|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Title: Bringing Safety Requirements in key areas on all Passenger Vessels on Domestic Voyages in line with modern Technical StandardsIA No: DfT00400RPC Reference No: RPC18- DFT-MCA-42849(1)Lead department or agency: Maritime and Coastguard Agency (MCA)Other departments or agencies: Department for Transport (DfT) |

|  |
| --- |
| Impact Assessment (IA) |
| Date: 13/07/2018 |
| Stage: Consultation  |
| Source of intervention: Domestic |
| Type of measure: Secondary legislation |
| Contact for enquiries: Joanna Dormon, Danny Fellowes |

 |
| Summary: Intervention and Options | **RPC Opinion:** GREEN |

|  |
| --- |
| Cost of Preferred (or more likely) Option |
| Total Net Present Value | Business Net Present Value | Net cost to business per year (EANDCB in 2016 prices, 2017 present value) | One-In, Three-Out | Business Impact Target Status |
| -£5.6m | -£10.4m | £1.1m | N/A | N/A |
| What is the problem under consideration? Why is government intervention necessary?The technical standards applicable to the current domestic passenger fleet vary depending on the age of the vessel. Since 2000, the MCA has introduced more rigorous regulations for domestic passenger vessels. These regulations apply, in general, to new build vessels. It is the MCA policy, in line with previous recommendations, where possible, to apply a single safety standard to new and existing vessels. Government intervention is required to revise the technical standards applied to existing vessels to bridge the safety gap between old and new vessels.  |
| What are the policy objectives and the intended effects?The objective of this policy is to provide suitable regulation for existing domestic passenger vessels which is comparable with modern regulations whilst being proportionate and pragmatic. The aim is to have a consistent domestic passenger ship safety standard irrespective of the age of the vessel. |
| What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)**Option 0:** Do nothing, maintain regulatory status quo. Promulgate best practice guidance suggesting ways for operators to improve level of vessel safety. This is the baseline or counterfactual against which the options are being appraised against. **Option 1:** Tailored amendment of the Regulations to achieve improvements in key safety areas with allowances, where possible, for alternative arrangements addressing the safety concern without prohibitive expense. Re-evaluate vessel against amended requirements and modify as required. This would provide a balance between not imposing significant costs, whilst ensuring an acceptable level of safety for the travelling public. **This is the preferred option.** **Option 2:** Compliance in full with requirements applicable to new vessels. Complete re-evaluation of the vessel and modification to achieve retrospective compliance. This may necessitate significant modification and technical requirements in some areas may not be able to be satisfied for certain vessels, regardless of expenditure.  |

|  |
| --- |
| Will the policy be reviewed? It will be reviewed. If applicable, set review date: January/2024 |

|  |  |
| --- | --- |
| Does implementation go beyond minimum EU requirements? | N/A |
| Are any of these organisations in scope? | MicroYes | SmallYes | MediumYes | LargeYes |
| What is the CO2 equivalent change in greenhouse gas emissions? (Million tonnes CO2 equivalent)  | Traded:N/A | Non-traded:N/A |

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 : |  |  Date :  | Enter a date |

# Summary: Analysis & Evidence Policy Option 1

Description:  **Tailored amendment of the Regulations to achieve improvements in key safety areas**

FULL ECONOMIC ASSESSMENT

|  |  |  |  |
| --- | --- | --- | --- |
| Price Base Year: 2017 | PV Base Year: 2019 | Time Period Years: 10 | Net Benefit (Present Value (PV)) (£m) |
| Low: 0.1 | High: -11.2 | Best Estimate: -5.6 |

|  |  |  |  |
| --- | --- | --- | --- |
| COSTS (£m) | Total Transition (Constant Price) Years | Average Annual (excl. Transition) (Constant Price) | Total Cost (Present Value) |
| Low  | 5.2 | 1 | 0.2 | 7.2 |
| High  | 11.5 | 0.2 | 13.6 |
| Best Estimate | 8.4 | 0.2 | 10.4 |
| Description and scale of key monetised costs by ‘main affected groups’The key costs to business (vessel owners) are related to purchasing and maintaining the following safety equipment for their vessels. The costs below present the central case (or best estimate):* Liferafts - £2,544,000
* Lifejackets - £253,000
* Lifejacket lights - £984,000
* Fire detection equipment - £1,608,000
* Fixed fire fighting equipment - £437,000
* Hand pumps - £87,000
* Bilge pumping arrangements - £1,021,000
* Bilge alarm arrangements - £636,000
* Ship modifications for post damage survivability - £2,527,000

There is also a familiarisation cost of £319,000 for understanding the requirements of the updated regulations. See section 10.1 for a full overview of the scale of the monetised costs in the low, central and high scenarios. |
| Other key non-monetised costs by ‘main affected groups’The costs associated with the improved damage survivability requirements are bespoke to each vessel and cannot be fully monetised without engineering analysis of each vessel. |
| BENEFITS (£m) | Total Transition (Constant Price) Years | Average Annual (excl. Transition) (Constant Price) | Total Benefit (Present Value) |
| Low  | 0.0 | N/A | 0.7 | 7.3 |
| High  | 0.0 | 0.2 | 2.4 |
| Best Estimate | 0.0 | 0.5 | 4.9 |
| Description and scale of key monetised benefits by ‘main affected groups’For additional liferaft capacity, the monetised benefits of prevented individual fatalities and injuries has been estimated at £4,856,000 in the central case. |
| Other key non-monetised benefits by ‘main affected groups’Higher vessel safety (above the additional liferaft capacity that has been monetised) is the key non-monetised benefit for passengers and businesses. |
| Key assumptions/sensitivities/risks Discount rate (%) | 3.5% |
| The actual costs for equipment cannot be estimated with certainty and are based on estimates provided by industry and the MCA. We built in sensitivities using the range of quotes received to construct a low, central and high scenario in each case. We have assumed the number of passengers on ships is based on estimates for the most common ship operating in similar waters. For costs related to post damage survivability, there is a risk that it may not be viable, either commercially to the operator or practically due to the original ship design, to upgrade certain vessels to meet the new requirements. For the monetised benefits, uncertainty exists over the average value of prevention of a fatal accident for maritime accidents, and the likelihood of events such as a person drowning occurring. |

BUSINESS ASSESSMENT (Option 1)

|  |  |
| --- | --- |
| Direct impact on business (Equivalent Annual) £m:  | Score for Business Impact Target (qualifying provisions only) £m: N/A |
| Costs: 1.2 | Benefits: 0.0 | Net: 1.2 |

# Summary: Analysis & Evidence Policy Option 2

Description: Compliance in full with requirements applicable to new vessels

FULL ECONOMIC ASSESSMENT

|  |  |  |  |
| --- | --- | --- | --- |
| Price Base Year: 2017 | PV Base Year: 2019 | Time Period Years: 10 | Net Benefit (Present Value (PV)) (£m) |
| Low: -0.6 | High: -12.5 | Best Estimate: -6.7 |

|  |  |  |  |
| --- | --- | --- | --- |
| COSTS (£m) | Total Transition (Constant Price) Years | Average Annual (excl. Transition) (Constant Price) | Total Cost (Present Value) |
| Low  | 5.9 | 1 | 0.2 | 7.9 |
| High  | 12.8 | 0.2 | 15.0 |
| Best Estimate | 9.5 | 0.2 | 11.5 |
| Description and scale of key monetised costs by ‘main affected groups’The key costs to business (vessel owners) are related to purchasing and maintaining the following safety equipment for their vessels. The costs below present the central case (or best estimate):* Liferafts - £2,544,000
* Lifejackets - £253,000
* Lifejacket lights - £984,000
* Fire detection equipment - £1,608,000
* Fixed fire fighting equipment - £437,000
* Hand pumps - £87,000
* Bilge pumping arrangements - £1,021,000
* Bilge alarm arrangements - £636,000
* Ship modifications for post damage survivability - £3,629,000

There is also a familiarisation cost of £319,000 for understanding the requirements of the updated regulations. See section 11.1 for a full overview of the scale of the monetised costs in the low, central and high scenarios. |
| Other key non-monetised costs by ‘main affected groups’The costs associated with the improved damage survivability requirements are bespoke to each vessel and cannot be fully monetised without engineering analysis of each vessel. The cost of any replacement vessels will be greater under Option 2 due to the addition of Class B vessels which may have greater difficulty complying with newer damage survivability standards. The cost of assessing existing vessels against Classification Society Rules will cost operators through the preparation of pre-classification information packs, surveys and assessments costs. |
| BENEFITS (£m) | Total Transition (Constant Price) Years | Average Annual (excl. Transition) (Constant Price) | Total Benefit (Present Value) |
| Low  | 0.0 | N/A | 0.7 | 7.3 |
| High  | 0.0 | 0.2 | 2.4 |
| Best Estimate | 0.0 | 0.5 | 4.9 |
| Description and scale of key monetised benefits by ‘main affected groups’For additional liferaft capacity, the monetised benefits of prevented individual fatalities and injuries has been estimated at £4,856,000 in the central case. |
| Other key non-monetised benefits by ‘main affected groups’Higher vessel safety (above the additional liferaft capacity that has been monetised) is the key non-monetised benefit for passengers and businesses. |
| Key assumptions/sensitivities/risks Discount rate (%) | 3.5% |
| The actual costs for equipment cannot be estimated with certainty and are based on estimates provided by industry and the MCA. We built in sensitivities using the range of quotes received to construct a low, central and high scenario in each case. We have assumed the number of passengers on ships is based on estimates for the most common ship operating in similar waters. For costs related to post damage survivability, there is a risk that it may not be viable, either commercially to the operator or practically due to the original ship design, to upgrade certain vessels to meet the new requirements. For the monetised benefits, uncertainty exists over the average value of prevention of a fatal accident for maritime accidents, and the likelihood of events such as a person drowning occurring. |

BUSINESS ASSESSMENT (Option 2)

|  |  |
| --- | --- |
| Direct impact on business (Equivalent Annual) £m:  | Score for Business Impact Target (qualifying provisions only) £m: N/A |
| Costs: 1.3 | Benefits: 0.0 | Net: 1.3 |

# Evidence Base

## Background

The technical standards applicable to the current domestic passenger fleet vary depending on the area of operation, hull construction material, length and importantly, age. The table in annex A has been included for the benefit of vessel owners, to allow them to understand the relevant standards applicable for their vessel.

In general, passenger vessels on domestic voyages certified before 6th April 2010 on categorised waters (inland waters) and 1st July 1998 for seagoing vessel are required to meet the standards detailed in several domestic regulations dating from 1998 and 1999[[1]](#footnote-1). Collectively, these regulations are referred to as the 1998/99 regulations throughout this document.

The technical requirements contained in these regulations remain mostly unchanged since 1980[[2]](#footnote-2) and take little account for advances in technology and modern safety philosophy. Since these regulations were introduced, several new technical standards have subsequently been published over time[[3]](#footnote-3). Many of these new regulations were implemented in response to the Marchioness disaster and the subsequent safety inquiry (see Section 1.1). The new regulations are largely only applicable to new domestic passenger vessels certified after the legislation was enacted. These modern regulations significantly improve the safety standards of new vessels, in particular regarding fire safety, life-saving appliances and damage survivability.

However, concurrent with the development of new safety standards, the technical standards applicable to existing vessels have remained mostly unchanged. It is considered that the technical standards contained within the 1998/1999 regulations1 present a lower level of safety compared to regulations introduced more recently. It is acknowledged that many vessels which are certified in accordance with the 1998/99 regulations, could not be modified to comply with modern standards without excessive cost. This led to a review of the standards applied to those existing vessels.

The aim of the review was to increase the safety standard applied to existing vessels so that the overall safety of the existing vessels is comparable with the safety of vessels certified in accordance with modern requirements. Key areas identified for improvement are based on research carried out by the Maritime and Coastguard Agency (MCA) and close collaboration with industry.

Vessels which continue to be certified in accordance with the 1998/99 regulations are sometimes referred to as having ‘Grandfather Rights’.

### Marchioness

The passenger ship MARCHIONESS and dredger BOWBELLE collided on the Thames on the 20th August 1989 and 51 people lost their lives. The Marchioness Disaster led to Lord Justice Clark’s Thames Safety Inquiry. The Thames Safety Inquiry contained a key recommendation that new safety regulations for ships should, as a general rule, be applied equally to both new and existing vessels, subject to a power to grant exemptions. The inquiry said that the exemption power should only be exercised where –

1. compliance by an existing vessel with a new safety standard would be unreasonable, whether on grounds of practicability or for some other reason, and
2. the operator can also satisfy the Department that a satisfactory alternative measure will be put in place, which will achieve an equivalent level of safety.

It is important to note that significant changes have been made to domestic passenger ship regulation since the Marchioness accident, which are applicable to new and existing vessels, including the introduction of safety management systems and new Codes for both seagoing ships and those on inland waterways. The proposed regulations in this assessment serve to bridge the gap between the safety standard applied to existing and new vessels built to modern regulations.

### Research

A Formal Safety Assessment (FSA) was undertaken by the MCA, with consultant facilitation, between 2001 and 2003, which looked at all aspects of domestic passenger ship safety. This work considered domestic passenger ships operating on inland waterways and at sea. The outcome of this led to more detailed research being undertaken by independent consultants who focused on stability, evacuation, fire safety, bridge visibility and safety management standards and covered all operating environments in the UK.

The MCA purpose in conducting the research was to provide a baseline for future risk-based regulation of domestic passenger ships by highlighting any areas where the current regulatory framework could be improved to address the identified risks. These research reports were published in March 2005.

The FSA research concluded that the overall level of safety on passenger ships on the Thames was within the Health and Safety Executive’s “tolerable” range. This means that the level of risk is within that generally accepted by the public, provided risks are demonstrated to be as low as reasonably practicable. The reports identified areas where improvements could be made to current standards, for example by further embedding the safety management concept (which have already been implemented to a certain extent).

Many of the results of the initial FSA have been used to develop policy to date. Results from the Risk Assessment have been used within this Impact Assessment to calculate the monetised benefits associated with reduced risk to life when additional safety equipment is provided.

## Problem under consideration

Since 2000, the MCA has introduced more rigorous regulations for domestic passenger vessels. These regulations apply, in general, to new build vessels. These standards developed are considered to provide a high safety standard in line with other internationally recognised standards. Concurrent with these developments, the regulations for existing vessels have remained mostly unchanged (this applies to approximately 84% of the domestic passenger ship fleet). Generally, operators of these existing vessels have not voluntarily installed safety equipment over and above what is required in the regulations, even when a piece of safety equipment would otherwise be required for a new vessel.

## Rationale for intervention

Safety is the overarching rationale for revising the standards applied to domestic Passenger Vessels, with respect to the safety of passengers and crew. The proposed amendments to Regulations aim to raise safety levels for existing ships to align more closely with those for new ships. In the interests of encouraging continuous improvement of safety standards, it is necessary to take a pragmatic approach in applying new standards to the existing fleet. Given that it is difficult for passengers to objectively assess the safety of a vessel, and the impact on passengers compared to freight will be greater if an incident occurs, we believe a higher standard of safety is warranted relative to non-passenger carrying vessels. Additionally given that new vessels make up a relatively small proportion of the current domestic fleet, there is a lack of clear choice for passengers.

In summary below are the main market failures that continue to exacerbate this difference in safety standard:

* There is informational asymmetry as passengers do not understand the relative risks of the different vessels they travel on. Passengers are unable to differentiate between the risk profile of vessels that have higher safety standards and those that do not due to the complexity and inherently technical nature of standards on ships. Consequently there is no incentive for vessels to increase safety as vessels cannot make the distinction clear to passengers in order to charge more and recover the costs of safety improvements. As a result of safety equipment presenting a cost to operators, those who have chosen to install non-mandatory safety equipment following advances in technology and lowering costs, are seen to be at a commercial disadvantage.
* There are negative externalities if low safety standards impact on other parts of industry, passengers and government beyond what is already internalised in the costs to a business if a safety incident occurs. As a result, a two-tier safety level within the UK domestic passenger ship fleet presents a reputational risk to the industry and the MCA/DfT. If an accident were to occur on a vessel constructed and maintained to older regulations.
* Market competitiveness is impacted as existing vessels have an advantage over new entrants into the market due to being able to adhere to lower safety standards at a lower cost. This is not rectified through, for example, higher premiums on insurance for existing vessels, due to the fact that existing vessel are still certified in the same way as newer vessels, leading to the perception of similar safety levels.

These market failures mean that the level of safety provided on older domestic passenger vessels is likely to be below the socially optimum level. The result is a higher risk of a safety incident occurring on domestic passenger vessels, and when an incident does occur it leading to a serious injury or loss of life. It is considered that well-designed government intervention will bridge this gap.

## Policy objective

The objective of this policy is to provide suitable regulation for existing domestic passenger vessels which is comparable with modern regulations whilst being proportionate and pragmatic. The aim is to have a consistent domestic passenger ship safety standard irrespective of the age of the vessel.

## Consultation

We are consulting to consider both the policy and the associated costs in this Impact Assessment. The intent of the consultation is to more fully explore the viability of each of the separate proposed measures – both from a cost perspective and from a feasibility point of view. It is aimed to identify whether any considerations have been overlooked and provide justification for any areas where the proposals could be scaled back.

Following this first consultation on the policy and the Impact Assessment, a finalised Impact Assessment will be completed and the draft Regulations prepared, these Regulations will then be subject to a second shorter consultation. There is much scope for stakeholders to influence the policy around the individual proposals and also to refine the cost benefit information. The consultation document which will be provided alongside this Impact Assessment will further explain the policy behind each proposal and which vessels will be impacted as well as asking key questions and inviting comment.

## Description of options considered

### Option 0: Do nothing

Do nothing and maintain the regulatory status quo. Promulgate best practice guidance suggesting ways for operators to improve level of vessel safety.

This option would not address the safety gaps between older vessels and those built to new standards. Whilst major improvements have been achieved since the Marchioness tragedy the reality is that safety gaps in some areas mean that the consequences of such an incident have not appreciably changed. Although some operators have chosen to take advantage of safety advances, many have not. Operating vessels with less safety equipment can be seen as commercially attractive due to the reduced capital investment and maintenance required for safety equipment. Therefore, regulation is required to advance the level of safety within the domestic passenger ship fleet whilst promoting a level playing field.

Furthermore, following formal investigations, FSAs and research undertaken following the Marchioness disaster in 1989, using extensive resources over many years and the findings of which were presented to the public in 2005, Ministers have publicly committed to the implementation of the recommendations and a review of all the safety standards. Failure to implement this would mean that the recognised safety concerns were not being addressed and identified risks would be perpetuated. Such a situation could be seen as a betrayal of the travelling public who are entitled to expect the protection of robust and modern safety standards.

This is the baseline or counterfactual against which the options are being appraised against.

### Option 1: Implement revised standards that provide a balance between not imposing significant costs, whilst ensuring a minimum level of safety for the travelling public

This option would apply tailored amendments of the Regulations to achieve improvements in key safety areas of fire safety, damage stability, protection from water ingress and life-saving appliances rather than compliance with the requirements for a new ship in full as under Option 2. The ship would then be evaluated against amended requirements and modified as required.

It is recognised that the cost of installing safety equipment on existing vessels can be substantially more expensive than it would be on new vessels. Where possible, allowances have been made with the equipment that would be accepted for these existing ships rather than direct application of the equipment requirements for new ships. The proposed amendments also have allowances, for alternative arrangements which ensure the safety concern is addressed, without it being prohibitively expensive.

In some cases, the requirement that is set for Option 1 is lower than that for a new ship under Option 2. An example of this is the proposed damage stability requirements where under Option 2 a Category B ship would need to apply the requirements but under Option 1 the proposed application starts at Category C, which would bring more vessels into scope of the requirement. See annex B for definitions of categories of water.

The derivation of the proposed amendments was carried out in conjunction with industry representatives (48 operators and industry representatives). The proposed revised regulations reflect the advances in marine safety equipment and requires the provision of equipment which is, in general, comparable with a modern vessel. Only practicable changes which would provide a substantial increase in safety have been considered, following extensive discussions with affected stakeholders.

Amending and updating only certain areas in the Regulations would substantially increase safety levels of older vessels without causing disproportionate cost. Although it should be noted that to achieve risk reduction in the critical area of post-damage survivability[[4]](#footnote-4), it will still be necessary for affected vessels to make substantial modifications which may not be possible for some vessels. If a vessel cannot make the required modifications then it will no longer be able to be certified to operate under the same conditions.

**This is the preferred option and provides a proportionate and pragmatic approach to raising the standards for existing vessels whilst minimising the impact on industry.**

* 1. **Option 2: Full compliance with modern standards for all domestic passenger vessels**

This option would require compliance in full with requirements applicable to new vessels. Compliance with requirements for new vessels would require evaluation of the vessel against either MSN 1823 edition 2, the SSPS code or Directive 2009/45/EC depending on the vessel type. This evaluation would need to take into account all requirements of the instrument and not just those in the key safety areas identified under Option 1. The vessel would then be modified to achieve this retrospective compliance.

Achieving compliance in full with requirements for new vessels would be extremely costly and, in many cases, require extensive modification of the vessel. Whilst retrospective compliance would close the gap between old standards and new, it would likely render a high number of vessels unable to operate due to the wide-ranging modifications required and the fact that the main requirements for new ships do not currently take into account the difficulty in retrospective application to older vessels.

Under this option, seagoing vessels in this category would be required to comply with the EC Directive 2009/45/EC as if they were an existing vessel as, unlike the UK Regulations the Directive has separate provisions for new and existing ships. This option would require a complete re-evaluation of the vessel under the new framework and, depending on the vessel and its operation, could require significant modification. Although the EU directive does contain modified requirements for existing ships as opposed to new vessels it is considered that requirements in some areas such as stability may be difficult to rectify for certain vessels.

**This option offers the greatest reduction of risk but at potentially disproportionate economic cost.**

## Overview of Analysis

The costs and benefits of Option 1 and Option 2 have been estimated. In accordance with HM Treasury Green Book guidance, the policy is appraised over a 10-year appraisal period from 2019 to 2028 (inclusive) and a discount rate of 3.5% per year is used to discount all future costs and benefits to the start year we expect the regulations to be implemented, 2019. Costs and benefits are estimated in 2017 prices. All figures are presented as discounted and real unless stated otherwise. Figures presented are rounded when appropriate.

The proposed regulations will affect existing vessels i.e. vessels currently operating commercially as passenger ships. Newer vessels are not affected as they are certified via more modern regulations and the cost of this has been estimated in previous impact assessments. The cost to operators will be for additional equipment, modifications associated with the installation of such equipment, structural modifications to vessels and the periodic costs of maintaining additional equipment. Through our consultation we will seek to refine these estimates. We have currently assumed a 1 year transitional period whereby vessels will need to be compliant. We are consulting over what period is viable to allow vessels the time to conduct the necessary modifications to comply, and will adjust the transitional period as necessary for the final IA. A summary of monetised costs and benefits is presented in section 10.1 for Option 1, and 11.1 for Option 2.

## Application and potential number of vessels affected

The total number of vessels that are affected by amending existing regulations is shown in the table below. This information has been obtained from MCA databases and certification records. According to MCA records, there is an estimated 721 vessels in the domestic passenger ship fleet. The proposed regulatory amendments may affect 606 vessels, 84% of the fleet.

|  |
| --- |
| *Table 1: The number of vessels affected by class of vessel* |
|  | Class of vessel | Category[[5]](#footnote-5) of water | Number of vessels |
| Vessels operating on categorised waters | Class V | Category A | 93 |
| Class V | Category B | 86 |
| Class V | Category C | 223 |
| Class IV | Category D | 49 |
| Seagoing vessels not under the scope of EC Directive 2009/45/EC | Class VI | N/A | 123 |
| Class VI(A) | N/A | 1 |
| EU Restricted Vessels | N/A | N/A | 31 |
| Total number of vessels |  |  | 606 |

The existing regulations place requirements on vessels based on several parameters such as class, category of water, subdivision standard and the number of passengers. As a result, the potential number of vessels affected is different for each of the proposed amendments. The estimate of the number of vessels affected and associated cost for each of the proposed amendments is presented separately in each section.

It is noted that most vessels operate under different modes, which allows them to operate on different areas of water. The above table represent the most onerous distribution of vessels (i.e. the mode of each vessels which would be most affected by the revised regulations).

## Summary of approach to estimating the impact of the regulations to existing ships

Costs differ substantially between vessels as they have been built or modified to bespoke specifications and operate under different operating models and geographic areas. Equally, costs differ between vessels depending on the existing equipment on board and corresponding additional requirements. Therefore, two vessels are rarely the same when considering the costs associated with proposed regulation. Indicative vessels which best represent the type of vessel are used to estimate prices for the cost of installation.

We have used data from the MCA Certificate Database and Marine Office records to understand the characteristics of individual vessels. The costs faced by each vessel has been estimated wherever possible, and where not, indicative costs have been generated for typical vessel types.

The revised regulations have been separated into the following requirements:

* Life-saving appliances - Liferafts
* Life-saving appliances - Lifejackets
* Life-saving appliances – Lifejacket Lights
* Fire protection – Fire Detection
* Fire protection – Fixed Fire Fighting
* Fire protection – Powered Pumps
* Bilge Pumping Arrangements
* Bilge Alarm Arrangements
* Post Damage Survivability

Where additional equipment is required under the revised regulations, quotes were obtained from suppliers of marine equipment. The information on costs associated with the installation of equipment and modification of vessels is from operators and shipyards. Individual suppliers are not named within this document due to commercial sensitivity.

High and low estimates of the costs are provided to reflect uncertainty caused by vessel owners having the choice of fitting a basic or more sophisticated system. Whilst there is no requirement for vessel owners to go for the more sophisticated system, we expect many may do so as it may have simpler operating requirements. Note for the calculation of benefits, the high scenario represents the outcome that is consistent with what the high cost outcome is for overall NPV and vice versa.

Where we have been unable to estimate the monetised cost of a regulatory requirement, the scale of the cost has been provided through consultation with industry or by MCA technical experts.

Operators may choose to relocate vessels to a less onerous category of operation to avoid costs associated with certain proposed regulations. For example, a category C ship could choose to relocate to category B waters and thus not be required to amend the liferaft provision or to cease operation altogether. Moving the vessel may incur costs associated with the move and potential loss in revenue. This Impact Assessment assumes operators will choose to implement changes to the vessel rather than change the area of operation. Whilst we do expect that some operators may move vessels as this may be more cost effective than complying with the proposed regulations, it is difficult to estimate the likelihood of this occurring and complex to model and therefore not proportionate to do so. We consider this to be a conservative assumption.

## Monetised and non-monetised costs and benefits of option 1, the preferred option

### Summary of Monetised Costs and Benefits of Option 1, the preferred option

Table 2 presents a summary of all costs and benefits that have been monetised. A full description of each cost and benefit is presented in section 10.2.

|  |
| --- |
| *Table 2: Summary of all monetised costs and benefits of the preferred option* |
| **Requirement** | **Low**  | **Central** | **High** | **Number of Vessels**  |
| **Life-saving appliances – Liferafts (Cost)** | £2,544,000 | £2,544,000 | £2,544,000 | 285 |
| **Life-saving appliances – Liferafts (Benefit)** | £7,283,000 | £4,856,000 | £2,428,000 | 285 |
| **Life-saving appliances - Lifejackets** | £202,000 | £253,000 | £337,000 | 86 |
| **Life-saving appliances – Lifejacket Lights** | £886,000 | £984,000 | £1,230,000 | 261 |
| **Fire protection – Fire Detection** | £1,106,000 | £1,608,000 | £2,110,000 | 606 |
| **Fire protection – Fixed Fire Fighting** | £90,000 | £437,000 | £810,000 | 211 |
| **Fire protection – Hand pumps** | £76,000 | £87,000 | £98,000 | 355 |
| **Bilge Pumping Arrangements** | £447,000 | £1,021,000 | £1,595,000 | 539 |
| **Bilge Alarm Arrangements** | £61,000 | £636,000 | £1,212,000 | 606 |
| **Post Damage Survivability** | £1,624,000 | £2,527,000 | £3,045,000 | 204 |
| **Familiarisation Cost** | £137,000 | £319,000 | £651,000 | See 10.2.11 |
| **NPV** | £111,000 | -£5,559,000 | -£11,204,000 |   |

The total EANDCB in the (preferred) central scenario is £1.1m (2016 prices, 2017 present value) combining all the costs detailed above. The total NPV is -£5.6m in the central case with £0.1m and -£11.2m in the low and high cases. See below for a detailed explanation of each impact.

### Calculations of the monetised and non-monetised impacts

#### Lifesaving appliances – Liferafts

Current requirements allow certain vessels to carry liferafts for fewer than 100% of the persons on board (as little as 60% of the persons on-board) and for the remaining capacity to be made up with buoyant apparatus. As a result, in the event of an evacuation up to 40% of persons on board may need to enter the water.

We are proposing to address this by ensuring that all seagoing vessels and vessels on Category C and D waters are required to fit liferafts to accommodate 100% of the persons on board. This allows for the evacuation of all persons on board into liferafts without the need to enter the water.

* + - 1. *Monetised costs*

Based on a review of MCA databases and certification records, we estimate 285 ships would require additional liferaft provision. The number of liferafts needed per vessel is dependent on:

1. Existing liferaft provision (estimated using the current applicable requirement for each vessel); and
2. Passenger carrying capacity (taken from administrative records).

Using this data, we have been able to estimate the maximum additional liferaft capacity needed.

The combination of liferafts purchased to meet the necessary carrying capacity will be dependent on the preferences of the vessel owner. However, we have assumed that each vessel owner would prefer the option that takes up the least amount of space, with cost taking a secondary priority. For example, whilst it may be cheaper to go for two liferafts carrying 50 passengers each, a 100-person liferaft would take up less space, therefore we assume in the analysis that a vessel owner would prefer the 100 person liferaft. Using prices quoted by retailers, the following cost assumptions have been used in the analysis:

|  |
| --- |
| *Table 3: Liferaft Costs* |
| **Liferaft Capacity (people)** | **Cost per Liferaft** |
| 25  | £2,000 |
| 50 | £3,210 |
| 100 | £6,945 |

Liferafts are initially serviced after 12 months and every 24 months thereafter. Therefore, over the appraisal period liferafts will be serviced five times. The average servicing cost using estimates provided to the MCA by marine suppliers is approximately £450.

In addition to the cost of buying a liferaft, buyers would need to get a hydrostatic release unit which has been estimated as £50 per liferaft. A hydrostatic release unit is a device which allows the automatic release of liferafts when needed.

This total cost of liferafts is summarised as follows:

|  |
| --- |
| *Table 4: The purchasing and maintenance costs of additional Liferaft* |
| **Liferaft Capacity** | **Number of Liferafts required** | **Purchasing cost**  | **Servicing costs**  | Total Cost  |
| 25  | 139 | £285,000 | £265,000 | £550,000 |
| 50  | 188 | £613,000 | £358,000 | £971,000 |
| 100 | 115 | £804,000 | £219,000 | £1,023,000 |
| Total | 442 | £1,702,000 | £841,000 | £2,544,000 |

* + - 1. *Non-monetised costs*

Some vessels may need to create additional stowage areas for liferafts. We expect this to affect only a minority of vessels and be low cost when vessels are affected as liferafts are intended to replace buoyant apparatus already on board the vessels. Additional stowage area may on some vessels reduce the passenger carrying capacity and have revenue implications for operators. We however expect the number of instances of this to be minimal. Where additional stowage space is required this is unique to each vessel and cannot be calculated without detailed engineering analysis.

Additionally, liferafts will be slightly heavier than buoyant apparatus and may require an additional stability check. The need for a stability check will depend on the specific arrangement of the vessel and its life-saving appliance and due to this complexity has not been monetised. We expect the scale of this cost to be low as stability checks are carried out routinely as a standard part of a vessel's operations.

* + - 1. *Monetised benefits*

The Formal Safety Assessment (FSA) conducted estimated a risk model which looked at the probability of various incidents involving passenger vessels, and the likelihood of an individual fatality, an injury, or a group fatality. [[6]](#footnote-6) These probabilities are based on databases of historic accidents. We have monetised benefits of prevented *individual* fatalities and injuries only, and do not consider that society has a greater aversion to multiple fatalities resulting from a single incident.

As would be expected, the risk of an incident varies depending on the location of the journey, with busier waterways at greater risk. The FSA estimates the individual risk of an injury, fatality, or accident, as well as the frequency that different types of accident occur. These are detailed in full in annex C, with only key information presented in this section. The FSA also provides for each accident type an event tree with probabilities. An example event tree for a collision accident is presented in annex D. We assume that any passenger who in the risk model would have drowned, would now be saved due to the provision of a liferaft.

Firstly, we calculate the average probability of a fatality occurring due to drowning per incident. We estimate this by constructing a weighted average of the probability of drowning in each accident category by the chance of that accident category occurring in the event of an incident. Table 5 presents the frequency of incidents by accident category and the probability of a fatality if that accident occurs. For example, collisions represent 10% of all incidents. Where an incident involving a collision does occur, there is a 1.76% chance there will be a fatality, of which there is an 0.07% chance that there will be a fatality due to drowning. The accident category ‘Personal’ which represent 11% of incidents has been omitted below.

|  |
| --- |
| *Table 5: Probability of a fatality occurring due to drowning per accident* |
| Accident category | **Frequency of incident (from FSA)** |  **Probability of fatality** |
| ***Total*** | ***of which due to drowning*** |
| Collision | 10% | 1.76% | 0.07% |
| Grounding | 13% | 0.01% | 0.01% |
| Contact | 49% | 0.67% | 0.06% |
| Flooding | 1% | 2.81% | 2.81% |
| Fire | 16% | 3.55% | 0.04% |
| Weighted average |  | 1.24% | 0.08% |

Given an incident has occurred, on average there is a 1.24% chance of a fatality, of which the chance of the fatality due to drowning is 0.08%. That means, given an incident has occurred, the provision of a liferaft has reduced the probability of a fatality by 0.08%.

To calculate the prevented fatalities per vessel per year as shown in table 6, we first calculate the risk of an incident occurring. Using data from the FSA on the risk of a fatality occurring for each operating environment, we divide this by probability that a fatality occurs given there is an incident. For example, in the case of Tidal/Estuaries, you divide 0.000015% by 1.24% to equal 0.00121%. This is shown using probabilities in Figure 1.

***Figure 1: Estimating the Probability of an Incident Occurring***

*(1) Presents the probability of a fatality occurring given that an incident has occurred:*

$$ (1) P\left(Incident\right)= \frac{P(Fatality and Incident)}{P(Incident)}$$

*Given that when a fatality occurs it is always classed as an incident, then we can simplify P(Fatality and Incident) = P(Fatality). We can rearrange (1) to estimate the probability of an incident occurring:*

$$ (2) P\left(Incident\right)= \frac{P(Fatality)}{P(Fatality|Incident)}$$

*Taking (2) and the example of vessels operating on Tidal/Estuaries, then we estimate the following:*

$$\left(3\right) 0.00121\%= \frac{0.000015\%}{1.24\%}$$

Having estimated the probability of a fatality occurring due to drowning given that an incident has occurred (0.08%) and the probability of an incident occurring (0.00121%), we now estimate the risk of drowning. We multiply the risk of an incident occurring by the risk of drowning per incident. In the previous example, this is 0.00121% multiplied by 0.08%, which equals 0.0000010%. This is shown using probabilities in Figure 2.

***Figure 2: Estimating the Risk of Drowning***

*First taking (2) from figure 1:*

$$(2) P\left(Incident\right)= \frac{P(Fatality)}{P(Fatality|Incident)}$$

*We can rearrange (2) to estimate the risk of a fatality occurring due to drowning:*

$$\left(4\right) P\left(Fatality\right)= P\left(Incident\right)×P(Fatality|Incident)$$

*Taking (4) and the previous example of vessels operating on Tidal/Estuaries, then we estimate the following:*

$$\left(5\right) 0.0000010\%=0.00121\%×0.08\%$$

Finally, to calculate the prevented fatalities per vessel per year you multiply the risk of drowning by the average number of passengers per vessel that will be covered by additional liferafts and the number of trips per year (0.0000010% x 99 x 1369 = 0.00131). So, if there were 1000 vessels operating on tidal water or estuaries, we would expect 1.31 fatalities to be prevented as a result of additional liferafts per year. Using MCA records, the average number of passengers per vessel is estimated by taking the average of the passenger capacity of all the vessels affected in each operating environment. Trips per year were estimates as part of the FSA.

|  |
| --- |
| *Table 6: The fatalities prevented per vessel per year from additional liferafts by operating environment* |
| Operating environment\* | **Risk of fatality per voyage (from FSA)**  | **Risk of an incident occurring per voyage** | **Average number of passengers covered by additional liferaft per vessel\*\*** | **Trips per year (from FSA)** | **Prevented fatalities per vessel per year from additional liferafts** |
| Tidal/ Estuaries (Class V(C) & IV) | 0.000015% | 0.00121% | 99 | 1369 | 0.00131 |
| Coastal Waters (Class VI & VI (A) & EU restricted) | 0.000013% | 0.00105% | 52 | 3690 | 0.00161 |

*\* The ‘Inland Waters’ and ‘Lochs & Lakes’ operating environments are omitted in the table as the proposed changes do not affect vessels operating in those waters*

*\*\* Figures assumed from MCA records on capacity*

To monetise this benefit, we use the WebTAG value of a prevented fatality[[7]](#footnote-7) is presented as follows:

|  |
| --- |
| *Table 7: WebTAG average value of prevention of a fatal accident*  |
| Casualty type | **Lost Output** | **Human Costs** | **Ambulance Costs** | Total |
| Fatal | £662,000 | £1,263,000 | £1,000 | £1,927,000 |

It should be noted that these are based on land values and therefore does not include search and rescue costs, which due to the sheer variance of costs could not be estimated. This will likely lead to the underestimation of the value of the benefit. The total benefit per year is shown in table 8 by class of vessel affected.

|  |
| --- |
| *Table 8: The monetised benefit of additional liferafts in 2019 by vessel class* |
| Class  | **Area of operation** | **Monetised benefit per vessel per year** | **Number of vessels** | **Monetised benefit in 2019** |
| Class V(C) | Tidal / Estuaries | £2,520 | 123 | £330,000 |
| Class IV | Tidal / Estuaries | £2,520 | 8 |
| Class VI | Coastal Waters | £3,110 | 122 | £479,000 |
| Class VI(A) | Coastal Waters | £3,110 | 1 |
| EU Restricted | Coastal Waters | £3,110 | 31 |
| Total |  |  | 285 | £809,000 |

Applying the value of a prevented fatality of £1,927,000 to the estimated number of prevented fatalities per vessel year, 0.00131 and 0.00161, gives a monetary benefit of £2,520 and £3,110 per vessel per year for the Tidal/Estuaries and Coastal Waters areas of operation, respectively. We then multiply this by the number of vessels in each area of operation that will require new liferafts, taken from MCA records. In total for 2019 the provision of liferafts provides a benefit of £809,000.

Over the ten-year appraisal period, assuming the value of a prevented fatality increases in line with forecasted growth in GDP per capita[[8]](#footnote-8), the monetised benefit is £7.283 million. This is the low cost (or high benefit) estimate as it assumes vessels always operate at full capacity. For the central cost estimate, to compensate for this and to assume vessels do not always operate at capacity we have retained 2/3 of this benefit and for the high cost estimate, we have retained 1/3 of this benefit. We believe this is a conservative assumption. When constructing the low, central and high scenario we have treated the benefit of reduced fatalities so the high scenario represents the highest overall net cost when considered amongst all other costs and vice versa.

|  |
| --- |
| *Table 9: The total value of liferaft provision in fatalities prevented* |
| Monetised benefit | **Low** | **Central** | **High** |
| Liferaft provision | £7,283,000 | £4,856,000 | £2,428,000 |

##### Non-monetised benefits

Each person not accommodated by a liferaft is provided with buoyant apparatus. Liferafts allow for dry shod evacuation (i.e. without entering water) rather than buoyant apparatus that requires a person to enter the water. Therefore, for vessels with less than 100% liferaft provision, some passengers/crew would need to enter the water during abandonment with the additional associated risks such as cold-water shock that entering the water brings. There is an additional risk to anyone with mobility difficulties.

#### Lifesaving appliances - Lifejackets

The regulations also require vessels operating in Category B waters to carry lifejackets. Currently they are not required to do so if the vessel was built before 2010.

##### Monetised costs

Using MCA records, we believe 86 vessels will be affected. Subsequently based on the number of passengers that can be carried on those vessels, 8,417 additional lifejackets will be needed, assuming no vessels have voluntarily gone beyond what is currently required. We obtained a range of cost estimates from industry and quotes from retailers for the cost of a lifejacket. These estimates were used to construct a low, central and high scenario of £24, £30 and £40. This will be a one-off cost incurred in the first year of implementation. The total cost of purchasing lifejackets was calculated as follows:

|  |
| --- |
| *Table 10: The total costs of additional lifejackets* |
|  | **Low** | **Central** | **High** |
| Number of Lifejackets required | 8417 | 8417 | 8417 |
| Cost per Lifejacket | £24 | £30 | £40 |
| Total Cost | £202,000 | £253,000 | £337,000 |

To estimate, for example, the total cost of additional lifejackets in the central scenario, you multiply the number of lifejackets required, 8417, by the cost per lifejacket, £30 (8417\*30 = £252,510)

##### Non-monetised costs

Some vessels may have to create additional storage areas such as additional lockers for lifejackets. This area may, on some vessels, reduce the passenger carrying capacity where vessels are unable to store lifejackets in spaces already available e.g. below seats. As this will depend on the specific arrangement and current passenger capacity of each vessels, we are not able to monetise it without disproportionate levels of primary data collection.

##### Non-monetised benefits

Without these changes in the event of an accident where persons had to enter the water a person may not be equipped with a lifejacket. Under new proposals all passengers will be provided with a lifejacket or buoyancy aid, therefore in the unlikely event of entering the water the risk of drowning and cold-water shock would be reduced significantly. This is particularly important during any evacuation, whether this is to liferafts, ship to ship or ship to shore. This benefit has not been monetised due to a lack of sufficient data.

#### Lifesaving appliances – Lifejacket lights

Current requirements for existing ships do not require the fitting of lifejacket lights. It is proposed to amend this by ensuring that seagoing vessels operating in the hours of darkness be required to fit lifejacket lights. It is noted that the Class VI limits do not permit operation in the hours of darkness, however some may operate during twilight (in the hour after sunset).

##### Monetised costs

There are 272 vessels, 223 Class V (C) and 49 Class IV vessels, that fall within scope of this requirement. We surveyed 69 vessels regarding their operating practices. Of the 69 vessels, 96% of Class V vessels (who operate in Category C waters) and 95% of Class IV vessels, operated at night. We then estimate based on these probabilities that 261 (out of a possible 272) vessels will be affected. Of this, 214 are Class V (C) and 46 are Class IV vessels.

Using data from MCA records, we estimate that 46,519 lifejacket lights are potentially required based on the passenger capacity of the 272 vessels. However, given the number of vessels that do not operate during darkness we estimate a total of 44,525 lifejacket lights are needed for the 261 that operate during darkness, assuming no vessels currently have lifejacket lights unless they are already required. We obtained a range of cost estimates for lifejacket lights from industry and from quotes from retailers, and used them in the high, low and central scenario of £11, £12 and £15 respectively.

We also assume that lifejacket lights will be replaced after 5 years, which is the typical lifespan of such lights. The total purchasing costs will be two one-off costs, incurred in the first and sixth years of the regulation. The total cost of purchasing lifejacket lights was calculated as follows:

|  |
| --- |
| *Table 11: Overview of the cost of additional lifejacket lights* |
| **Cost** | **Low** | **Central** | **High** |
| Average cost of a Lifejacket light | £11 | £12 | £15 |
| Number needed  | 44,525 | 44,525 | 44,525 |
| Total cost | £886,000 | £984,000 | £1,230,000 |

To calculate, for example, the total cost for lifejacket lights in the central scenario, you multiply the number of lights required, 44,525, by the cost per light, £12 (44,525\*12 = £534,300). This cost is also incurred in 2024 and discounted.

##### Non-monetised costs

The cost of installing lifejacket lights to lifejackets will vary depending on the model of jacket and light and the number of lights to be fitted. The associated costs are likely to be very small and have not been monetised.

##### Non-monetised benefits

Lifejacket lights allow for visibility during night time and during adverse weather. In an event of an incident where passengers and crew have entered the water, a lifejacket light makes it easier for them to be recovered and therefore reduces the likelihood of a fatality. The Royal National Lifeboat Institution (RNLI) suggests looking for a lifejacket light when purchasing a lifejacket saying, “A flashing light or strobe on our lifejacket makes you much easier to find at night or in poor visibility and can be easily attached.” [[9]](#footnote-9) Note that lifejacket lights are active and do not require a light to be shone on the person in water.

#### Fire protection – Fire detection

Current requirements do not require fire detection. Fire detection allows early awareness of fires and reduces the probability of serious fires developing. The proposed regulations will require fire detection system to be installed in all enclosed machinery spaces (which are where fires are more likely to occur) and any passenger sleeping spaces on all vessels of Class III-VI(A).

##### Monetised costs

The requirement to have fire detection leads to equipment purchasing and installation costs as well as servicing costs.

We assume that no vessels are currently compliant with the requirement, though this may be a conservative assumption. The number of vessels affected is therefore 606 as detailed in section 8. We plan to consult on the number of vessels affected to determine if an appreciable number of operators already have existing fitted detection systems. The total cost of fire detection equipment is shown in the table below.

|  |
| --- |
| *Table 12: Cost of purchasing, installation and servicing of fire detection equipment* |
| **Cost**  | **Low** | **Central** | **High** |
| Average Cost for Fire Detection Equipment per vessel | £684 | £1,512 | £2,340 |
| Average Cost of Annual Service of Equipment per vessel | £150 | £150 | £150 |
| Total Purchasing Cost  | £414,000 | £916,000 | £1,418,000 |
| Total Servicing Cost | £692,000 | £692,000 | £692,000 |
| Total Cost | £1,106,000 | £1,608,000 | £2,110,000 |

A one-off cost is incurred in the first year of the regulation for purchasing and installation of fire detection equipment. Based on the range of estimates provided to us by suppliers, we have assumed a purchasing and installation cost of £684, £1,512, and £2,340 in the low, central and high scenarios respectively. A fire detection system will need servicing annually, though the servicing costs will vary dependent on the type of system installed and the vessel type. Based on retail estimates, we estimate the average cost to be approximately £150 per vessel per year. The equipment is serviced annually, so a cost is estimated from 2020 onwards.

To calculate, for example, the total purchasing and installation cost of additional fire detection equipment in the central scenario, you multiply the number of vessels affected, 606, by the average cost of additional fire detection equipment, £1,512 (606\*1,512 = £916,272). The total servicing cost is then the cost of servicing per vessel, £150, multiplied by the number of vessels,606 (606\*150 = £90,900) in each year thereafter and discounted.

##### Non-monetised costs

No non-monetised costs have been identified for fire detection equipment.

##### Non-monetised benefits

Early fire detection is essential to prevent a fire spreading and allow rapid fire fighting and/or an orderly abandonment of the vessel. Accident statistics compiled in 2007 during the development of The Inland Waters Passenger Ship Code showed that approximately 14% of accidents to Class IV and V passenger vessels were due to fire or explosion. Fire detection and fixed firefighting systems have contributed to the effective resolution of fires on board vessels in several incidents.[[10]](#footnote-10),[[11]](#footnote-11),[[12]](#footnote-12) This has not been monetised due to incomplete data.

#### Fire protection – Fixed firefighting

On some small vessels, the current requirements do not mandate fixed firefighting within main machinery spaces. Fixed firefighting systems are a proven effective method of fighting fires within machinery spaces and are required widely throughout modern standards.

It is proposed to require a fixed firefighting system in all enclosed machinery spaces on all vessels of Class III-VI(A). On smaller vessels with boxed engines, where the installation of fixed firefighting is impracticable, equivalent arrangements will be considered, providing opening of the machinery space is not required to fight the fire.

##### Monetised costs

Based on the range of estimates provided to us by suppliers, we have assumed the following range of costs for purchasing and installing fixed firefighting systems:

|  |
| --- |
| *Table 13: The cost per vessel of purchasing and installing fixed firefighting systems* |
| Cost  | **Low** | **Central** | **High** |
| Fixed firefighting | £426 | £2,072 | £3,840 |

We also assume that no vessels, under 21.34m, are currently compliant with the requirement (as there is no current requirement for these vessels), though this may be a conservative assumption. Therefore, 211 vessels will be affected by the regulations, as outlined below:

|  |
| --- |
| *Table 14: The total cost by vessel type affected of purchasing and installing fixed firefighting systems* |
| **Vessel type** | **No of vessels** | **Low** | **Central** | **High** |
| Class V, VI & VI(A) less than 21.34m | 200 | £85,000 | £414,000 | £768,000 |
| Class IV less than 21.34m | 10 | £4,000 | £21,000 | £38,000 |
| Seagoing EU C&D Restricted less than 21.34m | 1 | £0 | £2,000 | £4,000 |
| Total | 211 | £90,000 | £437,000 | £810,000 |

This will be a one-off cost incurred in the first year of the regulation. To estimate the cost in the high scenario, for example, for Class IV vessels less than 21.34m you do the following: Multiply the cost of purchasing and installation of equipment, £3,840, by the number of ships affected, 10 (3,840\*10 = £38,400). This is then rounded to the closest £1000.

##### Non-monetised costs

Fixed firefighting systems will need to be inspected and serviced periodically. Inspection will be carried out by the ship’s crew and the servicing intervals and costs will vary dependent on the type of system installed and the vessel type. However, we expect the scale of the servicing costs to be lower than the purchasing costs.

##### Non-monetised benefits

Fixed firefighting in the engine room provides an opportunity to fight a fire without entering the space. This provides several safety benefits:

* Reduced risk associated with entering the space (smoke inhalation, burns, death etc.).
* Increased speed of response to a fire and subsequent reduced risk of fire spreading.
* ‘Total flooding’ of the space with the firefighting medium (water, gas etc.) which has the ability extinguish all the fire within the space in one ‘shot’.

Fixed firefighting is widely regarded as the most effective means of fighting engine room fires, as noted by the Marine Accident Investigation Branch (MAIB) reports[[13]](#footnote-13).

#### Fire protection – Powered pumps

Current requirements make use of hand pumps for fighting fires. It is proposed to require fire pumping capacity to be met with powered pumps. This amendment would cease the use of hand pumps to fulfil capacity and would mean that pumping could be achieved with a more efficient use of limited crew and without the possibility of asking passengers to ‘man the pumps’.

It is acknowledged that the engines and arrangements of many vessels may be unsuitable for fixed powered fire pumps. Equivalent arrangements for smaller vessels by the carriage of additional portable fire extinguishers are acceptable. Note, this is a separate system to the fixed firefighting system described in 10.2.5.

##### Monetised costs

The costs associated with installing a powered fire pump will vary depending on the specific construction of the vessel, particularly the type of engines and electrical supply already on-board. The most appropriate pumping system (and associated cost) would not be known until an engineering analysis of each vessel is carried out. Therefore, we have not been able to estimate the cost of powered pumps.

We have estimated the cost of carrying additional portable fire extinguishers as a proxy. Whilst fire extinguishers are cheaper than installing powered fire pumps, vessels may install the pumps or fire extinguishers. We do expect however, that some vessel owners will choose to install a pump regardless of the cost.

The number required will be dependent on the length of the ship. Those under 15m in size require one while those over 15m in size (up to 21.34m) require two. The costs that have been estimated are based on a sample of retail prices. The costs are:

|  |
| --- |
| *Table 15: Cost per vessel of additional fire extinguishers* |
| Cost | **Low** | **Central** | **High** |
| Cost per Fire extinguisher | £42 | £63 | £85 |
| Annual Servicing Cost per extinguisher | £15 | £15 | £15 |

This change affects only Class V and Class VI/VI(A) vessels. There is also an additional annual servicing cost based on retail estimates of £15 per extinguisher, this gives total costs of:

|  |
| --- |
| *Table 16: The total cost of purchasing and servicing of additional fire extinguishers* |
|   | **Low** | **Central** | **High** |
| Number of vessels affected\*: | 355 | 355 | 355 |
| of which less than 15m | 214 | 214 | 214 |
| of which 15 or more | 141 | 141 | 141 |
| Total number of extinguishers needed | 496 | 496 | 496 |
| Total Purchasing costs | £21,000 | £31,000 | £42,000 |
| Total Servicing costs | £56,000 | £56,000 | £56,000 |
| Total Cost | £76,000 | £87,000 | £98,000 |

 \* Class V and Class VI/VI(A) vessels only

To calculate, for example, the total purchasing cost in 2019 in the low scenario you estimate the following: Multiply the number of vessels of more than 15m,141, by the number of additional extinguishers they require, 2, plus one extinguisher for each vessel of less than 15m ((141\*2) +214 = 496). You then multiply this by the cost per extinguisher, £42 (496\*42 = £20,832). The servicing cost of £150 is applied annually from 2020 onwards, and discounted.

##### Non-monetised costs

The installation cost for portable fire extinguishers will vary depending on the specific arrangement of the vessel but is expected to be low.

##### Non-monetised benefits

Manual fire pumps require someone to ‘man the pump’, this can mean placing someone near a fire in enclosed/semi-enclosed spaces to operate the pump which could be dangerous, as pointed out by MAIB reports[[14]](#footnote-14). Hand fire pumps require a crew member to pump water in addition to the crew fighting the fire. Crew pumping water could be carrying out other valuable duties in the event of a fire, such as marshalling of passengers, navigation etc.

Powered fire pumps and fire extinguishers do not require crew to man the pump, therefore all effort can be focused on the initial firefighting. Fire extinguishers and fire pumps are more immediately available, this may allow for rapid fire fighting and prevent the fire spreading.

Note, where portable fire extinguishers are provided in lieu of a powered fire pumps, the hand fire pumps will still be available onboard for secondary firefighting duties, such as boundary cooling, this has proven an effective arrangement in previous incidents[[15]](#footnote-15).

#### Fire protection – Containment of fire

In certain areas, the requirements relating to the containment of fire for existing vessels do not align with those for new vessels, particularly with respect to protection of certain machinery spaces, galleys and life-saving appliances protection.

It is proposed to address this by requiring that the fire protection of these areas be revised in line with modern standards. This may, in some cases, mean increasing additional fire protection. This is normally achieved by adding suitable insulation and/or by replacing doors with ones more suitable for containing fires.

##### Non-monetised costs

The number of areas requiring fire protection is not known but is expected to be extremely low. In most cases, it is expected that the level of fire protection will already be adequate (due to the inherent structure of the vessel). Minor modifications may be required in some instances though MCA surveyors are not aware of any vessels requiring additional protection. This requirement has been added to the regulations to make explicit what is otherwise sensible safety practise.

Where additional modifications are required, it will most likely to be in the form of adding suitable insulation. The cost of this is not expected to be very significant.

##### Non-monetised benefits

Fire protection in hazardous areas prevents the spread of fire throughout the vessels and allows for effective firefighting. This is particularly important on vessels constructed of combustible materials (wood and glass fibre) as seen in previous incidents[[16]](#footnote-16)

#### Bilge Pumping Arrangements

Current requirement makes use of hand powered pumps for pumping bilges. It is proposed to require bilge pumping capacity to be met with powered pumps. This amendment would cease the use of hand pumps to fulfil capacity and would mean that pumping could be achieved with a more efficient use of limited crew and without the possibility of asking passengers to ‘man the pumps’ in the event of water ingress.

It is acknowledged that the engines and arrangements of many vessels may be unsuitable for fixed powered bilge pumps. Equivalent arrangements for smaller vessels by the carriage of portable pumps would be acceptable.

##### Monetised costs

The cost of purchasing and installing bilge pumps will be dependent on the specific vessel. However, we have been able to estimate a range of purchasing and installing costs, provided to us by suppliers:

|  |
| --- |
| *Table 17: Cost of purchasing and installation of Powered Pumps* |
| Cost per vessel | Low | Central | High |
| Purchasing & Installing | £830 | £1,895 | £2,960 |

Based on MCA administrative records, we are able to estimate the number of vessels that will require powered bilge pumps:

|  |
| --- |
| *Table 18: An overview of the number of vessels affected by additional bilge pump requirements* |
| Class | **Category** | **Number of passengers** | **No. of Vessels** |
| V | All | All | 402 |
| IV  | D | >50 | 6 |
| VI  | Seagoing < 10-mile voyage, < 1 mile from land | ≤100 | 111 |
| VI(A) | To Isolated Communities <6 Mile Voyage <3 Mile from Land | ≤50 | 1 |
| VI  | Seagoing < 10-mile voyage, < 1 mile from land | ≤100 | 19 |
| Total |  |  | 539 |

The total costs are therefore as follows:

|  |
| --- |
| *Table 19: Overview of the total cost of additional bilge pump requirements* |
| **Cost** | **Low** | **Central** | **High** |
| Total Purchasing & Installation Cost | £447,000 | £1,021,000 | £1,595,000 |

This is a one-off cost incurred in the first year of the regulation. To estimate, for example, the cost of additional bilge pump requirements in the central scenario, multiply the number of affected vessels, 539 by the cost per vessel of additional powered pumps, £1,895 (539\*1,895 = £1,021,405).

##### Non-monetised costs

Bilge pumping systems will need servicing and periodic inspection by the ship’s crew, though the servicing costs will vary dependent on the type of system installed and the vessel type. However, we expect the scale of the servicing costs to be lower than the purchasing costs.

The alarm and electric bilge pumping of the fishing vessel Random Harvest[[17]](#footnote-17) (of similar size and construction to some smaller passenger vessel) contained serious flooding caused by a hull fitting being lost. Powered bilge pumps were able to deal immediately with the flooding of passenger vessel ‘Surprise’[[18]](#footnote-18) following grounding and allowed the skipper to manage the situation. This ended in all passengers and successful being successfully rescued and the boat recovered.

##### Non-monetised benefits

As powered pumps are a more effective form of bilge pumping, it reduces the likelihood of passengers and crew being forced to abandon a vessel in the event of a flooding incident.

Hand pumps also require a person to ‘man the pump’ rather than perform critical duties on-board. Replacement of hand pumps with powered pumps or equivalent frees crew members for other important duties, such as marshalling crew, preparing Life Saving Appliances (LSAs) etc.

#### Bilge Alarm Arrangements

Currently there is no requirement to fit bilge alarms in compartments where bilge water can accumulate. Such alarms allow the detection of water ingress and hence can help to prevent catastrophic flooding or foundering. It is proposed to require bilge alarms on all vessels of Class III-VI(A).

##### Monetised costs

The cost of bilge alarms can vary significantly depending on whether a vessel owner chooses a relatively basic arrangement or a more sophisticated arrangement. As we believe some owners will choose the costlier system, we have used a wider range of costs for purchasing and installing bilge alarm systems. Using estimates provided to us by industry, we have assumed the following range of costs:

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| *Table 20: The cost per vessel of additional bilge alarm requirements* |
| Per vessel cost  | Low | Central | High |
| Purchasing & Installing | £100 | £1,050 | £2,000 |

We have assumed no existing compliance, and all 606 vessels will be affected. The consultation will ask for information on the number of vessels affected to see if an appreciable number of operators already have bilge alarms in affected compartments.

Therefore, the total cost will be as follows:

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| *Table 21: Overview of the total cost of additional bilge alarm requirements* |
| **Cost** | **Low** | **Central** | **High** |
| Total Purchasing & Installation Cost | £60,600 | £636,300 | £1,212,000 |

This is a one-off cost incurred in the first year of the regulation. To estimate, for example, the cost of additional bilge alarms in the central scenario, multiply the number of affected vessels, 606 by the cost per vessel of additional bilge alarms, £1,050 (606\*1,050 = £636,300)

##### Non-monetised costs

The cost of testing and servicing pumps and alarms. These associated costs are likely to be small relative to the purchasing and installing costs and have not been monetised.

##### Non-monetised benefits

Bilge alarms detect water in the vessel and allow for early intervention by the crew and can prevent a catastrophic event such as flooding or foundering (sinking/capsizing). This is demonstrated in the Millennium City,[[19]](#footnote-19) Vixen,[[20]](#footnote-20) MAIB investigations amongst others.[[21]](#footnote-21),[[22]](#footnote-22)

The alarm and electric bilge pumping of the fishing vessel Random Harvest[[23]](#footnote-23) (of similar size and construction to some smaller passenger vessel) contained serious flooding due to a hull fitting being lost.

The MAIB has made similar recommendations[[24]](#footnote-24) for vessels of similar size and construction as domestic passenger vessels for the installation of bilge alarms.

#### Damage Survivability

Many existing vessels need only comply with an intact stability standard and consequentially have no provision for damage stability. This means that these vessels are not required to survive relatively minor damage, such as a collision and subsequent hull failure.

It is proposed to require all vessels operating at sea, on Category D and Category C (tidal) waters to achieve a level of damage survivability. This can be achieved by providing inherent buoyancy or by subdividing the vessel. It is proposed to include an allowance such that vessels operating on non-tidal Category C waters may be excluded from the requirement subject to the undertaking of a detailed risk assessment and MCA approval.

##### Monetised costs

The number of vessels that may be affected is assumed to be all vessels that are not known to currently meet the new damage survivability standards excluding those category C vessels operating on non-tidal waters – these are assumed to have undertaken satisfactory risk assessments to apply the allowance from the requirements. The majority of those, 178, are currently assessed against the heeling test survivability standard that is not sufficient to meet new requirements. The other 26 vessels survivability standard is either unknown or not sufficient to meet the new requirements.

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| *Table 22: Overview of the number of vessels that do not meet new damage survivability standards* |
| **Vessel Type** | Number of Vessels Affected |
| Class V (C) - 'Tidal' | 83 |
| Class VI & VI(A) | 121 |
| Total | 204 |

The solution to achieve inherent buoyancy or subdivision would be bespoke to each vessel. The cost associated with each vessel cannot be accurately estimated without a detailed engineering analysis having been carried out for each vessel. It is considered that many vessels will be impacted in one of two ways.

1. Firstly, some vessels will have originally been built with subdivision and subsequently would require relatively little work to verify that subdivision of the vessel is in accordance with the proposed standard. This would likely consist of a detailed survey of the vessel and stability calculations using computer software.
2. Some vessels will have not have been built with any subdivision and will require substantial work to meet a satisfactory level of damage survivability. This work could effectively mean rebuilding the vessel and may not be practicable in all cases. Open vessels (those without decks) are likely to be those which cannot easily meet the proposed standard. The number of vessels in this position is not known and would rely on an engineering analysis of each vessel.

To estimate an indicative cost of the above, experts within the MCA have estimated indicative costs for 16 vessels. When selecting the sample of vessels, we have taken a range of vessels by vessel class, age and the number of passengers the vessel can hold. We take these indicative costs to estimate a low, central and high scenario for all the vessels that may require change to meet the new damage survivability standard.

We have divided the costs to vessels into 3 separate categories. The first is consultancy costs for conducting a detailed survey of the vessel. As this is required to understand what work would need to be carried out on the vessel to bring it in compliance with the proposed regulations we have not included an additional familiarisation cost in section 10.2.11 for this purpose. The second is the actual work that will need to be conducted on each vessel. This is subject to the most variation in cost between vessels. This includes additional steelwork, modifications to decks, additional buoyancy/ballast material, labour costs, equipment installation and testing. The third is costs for plan approvals, stability assessments, on-site surveys, inclining, administration and structural assessments, which are services provided by the MCA for which operators pay a fee.

The central estimate is based on the median estimate of each category (Consultancy Costs, Yard Costs and MCA Costs), with the low and high scenarios representing the 25th and 75th percentile respectively. There is a high variation in the number of vessels that will need very little work and some a substantial amount. The median (rather than the mean) is used to avoid skewness in the data by outliers in our estimates of 16 vessels. The low, central and high scenarios are calculated based on the costs for consultancy, yard upgrades and MCA costs individually rather than the total cost for each example vessel.

We acknowledge that although the average yard cost in the central scenario is £4,500, in reality the cost will disproportionately impact particular vessels. Within our estimates of the vessels affected, the cost of yard work ranges from negligible cost to £32,000. Through our consultation with industry we will gain a better understanding of these costs and what actions we can take to mitigate the burden on vessel owners.

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| *Table 23: An overview of indicative costs of damage survivability requirements* |
| **Cost** | **Low** | **Central** | **High** |
| Average Consultancy Cost per Vessel | £4,500 | £5,000 | £5,500 |
| Average Yard Cost per Vessel | £900 | £4,500 | £5,700 |
| Average MCA Cost per Vessel | £2,600 | £2,900 | £3,800 |
| Total Consultancy Cost | £915,000 | £1,017,000 | £1,112,000 |
| Total Yard Cost | £179,000 | £918,000 | £1,158,000 |
| Total MCA Cost | £530,000 | £592,000 | £775,000 |
| Total Cost | £1,624,000 | £2,527,000 | £3,045,000 |

##### Non-monetised costs

It is likely as a result of vessels not having been built with subdivision, as discussed above, it may not be viable – either practically or commercially – to apply the requirements. We have not monetised the cost of vessels in this situation. We have not been able to monetise this due to having a lack of reliable data of vessel replacement costs, the type and number of vessels that would need replacing and likelihood that the cost of replacement may be too high for individual operators to purchase a replacement.

There also may be a loss in revenue during upgrade. We have not been able to monetise the lost revenue each revenue will sustain while it is being upgraded rather than in passenger use. This is not feasible to estimate without knowing the revenue of the affected ships.

We have not monetised the cost of undertaking risk assessments for non-tidal Category C vessels to support application of the allowance from the proposed requirements. Each individual operator may choose to conduct their risk assessment in a different way and it is considered likely that operators with multiple vessels will be able to apply much of the assessment to all of their vessels – reducing the cost per vessel. It is even considered possible that a group of operators from the same region may join together to produce risk assessments collaboratively. With so many variables it has not been considered proportionate to monetise this cost. In any case the cost of risk assessment is likely to be lower than application of the damage stability requirement.

##### Non-monetised benefits

According to MAIB data[[25]](#footnote-25), there were 144 collisions involving passenger vessels from 1992 to 2016. This is for UK passenger vessels, excluding international vessels with a length greater than 15m and not more than 100m. Although it is not possible to directly link the MAIB data to vessels within scope of the proposed changes, given the composition of the fleet it is likely that the majority of these vessels are covered.

Increasing the post damage survivability would significantly raise safety levels in the event of a collision or other hull breach. Subdivision allows the vessel to remain afloat, in a relatively stable condition after the hull is holed or hull fitting fails. The aim being to allow for the vessel to survive a level of damage or ultimately provide time for an orderly evacuation of the vessel.

Subdivision can allow for the flooding to be contained long enough for the bilge pumps to maintain the water level and allow the ship to reach a safe landing. Without subdivision a vessel is vulnerable to uncontrollable flooding – which could result from a small hull breach and then rapid capsize. Conversely in a subdivided ship the flooding will be limited – as can be seen from the results of various incidents[[26]](#footnote-26).

A vessel’s value may also increase as a result of the upgrades to bring it to the proposed damage survivability standards.

#### Familiarisation costs

Vessels will be subject to a familiarisation cost the first year the regulations come into force. This is split into 2 elements. The first is a general familiarisation time for understanding the regulations and if your vessel is currently compliant. Due to the nature of the changes, relating to various existing regulations, there are sizeable number of pages of legislation to read to understand the changes. However, the MCA plan to release summary guidance to inform vessels of the requirements, and we anticipate this to take the average vessel on average 2, 3.5 and 7 hours to understand the changes in the low, medium and high scenarios respectively. The second element of familiarisation is specific to each one of the changes and represents the time taken per vessel to understand what is required for their vessel to meet the new requirements and any time to purchase or procure contracts to purchase equipment or carry out work. As each change affects a different number of vessels we have treated these separately. These are summarised below. All familiarisation times are assumed to be the time it takes the average vessel affected to familiarise.

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| *Table 24: The time per vessel to familiarise with different elements of the changes* |
| **Type** | **Time to familiarise (Hours)** | **No. of Vessels Affected** |
| **Low** | **Central** | **High** |
| General Familiarisation | 2 | 3.5 | 7 | 606 |
| Life-saving appliances – Liferafts | 2 | 3 | 5 | 285 |
| Life-saving appliances - Lifejackets | 2 | 5 | 7 | 86 |
| Life-saving appliances – Lifejacket Lights | 0.75 | 1 | 2 | 261 |
| Fire protection – Fire Detection | 3 | 5 | 8 | 606 |
| Fire protection – Fixed Fire Fighting | 4 | 7 | 14 | 211 |
| Fire protection – Hand pumps | 3 | 6 | 9 | 355 |
| Bilge Pumping Arrangements | 3 | 6 | 9 | 539 |
| Bilge Alarm Arrangements | 2 | 4 | 6 | 606 |
| Damage Survivability | See 10.2.10 | See 10.2.10 | See 10.2.10 | 204 |

The rationale behind the individual familiarisation times is explained below:

* **Liferafts** - Most operators lease their liferafts so the procurement process is not expected to be lengthy as suppliers will take on the majority of the burden of finding suitable liferafts. These times are estimated based on experience and from previous IAs for procurement of Life Saving Appliances (LSA) for each vessel. It is considered that the majority of vessels will fall into the low and central bands with the high cost of procurement being for those vessels where liferafts are not leased.
* **Lifejackets** – The time for procuring lifejackets is likely to be higher than for liferafts as some operators will need to make decisions on the type of jacket or buoyancy aid carried which will likely depend on stowage arrangements. For vessels where the arrangement does not facilitate stowage of the jackets the operator may decide to purchase more compact or even inflatable jackets although these will be higher cost options and for inflatable jackets will have servicing implications.
* **Lifejacket lights** – It is considered that time taken for procurement will be low due to the low level of complexity of lifejacket lights.
* **Fire detection** – Much as with Fixed fire-fighting, there are many systems available on the market where fire detection is concerned. Currently there a sudden diversification in the types of system available, each with their own specific merits. It may well take operators some time to ascertain which type is most suitable for their needs and budget.
* **Fixed Firefighting** – The time for procuring fixed firefighting is likely to be longer than for other safety equipment due to the complexity and variety of the systems available on the market. Operators will need to decide upon which type of system is most suitable for the intended purpose, possibly depending on whether the space is a manned machinery space. Given the nature and size of the spaces on these vessels it is possible the MCA will allow the use of some of the non-harmful aerosols which are MCA as opposed to Marine Equipment Directive (MED) approved systems.
* **Hand pumps** - Fire pumps are relatively common, in all sizes, and given that they need not necessarily be mechanically driven. We do not anticipate the selection of pumps being overly burdensome in terms of time. The pumps for both fire and bilge are likely to be procured at the same time, noting that their capacity and basic function is the same.
* **Bilge pumps -** Vessel operators will need to consider the arrangement of the vessel and the bilge pumping system as well as electrical capacity. It should be noted that many operators have multiple vessels with similar arrangements so will be able to use the same procurement rationale across their fleet

We plan to consult on these familiarisation times to increase the robustness of the estimates. The overall cost associated with the times above is presented below.

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| Table 25: The total familiarisation cost of the new regulations |
| **Type** | **Time to familiarise (Hours)** |
| **Low** | **Central** | **High** |
| Total Hourly Wage (ASHE Survey 2017, Water Transport) | £15.72 | £19.96 | £24.79 |
| General Familiarisation | £19,000 | £42,000 | £105,000 |
| Life-saving appliances – Liferafts | £9,000 | £17,000 | £35,000 |
| Life-saving appliances - Lifejackets | £3,000 | £9,000 | £15,000 |
| Life-saving appliances – Lifejacket Lights | £3,000 | £5,000 | £13,000 |
| Fire protection – Fire Detection | £29,000 | £60,000 | £120,000 |
| Fire protection – Fixed Fire Fighting | £13,000 | £29,000 | £73,000 |
| Fire protection – Hand pumps | £17,000 | £43,000 | £79,000 |
| Bilge Pumping Arrangements | £25,000 | £65,000 | £120,000 |
| Bilge Alarm Arrangements | £19,000 | £48,000 | £90,000 |
| Damage Survivability | See 10.2.10 | See 10.2.10 | See 10.2.10 |
| Total (exc Damage Survivability) | £137,000 | £319,000 | £651,000 |

To estimate, for example, the familiarisation cost of bilge pumping arrangements in the low scenario, the calculations is as follows: 3 hours to familiarise multiplied by the 539 vessels affected multiplied by the hourly wage, £15.72 (3\*539\*15.72 = £25,424.65). Gross Earnings data has been sourced from 2017 Annual Survey of Hours and Earnings (ASHE) data for Water Transport. The size and type of businesses affected due to the nature of market is subject to a large degree of variation. The 30th percentile (£15.72) is used as a low scenario, the median (£19.96) in the central, and the 70th percentile (£24.79) as the high scenario. This wide range reflects this uncertainty. The 30th and 70th percentile were used as ranges due to ranges above the 70th percentile for water transport considered unreliable by the ONS. An uplift of 20.9% has been applied to represent non-wage labour cost to business such as national insurance and employer pension contributions. Wages are grown in real terms over time by projected GDP per capita growth.[[27]](#footnote-27)

## Monetised and non-monetised costs and benefits of option 2

### Summary of Monetised Costs and Benefits of Option 2

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| *Table 26: Summary of all monetised costs and benefits of Option 2* |
| **Requirement** | **Low**  | **Central** | **High** | **Number of Vessels**  |
| **Life-saving appliances – Liferafts (Cost)** | £2,544,000 | £2,544,000 | £2,544,000 | 285 |
| **Life-saving appliances – Liferafts (Benefit)** | £7,283,000 | £4,856,000 | £2,428,000 | 285 |
| **Life-saving appliances - Lifejackets** | £202,000 | £253,000 | £337,000 | 86 |
| **Life-saving appliances – Lifejacket Lights** | £886,000 | £984,000 | £1,230,000 | 261 |
| **Fire protection – Fire Detection** | £1,106,000 | £1,608,000 | £2,110,000 | 606 |
| **Fire protection – Fixed Fire Fighting** | £90,000 | £437,000 | £810,000 | 211 |
| **Fire protection – Hand pumps** | £76,000 | £87,000 | £98,000 | 355 |
| **Bilge Pumping Arrangements** | £447,000 | £1,021,000 | £1,595,000 | 539 |
| **Bilge Alarm Arrangements** | £61,000 | £636,000 | £1,212,000 | 606 |
| **Post Damage Survivability** | £2,333,000 | £3,629,000 | £4,373,000 | 293 |
| **Familiarisation Cost** | £137,000 | £319,000 | £651,000 | See 10.2.11 |
| **NPV** | -£598,000 | -£6,662,000 | -£12,532,000 |   |

The total EANDCB in the (preferred) central scenario is £1.2m (2016 prices, 2017 present value) combining all the costs detailed above. The total NPV is -£6.7m in the central case with -£0.6m and -£12.5m in the low and high cases. See below for a detailed explanation of each impact.

All costs detailed under option 1 apply to option 2. To avoid repetition we only present the additional impacts to option 2 in section 11.2 and have referred to the calculation of the impacts under option 1 where relevant. Note option 2 is still compared to the same ‘do-nothing’ baseline.

### Calculations of the monetised and non-monetised impacts

#### Monetised Costs

Please refer to the monetised costs in section 10.2[[28]](#footnote-28) for more details on monetised costs of Option 2. The additional monetisable costs that are only incurred under Option 2 are presented below.

##### Damage Survivability

In addition to the costs to post-damage survivability requirements under option 1 (see section 10.2.10), Option 2 will require more vessels, Category C (Non-Tidal) vessels and Category B vessels, to be fully compliant with current post-damage survivability standards for new vessels. We have estimated this adds a further additional 89 vessels that are affected by the regulations, bringing the total affected to 293. See table 27 for a full breakdown of vessel affected.

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| *Table 27: Overview of the number of vessels that do not meet new damage survivability standards* |
| **Vessel Type** | Number of Vessels Affected |
| Class V (C) - 'Tidal' | 83 (included under Option 1 & 2) |
| Class VI & VI(A) | 121 (included under Option 1 & 2) |
| Class V (C) – ‘non-tidal’ | 38 (Option 2 only) |
| Class V (B) | 51 (Option 2 only) |
| Total | 293 |

Table 28 first presents the additional costs related to the further 89 vessels that are exclusively impacted by option 2, then a total cost which represents the total cost under option 2 compared with the baseline. For example to calculate the additional cost of yard work under option 2 in the central scenario, we take the Yard cost for the average vessel, £4,500, and multiply this by the number of additional vessels, 89, to estimate a total additional cost of £401,000 (rounded). To compare the total cost of option 2 against the baseline, presented in the last row below, we add the costs presented here to the existing costs for the 204 vessels affected that are affected under both Option 1 and Option 2, detailed in section 10.2.10.1.

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| *Table 28: An overview of indicative costs of damage survivability requirements* |
| **Cost** | **Low** | **Central** | **High** |
| Average Consultancy Cost per Vessel | £4,500 | £5,000 | £5,500 |
| Average Yard Cost per Vessel | £900 | £4,500 | £5,700 |
| Average MCA Cost per Vessel | £2,600 | £2,900 | £3,800 |
| Total **additional** Consultancy Cost | £399,000 | £444,000 | £485,000 |
| Total **additional** Yard Cost | £78,000 | £401,000 | £505,000 |
| Total **additional** MCA Cost | £231,000 | £258,000 | £338,000 |
| Total additional Cost above option 1 | £709,000 | £1,102,000 | £1,328,000 |
| Total Cost | £2,333,000 | £3,629,000 | £4,373,000 |

#### Non-monetised Costs

Please refer to the non-monetised costs in section 10.2[[29]](#footnote-29) for more details on the non-monetised costs of Option 2. The additional non-monetisable costs that are only incurred under Option 2 are presented below.

##### Assessment against Classification Society Rules

As well as encompassing all of the modifications proposed for Option 1 there is a fundamental difference with the newer regulations that ships would be required to comply with under Option 2. Newer regulations must have their hull and machinery built to Classification Society rules. A classification society is a [non-governmental organization](https://en.wikipedia.org/wiki/Non-governmental_organization) that establishes and maintains technical standards for the construction and operation of [ships](https://en.wikipedia.org/wiki/Shipping) and [offshore structures](https://en.wikipedia.org/wiki/Offshore_platform). For certain larger vessels this means that they must be surveyed and certified by a Classification Society, for other vessels the assessment can be done by MCA utilising the rules of a Classification Society. The Classification Society requirements cover such fundamental elements of ship design as hull thickness and dimensions of key structural aspects as well as requirements for machinery. When a vessel is being built this does add an additional cost relative to not using Classification Society rules but as it is done from the beginning it is factored into the cost of build.

To respectively reassess an existing vessel against Classification Society rules is significantly more difficult as it is often hard to determine what it was originally built to. All vessels would need to prepare a pre-classification information pack including detailed plans of the vessel structure and systems. It has previously been estimated that the cost of production of this package is in the order of £30-40k per vessel and that is before the survey and assessment costs of the Classification society. As the vessels in the scope of this review are all certified by the MCA it means that at some point – either at build or on conversion to a passenger ship their hull structure and machinery has been assessed and accepted by the MCA, this means that the re-assessment against Classification Society rules that would be required by Option 2 is a duplication of cost and effort for operators.

As outlined above retrospective assessment against Classification Society rules would impose a large burden and duplication of cost and effort. For vessels required to be assessed by the Classification Society themselves (as opposed to the MCA) there is also the issue that Classification Societies can be reluctant to take on such vessels as they may not have appropriate rules for assessment and the vessels will not have been built to modern rules. Classification Societies generally view the approval of such vessels as a liability due to not having been involved at build and will often decline involvement.

##### Compliance

Category B vessels will likely have a difficulty complying with the additional post-damage survivability requirements that they will have to adhere to under Option 2 as they are generally quite dimensionally constrained due to width of waterway and bridges etc. We have not been able to monetise this due to having a lack of reliable data of vessel replacement costs, the type and number of vessels that would need replacing and likelihood that the cost of replacement may be too high for individual operators to purchase a replacement. This is however likely to be a significant cost above Option 1 with a relatively small safety benefit.

There are many other areas where requirements of newer Regulations differ from those in existing regulations which may result in the older vessels incurring additional cost for compliance. Such differences occur in areas including guard rail heights and the number of stairways to access upper decks. Some of these requirements would be challenging to retrospectively apply – for example fitting an extra stairway. A full gap analysis and assessment of uplift in cost has not been carried out for Option 2 as to do so is not considered proportionate given the costs will apply to each vessel individually. This would be a complex and costly process to undertake to obtain the necessary data.

#### Monetised Benefits

Please refer to section 10.2.1.3 for the monetised benefits of option 2. We have not monetised any additional benefits.

#### Non-monetised Benefits

Please refer to the non-monetised benefits in section 10.2[[30]](#footnote-30) for more details on the non-monetised benefits of Option 2. The additional non-monetisable benefits that are only incurred under Option 2 are presented below.

Option 2 would confer some safety benefit over Option 1 most notably in extending the post-damage survivability requirements to Class V(B) vessels and Class V(C) non-tidal. It is considered however that such benefit will be small as vessels in these areas are at lower risk from incurring damage in the first place, principally due to lower risk of collision due to lack of larger vessels.

Whilst there are other areas of the newer Regulations where there will be a safety benefit it is considered that the changes proposed under Option 1 encompass the key safety areas where the changes are most needed and that the safety benefits of making the additional changes that Option 2 requires will not outweigh the additional costs.

From the point of view of certification and enforcement a theoretical benefit of Option 2 is that there would no longer be separate Regulations in force and it would be much simpler to understand what each vessel must do. In reality if Option 2 were pursued it is considered likely that many vessels would be carrying exemptions and in effect have a bespoke compliance regime. Option 2 would remove the incentive to maintain old ships but potentially at the expense of putting much of the existing fleet out of viable economic operation.

## Proportionality

The impact is not expected to fall disproportionately on a specific group. However, it is recognised that there will be substantial impact across the domestic passenger shipping industry. The effect of the proposed policy has been quantified and monetised wherever possible. Where it has not been possible to monetise the costs and benefits of the proposed regulation, the Impact Assessment has included a qualitative description of the impact.

Costs have not been monetised where there is a very low impact or insufficient information available. Information may not be available due to substantial differences between vessels as they have been built or modified to individual specifications and operate under different operating models and geographic areas. To fully monetise all aspects of the impact, substantial engineering evaluation of each vessel would need to be carried out. To do this, substantial data would need to be gathered, in some instances the required information would need to be produced at the expense of the operators. It is judged that this level of analysis is not proportionate or justified. Similarly, fully monetised costs are not possible due to the lack of vessel specific information.

Data is available, through records and certificates compiled and kept by the MCA. This data has been used throughout this assessment. FSA and cost benefit analysis has previously been carried out and incorporated into this impact assessment.

Formal research into technical aspects has been carried out in the past but has yielded little worthwhile results. Therefore, no new research has been commissioned as it is not felt that this would be cost-effective.

### Certainty of impacts

For many the proposals, the impacts are relatively certain. For some aspects, where specific information is not available, or engineering analysis is required first, the impact is less certain.

It is not possible to give an exact figure for the number of vessels affected by some aspects of the proposed regulations. Where this is the case, sensible technical assumptions have been about the vessels to produce estimate which is as accurate as possible.

### Policy and evidence development

At the early stages of policy development industry working groups were established with operators who may be affected. The working groups were made up of different size of operators which reflect the industry and industry associations. Three working groups were held between 15th April 2016 and 21st July 2016 with 48 operators and industry representatives. These groups identified areas in which regulations could be amended and the impact this may have.

Following the working groups an information gathering questionnaire was sent out to industry on 1st December 2016. 24 responses were gathered which represents 94 vessels. This questionnaire informed the impact of the regulations and allowed the policy to be refined where necessary.

Further analysis was carried out by way of industry visits to gather high quality information and refine policy options. This consisted of 5 visits to operators.

This work was specific to the review and in addition to regular stakeholder engagement as part of the MCAs ongoing commitment to the industry which primarily consists of the Domestic Passenger Ship Steering Group with 42 members and RoRo steering group with 12 members.

Monetised costs were gathered from the wider industry through the information gathering exercise. This was refined using freely available information on the cost of equipment. Targeted consultation and information gathering was carried out with equipment suppliers’ shipyards and operators to give fully monetised cost for indicative vessels.

## Risks

### Risks on implementing the proposed changes

This is a tailored option and would close the most significant safety gaps between regulations for new and existing ships without requiring a wholesale reassessment of the vessel.

These measures are intended to align the safety standard applied to new and existing vessels in key areas and provide a significant improvement in safety. The measures may not prevent catastrophic accidents from occurring, such as capsizing of vessels following a collision.

### Risks of doing nothing

The consequences of doing nothing is that standards cannot be raised. Any improvements would need to be voluntarily adopted which would lead to an uneven ‘playing field’ for operators and would mean that safety improvements on the worst vessels could not be enforced. The identified risks would thus be perpetuated.

Doing nothing would not address the safety gaps between older vessels and those built to new standards. Whilst major improvements have been achieved since the Marchioness tragedy the reality is that safety gaps in some areas mean that the consequences of such an incident have not appreciably changed. Without regulatory amendment, market failures will continue.

## Wider impacts

### Equality Impact Assessment

Persons of reduced mobility will benefit from the carriage of liferafts and lifejackets in the event of an emergency. The MCA considers that there are no other effects, positive or negative, on outcomes for persons in relation to their age, disability, gender assignment, pregnancy and maternity, race, religion or belief, sex and sexual orientation.

### Small and Micro Business Assessment

A large proportion of the domestic passenger ship industry are small firms and the new regulations apply across the board, so no one area of this industry is penalised over others.

The proposed requirements reflect the risks faced by vessels operating on different categories of water. The benefit and costs associated with the requirements vary depending on the area of operation for a specific vessel. It is expected that all businesses, regardless of size, will be affected the same way. Data from the Office for National Statistics (ONS) provides a breakdown of the number of UK businesses for sea, coastal and inland passenger water transport by employment size band.

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| --- |
| *Table 29 : The number of UK businesses by employment size band and SIC Class (2017)* |
| **SIC Class** | **Employment Size Band** |
|   | **0-4** | **5-9** | **10-19** | **20-49** | **50-99** | **100-249** | **250+** | **Total** |
| 5010 : Sea and coastal passenger water transport | 450 | 60 | 45 | 30 | 10 | 10 | 5 | 610 |
| 5030 : Inland passenger water transport | 145 | 30 | 15 | 15 | 5 | 0 | 0 | 210 |
| Total | 595 | 90 | 60 | 45 | 15 | 10 | 5 | 820 |

 *Source: ONS, UK business; activity, size and location: 2017[[31]](#footnote-31)*

The requirements to which this Impact Assessment refers has been developed in consultation with the Domestic Passenger Ship Steering Group (DPSSG). The formal consultation exercise will be directed at all ship owners and will seek to identify further information from this sector on potential costs to small businesses. Responses to the consultation will be considered in the final version of this Impact Assessment.

### Competition Assessment

The proposed requirements should have a small positive impact on competition, as it prevents owners of older vessels from undercutting newer vessels by complying with a less burdensome safety regime. However, this will need to be balanced against the fact that these requirements could lead to a reduction in the number of suppliers, where vessel owners are unable to make their vessels comply with the new requirements and are unable to procure a new vessel.

### Justice Impact Test

A separate JIT is to be developed ahead of the amendments of the relevant Statutory Instruments.

### Family Test

This measure is not expected to impact families.

### Health Impact Assessment

This measure is not expected to impact health.

### Rural Proofing Toolkit

This measure is not expected to impact those in a rural setting unfairly.

### Sustainable Development

This measure is not expected to impact sustainable development

### Others

We believe there are no other significant wider impacts pertinent to this regulation.

## Summary and preferred option with description of implementation plan

Option 1, the preferred option, implements technical safety standards in key safety areas which gives a comparable safety standard for new and existing vessels. Allowances have been made, where possible, for alternative arrangements which ensure the safety concern is addressed, without being prohibitively expensive. Although the NPV of the preferred option under the central scenario is negative, we believe the net impact of the non-monetised costs and benefits, especially around safety, would if quantified lead to a positive NPV.

We believe the additional benefits under Option 2, requiring vessels to be fully compliant with current regulations, do not provide value for money due to the excessive additional burden these elements will place onto businesses. Although we have not been able to fully quantify the extent of the additional cost through Option 2, the non-monetised costs are likely to be significant. A tailored approach considered under Option 1 meets our stated policy objectives at a minimum possible burden on industry. Through our consultation, we will seek to refine this approach.

It is planned to amend the relevant Statutory Instruments and Marine Shipping Notices to implement the proposed regulations. Vessels are surveyed and certificated annually and as a result we do not envisage additional monitoring will be required above current practices.

The regulations will be made as soon as possible and will be reviewed five years to assess the impact, the value of the guidance and whether anything can be done to improve the regime. A detailed Post Implementation Review (PIR) plan will be included in the final stage Impact Assessment. In the meantime, the MCA will continue to work with the industry to ensure practical implementation.

| **Vessel Particulars** | **Annex A: Applicable Technical Standards for Passenger Ships on Domestic Voyages** |
| --- | --- |
| **Area of operation** | **Age of vessel** | **Hull construction material** | **Vessel Length6** | **UK Class III to VI(A) Regulations4** | **Directive 2009/45/EC, as amended**  | **Existing Phased in Directive 2009/45/EC, as amended by Directive 2010/36/EU** | **Safety Code for Passenger Ships Operating Solely in UK Categorised waters (MSN 1823)7** | **Small Seagoing Passenger Ship (SSPS) Code1**  |
|
| **Seagoing** | Any2 | Not steel or equivalent | < 24m  |  |  |  |  | X1 |
| "New" | Constructed on or after 1 July 1998; | Steel or equivalent | ≥ 24m |  | X |  |  |  |
| Not steel or equivalent | Any  | X |  |  |  |  |
| "Existing"  | Constructed before 1 July 1998. | Steel or equivalent | ≥24m |  |  | X3 |  |  |
| Not steel or equivalent | <24m | X |  |  |  |  |
| **Non-Seagoing**  | "New"  | Certified7 on or after 6th April 2010 | All | All |  |  |  | X |  |
| "Existing"  | Certified7 before 6th April 2010 | All | All | X |  |  |  |  |
| Notes: |
| 1 This is a voluntary code introduced in June 2015 which provides a comparable standard to Directive 2009/45/EC, as amended by Directive 2010/36/EU and Directive 2016/844 and may be used as an equivalence to UK Class III to VI(A) Regulations. For further guidance see MGN 535 (M).  |
| 2 For new vessels operators are encouraged to use the Small Seagoing Passenger Ship Code in lieu of the Class VI/VI(A) regulations as the Code allows for greater plying limits.  |
| 3 The European Commission has agreed an equivalence arrangement under which “existing” UK Class III, VI and VI(A) ships (those constructed before 1 July 1998) may continue to operate under the UK regulations applicable to those classes, subject to certain conditions and restrictions. Details of this equivalence arrangement are set out in MSN 1811 (as amended or superseded). |
| 4 The Merchant Shipping (Passenger Ship Construction: Ships of Classes III to VI(A)) Regulations (including MSN 1699 (M)), The Merchant Shipping (Life-Saving Appliances For Passenger Ships Of Classes III To VI(A)) Regulations and The Merchant Shipping (Fire Protection - Small Ships) Regulations.  |
| 5 The majority of the requirements for this code are made mandatory by the Merchant Shipping (Passenger Ships) (Safety Code for UK Categorised Waters) Regulations 2010 (SI 2010/680).6 Loadline length |
| 7 For the purpose of this Code a new passenger ship is any ship not holding a valid passenger ship certificate issued under the regulation 11 of The Merchant Shipping (Survey and Certification) Regulations 1995 (SI 1995/1210) on the date this Code enters into force. Transitional arrangements are permitted in some circumstances as outlined in SI 2010/680. A second edition of MSN 1823 applies to new ships built after 1 January 2018. |

**Annex B – Definitions**

**Category of Water**

**Category A** - narrow rivers and canals where the depth of water is generally less than 1.5 metres.

**Category B** - wider rivers and canals where the depth of water is generally 1.5 metres or more and where the significant wave height could not be expected to exceed 0.6 metres at any time.

**Category C** - tidal rivers, estuaries and large, deep lakes and lochs where the significant wave height could not be expected to exceed 1.2 metres at any time.

**Category D** - tidal rivers and estuaries where the significant wave height could not be expected to exceed 2 metres at any time.

**Cold water shock** - This is the uncontrollable reaction of the body when it is first submerged in cold water (15°C or lower). The water temperature in the UK is 6-10 °C in the winter to 15-20 °C in the summer. In initial submersion, the body will experience a gasp reflex, which is a rapid intake of air. This is followed by a fourfold increase in breathing rate and associated increases in heart rate and blood pressure, making some people susceptible to heart attacks. These symptoms will last up to 3–5 minutes during which even the fittest person is unable to swim or to focus on breathing. Wearing a lifejacket with the correct buoyancy is vital to survival.[[32]](#footnote-32)

Without a lifejacket even the most competent swimmer will suffer from ‘swim failure’ after around 30 minutes of swimming in cold water. Research[[33]](#footnote-33) has shown significantly longer survival times when using buoyancy aids or lifejackets.

**Annex C: MCA Formal Safety Assessment (FSA) (2001-2003) - Estimates of risk**

The FSA estimates that the individual risk of an injury, fatality, or accident:

|  |
| --- |
|  |
| Operating environment | Individual risk of passenger fatality per voyage | Individual risk of passenger injury per voyage | Risk of accident per voyage |
| Tidal / Estuaries | 1.5 × 10-7 | 3.6 × 10-2 | 4.3 × 10-6 |
| Inland Waters | 9.1 × 10-8 | 2.0 × 10-2 | 2.3 × 10-6 |
| Lochs and Lakes | 1.4 × 10-7 | 3.4 × 10-2 | 4.1 × 10-6 |
| Coastal Waters | 1.3 × 10-7 | 9.5 × 10-2 | 3.8 × 10-6 |

The FSA also estimates the frequencies of various types of accident:

|  |
| --- |
|  |
| Accident category | Individual risk of passenger fatality |
| Collision | 10% |
| Grounding | 13% |
| Contact | 49% |
| Flooding | 1% |
| Fire | 16% |
| Personal | 11% |
| Total | 100% |

**Annex D: MCA Formal Safety Assessment (FSA) (2001-2003) – Probability trees**

This shows the various different outcomes from a collision and the probability of the outcome occurring. There are three outcomes; no fatalities, a fatal impact and an evacuation of a ship. If the impact is fatal or there are no fatalities the provision of liferafts is irrelevant. As such this analysis only looks at when an evacuation occurs.

A further event tree shows what happens when there is an evacuation and the chances of death:

This shows four outcomes, trapped inside the ship, drowning, rescue from water and dry rescue (from the boat). For this measure it is assumed the provision of liferafts will not affect deaths by being trapped inside. In addition, if you are rescued from the water, you may gain value from being in a liferaft but there is no change in surviving rates. This measure therefore only takes into account lives that could be saved from a liferaft avoiding drowning.

1. Those pertinent to this assessment are:

The Merchant Shipping (Fire Protection: Small Ships) Regulations 1998, as amended (SI 1998/1011) (Merchant Shipping Notices (MSN) 1665(M), 1666(M), 1667(M), 1668(M),1669(M) and 1670(M));

The Merchant Shipping (Passenger Ship Construction: Ships of Classes III to VI(A)) Regulations 1998, as amended (SI 1998/2515) (MSN 1699(M));

The Merchant Shipping (Life-Saving Appliances for Passenger Ships of Classes III to VI(A)) Regulations 1999, as amended (SI 1999/2723) (MSN 1676(M)); [↑](#footnote-ref-1)
2. Merchant Shipping (Passenger Ship Construction) Regulations 1980 and the Merchant Shipping (Passenger Ship Construction and Survey) Regulations 1984. [↑](#footnote-ref-2)
3. These are:

Directive 2009/45/EC of the European Parliament and of the Council on safety rules and standards for passenger ships as amended by Directives 2010/36 and 2016/844

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Small Seagoing Passenger Ship Code [↑](#footnote-ref-3)
4. Post -damage survivability is the ability for a vessel to stay afloat following damage. [↑](#footnote-ref-4)
5. See annex B for full definitions of the different categories of water. [↑](#footnote-ref-5)
6. For more information on the FSA see section 1.2. [↑](#footnote-ref-6)
7. WebTAG TAG data book, May 2018 – Unit A4.1.1, https://www.gov.uk/government/publications/webtag-tag-data-book-may-2018 [↑](#footnote-ref-7)
8. WebTAG TAG data book, May 2018 – Annual Parameters (originally from OBR), https://www.gov.uk/government/publications/webtag-tag-data-book-may-2018 [↑](#footnote-ref-8)
9. http://completeguide.rnli.org/lifejackets.html [↑](#footnote-ref-9)
10. https://www.gov.uk/maib-reports/fire-in-engine-room-on-tug-sd-dexterous-off-gareloch-scotland [↑](#footnote-ref-10)
11. https://www.gov.uk/maib-reports/fire-in-engine-room-of-wind-farm-workboat-windcat-3-in-the-solway-firth-scotland [↑](#footnote-ref-11)
12. https://www.gov.uk/maib-reports/fire-in-engine-room-of-general-cargo-vessel-saline-while-in-the-approaches-to-the-humber-estuary-england [↑](#footnote-ref-12)
13. https://www.gov.uk/maib-reports/fire-in-engine-room-of-twin-rig-prawn-stern-trawler-amy-harris-iii-off-the-isle-of-arran-scotland [↑](#footnote-ref-13)
14. https://www.gov.uk/maib-reports/fire-in-engine-room-and-subsequent-abandonment-of-twin-rig-trawler-denarius-83-miles-off-kinnaird-head-scotland [↑](#footnote-ref-14)
15. https://www.gov.uk/maib-reports/fire-in-engine-room-on-pilot-boat-haven-hawk-south-east-of-harwich-england [↑](#footnote-ref-15)
16. https://assets.publishing.service.gov.uk/media/547c70e6ed915d4c100000c1/pride-of-bath.pdf [↑](#footnote-ref-16)
17. https://www.gov.uk/maib-reports/flooding-of-charter-fishing-vessel-random-harvest-off-brighton-england [↑](#footnote-ref-17)
18. https://www.gov.uk/maib-reports/grounding-and-evacuation-of-domestic-passenger-vessel-surprise [↑](#footnote-ref-18)
19. https://www.gov.uk/maib-reports/contact-made-by-passenger-vessel-millennium-city-with-westminster-bridge-river-thames-england [↑](#footnote-ref-19)
20. https://www.gov.uk/maib-reports/sinking-of-small-passenger-ferry-vixen-in-ardlui-marina-loch-lomond-scotland [↑](#footnote-ref-20)
21. https://www.gov.uk/maib-reports/flooding-and-sinking-of-seine-netter-neptune-off-the-shetland-isles-scotland [↑](#footnote-ref-21)
22. https://assets.publishing.service.gov.uk/media/547c7111ed915d4c0d0000f7/vertrauen.pdf [↑](#footnote-ref-22)
23. https://www.gov.uk/maib-reports/flooding-of-charter-fishing-vessel-random-harvest-off-brighton-england [↑](#footnote-ref-23)
24. https://www.gov.uk/maib-reports/flooding-and-sinking-of-grab-hopper-dredger-abigail-h-while-alongside-at-the-port-of-heysham-england [↑](#footnote-ref-24)
25. Prepared by MAIB for MCA 25 September 2017 [↑](#footnote-ref-25)
26. https://assets.publishing.service.gov.uk/media/55c3108aed915d534600000c/MAIBInvReport-18\_2015.pdf [↑](#footnote-ref-26)
27. http://cdn.budgetresponsibility.org.uk/Nov2017EFOwebversion-2.pdf, Up to 2022 and WebTAG 2022-2066 from OBR FSR Jan 17, table 1.1, published 17/01/2017 (adjustment made to convert from FY to CY), from 2023- 2027 [↑](#footnote-ref-27)
28. See 10.2.1.1, 10.2.2.1, 10.2.3.1, 10.2.4.1, 10.2.5.1, 10.2.6.1, 10.2.8.1, 10.2.9.1, 10.2.10.1, 10.2.11 for the calculation of the monetised costs that are included under both Option 1 and Option 2. [↑](#footnote-ref-28)
29. See 10.2.1.2, 10.2.2.2, 10.2.3.2, 10.2.4.2, 10.2.5.2, 10.2.6.2, 10.2.7.1, 10.2.8.2, 10.2.9.2, 10.2.10.2 for the mon-monetised costs that are included under both Option 1 and Option 2. [↑](#footnote-ref-29)
30. See 10.2.1.4, 10.2.2.3, 10.2.3.3, 10.2.4.3, 10.2.5.3, 10.2.6.3, 10.2.7.2, 10.2.8.3, 10.2.9.3, 10.2.10.3 for the mon-monetised benefits that are included under both Option 1 and Option 2. [↑](#footnote-ref-30)
31. https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/bulletins/ukbusinessactivitysizeandlocation/2017 [↑](#footnote-ref-31)
32. RNLI guide to lifejackets and buoyancy aid [↑](#footnote-ref-32)
33. Tipton, M., Mccormack, E. & Turner, C., 2013. International Data Registration for Accidental and Immersion Hypothermia: The UK National Immersion Incident Survey – Revisited. Drowning, pp.921–923. [↑](#footnote-ref-33)