American and US Caribbean Sea ECAs from 2016	Central	£8m
	Low	£1m
	High	£60m

[50] Note that values under £10 million have been rounded to the nearest million and values over £10 million have been rounded to the nearest £10 million.

Total Costs	Central	£1,040m
	Low	£300m
	High	£1,850m

7.4 Overall approach taken

128. In this section, the costs and benefits are appraised over a ten-year period with a discount rate of 3.5%. Costs are estimated in 2020 prices. It has not been possible to monetise all the costs of each option due to data limitations. Where quantification of a cost has not been possible, a qualitative description of the impact has been provided.

129. Furthermore, it should be noted that the estimates that are presented in the Impact Assessment are dependent on the data sources that have been used in this analysis and the assumptions that have been made. There are considerable uncertainties around some of these assumptions and therefore these estimates should be interpreted as indicative estimates of the order of magnitude of these costs and benefits.

130. The costs and benefits to business that have been identified are listed below.

Monetised Costs

- Cost to ship owners of complying with the new sulphur limits in non-EU/ ECA waters by switching to lower sulphur fuels or by use of an exhaust gas cleaning system (which is an abatement technology) (direct)
- Cost to ship owners of complying with the NOx Tier III standards in the North Sea and Baltic Sea ECAs – by using a post combustion abatement technology (e.g. Selective Catalytic Reduction), or an alternative fuel (such as liquefied natural gas) (direct).
- Cost to ship owners of complying with the NOx Tier III standards in North American and US Caribbean Sea ECAs – by using a post combustion abatement technology (e.g. Selective Catalytic Reduction), or an alternative fuel (such as liquefied natural gas) (direct).

Unmonetised Costs

- Familiarisation costs to each ship owner / charterer of understanding the regulation (direct)
- Cost to ship owners of complying with the NOx Tier I standards (direct)
- Cost to ship owners of complying with NOx Tier II standards (direct)
- Cost to fuel suppliers of providing low sulphur fuel oil (indirect)

7.5 Costs

7.5.1 Monetised Costs

7.5.1.1 Cost to ship owners of complying with the new sulphur limits

131. Ship owners can comply with the new sulphur limits by switching to lower sulphur fuels, or by using an exhaust gas cleaning system (EGCS) or an alternative low sulphur fuel. The limit banning the use of fuel over 0.5% sulphur came into effect on 1 January 2020, with the ban on the carriage of non-compliant fuel coming into force on 1 March 2020. The latter was introduced to improve enforcement of the former. As there is no legitimate reason why a ship should be carrying non-compliant fuel in its bunkers, the carriage ban does not impose any cost or burdens on compliant ships. As a consequence, there is no additional cost to shipowners with complying with the carriage ban.

132. As explained in Paragraph 197, the international (and UK) regulations are goal based. In the case of the sulphur limits, shipowners may either use compliant fuel, an emissions abatement system or an alternative fuel to meet the requirements. For the reasons explored in Paragraphs 139 – 141, we have assumed that shipowners will not use EGCS abatement technology. Section 9.1 also explores the barriers to developing new innovative technology and the use of alternative fuels. For the purposes of this assessment, the simplifying assumption has been made that UK shipowners will comply with these regulations by switching to lower sulphur fuel.

133. Vessels in Scope - Given the regulations that are already in place, which are discussed in Table 5, the global sulphur cap will only change the sulphur limit that vessels operating outside European waters and ECAs are subject to; these requirements affect vessels over 400 gross tonnes.

134. In order to estimate the costs of these requirements to UK businesses, this analysis estimates the costs in respect to trading vessels which are on the UK register of ships and have some element of UK ownership.

135. The international regulations are also likely to have an impact on non-UK flagged vessels with some element of UK ownership. However, the available data that we have used in this analysis only covers UK flagged ships. Therefore, this analysis does not take any impacts on non-UK flagged vessels into account.

136. For trading vessels which are on the UK register of ships and have some element of UK ownership, the number and type of vessels that would need to comply with regulations were estimated using the below data sources:

a) 2017 Automatic Identification System (AIS) data was used to gather information on the number of UK flagged vessels operating inside and outside European and ECA waters, and the time they spent inside / outside of these waters. Some ships do not occur in the AIS data, these will tend to be smaller ships and ships operating in areas with poor satellite coverage (e.g. polar regions).

b) The most recent AIS data we have access to is from 2017 and it is assumed that, in the absence of more recent data, the number and characteristics of vessels covered in AIS data will be the same in 2020.

c) 2017 UK fleet data has also been used to ensure consistency with the AIS data. 2017 UK fleet data shows that UK flagged trading ships of 400GT or more that are UK owned have 90% coverage in 2017 AIS data. A scaling factor has been applied to the AIS data in order to have 100% coverage.

d) The AIS data has been matched to Consolidated European Reporting System (CERS) data to get the ships characteristics (size, ownership, type). The CERS dataset does not include some ships that have not called at UK ports or do not carry cargo.

e) Due to the coverage issues in both AIS and CERs data there is uncertainty around the vessel numbers estimation. Further discussion of the limitations of the data used for vessel numbers can be found in Annex C.

137. Based on the above data, it is estimated that, in 2017, there were 182 trading vessels over 400GT on the UK Flag with UK ownership, and that in 2017, these vessels spent 51% of operating time outside of EU and ECA waters (the North Sea ECA, Baltic Sea ECA, North American ECA and US Caribbean ECA). Given the uncertainty regarding how the number of ships on the UK flag and their operating patterns will change over time, and the complexities associated with modelling this, we have assumed that these values remain constant over the appraisal period for the purposes of this Impact Assessment.

138. It has been assumed that the new sulphur limits will not have a significant effect on non-trading vessels. The majority of UK owned non-trading vessels over 400GT will already be using low sulphur fuel - either because they operate in an ECA, or because they operate inside EU waters - and would be subject to the 0.1% or 0.5% limits already in place. Based on the data outlined in Paragraph 136, it is estimated that, in 2017, there were 157 non-trading vessels over 400GT on the UK Flag with UK ownership, and that in 2017, these vessels spent 95% of operating time inside EU and ECA waters. Given the small proportion of time non-trading vessels spend outside EU and ECA waters, it has not been considered proportionate to seek to monetise the impact of the new sulphur limits on these vessels.

139. Exhaust Gas Cleaning System (EGCS) - The number of ships on the UK flag with UK ownership that we expect to have installed EGCS at the time of the writing of this assessment is estimated to be a very small proportion – less than 1 in 10 of the ships in scope of this analysis[51]. There is also uncertainty around the date these systems were installed and whether ship owners installed them on vessels to comply with the global sulphur limit or for previous EU regulations for which the costs are already incurred in the constructed counterfactual.

140. EGCS are only a profitable investment while there is a significant price spread between Very Low Sulphur Fuel Oil (VLSFO) and High Sulphur Fuel Oil (HSFO) as the technology allows ships to continue using high sulphur fuel. After the initial price spike in VLSFO in response to the increase in demand from the sulphur limit entering into force on 1 Jan 2020, the spot price has decreased rapidly (in response to real world impacts on the maritime sector)[52]. Due to the low price spread in the VLSFO-HSFO prices, reports estimate that the payback period for scrubber technology is currently lengthening[53].

141. Given the small proportion of relevant ship-owners that we estimate have installed EGCS, the current uncertainty around the future take-up of systems and the complexities associated with modelling this, a simplifying assumption has been adopted on proportionality grounds, and it is assumed that all ship-owners will comply with the new sulphur limits by switching to lower sulphur fuels for the purposes of this assessment.

142. Fuel Switching - A key aspect of estimating the costs of this new regulation is the assumed price differential between high sulphur fuels and low sulphur fuels or the 'fuel premium'. Assumptions on future fuel consumption also significantly affect the results. The fuel premium scenarios and assumptions on future fuel consumption are discussed in more detail below.

[51] Estimates based on data provided by the MCA on the number of notifications uploaded to the IMO GISIS system

[52] https://shipandbunker.com/prices/av/global/av-glb-global-average-bunker-price

[53] https://shipandbunker.com/news/world/486926-scrubber-payback-time-to-lengthen-further-as-hsfo-discount-reaches-new-lows

143. Fuel Premium – forecasts of the price premium of compliant lower sulphur fuels are extremely uncertain. The uncertainty goes beyond the difficulty inherent in price forecasting in general as it depends critically on the behaviours and investment decisions of both shipping operators and refineries. For the purposes of this impact assessment, the fuel premium (or price spread) has been estimated by analysing the price gap between 0.5% sulphur fuel (VLSFO) and 3.5% sulphur fuel (HSFO) over the past c. 7 months since VLSFO started to become widely available globally (October 2019).

144. Global fuel costs have shown significant volatility over the period since VLSFO was introduced. VLSFO experienced a significant price spike in January 2020 in response to the increase in demand from the implementation of the IMO 0.5% sulphur fuel cap. However, the spot price has since decreased significantly in response to major geopolitical events (COVID-19 pandemic). We have assumed that the price fluctuation over this period is likely to reflect the extreme levels prices will reach. The minimum and maximum price gap over this time period are applied in the low and high scenarios respectively. It is expected that the central fuel premium will fall within this range. However, it is highly uncertain how conditions will develop over the appraisal period. Therefore, as a simplifying assumption, we have taken the average price gap over the period since VLSFO was introduced to be the best estimate for the purposes of this Impact Assessment.

145. To estimate the fuel premium, we have utilised the global 20 ports average bunker prices from Ship and Bunker for 0.5% sulphur fuel (VLSFO) and 3.5% sulphur fuel (IFO 380)[54]. It is assumed that the global 20 ports average bunker prices will be representative of what the majority of commercial ships pay for fuel. The high, low and average prices for each fuel type of the period from the 7th October 2019 – 5th May 2020 have been used in the analysis. The fuel premium is assumed to be the price of VLSFO minus the price of IFO 380. The premium is then converted from $/mt to £/mt using average exchange rates for the year to 31 March 2020.[55] Given the uncertainty regarding how the fuel premium may evolve over time and the complexities associated with modelling this, the fuel premium assumptions are assumed to remain constant over the appraisal period in real terms for the purposes of this Impact Assessment on proportionality grounds[56].

Table 7 – Estimated fuel premium from switching from 3.5% sulphur fuel to 0.5% sulphur fuel (£ per metric tonne, mt) (2020 prices)

Scenario	Fuel Premium (£/mt)
Central	£141
Low	£41
High	£224

146. Average annual fuel consumption per ship - As specific estimates are not available for the vessels in scope of this analysis, the average fuel consumption per year globally for each ship type and size is assumed to equal the estimates from the IMO's most recent Greenhouse Gas Study.[57] There is uncertainty regarding how the average fuel consumption per year will change over time for the vessels in scope of this analysis. Given the complexities associated with modelling this, it has not been considered proportionate to seek to reflect this in this analysis and it is assumed that the

[54] https://shipandbunker.com/prices/av/global/av-g20-global-20-ports-average

[55] https://www.gov.uk/government/publications/exchange-rates-for-customs-and-vat-yearly

[56] For the purposes of this impact assessment, these estimates are treated as being in 2020 prices as the majority of the time period they relate to is in 2020.

[57] Table 14 in: http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Third%20Greenhouse%20Gas%20Study/GHG3%20Executive%20Summary%20and%20Report.pdf

average fuel consumption per ship remains constant over the appraisal period for the purposes of this Impact Assessment.

147. Cost to UK Shipowners - To estimate the total annual cost to UK shipowners of switching fuel from HSFO to VLSFO, we multiplied the estimated total annual fuel consumption of in-scope vessels by the estimated average proportion of time they spent in non-ECA/EU waters by the fuel premium (VLSFO fuel price – HSFO fuel price) assumptions.

Table 8 – An overview of the estimated cost to UK businesses of switching to 0.5% compliant sulphur fuel.[58]

Scenario	Annual Cost (£m)	Total Cost (Present Value, £m)
Central	£120m	£1,010m
Low	£30m	£290m
High	£190m	£1,600m

7.5.1.2 Cost to ship owners of complying with NOx Tier III standards in North Sea and Baltic Sea ECAs

148. For ships to comply with the NOx Tier III standards they need an engine which is compliant, either with a Selective Catalytic Reduction (SCR) or Exhaust Gas Recirculation (EGR), or they can use an alternative low NOx fuel.

149. Vessels in Scope - The ships affected by this measure are all newbuild ships with an engine rating power greater than 130kW from 1 January 2021 operating in the North Sea and the Baltic Sea ECAs. In order to estimate the costs of these requirements to UK businesses, this analysis estimates the costs in respect to vessels which are on the UK register of ships and have some element of UK ownership. For the reasons explained in Paragraph 135 this analysis does not take any impacts on non-UK flagged vessels into account.

150. For the purposes of this impact assessment it has not been possible to estimate the number of newbuild ships with an engine rating power greater than 130kW using existing analysis carried out by the department. Based on advice from the MCA, it has been assumed that the vast majority of vessels with engine rating power greater than 130kW will be over 400GT. It should be noted that there may be some exceptions to this assumption where a vessel is below 400GT but the installed engine rating power is above 130kW. However, given the reasons explained in Paragraph 119, this simplifying assumption has been adopted on proportionality grounds and this analysis estimates the costs in respect to vessels over 400GT.

151. Based on the analysis described in Paragraph 136 we have estimated that, in 2017, there were 339 trading and non-trading vessels over 400GT on the UK Flag with UK ownership and that 72% of these vessels entered either the North Sea or the Baltic Sea ECAs (244 vessels). For the reasons explained in Paragraph 137 it is assumed that this proportion will stay constant over the appraisal period.

152. We have estimated that around 29 new-build trading and non-trading vessels over 400GT will join the UK flag each year based on historic UK fleet data. In addition, we have estimated that 69% of existing ships on the UK flag over 400GT have some element of UK ownership based on the analysis described in Paragraph 136. We have then multiplied the number of new-build vessels joining the UK

[58] Note that values under £10 million have been rounded to the nearest million and values over £10 million have been rounded to the nearest £10 million

flag each year (29) by the proportion of existing ships on the UK flag with UK ownership (69%) to estimate that around 20 new-build trading and non-trading vessels over 400GT will join the UK flag each year. In the absence of any better evidence, this estimate has been used for the purposes of this Impact Assessment. However, it should be recognised that this estimate is subject to considerable uncertainty as it is not possible to estimate accurately the number of ships with UK ownership that will join the UK flag over the next 10 years.

153. The estimated number of new-build trading and non-trading vessels with UK ownership is multiplied by the current proportion of vessels with UK ownership that enter the North Sea and Baltic Sea ECAs (72%) to obtain an estimate of the number of extra new build UK flagged vessels with UK ownership that will need to install SCR/ EGR compliant engines to comply with the North Sea and Baltic Sea ECAs over the appraisal period – around an additional 14 vessels per year. In the absence of any other evidence, this value is assumed to remain constant over time and the number of new build ships in scope is expected to increase by this amount each year. The table below shows how the estimated number of UK flagged ships with UK ownership that need to comply with the NOx Tier III standards in the Baltic Sea and North Sea ECAs changes during the appraisal period.

Table 9 – An overview of the number of UK flagged ships with UK ownership that are estimated to need to comply with the NOx Tier III standards in the Baltic Sea and North Sea ECAs during the appraisal period[59]

Estimated number of additional new build UK flagged ships with UK ownership that operate in Baltic Sea or North Sea ECAs per year	Estimated number of UK flagged ships with UK ownership that need to comply with the NOx Tier III standards in the Baltic Sea and North Sea ECAs in 2021	Estimated number of UK flagged ships with UK ownership that need to comply with the NOx Tier III standards in the Baltic Sea and North Sea ECAs in 2029
14	14	129

154. Ships brought into service before 2021 would not be affected unless they have a major engine refit. It is extremely rare for a ship to undergo a major engine conversion within its operational lifetime. There might be occasions where an owner decided to uprate the engine to increase power by more than 10% - which would be classed as a major conversion under the NOx Technical Code. However, this would be rare and would be the owners' choice, rather than something imposed on them by the regulator. The costs applicable to engine refits have not been monetised as it is not considered proportionate to do so given the small proportion of ships expected to be affected.

155. Compliance costs per ship – Given the uncertainty regarding the costs of compliance per ship and the complexities associated with modelling this, it was not considered proportionate to undertake new analysis of this and we have made use of estimates of the annual cost of compliance per ship using a mixture of SCR and EGR equipment from a detailed economic impact assessment of a NOx ECA in the North Sea carried out by the Danish Ministry of the Environment[60], which appears to be most relevant existing evidence on this. The report assumes that the cost of complying with the NOx Tier III standards is dominated by the capital expenditure of purchasing and installing the required technology. The other major cost component is the operating expenditure. Fuel cost is considered to be a minor cost component.

156. The estimates in the Danish Ministry of the Environment report are in 2016 EUR, and have been uprated to 2020 prices and converted to GBP for use in this Impact Assessment. The estimates used

[59] Note that these estimates have been rounded to the nearest whole number.

[60] https://www2.mst.dk/Udgiv/publications/2012/06/978-87-92903-20-4.pdf

in this Impact Assessment are presented in the table below. As the Danish Ministry of the Environment report does not contain detailed evidence on how these estimates will change over time, we have assumed that these estimates will remain constant over time in real terms for the purposes of this Impact Assessment.

Table 10: Estimated Annual Cost of Compliance per Ship (2020 prices, £) [61] [62]

Scenario	Cost of Compliance (GBP, 2020)
Central	£49,030
Low	£6,130
High	£377,160

157. Cost to UK Shipowners - To estimate the total cost to UK shipowners of installing compliant engines each year, we have multiplied the estimates of the annual compliance costs by the estimated number of new build vessels in scope. This provides us with estimates for the total cost to business of this amendment.

Table 11: An overview of the estimated cost to UK businesses of complying with NOx Tier III standards on new build vessels in the North Sea and Baltic Sea ECAs from 1 January 2021 (2020 – 2029, £m)[63]

Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total (Present Value)
Central	£0.0	£0.7	£1.4	£2.1	£2.8	£3.5	£4.2	£4.9	£5.6	£6.3	£30
Low	£0.0	£0.1	£0.2	£0.3	£0.4	£0.4	£0.5	£0.6	£0.7	£0.8	£3
High	£0.0	£5.4	£10.8	£16.2	£21.6	£27.0	£32.4	£37.8	£43.2	£48.6	£200

7.5.1.3 Cost to ship owners of complying with the new NOx Tier III standards in North American and US Caribbean Sea ECAs

158. For ships to comply with the NOx Tier III standards they need an engine which is compliant, either with a Selective Catalytic Reduction (SCR) or Exhaust Gas Recirculation (EGR), or they can use an alternative low NOx fuel.

159. Vessels in Scope - The ships affected by this measure are all newbuild ships with an engine rating power greater than 130kW from 1 January 2016 operating in the North American and the US Caribbean Sea ECAs. In order to estimate the costs of these requirements to UK businesses, this analysis estimates the costs in respect to vessels which are on the UK register of ships and have some element of UK ownership. For the reasons explained in Paragraph 135 this analysis does not take any impacts on non-UK flagged vessels into account

160. For the purposes of this impact assessment, the vessels in scope are considered to be newbuild ships over the appraisal period (2020 – 2029). We have assumed that newbuild vessels between 2016 – 2020 have already incurred the compliance costs associated with this measure and are therefore out of scope as this would be a sunk cost.

[61] https://www2.mst.dk/Udgiv/publications/2012/06/978-87-92903-20-4.pdf

[62] Note that these estimates have been rounded to the nearest £10.

[63] Note that Total Present Values under £10 million have been rounded to the nearest million and values over £10 million have been rounded to the nearest £10 million. Annual costs have been rounded to 1 decimal place.

161. For the reasons explained in Paragraph 150 it has not been possible to estimate the number of newbuild ships with an engine rating power greater than 130kW using existing analysis carried out by the department. Therefore, a simplifying assumption has been adopted that the vast majority of vessels with engine rating power greater than 130kW will be over 400GT and this analysis estimates the costs in respect to vessels over 400GT.

162. Based on the analysis described in Paragraph 136, we have estimated that, in 2017, there were 339 trading and non-trading vessels on the UK Flag greater than 400GT with UK ownership and that, in 2017, 18% of these vessels entered either the North American or the Caribbean Sea ECAs (60 vessels). For the reasons explained in Paragraph 137, it is assumed that this proportion will stay constant over the appraisal period.

163. Based on the analysis described in Paragraph 152, we have estimated that around 20 new-build trading and non-trading vessels greater than 400GT with UK ownership will join the UK flag each year based on historic UK fleet data. As stated in paragraph 152, this estimate is subject to considerable uncertainty.

164. The estimated number of new-build trading and non-trading vessels is multiplied by the current proportion of vessels with UK ownership that enter the North American and US Caribbean Sea ECAs (18%) to obtain an estimate of the number of extra new build UK flagged vessels with UK ownership that will need to install SCR/ EGR compliant engines to comply with the North American or US Caribbean Sea ECAs over the appraisal period – around an additional 3 trading vessels per year. In the absence of any other evidence, this value is assumed to remain constant over time and the number of new build ships in scope is expected to increase by this amount each year. The table below shows the estimated number of UK flagged ships with UK ownership that need to comply with the NOx Tier III standards in the North American and US Caribbean Sea ECAs changes during the appraisal period.

Table 12 – An overview of the number of UK flagged ships with UK ownership that are estimated to need to comply with the NOx Tier III standards in the North American and US Caribbean Sea ECAs during the appraisal period[64]

Estimated number of additional new build UK flagged ships with UK ownership that operate in North American and US Caribbean Sea ECAs per year	Estimated number of UK flagged ships with UK ownership that need to comply with the NOx Tier III standards in the North American and US Caribbean Sea ECAs in 2020	Estimated number of UK flagged ships with UK ownership that need to comply with the NOx Tier III standards in the North American and US Caribbean Sea ECAs in 2029
3	3	35

165. Due to the reasons explored in paragraph 154 we do not expect the cost of retrofitting ships brought into service before 2016 to be significant. Therefore, the costs applicable to engine refits have not been monetised.

166. Compliance costs per ship – we have made use of estimates of the annual cost of compliance per ship using a mixture of SCR and EGR equipment from a detailed economic impact assessment of a NOx ECA in the North Sea carried out by the Danish Ministry of the Environment. This is discussed in more detail in paragraphs 155 and 156, and table 10 outlines the per-ship cost estimates used in the analysis.

[64] Note that these estimates have been rounded to the nearest whole number.

167. The compliance costs presented in the Danish Ministry of the Environment report are estimated for the North Sea ECA and are European specific. We expect that there will be some difference in the compliance costs for the North American and US Caribbean ECAs. Whilst there is an existing study available for the North American ECA[65], the evidence in this study is not in the appropriate format for our analysis as it does not report the annual compliance cost per ship. For the purposes of this impact assessment, it has not been possible to use the detailed data from this study to estimate these compliance costs. Therefore, in the absence of any better evidence for these ECAs, we have assumed that costs will be similar to the European specific estimates in the Danish Ministry of the Environment report.

168. Cost to UK Shipowners - To estimate the total cost to UK shipowners of installing compliant engines each year, we have multiplied the estimates of the annual compliance costs by the estimated number of new build vessels in scope. This provides us with estimates for the total cost to business of this amendment.

169. However, it should be noted that there may be some duplication in capital costs as the proportion of ships operating in either the North American or US Caribbean Sea ECAs includes ships that may also operate in the North Sea or Baltic Sea ECAs. For ships that operate in both the American and European ECAs, double counting of the capital costs may arise as UK ship owners will only need to install equipment once to comply with the measures in all ECA areas. Therefore, the estimated costs may be an overestimation of the costs UK ship owners face in reality.

Table 13: An overview of the estimated cost to UK businesses of complying with NOx Tier III standards on new build vessels in the North American and US Caribbean Sea ECAs (2020 – 2029, £m)[66]

Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total (Present Value)
Central	£0.2	£0.3	£0.5	£0.7	£0.9	£1.0	£1.2	£1.4	£1.5	£1.7	£8
Low	£0.0	£0.0	£0.1	£0.1	£0.1	£0.1	£0.1	£0.2	£0.2	£0.2	£1
High	£1.3	£2.6	£4.0	£5.3	£6.6	£7.9	£9.2	£10.5	£11.9	£13.2	£60

7.5.2 Non-Monetised Costs

7.5.2.1 Familiarisation costs to UK businesses

170. For the reasons explained in Section 6.3.1.3, the familiarisation costs are not expected to be significant and will have already been incurred. As we expect the familiarisation costs to be an order of magnitude smaller than the costs that have been monetised it has not been considered proportionate to seek to monetise these costs.

7.5.2.2 Cost to ship owners of complying with the NOx Tier I and Tier II standards

171. The ships affected by the NOx Tier I standards are UK flagged vessels with some element of UK ownership that have large engines (5,000kW and over) and came into service after 1 January 1990.

[65] https://www.epa.gov/sites/production/files/2018-05/documents/mepc59-6-5.pdf

[66] Note that Total Present Values under £10 million have been rounded to the nearest million and values over £10 million have been rounded to the nearest £10 million. Annual costs have been rounded to 1 decimal place.

In addition, the ships affected by NOx Tier II standards are UK flagged vessels with over 130kW power output with some element of UK ownership that came into service after 1 January 2011.

172. Based on discussions with equipment manufacturers, we understand that these standards are not particularly difficult to achieve (e.g. they should not require a post-combustion emissions abatement system to be installed)[67]. So, the costs of meeting these standards is expected to be significantly smaller than the costs we have monetised. However, we have not identified any quantitative evidence on the costs of meeting these standards. Therefore, it has not been possible to monetise these costs.

7.5.2.3 Cost to fuel suppliers of providing low sulphur fuel oil

173. There may be some indirect transitional costs incurred by fuel suppliers as they may need to clean out their fuel storage facilities (bunkers) which previously stored HFO to avoid contamination with new compliant fuels. However, the issue has not been raised by UK suppliers and we do not expect this to be a significant cost as the UK is not a significant supplier of HFO for shipping (see Paragraph 186).

174. In the past, fuel suppliers had raised concerns that the new sulphur regulations could impact UK refineries negatively. More recently however, the industry associations have indicated there should be a slight benefit to UK refineries as they expect the margins for selling VLSFO will be higher than the margins they received from selling HFO.

7.5.3 Impacts of IMO Regulations outside of the scope of the BIT Target

175. There are expected to be other costs and benefits that do not accrue to UK businesses which result from the IMO regulations. For completeness, these are briefly discussed below. In addition, a number of risks are discussed in Section 8.

7.5.3.1 Costs from increased greenhouse gas emissions

176. The available evidence[68] indicates that the use of some NOx abatement technologies and SOx exhaust gas cleaning systems results in slightly higher fuel consumption, which would lead to a modest increase in greenhouse gas emissions.

177. There is also a risk that the switching from HFO to VLSFO could result in higher greenhouse gas emissions, although there is uncertainty around the level of increase because VLSFO is a new fuel type and we are not aware of what emission factor (t-CO_2/t-fuel) the fuel has. Moreover, as 0.5% sulphur fuel is a blend of different fuels, the emission factor for these fuels may vary depending on the blend and process used to produce it. However, we are not expecting the risk of higher emissions will be significant. For example, DG CLIMA reports that emission factor for Light Fuel Oil (LFO) – a 1% sulphur fuel which was commonly used in ECAs before 2015 and probably the nearest equivalent fuel type to VLSFO - is 3,151[69]. This is only marginally higher than the emission factor of Heavy Fuel Oil (HFO) which has a value of 3,114.[70]

7.5.3.2 Benefits from the improvement in air quality in the UK and globally

[67] Tier II standards are expected to be met by combustion process optimization. The parameters examined by engine manufacturers include fuel injection timing, pressure, and rate (rate shaping), fuel nozzle flow area, exhaust valve timing, and cylinder compression volume. http://www.marinewiki.org/index.php/Allowable_NOx_Emissions

[68] For example, the Danish Ministry of the Environment IA states that "There is a minor increase in fuel consumption associated with the technology [EGR]" https://www2.mst.dk/Udgiv/publications/2012/06/978-87-92903-20-4.pdf

[69] DG CLIMA guidance on the EU MRV and shipping fuel

[70] https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1712140936_ED61406_NAEI_shipping_report_12Dec2017.pdf

178. The IMO regulations are expected to lead to reductions in both sulphur and nitrogen oxide emissions globally (see Paragraph 8 for more details).

179. **Sulphur Emissions -** The new global 0.5% sulphur limit introduced in the international regulations will only affect ships operating outside of European waters. So, in the absence of detailed air quality modelling, the extent that this will result in benefits to the UK is uncertain.

180. There may also be some UK crew on board affected vessels who will enjoy better air quality on and around their ship, although again, no quantitative evidence is available on this.

181. **Nitrogen Oxide (NOx) Emissions –** We expect that NOx emissions around the UK will decrease due to the NOx Tier III standards in the North Sea and Baltic Sea ECAs.

182. In particular, a review commissioned by BEIS which considered the methodology used to estimate the emissions of shipping in the UK's National Atmospheric Emissions Inventory (NAEI), found that future NOx emissions factors (emissions per tonne of fuel used) were expected to reduce over time. This was due in part to the continued turnover in the fleet resulting in a higher proportion of vessels with engines that meet stricter NOx emission standards (e.g. NOx Tier II), but also as a direct consequence of designating the North Sea as a NOx ECA and applying the NOx Tier III standard to new ships from 2021. The report assumes that these two effects will lead to a reduction in the average NOx emission factor of 4% per year from 2021, compared with its assumption of 0.7% reduction per year in the period to 2020.[71]

183. However, there is significant uncertainty over the extent that the new vessels will operate in the NO_X ECAs in the future.

184. Nonetheless, as the Tier III controls only apply to new ships and engines, it is expected that the impacts of NOx Tier III standards will increase over time as the number of new ships operating in these waters increases.

8 Risks and unintended consequences

8.1 Risks and consequences from the IMO requirements

185. From the outset, there have been a number of technical and operational challenges to applying the global 0.5% global cap – not least because the new fuels have only recently come onto the market, and its application had to be implemented overnight (on 1 January 2020) rather than phased in over a period of time. The UK has worked with the IMO and associations representing ship owners, operators and fuel suppliers to minimise the disruption during transition[72]. As a consequence of this work, the IMO was able to publish guidelines to address the key risks and issues which would arise. With the help of the International Organization for Standardization (ISO) and industry associations, a comprehensive package of best practice guidelines for ship owners and oil suppliers are now freely available[73]. This includes:

a) Advice on supplying, purchasing and handling the new fuels;

[71] https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1712140936_ED61406_NAEI_shipping_report_12Dec2017.pdf

[72] Discussions took place in the IMO's Marine Environment Protection Committee (MEPC) and in IMO's Pollution Prevention and Response sub-committee (PPR).

[73] For example, on the IMO website - http://www.imo.org/en/MediaCentre/HotTopics/Pages/Sulphur-2020.aspx

b) Advice for ship operators about transitioning to the new sulphur limit (including an optional 'ship implementation plan') and;

c) A template for shipowners to report if compliant fuel is not available – *a fuel oil non-availability report (FONAR)*.

186. Although the review on fuel availability, commissioned by the IMO in 2015[74], concluded that sufficient 0.5% sulphur fuel would be available by 2020, some industry representatives remained sceptical. In the third and fourth quarters of 2019, several suppliers confirmed that **0.5% sulphur had become available** in most parts of the world, and OPEC stating in November 2019 that disruption to the global oil industry would be less severe than expected[75]. The UK is not a major supplier of marine fuel (~3 mt in 2014 compared with a 300mt/year global market in 2012), much of this fuel is already ultra-low sulphur and compliant with the new 2020 limits[76]. Discussions with UK bunker suppliers and the UK Petroleum Industries Association (UKPIA) have indicated no significant concerns with the supply of marine fuel in the UK.

187. Before the implementation of the 0.5% global sulphur cap, concerns had been raised about the possible knock-on effects to other parts of the economy, notably on the aviation sector and on pump prices for the road sector. [77] The concern was that if the maritime sector was using more middle distillate fuel – which is also used in these other sectors - to blend VLSFO, then this would restrict the supply. However, the anticipated surge in over-the-road diesel prices due to the 0.5% sulphur cap does not appear to have occurred. We are not aware of any reports either in late 2019 or in 2020 that the new sulphur limit has had an impact on pump prices[78] [79].

188. A small subsection of ship owners had raised **safety concerns** in the trade press about the handling and storage of the new blended fuels – suggesting that in extreme cases the fuels could result in engine failure. Most common marine fuels are blends of different feedstocks, and the bulk of 0.5% sulphur marine fuel is a blended product. Blends are more complex, have more storage and stability issues if not handled carefully, fuel husbandry is becoming more important. However, the new guidelines address these concerns and the Institute of Marine Engineering, Science and Technology (IMAREST) noted at the recent IMO workshop[80] that there was little technical concern if the fuel was handled correctly.

189. As well as concerns about fuel availability and vessel safety, it was recognised that **effective enforcement** was needed to avoid distortions in competition. To prevent ships using high sulphur fuel in international waters, the IMO has banned ships from carrying non-compliant oil in fuel tanks after 1 March 2020. This means that it should be easier for Port State Control Officers to detect if ships are attempting to evade the rules, and to demonstrate non-compliance (it is easier to prove that a ship is carrying non-compliant fuel, than it was using non-compliant fuel if the vessel subsequently switches over to compliant fuel shortly before its arrival).

190. Vessels which use an exhaust gas cleaning system (EGCS) may continue using high sulphur fuels. Many of these systems take onboard and discharge sea water which is used to remove SOx

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[74] CE Delft – "Assessment of Fuel Availability" Final report – July 2016. http://www.imo.org/en/OurWork/Documents/MEPC%2070-INF.6%20-%20Assessment%20of%20fuel%20oil%20availability.pdf

[75] *Lloyds List article 5/11* ***"Opec forecasts 'less severe' IMO 2020 implementation".***

[76] The 300mt figure is from https://www.concawe.eu/wp-content/uploads/2017/01/marine_factsheet_web.pdf and associated research. The 3mt figure is from https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1712140936_ED61406_NAEI_shipping_report_12Dec2017.pdf.

[77] https://www.ft.com/content/5124f4cc-c17c-3479-b655-a8d8b85e7823 - article by John Dizard 12 April 2019

[78] https://www.freightwaves.com/news/freightwaves-oil-report-so-where-is-the-impact-from-imo-2020

[79] https://www.ttnews.com/articles/diesel-prices-remain-stable-imo-2020-mandate-set-begin

[80] IMO Symposium on IMO2020 and Alternative Fuels – 17-18 October 2019 http://www.imo.org/en/About/Events/Pages/Symposium-on-IMO-2020-and-Alternative-Fuels--.aspx

from the exhaust emissions. Although the IMO has standards[81] for 'discharge waters' from these systems, one unintended consequence of reducing air pollution using an EGCS which has been highlighted by some States, is the potential **impact on local water quality** if numerous ships operate these systems. Some UK ports are concerned about the potential impact on harbour sediments from EGCS use and, like some German and Belgium ports, may decide to ban EGCS use in harbour waters as a precautionary measure. The Department has spoken to owners who have installed EGCS, and their view is that a ban in harbours would not significantly undermine the return on their investments. The evidence is not yet conclusive however, so the IMO is reviewing the evidence. The UK supports this evidence-led approach.

191. The main risk in respect of the NOx Tier III standard for the North Sea ECA in 2021 is to ensure compliance – both legally and in spirit. For example, there is anecdotal evidence that some ships are being part-constructed now so that they can be certified as being pre-2021, despite the fact that they will not come into service until after 2021. Although this is permitted under Annex VI, it could be argued that it is not within the spirit of the international rules and will delay the air quality benefits that would otherwise have been secured much earlier.

192. Some ship operators may decide to redistribute the ships in their fleet so that all vessels purchased after 2021 operate outside the North Sea and Baltic ECAs to avoid meeting the NOx Tier III requirements, and older vessels (which are not required to meet Tier III), operate inside it. Either way, the consequences of these actions are that the UK and other States which border the North Sea ECA, would receive fewer air quality benefits than we might otherwise expect.

193. Those vessels which have NOx Tier III abatement technology onboard might be tempted to delay for as long as possible, the switch from Tier II to Tier III mode when entering an ECA – due to the additional cost of operating in Tier III mode. However, under existing international requirements, Tier III engines are required to have tamper-proof emissions monitoring equipment[82], so it will be possible for a UK Port State Control inspector to see if this occurs.

8.2 Risks and consequences of this SI

194. One unintended consequence of the Government implementing the NOx Tier III standard for new ships in the North Sea ECA, is that some ship operators (especially for ships operating in UK domestic waters) might **delay renewing their ships**. As a result, the average age of vessels operating inside the ECA may gradually increase, which could reduce the efficiency and reliability of the fleet, as well as emissions reductions. Although much of the risk flows from the IMO requirements rather than the UK regulation, we expect there is a higher risk of this occurring for ships operating exclusively in UK waters, where there could be less competition and there is no threat of enforcement action by port State control inspectors.

195. Ships which use UK ports are used to switching to low sulphur fuels when entering the North Sea ECA, so we would expect them to be more prepared than vessels in some other parts of the world (e.g. South America) where ECAs do not exist. Under current (EU) legislation, at least 10% of ships calling at UK ports annually will be inspected, out of which 30% will have their fuel sampled (see paragraph 87). The UK has a good record of meeting its enforcement targets, and we are not expecting the new requirements to place any significant extra burden on our ship inspectors. We are

[81] Resolution MEPC.259(68) 2015 Guidelines for Exhaust Gas Cleaning Systems.

[82] MEPC.1/circ.854 1 July 2015.

planning to retain our current enforcement targets for sulphur inspections, but we are also aware that new technologies are being trialled by other States to monitor emissions remotely using 'sniffers' in drones and to test fuel samples locally rather than using a laboratory, so the results can be known in minutes[83]. These technologies would require **extra resources** but could significantly improve detection rates for non-compliant vessels. If other countries dedicate more resources to innovative enforcement methods which are more effective than those used in the UK, then there is a risk that UK flagged vessels may be subject to more effective scrutiny and enforcement in non-UK ports employing these methods compared to foreign flagged vessels arriving at UK ports.

9 Wider impacts

9.1 Innovation Test

196. Unlike some environmental legislation, the international (and UK) regulations are goal based, in as far as the legislation does not prescribe the means or technology that must be used to comply with the new sulphur limits and NOx standards. In the case of sulphur, shipowners may either use compliant fuel, an emissions abatement system or an alternative fuel to meet the requirements. There is also a choice of post combustion technologies which can be linked to a new engine, for it to achieve the new NOx Tier III standard for operations in an emission control area (ECA).

197. The UK has favoured giving shipowners the option to use emissions abatement technology to meet sulphur requirements for several reasons:

- It provides shipowners more choice in terms of meeting the new sulphur limit;
- It has encouraged equipment manufacturers to develop and trial emissions abatement technology;
- Encouraging the maritime sector to think more strategically in terms of 'green' shipping, leading to a less risk-adverse approach in dealing with technology and alternative fuels.
- Going beyond the requirements – e.g. Emission abatement technology is capable of removing more sulphur than is needed, and also reduces some other pollutant emissions such as particulate matter (PM).

198. There is little scope to tweak the legislation to encourage further innovation and to remove barriers to make it more flexible and outcome focused. The only way of doing this would be via the IMO, and doubts remain about the merits of permitting green technologies and alternative fuels. There was considerable resistance in 2008 from some IMO States and IMO bodies for this goal-based approach, and there still is resistance to the use of emissions abatement technology as an alternative to compliant fuel.

199. There are no regulatory barriers in our domestic legislation to using alternative fuels and green technologies to achieve emissions reductions providing these systems are type approved and, where appropriate, meet the requirements in existing IMO guidelines. Increasing the cost of compliant diesel fuel could help to incentivise investments in alternative fuels (such as liquified natural gas (LNG), methanol or electric hybrid vessels) which generate fewer pollutants and emissions

[83] Canadian inspectors have used handheld devices for testing sulphur content in fuel: http://www.gard.no/web/updates/content/21951078/onboard-verification-of-fuel-sulphur-content. Parker Kittiwake launched a scanner in 2018: https://vpoglobal.com/2018/04/26/parker-kiitiwake-launches-portable-sulphur-fuel-test-kit/.

abatement technologies. The latest international emissions standards have encouraged innovation in green technologies and should hastened the development of new equipment and alternative fuels.[84]

200. However, new equipment would need to be type approved to an agreed international standard and certified for use. For exhaust gas cleaning systems, this can be done in two ways:

- 'Scheme A' – initial certification of exhaust gas cleaning performance, followed by periodic survey, with continuous monitoring of key system operating parameters and daily emission checks to confirm performance in service; and
- 'Scheme B' – performance confirmation by continuous monitoring of exhaust emissions using an approved system, which is also subject to periodic survey, with daily checks of key system operating parameters.

New equipment needs to be certified before the ship becomes operational and recertified (as necessary) as part of its annual or 5-year survey regime. The MCA is responsible for certifying equipment on UK registered ships, but nearly all this work has been delegated to ship classification societies (such as Lloyd's Register). Nearly all ships which are affected by this legislation use one of these classification societies, both for surveys and to ensure the ship and its equipment operates safely and efficiently.

201. Apart from the additional capital cost of installing equipment on ships to use alternative fuels, examples of non-regulatory barriers to adoption of alternative fuels include a lack of independent information on the performance of alternative fuels, leading to high uncertainty and deterring investment[85]. The lack of facilities in most UK ports for providing fuels like LNG, methanol and shore side electricity (for ships to plug into in order to run auxiliary systems when at berth) is often cited as the reason why more ships do not use alternative fuels. In response, many ports have pointed to the lack of demand for alternative fuels from ships, as well as the high installation costs of supplying and storing alternative fuels as a barrier[86]. We are aware of three UK ports which offer LNG bunkering for ships, but the fuel is delivered to the port on the back of a lorry rather than provided by a permanent shore based facility or from a bunker barge (as it is in some foreign ports). Some of these alternative fuels have specific handling and storage requirements on ships (LNG has to be stored in liquid form at -162C), which may require additional crew training and safety systems. There are often operational and technical standards which need to be agreed internationally before the widespread adoption of new technologies and fuels can be rolled out commercially.

9.2 Small and Micro Business Assessment

202. Shipping by definition, is one of the most global businesses and requires all participants to adhere to international standards to prevent distortions in competition. There are some exemptions and exceptions to MARPOL Annex VI requirements but these tend to be linked to the vessel type, where the vessel operates and its age, size and power output. However, there are no additional

[84] Paragraph 30 – DfT Clean Maritime Plan 2019
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815664/clean-maritime-plan.pdf

[85] Paragraph 92 Clean Maritime Plan -
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815664/clean-maritime-plan.pdf

[86] Paragraph 101 Clean Maritime Plan

exemptions the UK can make to the SOx and NOx requirements for the small and micro UK businesses which are affected by these requirements[87].

203. The BEIS Business Population Estimates for the UK and regions in 2019[88] has evidence of the number of small and micro businesses classified as the below:

a) Sea and Coastal Passenger Water Transport - 195 businesses are micro; 40 are small out of 245 businesses. However, micro businesses only account for 1.7% of turnover.

b) Sea and Coastal freight water transport - 300 businesses are micro; 70 businesses are small out of 390 businesses. They account for 22.9% and 21.4% of turnover respectively.

204. The vast majority of the businesses classified in these categories are micro businesses. However, there is a high level of uncertainty around whether these estimates are representative of the businesses in scope of this impact assessment. The key uncertainties being that not all of these businesses will operate ships and, those that do, may not operate ships within scope.

205. The impacts of the new sulphur requirements on businesses will vary depending on the fuel consumption of the vessels they own. Vessels that consume a larger amount of fuel will face higher costs from the increased price of low sulphur fuel oil. It is likely that larger vessels will have a higher fuel consumption[89] however, we expect that larger vessels will carry more cargo and passengers and tend to operate more efficiently when fully loaded. Therefore, the impact that higher fuel costs will have on the returns of businesses that operate larger vessels is uncertain. We expect that new vessels will be more fuel efficient than older vessels, therefore businesses that operate an older profile of vessels are likely to face higher costs from the sulphur requirements. As discussed in paragraph 10 the new sulphur requirements only apply to UK owned vessels operating in non-EU and non-ECA waters and under the Do Nothing scenario we expect that UK vessels operating internationally will already be complying with these requirements. (This is explained in further detail in Section 6.2)

206. The Danish Ministry of the Environment report[90]notes that although there is a general trend that an increase in ship size is associated with increased annual costs of compliance in NOx ECAs, the annual costs of compliance will differ greatly between ship types. For example, the cost levels for container, passenger and roro cargo/vehicle are higher than for other ship types. There are two explanations for high annual costs. Firstly, ships with larger engines have higher capital expenditure of installing technology. Secondly, ships operating inside NOx ECAs more frequently will have higher operating costs.

207. No specific action is proposed to minimise the regulatory burden on small business, with regard to these requirements. It would not be practical to apply different standards to vessels operated by these companies. Any attempt to do so could distort competition and would not be permitted under international law. As discussed in Paragraph 197, the regulations are an overall target and the legislation does not prescribe the means or technology that businesses must use to comply with the new sulphur limits and NOx standards. The regulations focus on the outcome of reduced emissions of sulphur oxides (SOx) and nitrogen oxides (NOx), allowing businesses to meet those targets in the

[87] We do not have access to any estimates of the number of affected ships which are owned by small and micro UK businesses.

[88] https://www.gov.uk/government/statistics/business-population-estimates-2019

[89] http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Third%20Greenhouse%20Gas%20Study/GHG3%20Executive%20Summary%20and%20Report.pdf: the IMO GHG Study (2014) estimates that a general cargo ship of the size category 0 – 4,999 has an average fuel consumption per year of 600 tonnes and a general cargo ship of the size category 5,000 – 9,999 has an average fuel consumption per year of 1,900 tonnes.

[90] https://www2.mst.dk/Udgiv/publications/2012/06/978-87-92903-20-4.pdf

most cost effective way for their business model and size. The two primary expected methods are exhaust abatement or cleaner fuels. The level of fixed and variable costs can vary depending on the method that is used, and the methods used may therefore potentially vary across business size.

208. Whilst being mindful of a need to minimise impact of regulation on small business where possible, inclusion of all consumers of marine fuel is necessary to achieve the policy outcomes. The impact of the sulphur regulations to an individual business will depend upon the amounts of fuel supplied or consumed by vessels owned by the business, whilst the impact of the NOx regulations to an individual business will depend upon the profile of ships they own and will vary depending upon the ship types, sizes and frequency of time spent inside NOx ECAs.

9.3 Equalities Impact Assessment

209. This policy has no impact on those with protected characteristics under the Public Sector Equality Duty.

9.4 Justice Impact Test

210. The Ministry of Justice considered these proposal under reference number JIT 574. Regulation 32(1)(d) (offences) of the 2008 Regulations is amended to enable more effective enforcement action to be taken against owners, managers and demise charterers (as well as the masters of ships) in respect of certain existing offences and to create new offences in respect of the new requirements.

211. Prosecutions through the Courts are extremely rare, as other measures implemented by Port State Control Officers (recording a deficiency, detaining the ship until a deficiency is corrected, or requiring a ship to debunker non-compliant fuel) have proved to be effective means of controlling and enforcing air quality legislation for shipping. The Department for Transport would pay the cost of any prosecutions which are brought before the Courts.

9.5 Trade Impact

212. We do not expect that there is a need to notify the EU or WTO.

213. The proposed regulations could improve trading conditions for UK flagged ships trading internationally. If the UK failed to implement its obligations under these international agreements this could result in UK flagged ships being challenged more frequently during port state control checks in foreign ports, leading to expensive delays and inconvenience for UK flagged ships trading internationally. Implementing the measures would avoid such a cost and improve trading conditions for UK flagged ships operating internationally.

214. We expect that the global 0.5% sulphur cap in the IMO's regulations will lead to an increase in international maritime transport costs due to an increase in the price of fuel and the costs of compliant technology. A report carried out by the OECD estimates that, due to the sulphur cap of

0.5%, shipping costs could increase between 20% and 85% depending on the assumptions regarding speed, fuel price and ship size.[91]

215. The extent of the impact on global trade flows from increased shipping costs depends on the ability of the shipping sector to absorb the cost increases. Maritime transport costs make up a substantial share of the value of traded goods, so an increase in maritime transport costs could translate into higher prices of traded goods. The OECD report estimates that on average around 5% of the imported value of manufactured goods can attributed to shipping, this is 11% for agricultural goods and 24% for industrial raw materials.[92] These shares can be higher for specific categories of goods.

9.6 Competition Assessment.

216. The measures considered in this Impact Assessment are unlikely to have a direct effect on the number of suppliers or on suppliers' incentives to compete vigorously. However, they may have some indirect effects on competition in the shipping market.

217. There is a risk that the international IMO regulations could indirectly limit the number or range of suppliers. The measures will not have a uniform cost impact across all suppliers and are likely to raise the costs of some existing suppliers relative to others. This policy is likely to favour suppliers with newer, more fuel-efficient vessels. There will be a greater cost impact for suppliers with less fuel-efficient vessels. If suppliers with inefficient, older ships are now facing significantly higher fuel costs they may no longer be able to compete with rivals who own fuel-efficient vessels. Where the cost is significant, suppliers may choose to exit the market since their profitability may be adversely affected.

218. If the measures are not enforced consistently there is a risk that the policy could have differing effects in different geographic markets. Effective and consistent enforcement is important to guarantee a level playing field in the global shipping market. Variation in enforcement from different IMO flag states could result in non-compliant operators enjoying an unfair competitive advantage over compliant operators who incur considerable compliance costs.[93] The UK is one of the better performing flag states – currently ranked 4th overall in the league table. UK vessels had 13 detentions in the last three year period, and none of these were for sulphur breaches[94].

219. Vessels which are registered to a flag State which is more lenient with regard to enforcing international legislation, are more likely to be targeted for a port State inspection, particularly if the ship has a poor record of compliance. The UK and other States who are either members of the Paris MoU or Tokyo MoU, have already taken action to encourage vessels to comply (see Box 1 in Section 6.2). Moreover, the IMO's ban on the carriage of non-compliant fuel will make it extremely risky and difficult for ships to bunker and use non-compliant fuel in international waters.

[91] https://www.itf-oecd.org/sites/default/files/docs/sulphur-emissions-shipping.pdf

[92] https://www.itf-oecd.org/sites/default/files/docs/sulphur-emissions-shipping.pdf

[93] https://www.itf-oecd.org/sites/default/files/docs/sulphur-emissions-shipping.pdf

[94] https://www.parismou.org/inspection-search/inspection-search

10 Post implementation review

220. A statutory review clause is included in 'The Merchant Shipping (Prevention of Air Pollution from Ships) Regulation 2008', which also covers later amendments such as the 2020 Regulation which this assessment refers to. A review of the 2008 Regulations was due to be published by 16 December 2019, but is now expected to be published by 16 December 2020.

221. Provisions in the new 2020 amending regulations will be reviewed in 2025, when the 2008 regulations are reviewed again in five years' time. We expect that any further amendments to the 2008 regulations, would be in response to changes to MARPOL Annex VI. The Department has well established procedures for consulting key stakeholders before decisions to amend the MARPOL Convention is taken at the IMO. As a consequence, any future amendments we make to 2008 Regulations will have already been considered by officials and stakeholders as part of these international negotiations. We will consult stakeholders before we conduct the PIR in 2025. But at this stage, we consider that the 2008 Regulation is a well established regime for implementing international emissions controls, and as such, we would not expect the PIR to recommend any major changes.

Annex A

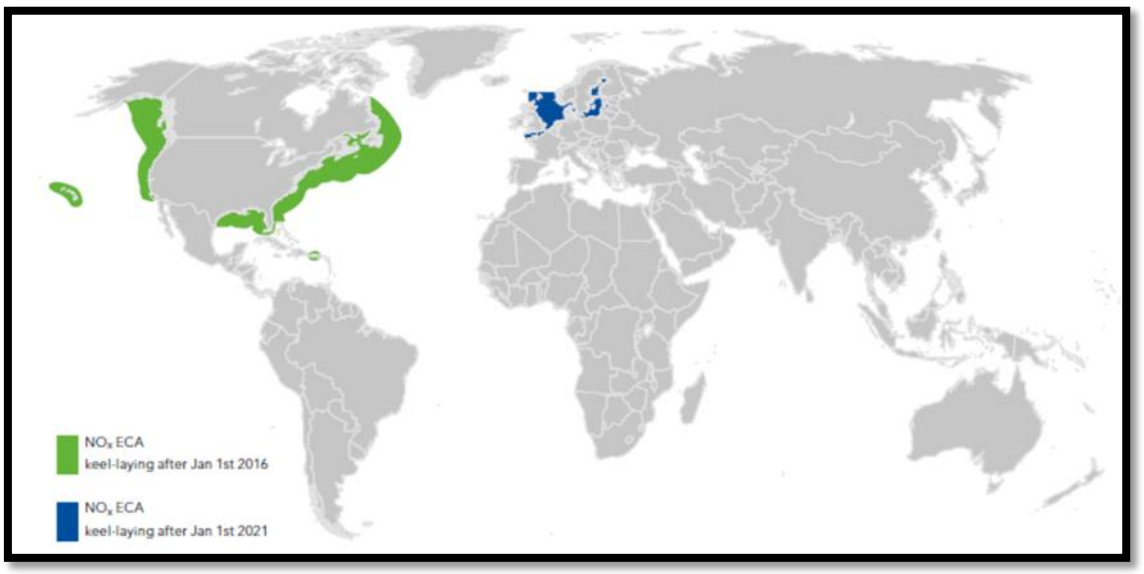
Gaps in domestic legislation:

The map shows the North Sea and Baltic Sea ECAs in dark blue – where 0.1% sulphur fuel has been used since 2015 under the 2014 Regulations. The light blue area represents EU waters (under this legislation, waters belonging to the UK, the EU and EEA states) which are subject to 0.5% limit (from 1 January 2020) under our domestic 2014 Regulations. All European requirements – including the 0.5% sulphur limit for ships operating in EU waters from 2020 onwards, have been implemented under:

The Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008.

The Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2010.

The Merchant Shipping (Prevention of Air Pollution from Ships) and Motor Fuel (Composition and Content) (Amendment) Regulations 2014.



a) 0.5% sulphur cap on fuel use: The IMO has introduced a global ban on the use of fuel oil which exceeds 0.5% for ships which has more than 0.5% sulphur from 1 January 2020, unless the ship is using an exhaust gas cleaning system – in which case it may continue using high sulphur fuel oil. As regulation 2014 has already implemented this limit for ships operating in EU waters (including the UK's), the main impact of the global cap will be on UK flagged vessels operating outside EU waters. If a UK flagged vessel is found to be using non-compliant fuel outside UK waters (say, by a ship inspector in another state), enforcement action can be taken both by the port State and the Flag State Administration (for UK flagged ships, it would be for the Maritime and Coastguard Agency to consider further action).

b) Ban on the carriage of >0.5% sulphur fuel oil: This prohibits ships from carrying high sulphur fuel oil (>0.5%) in any of their fuel tanks. This is one of the measures which the IMO adopted in October 2018, to encourage compliance with the sulphur limit. Most States (including the UK) can only prosecute ships for offences which occur within their waters, rather than offences committed on the high seas. The ban does not apply to the carriage of fuel as cargo, nor would it apply to ships which use exhaust gas cleaning systems to achieve compliance.

c) NOx Tier II standard for new ships: NOx Tier I standard (which applies to all ships constructed (and engines) on or after 1 January 2000) was implemented domestically under the 2008 regulations. Subsequently, MARPOL Annex VI was amended so that large engines (5,000kW and over) which were constructed for ships coming into service since 1 January 1990, also had to meet the NOx Tier I standard. Neither this provision, or the requirement for ships / engines constructed on or after 1 January 2011 should meet the NOx Tier II standard, has been implemented into our domestic legislation yet. The Department understands that neither NOx Tier I or Tier II are particularly difficult to achieve, and should not require a post-combustion emissions abatement system.

Ships within scope would be certified as NOx Tier II compliant by the Flag State or by one of its Recognised Organisations, as part of the 5-year survey which apply to all ships.

Tier	Ship construction date on or after	Total weighted cycle emission limit (g/kWh) n = engine's rated speed (rpm)		
		n < 130	n = 130 - 1999	n ≥ 2000
I	1 January 2000	17.0	$45 \cdot n^{(-0.2)}$ e.g., 720 rpm – 12.1	9.8
II	1 January 2011	14.4	$44 \cdot n^{(-0.23)}$ e.g., 720 rpm – 9.7	7.7
III	1 January 2016	3.4	$9 \cdot n^{(-0.2)}$ e.g., 720 rpm – 2.4	2.0

We expect ships on international journeys to be already compliant to this international standard. This is because countries can enforce these requirements on all ships calling at their ports under the IMO's Port State Control regime. As a consequence, UK registered ships would still need to have the correct certificates to demonstrate compliance when they call at ports in countries that are enforcing these requirements.

d) NOx Tier III standard for ships operating in the North American and US Caribbean ECAs: UK flagged ships which operate in these waters and came into service from 1 January 2016, must be compliant with the stricter NOx Tier III requirements. This is a significantly higher standard than NOx Tier II. To comply, most ships would be expected to install a post-combustion abatement technology – either a selective catalytic reduction system (SCR) or an exhaust gas recirculation system (EGRS). Alternatively, shipowners may use an alternative fuel to meet the stricter NOx limits, such as using liquefied natural gas (LNG), which in addition to having negligible SOx and PM, can meet the NOx tier III standard without using an additional abatement technology.

The NOx Tier III requirements inside ECAs do not apply to older vessels (pre-2016). Moreover, because the US Authorities are enforcing the requirements (see Box 1 in Section 6.2) we would expect ships within scope to already comply with the ECA standards. The UK regulations would apply to UK flagged ships that are within scope and operating in the two ECAs. If UK flagged vessels are already compliant (which they should be) then the impact of this regulation should be zero.

e) NOx Tier III standards for all ships in the North Sea and Baltic Sea ECAs: From 1 January 2021, all new ships operating in these waters will need to meet the NOx Tier III standard. Ships brought into service before 2021 would not be affected – unless they have a major engine refit. Again, for new ships to comply they would need an engine which is compliant – either with an SCR or EGRS, or which can use an alternative low NOx fuel. Once a ship has left the ECA, we assume that the vessel would switch off the emissions abatement system.

Annex B

Ambulatory Reference

1 Definition of ambulatory reference

An ambulatory reference for the purposes of this Impact Assessment is a reference in domestic legislation to specific provision in an international instrument which is interpreted as a reference to the specific provision as modified from time to time (and not simply the version of that provision which exists at the time the domestic legislation is made).

2 What does an ambulatory reference provision achieve?

The effect of the ambulatory reference provision is that amendments to any parts of the International Convention which are specifically referred to in the Statutory Instrument (SI) will automatically be transposed into UK law at the same time as they come into force internationally. No additional SIs/ amendments to existing SIs will be required to bring such amendments into force.

3 Enabling Power to make Ambulatory Reference

On 26 March 2015, the Deregulation Act 2015 received Royal Assent. The Act inserted new section 306A of the Merchant Shipping Act 1995 (MSA 95), which contains a power to make ambulatory references to international instruments in secondary legislation. This power will only be used for "technical", and therefore non-controversial, aspects of the Convention.

4 What assurances are in place to prevent undesirable amendments to international Conventions automatically coming into force?

1. An ambulatory reference provision will be incorporated into secondary legislation and the instrument will make appropriate references to an international convention. The suitability of the international convention will be assessed (taking into consideration the nature of amendments and the likelihood of whether they will be controversial) prior to the use of the power being approved.

2. If the law is changed down the line due to an ambulatory power, then Ministers will inform Parliament via a Written Ministerial Statement.

3. Where the UK does not agree with a proposed amendment to an international convention, the UK may object to it in the IMO; if the amendment still comes into force internationally, it will not come into force with respect to the UK. This facility will be available for exceptional circumstances; however, this "opt-out" it is not expected to be used frequently, if at all, because:

    a. any UK arguments deemed necessary to shape the amendments will have been applied in the international negotiation stage;
    b. the amendments, being of a technical nature, are not expected to be politically controversial;
    c. the amendments, once agreed, will in any case be binding on the international community and therefore it will be necessary for UK ships wishing to operate internationally without hindrance to comply anyway.

5 Regulatory process supported by the Better Regulation Executive for Ambulatory Reference measures

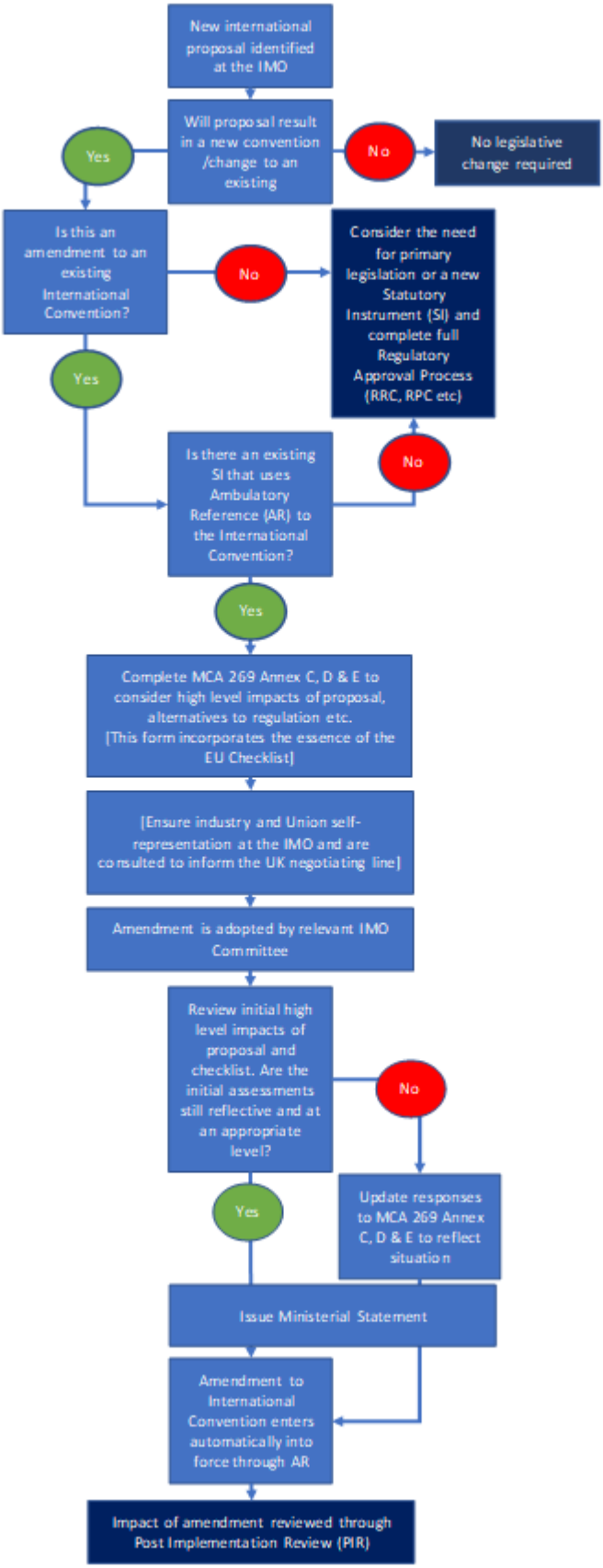
A flow diagram of the agreed scrutiny process is depicted overleaf. In essence the process will require:

- an ambulatory reference provision to be included in secondary legislation which will follow the full parliamentary and regulatory processes;
- subsequent technical amendments during the international negotiation process, will continue to be subject to:
    - consideration of high level impacts
    - stakeholder engagement;

- full post implementation review to be undertaken to evaluate whether the policy has achieved its goal and is still valid, and also evaluate the costs and benefits of all the technical amendments enacted since the previous review (or impact assessment).

The proposed approach streamlines the traditional regulatory process and directs it where the greatest influence can be achieved, at negotiation stage. The principles of Better Regulation are still captured:

- Alternatives to regulation – prior to work commencing on any proposal at the IMO, a case for action must be demonstrated against the following criteria: practicality, feasibility and proportionality; costs and benefits to industry, including legislative and administrative burdens; and alternatives to regulation.
- Consultation – industry is represented at the IMO through non-governmental organisations, which are heavily involved in early stage policy development, contributing to working and drafting groups where policy is designed, as well as participating in plenary where policy is examined. Industry representatives are invited to meetings hosted by the MCA prior to IMO sessions to assist with the development of the UK's negotiating position.
- Assessment of impact – a high level consideration of impact is undertaken at proposal stage to inform the UK's negotiation position. Post implementation reviews will be used to assess the robustness of the original assessment and will be timed to ensure they can feed into negotiations for future rounds of amendments.



6 How does Ambulatory Reference support Economic Growth?

The UK's ability to implement international agreements efficiently and effectively is important to the commercial shipping sector for a number of reasons:

- timely implementation means that UK ships plying internationally can properly be issued with certificates that confirm compliance with relevant international rules. Recent experience with the Maritime Labour Convention has highlighted a risk that relying on new statutory instruments to implement all revisions could result in the UK delaying ratification of major agreements, potentially restricting the participation of UK shipping in international trade;

- the uniform implementation of international rules in all contracting states is vital in order to achieve a level playing field for UK ships that trade internationally. The UK must be capable of certifying its own ships to the relevant standards; failure to do so makes it much more likely that a UK ship will be detained in a non-UK port for non-compliance. We must also be able to enforce those same standards against non-UK ships in UK ports, to ensure that compliant UK ships are not disadvantaged;

- previous implementation practice has created a complicated and disjointed regulatory regime that diverges significantly from the international structure. This creates administrative burden for industry, because of the needless duplication of effort needed to ascertain the domestic legal position, and because of the unnecessary complexity of the domestic regime;

- a transparent, accessible and up-to-date legal regime is a vital component of a quality flag. Improving the way we implement international law will reflect the UK's ambition to make its flag a more attractive place to do business, as well as protecting our reputation as a world-class maritime administration, both with industry and the international institutions (such as the EU and the IMO) with responsibility for maritime policy;

- when discussing technical matters with overseas clients or shipyards and designers, it helps to have a common source of reference. Those working within the UK regime will be familiar with the UK's implementation, but those in other states will have no knowledge of it;

- when an owner wishes to change flag to the UK, the ship will have been constructed to the international requirements. Differences in UK law (occasionally deliberate gold-plating, but mostly differences in legislative drafting styles and delays in implementing amendments) make assessing a ship's compliance unnecessarily complicated, and may create additional hurdles capable of discouraging owners from transferring to the UK.

Annex C

Additional Information on Data used in Analysis

Automatic Identification System (AIS) Data

1. The **Automatic Identification System** (AIS) is an automatic tracking system adopted by the IMO to provide vessel information primarily for the purposes of maritime safety (e.g. collision avoidance).
2. The technology works with transponders which automatically broadcast information at regular intervals via a Very High Frequency (VHF) transmitter.
3. Data from AIS messages gives the position of a vessel at any given time which is combined with voyage information about the vessel's trip.
4. The **European Maritime Safety Agency** (EMSA) provided global AIS data for UK flagged ships covering all of 2017.
5. The data from EMSA was limited and only contained MMSI (a ship identifier), date/time of signal, and location (latitude/longitude).
6. To get more information about each ship, this data was matched to **Consolidated European Reporting System** (CERS) data to get an IMO number that could then be matched to world fleet data (purchased from IHS Global and used in DfT fleet statistics).
    - 263 ships in the AIS data could not be matched to UK fleet data
    - 694 ships in the AIS data were matched to UK fleet data (39% of the fleet data)
    - 1,098 ships from the UK fleet data were not matched to the AIS data
7. The ships in the AIS that could not be matched are probably actually in the fleet data, but just do not occur in the CERS data, as there are limits to what CERS records (e.g. some ships that have not called at a UK port are not in CERS). The fleet data does not include ships under 100 GT, but it is unlikely ships that small would be using AIS.
8. The majority (89%) of unmatched ships in the fleet data were non-trading ships, which would be more likely to not be in CERS or to not be transmitting AIS signals.