Heavy Fuel Oil and Bunkering Activity in the South Georgia & the South Sandwich Islands Maritime Zone

King Penguins, St. Andrew’s Bay, South Georgia. (Sheilapic76; CC BY 2.0)
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Executive Summary

The island group of South Georgia & the South Sandwich Islands (SGSSI) is an Overseas Territory of the United Kingdom. The Territory is administered by a small team based in Stanley in the Falkland Islands as well as a number of officers based at King Edward Point on South Georgia.

Activities undertaken in the Territory include scientific research, tourism and commercial fishing. All activities are ship-based, which is the only means of accessing the islands. Vessels operating in the SGSSI maritime zone include fishing vessels (long-liners and trawlers), fishing support vessels (reefers and tankers), passenger vessels, research vessels, a fishery patrol vessel, British naval vessels, and yachts.

SGSSI is a haven for the largest and most diverse populations of seabirds and marine mammals on Earth, and the most speciose marine ecosystem in the whole Southern Ocean. Combined with its wilderness, heritage and economic (tourism and fisheries) values, the Territory holds tremendous worth in a global context.

Existing pressures on the environment and wildlife include a rapidly changing climate which is predicted to have significant implications for some species, including for krill on which many SGSSI top predators depend.

Consistent with the global significance of the Territory’s natural ecological value, the Government of South Georgia & the South Sandwich Islands (G-SGSSI) has developed and implemented a range of management measures to protect the natural environment; including the designation of a marine protected area (MPA) which extends out to 200nm. The MPA establishes a series of restrictions on fishing (e.g. designated benthic closed areas).

Following the publication of its 5-year Strategy 2016-2020 the G-SGSSI has signalled its intent to explore ways to increase levels of safety and sustainability in the maritime zone in respect of the carriage and use of heavy fuel oil and of more effective regulation of bunkering activity.

Heavy fuels pose a significant environmental risk due to their persistence in the environment and the toxicity of the breakdown products. Ship-to-ship transfers of fuel (bunkering) also carry a risk of fuel spill through equipment or human failure.

The carriage and use of heavy fuel (as defined) south of 60° South is prohibited by the provisions of Chapter 9 of Annex I to MARPOL. This applies to all vessels operating in the Antarctic Treaty Area.

Collected data and information suggests that the majority of vessels operating in the maritime zone use marine gas oil (a light distillate fuel). Heavier (residual) fuels are carried and used by some trawlers and reefers. These vessels operate in the maritime zone for several months each year.
This strategic environmental assessment takes account of the current environmental state, and of the Government’s policy context to assess the risks posed by the carriage and use of heavy fuel oils and bunkering activities.

The risk of a spill event associated with the carriage and use of heavier fuel oils has been assessed as being ‘critical’; a combination of a ‘possible’ likelihood and potentially ‘major’ consequences for the environment. This level of risk is considered to be highly inconsistent with Government policy and/or with the provisions of the MPA and is unlikely to be tolerable. Ideally, for this level of risk regulatory or management intervention will need to be initiated within 12 months so as to reduce the risk to a more acceptable level.

The risk of a spill event associated with bunkering activity has been assessed as being ‘high’; a combination of an ‘unlikely’ likelihood but potentially ‘major’ consequences for the environment, if a large spill of heavier fuels was spilt in Cumberland East Bay. This level of risk is considered to be inconsistent with Government policy and/or the MPA, though may be tolerable under some circumstances. Ideally, regulatory and/or management intervention will need to be initiated within 1 to 3 years to reduce risk level further if practicable.

It is also noted that an oil spill event, particularly involving heavier fuel oils, is likely to have both reputational and financial implications for G-SGSSI. The Government has clearly set out its strategy of “world-class environmental management underpinned by high standards of governance”, and actions it has taken in recent years, including the designation of the MPA, are consistent with that policy. An oil spill event would significantly detract from and potentially undermine the current policy and management actions that have been taken. Implications that could arise include a reduction in tourism numbers and a disruption to fishing activity with potential loss of revenue as a consequence.

An oil spill event also has potential to interrupt globally significant scientific research and data sets.

Whilst the issue of carriage and use of heavy fuel oils by vessels is, to an extent, under ongoing scrutiny by the international community (through the IMO), the current effort is unlikely to achieve the stated objectives of G-SGSSI in a timely manner. As such, given the risk levels assessed in this report, it is suggested that achieving GSGSSI policy objectives is far more likely through direct action than awaiting developments internationally.

In considering options to better control the carriage and use of heavier fuel oils, a definition will be required and two options are proposed: the definition used by IMO to prohibited the carriage and use of heavy fuel oils in the Antarctic Treaty Area, or a much stricter definition that would essentially restrict fuel use in the SGSSI maritime zone to a marine gas oil (for example a DMA grade as specified in ISO 8217); the latter will clearly have a greater impact on the risk rating than the former.

A series of measures for introducing these controls are explored, and the implications and benefits of each are considered.
With regard to the carriage and use of heavy fuel oils these measures include:

- Doing nothing;
- Putting a condition on fishing licences to prohibit the carriage and use of heavy fuels oils (as defined);
- Putting in place a control on all vessels entering SGSSI internal waters to prohibit the carriage and use of heavy fuel oils (as defined) – perhaps by means of an Order under the Customs Ordinance;
- Seeking IMO designation of the SGSSI maritime zone as a particularly sensitive sea area, which could include controls on the carriage and use of heavy fuel oils by vessels entering the designated PSSA;
- Introducing a heavy fuel oil levy for vessels carrying and using heavy fuel oil (as defined) – possibly based on the volumes and the duration of stay in the SGSSI maritime zone.

With regard to bunkering activity identified control measures include:

- Doing nothing;
- Enhancing the management and oversight of bunkering activity including greater scrutiny of ship-to-ship operational plans and oil spill response plans as well as compliance monitoring of bunkering activity, and improved data collection;
- Prohibiting the bunkering of heavier fuel oils (as defined) – either as a condition on fishing and/or transhipment licences or by means of an Order under the Fisheries (Conservation and Management) Ordinance;
- Prohibiting the bunkering of all fuels in SGSSI waters - either as a condition on fishing and/or transhipment licences or by means of an Order under the Fisheries (Conservation and Management) Ordinance;
- Establishing a fuel spill response plan and providing training and response equipment for officers based at KEP.

In identifying a way forward, it is noted that doing nothing is unlikely to be tenable. G-SGSSI has signalled its intent to act, through its strategy document and in designating the SGSSI MPA. Further, the identified risk levels are sufficiently high to require response measures to be initiated in the short to medium term.

Consequently, this assessment sets out 13 recommendations for the Government of South Georgia & the South Sandwich Islands to consider.

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Recommendation 1. It is recommended that GSGSSI initiate action to address the risk associated with the carriage and use of heavy fuel oil in SGSSI waters and with bunkering activity. Ideally, action should be initiated in the short-term i.e. the next 12 to 24 months.
Recommendation 2. It is recommended that, in the first instance, G-SGSSI adopt as its definition of heavy fuel oil the definition used by IMO to prohibit the carriage and use of heavy fuel oil in the Antarctic Treaty Area (Chapter 9 of Annex 1 to MARPOL (Regulation 43). See Annex 2 of this report).

Recommendation 3. It is recommended that G-SGSSI take steps to improve the collection of data on the types and volumes of fuel being used by vessels operating in the SGSSI maritime zone (using specifications of ISO 8217) so as to inform future decisions on controlling fuels used in the SGSSI maritime zone.

Recommendation 4. It is recommended that G-SGSSI considers implementing a prohibition on the carriage and use of heavy fuel oils (as defined) by all vessels entering its internal waters. This could be achieved by means of an Order made under section 7(1)(a) of the Customs Ordinance 2016.

Recommendation 5. It is recommended that G-SGSSI prepares a consultation paper on the basis of this assessment, setting out its intended approach and circulates to all interested parties at the earliest opportunity.

Recommendation 6. Prior to implementing such a control, it is recommended that G-SGSSI work with the UK Government to notify international partners of the change, including through the IMO as appropriate (UNCLOS Article 211(2) refers).

Recommendation 7. It is recommended that G-SGSSI considers improving the level of scrutiny of bunkering activities in Cumberland East Bay, through a range of measures including: the requirement for vessels to provide their ship-to-ship operations plans, oil spill response plans (including equipment held on-board to respond to spills), and undertaking compliance monitoring against such plans.

Recommendation 8. In implementing Recommendation 7, it is recommended that G-SGSSI give consideration to seeking specialist advice on bunkering standards as well as providing training for its Government Officers in undertaking compliance checks against such standards.

Recommendation 9. It is recommended that G-SGSSI seek specialist advice in the development of a national oil spill response strategy or plan, and in parallel explores opportunities for developing an oil spill response capability at KEP including stationing oil spill response equipment and providing relevant training to its Government Officers.

Recommendation 10. To assess compliance with introduced controls, as well as to inform future management options, it is recommended that G-SGSSI improve the quality of data collected from vessels on the fuels they are carrying by requiring vessels to report against the ISO 8217 standard.

Recommendation 11. It is recommended that G-SGSSI continue the practice of collecting fuel samples from vessels and that consideration be given to testing a proportion of these for verification and compliance purposes.
Recommendation 12. It is recommended that G-SGSSI explores further the opportunity to seek ‘particularly sensitive sea area’ status, through the IMO, for the SGSSI maritime zone with a view to further raising the standards of fuel used by all vessels operating throughout the SGSSI maritime zone.

Recommendation 13. It is recommended that G-SGSSI continues to explore options for further raising the standard of fuel used by vessels operating within the SGSSI maritime zone, by seeking to phase out the carriage and use of all residual fuels. Achieving this will require ongoing dialogue with industry and vessel operators, setting a clear objective and timeline and identifying opportunities such as a fuel levy to help incentivise operators to move towards the desired standard.
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Acronyms

ACAP  Agreement on the Conservation of Albatross and Petrels
CBD  Convention on Biological Diversity
CCAMLR Convention on the Conservation of Antarctic Marine Living Resources
G-SGSSI Government of South Georgia & the South Sandwich Islands
HFO  Heavy fuel oil
IFO  Intermediate fuel oil
IMO  International Maritime Organisation
ISO  International Standards Organisation
MARPOL Marine Pollution Convention: Full title: *International Convention for the Prevention of Pollution from Ships*
MPA  Marine Protected Area
MEPC Marine Environment Protection Committee
MDO  Marine Diesel Oil
MGO  Marine gas Oil
NBAP National Biodiversity Action Plan
SEA Strategic Environmental Assessment
SGSSI South Georgia & the South Sandwich Islands
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1. Introduction

1.1 Background to the assessment

Following the publication of its 5-year Strategy 2016-2020 the Government of South Georgia & the South Sandwich Islands (GSGSSI) is exploring ways to increase levels of safety and sustainability in the maritime zone in respect of the use and carriage of heavy fuel oil and of more effective regulation of bunkering activity.

To further this initiative GSGSSI has commissioned a report reviewing current policies on the carriage and use of heavy fuel oil (HFO) and of bunkering activity in the maritime zone of South Georgia & the South Sandwich Islands (SGSSI).

This review has two elements:

1. Development of policy on the future use and/or carriage of heavy fuel oil in the SGSSI maritime zone. This will include:

   - an assessment of current heavy grade oil use and of the benefits and risks, including environmental (marine and terrestrial) risks, posed by the current policy of permitting the use and carriage of heavy grade oil at South Georgia;
   - exploring options and developing recommendations for a future policy on the use and/or carriage of heavy grade oil including appropriate timescales for implementation;
   - analysis of the relative merits and disadvantages of each option dealing with issues such as:
     - the practical effectiveness of measures in managing, reducing or eliminating risks including benefits arising from consistency of policy south of 60°;
     - environmental, reputational, economic and operational impacts, and potential impacts on both G-SGSSI and industries (including different types of vessel);
   - the mix of policy/regulatory measures which might best deliver these options.

2. Inputs to inform and support the better regulation of general bunkering activity at South Georgia including:

   - an assessment of current bunkering activity and of the benefits and risks, including environmental (marine and terrestrial) risks posed by the current policy of permitting ship-to-ship bunkering activity (in Cumberland East Bay). This assessment should consider the appropriate environmental response to an accident or incident such as an oil spill or ship wreck, including likely response times and costs - noting the challenges of operating in a remote location like SGSSI;
   - options for controlling future bunkering policy, ranging from retaining the status quo to full prohibition, which should consider the relative merits and disadvantages of each option including:
     - the practical effectiveness of measures in managing, reducing or eliminating risks;
environmental, reputational, economic and operational impacts on both GSGSSI and industries;
- what a best practice bunkering policy and procedure would look like, and how it could be introduced and implemented at South Georgia;
- appropriate timescales for the introduction of any new policy.

1.2 Strategic Environmental Assessment approach

To meet the requirements set out in 1.1 above, this assessment has been undertaken within the framework of a strategic environmental assessment (SEA).

The SEA process, as distinct from more activity-specific environmental impact assessments (EIA), offers a more holistic and comprehensive method of assessing the policy, regulatory, operational and environmental context and implications of plans or initiatives.

SEA is described as: a systematic and anticipatory process, undertaken to analyse the environmental effects (both positive and negative) of proposed plans, programmes and other strategic objectives and to integrate the findings into decision-making (Dalal-Clayton and Sadler, 2005).

There are a number of frameworks available to undertaking SEA, including the European Union’s SEA Directive 2001/42/EC (EU SEA Directive).

Based on the EU SEA Directive, the SEA framework has allowed us to:

- Outline the issues and the intended outcomes to the initiative i.e. the policy context (see Section 2.2);
- Summarise the current status of the activity in question over which new controls are being considered i.e. HFO carriage and use, and bunkering (see Section 2.3);
- Characterise the relevant aspects of the current state of the environment (see Section 2.1) and the likely state without implementation of the initiative i.e. business as usual. This can be achieved by means of a risk assessment of the actual or potential environmental consequences of the activity in question (see Section 4) as well as the potential cumulative environmental impacts of the activity in combination with other environmental pressures, such as a changing climate and increasing human activity (see Section 2.5);
- Summarise environmental objectives or controls established at international or local levels, which are relevant to the initiative and the way those objectives and any environmental considerations should be taken into account i.e. existing or planned controls through IMO, CCAMLR and G-SGSSI, including the SGSSI MPA and G-SGSSI Strategy (see Sections 2.2 and 5);
- Outline and assess potential policy and management alternatives to prevent, reduce and as fully as possible counter identified risks to the environment (see Section 6);
- Outline the rationale for selecting the alternatives, including the advantages, disadvantages and consequences of each alternative (see Section 6);
• Identify a preferred option or options with reasoning (see Section 7);
• Propose any on-going monitoring and frequency of monitoring that may be required to assess the effectiveness of implementing the preferred option (see Section 7).

SEA also provides an appropriate framework for supporting consultation with interested or affected stakeholders. This aspect of the SEA process will be undertaken by G-SGSSI at a later stage.

A strength of the SEA framework is its ability to provide an assessment of the environmental risks of the issue(s) in question. We have used a structured approach to assessing the risks associated with the carriage and use of heavy fuel by vessels operating in the SGSSI maritime zone and the conduct of ship-to-ship bunkering activities in Cumberland East Bay.

1.3 Risk assessment approach

Risk assessment sits within the broader strategic environmental assessment framework (discussed in Section 1.2 above).

Risk assessment is a rational and structured approach for identifying hazards, analysing risk and identifying controls, or risk-reduction measures. It also provides a means of facilitating a transparent decision-making process, and offers a proactive approach towards identifying and managing potential hazards before serious incidents occur.

A risk assessment process assists in providing a clear justification for proposed regulatory measures and for allowing a comparison of different options of such measures to be made.

It is an appropriate approach to use in the context of this assessment as a means of characterising the risks associated with the carriage and use of heavy fuel oil and of bunkering activities and for developing appropriate measures to address those risks.

Risk is an inherently subjective concept, with varying interpretations, methodologies and applications. Over the last few decades, the international oil and gas industry has invested significantly in understanding, evaluating and communicating risks associated with the exploitation and transport of hydrocarbons. Large scale pollution events such as the 1967 Torrey Canyon spill off the southwest coast of the UK and the 1989 Exxon Valdez spill in Prince William Sound, Alaska generated significant efforts to assess the risks associated with marine transport of hydrocarbons and the best approaches for managing those risks (Walker, 2017).

Various risk assessment approaches exist within the marine industry. See for example the guidelines for oil spill risk assessment and response planning for offshore installations jointly prepared by IPIECA and the International Association of Oil and Gas Producers (IPIECA,
2013). Of particular relevance to this assessment is the risk assessment framework prepared by the International Maritime Organisation (IMO), which takes a similar approach to the IPIECA methodology.

IMO’s Formal Safety Assessment (FSA) guidelines were approved in 2002 (MSC/Circ.1023/MEPC/Circ.392), and amended by MSC/Circ.1180-MEPC/Circ.474 and MSC-MEPC.2/Circ.5. IMO describes the FSA process as “a rational and systematic process for assessing the risks relating to maritime safety and the protection of the marine environment”.

FSA consists of five steps:

1. Identification of hazards - a list of all relevant accident scenarios with potential causes and outcomes. *What might go wrong?*
2. Assessment of risks - evaluation of risk factors. *How likely is it to happen and how bad could it be?*
3. Risk control options - devising regulatory measures to control and reduce the identified risks. *Can matters be improved?*
4. Cost benefit assessment - determining cost effectiveness of each risk control option. *What would it cost and how much better could it be?*
5. Recommendations for decision-making - information about the hazards, their associated risks and the cost effectiveness of alternative risk control options is provided. *What actions should be taken?*

The FSA methodology is summarized in figure 1.

![FSA Risk Methodology](image)

*Figure 1. Overview of IMO's Formal Safety Assessment methodology.*

IMO suggest that the application of FSA may be particularly relevant in the context of regulatory proposals that may have cost implications for the maritime industry or administrative
or legal burdens for the regulator (IMO, 2002). This approach meshes well with the SEA approach described in Section 1.2.

The FSA approach is consistent with the international risk standard (ISO 31000: 2009) and the Australian / New Zealand standard (or handbook) for managing environment-related risk (AS/NZS HB 203: 2006), both of which use the process shown in figure 2 below.

These international standards have been used as the framework for undertaking the risk assessment component of this study.

The FSA guidelines place emphasis on the availability of suitable data for each step of the FSA process, and that where data are not available expert judgment; simulations and analytical models should be used to achieve results (IMO, 2002). It is noted here and repeated in Section 2.3, that data on the carriage and use of fuel in the SGSSI maritime zone and of bunkering activities are limited.
The AS/NZS HB 203: 2006 guidelines provide that where numerical data are inadequate qualitative risk analysis can be useful. The AS/NZS standard provides that qualitative ranking methods can be used based on ordinal scales (usually a scale of descriptions) to rank consequences and likelihoods and that a risk matrix based on these qualitative measures may be used as a means of combining consequences and likelihood to give a measure of risk. This is the approach taken here and a risk matrix has been developed using this approach (Figure 14). The risk assessment approach is discussed further in Chapter 4.

1.4 Marine petroleum products

Marine petroleum products are variously described, and a wide variety of sometimes confusing terms are found in the literature and in common use.

ISO 8217: 2012, prepared by the International Standards Organisation (ISO), specifies the requirements for marine petroleum products and defines the standards for two broad categories of fuel types: distillate fuels (specification table included at Appendix 1a) and residual fuels (specifications table included at Appendix 1b)\(^1\).

The generic term heavy fuel oil (HFO) describes fuels that have a particularly high viscosity and density. In the 1973 Marine Pollution Convention (MARPOL), heavy fuel oil is defined either by a density of greater than 900 kg/m\(^3\) at 15°C or a kinematic viscosity of more than 180 mm\(^2\)/s at 50°C. Heavy fuel oils have large percentages of heavy molecules such as long-chain hydrocarbons and aromatics with long-branched side chains. They are distinctly black in colour.

Heavy fuel oils are widely used as marine fuel, and virtually all medium and low-speed marine diesel engines are designed for heavy fuel oil.

Heavy fuel oil is a residual fuel incurred during the distillation of crude oil. The quality of the residual fuel depends on the quality of the crude oil used in the refinery. To achieve various specifications and quality levels, these residual fuels are blended with lighter fuels such as marine gasoil or marine diesel oil. The resulting blends are often referred to as intermediate fuel oils (IFO) or marine diesel oils. They are classified and named according to their viscosity. The most commonly used types are IFO 180 and IFO 380, with viscosities of 180 mm\(^2\)/s and 380 mm\(^2\)/s, respectively. If there is a predominance of heavy fuel oil in a blend, it is assigned to the heavy fuel oil category. As these are blends of heavy fuel oil and lighter fuels, they can also be referred to as a heavy marine diesel oil. Heavy fuel oil cannot generally be pumped at a

\(^1\) For the purposes of this assessment, we will attempt to define fuel types using the ISO 8217: 2012 standard to the extent possible. Where the more generic terms of “heavy fuel oil” or “residual fuels” are used, they will be taken to include all heavy and intermediate fuel oils (IFOs). Marine gas oil (MGO) will be included in the generic term “distillate fuels”.
temperature of 20°C, and must therefore be preheated in the ship's tanks. To ensure the fuel is or remains able to be pumped, it must be heated to at least 40°C. At a temperature of 15°C, IFO has a bitumen-like consistency.

ISO 8217 stipulates that residual fuels, and therefore all heavy fuel oils, may not contain old oil or lubricating oils.

Marine gas oil (MGO) describes marine fuels that consist exclusively of distillates. Distillates are those components of crude oil that evaporate in fractional distillation and are then condensed from the gas phase into liquid fractions. MGO usually consists of a blend of various distillates. MGO is similar to diesel fuel, but has a higher density. Unlike heavy fuel oils, MGO does not have to be heated during storage. MGO has a transparent to light colour.

MGO is used in smaller medium- to high-speed auxiliary units or auxiliary motors and ship’s engines. The latter are typically found on fishing boats, small ferries or tugs. Unlike heavy fuel oil or heavy marine diesel oil with a large proportion of heavy fuel oil, MGO has a low viscosity and can easily be pumped into the engine at temperatures of around 20°C.

According to the ISO 8217 standard, the quality grades DMX, DMA, DMB and DMZ are also commonly referred to as marine gas oil2. But it is noted that DMB marine fuel can also contain a small proportion of heavy fuel oil, and as such it is not a pure distillate and thus not a “real” MGO.

MGO is produced with varying degrees of sulphur content, though the maximum permissible sulphur content of MGO is less than that of heavy fuel oil. The ISO 8217 DMA quality label has a maximum permissible value of 1.5%. Low sulphur MGO (LS-MGO) has a sulphur content of less than 0.1%. This marine fuel can be used in EU ports or Emission Control Areas (ECAs – see Section 5.2.7), which impose a sulphur emissions limit corresponding to that of LS-MGO. For this reason, most shipping companies use a low sulphur MGO variety (DMA) in these places.

As refineries are optimizing their production processes to produce less and less residual fuel (heavy fuel oil) due to the falling price of HFO, it is expected that MGO will be used more often in the years ahead, and engine technology in shipping will adapt as a result. The lighter MGO and marine diesel oil (MDO) fuels, however, are more expensive than HFO, which is still predominantly used in commercial shipping.

Marine diesel oil (MDO) generally describes marine fuels that are composed of various blends of distillates (MGO) and HFO. Unlike diesel fuels on land that are used for cars and trucks,

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2 In March 2017 (during the preparation of this report), ISO published an updated version of the 8217 standard (ISO 8217: 2017). The updated standard amends the scope and the general requirements of the standard and includes additional distillate fuel grades: i.e. additional grades, DFA, DFZ and DFB have been added, along with some additional changes to fuel specifications. However, these changes do not affect the assessment provided in this report nor the recommendations.
marine diesel oil is not a pure distillate. The different blending ratios of MDO oil can be controlled directly by processes in the refinery or by blending ready-made marine fuels. Marine diesel is similar to diesel fuel, but has a higher density. Unlike HFO, MDO does not have to be heated during storage.

MDO is sometimes used synonymously with the term “intermediate fuel oil” (IFO). In the strict sense, the term marine diesel oil mainly refers to blends with a very small proportion of HFO. This type of MDO is therefore sometime also classified as a distillate or a middle distillate. IFO, on the other hand, have a higher proportion of HFO. Accordingly, IFO types with particularly high proportions of HFO are sometimes classified as heavy fuel oils.

The following brief descriptions provide a useful summary:

- Marine diesel oil in general: a blend of distillates and heavy fuel oil
- Marine diesel oil in a narrow sense: a blend of distillates and heavy fuel oil, but with very low heavy fuel oil content
- Intermediate fuel oil (IFO): marine diesel with higher proportions of heavy fuel oil

According to ISO 8217, MDO with a lower proportion of heavy fuel oil include the DMB and RMA 10 fuels. The heavy fuel oil components in DMB marine diesel oil (classified as a distillate according to ISO 8217 as noted above), come mainly from residues of heavy fuel oil from tanks where DMB is stored. Due to this pollution by HFO, its colour changes can range from light brown to black. As emission limits for Emission Control Areas (ECAs) become ever stricter, DMB with its relatively high sulphur content of about 2% is being used much less frequently.

ISO 8217, classifies marine diesel oil RMA 10 as a residual fuel. It has a similarly low viscosity to DMB, but a higher maximum permissible sulphur content of 3.5%, and also a higher proportion of heavy fuel oil. This type of fuel is also usually darker than DMB. Its colour spectrum ranges from dark brown to black.

Intermediate fuel oils are black due to their higher proportion of heavy fuel oil. In ISO 8217, IFO fuels with RME, RMG and RMK designations and kinematic viscosities of 180 mm²/s or 380 mm²/s count as residual fuels. These marine diesel oils are viscous and must be heated so that they can be pumped.

Their different blending ratios make it possible to use MDOs in many different engines. Lighter versions like DMB and RMA 10 are used to power smaller medium- to high-speed marine engines and auxiliary power units, as well as auxiliary engines on very large ships, while the viscous IFO 380 is mainly used in large aggregates. Lightweight and low-sulphur marine diesel oil is sometimes burned in larger engines as well – whenever an area with stricter emission limits is being crossed. Once outside the area, ships will often switch back to a (cheaper) marine fuel with higher emissions.
2. Environmental, Policy and Operational Context

2.1 South Georgia & the South Sandwich Islands – current environmental state

South Georgia is located between latitudes 53°56’S and 54°55’S and longitudes 34°45’W and 38°15’W. The island is crescent-shaped, mountainous and heavily glaciated, with more than half the island covered in ice and snow. The northern coast is characterised by a series of fjords and inlets, whilst the southern coast is mainly formed of high sea cliffs.

Beaches are mainly (though not exclusively) located on the northern side of the island and around Bird Island at the western tip. Beaches are mostly formed of shingle, though some are sandy. These areas are particularly important access points for penguins and seals and often form bird nesting sites along the coastline.

The seven small islands (volcanoes) which comprise the South Sandwich Islands are located approximately 550km to the southeast of South Georgia. The smallest of the islands, Vindication Island, measures approximately 1.5km by 3km, and the largest, Montagu Island, 10km x 12km. The islands form an intra-oceanic island arc system (Leat et al., 2013), with several submerged volcanoes as part of the system.

The islands comprise layers of easily eroded lava, scoria and ash and the sheer vertical cliffs around most of the islands are undergoing rapid erosion by wave action from the Southern Ocean (Leat et al., 2013).

2.1.1 Climate

South Georgia’s climate is generally cold, wet, cloudy and windy though subject to rapid change as a result of lying in the path of westerly depressions. Temperatures range from extreme lows of -19.4°C to extreme highs of +26.3°C. The mean winter temperature is around -1.8°C (Rogers et al., 2015). Changing climatic conditions have been recorded on South Georgia since the 1920s, with average annual temperatures rising by more than a degree since 1950 (Gordon et al., 2008; Shanklin et al., 2009). Responses to these rising temperatures have included a retreat of most of the islands glaciers (Gordon et al., 2008 – discussed further in Section 2.5.1 below).

Little information is available on the climate of the South Sandwich Islands, though they are generally colder than South Georgia and the islands are surrounded by sea ice during the winter months. Severe storms affect the islands with oceanic swells of up to 15m in height (Rogers et al., 2015).
2.1.2 Oceanography

Oceanographic conditions around SGSSI are dominated by the Antarctic Circumpolar Current (ACC) which forms an eastward flowing circulation approximately between latitudes 50°S and 65°S. The ACC is bounded to the north by the Polar Front (a sharp oceanographic boundary with an obvious temperature differential between warmer (4 to 5°C) South Atlantic waters and colder (0 to -1°C) South Ocean conditions).

Closer to South Georgia, on-shelf flows show an anticlockwise pattern around the island from the south and southeast shelf, continuing on the northern shelf before exiting the shelf to the north and northwest. Flows from the southwest shelf tend to be northward, either joining off-shelf flows or turning eastward along the southern shelf (Young et al., 2014).

Modelling undertaken by Young et al (2014) noted significant seasonal and inter-annual variability in the flows around South Georgia. They also noted periods of pronounced anticlockwise shelf flows, associated with horizontal density gradients due to reduced wind mixing of shelf waters, and differences between shelf and oceanic waters, which significantly reduced off-shelf transport rates, and increased retention of waters on-shelf.

These anti-clockwise circulation patterns around South Georgia are likely to have an influence on the fate and impact of any fuel spilled into the sea within the vicinity of the island; not least heavier fuel oils which are more persistent, and tend to be more strongly influenced by currents, than by wind and wave actions (See Section 3.2).

2.1.3 Marine environment

The waters around South Georgia are among the most productive in the Southern Ocean. Large phytoplankton blooms, particularly to the northwest of South Georgia (Borrione and Schlitzer, 2013) support dense zooplankton populations close to the island, in particular Antarctic krill (*Euphausia superba*), which in turn support vast colonies of higher predators (Rogers et al., 2015; Young et al., 2014).

Antarctic krill, are a crucial component of the Southern Ocean food web, though demonstrate interannual variability in abundance around South Georgia. This variability seems to be attributable to a number of factors including sea ice dynamics along the western coast of the Antarctic Peninsula (Stammerjohn et al., 2008) as well as other factors such as winter sea surface temperatures further south (Fielding et al., 2014). Review of historic data suggest that there are 2 or 3 years in each decade where the abundance of krill at South Georgia is low, the predator foraging and breeding performance is reduced, and the krill fishery reports reduced catch levels and rates (Fedoulov et al., 1996; Brierley et al., 1997; Murphy et al., 1998).

Given the productivity significance of the waters around South Georgia, Rogers et al. (2015) point out that many aspects of the pelagic ecosystem of the region, including the wider Scotia Sea area, are poorly understood. Knowledge gaps include predator distributions (particularly in winter), specific components of food webs, and interactions between species.
Similarly, the intertidal and subtidal ecosystems of South Georgia & the South Sandwich Islands have been little studied; particularly so on the southern coast of South Georgia (Rogers et al., 2015). Studies that have been undertaken suggest a lack of strong intertidal zonation (Barnes et al., 2006) and a relatively impoverished fauna and flora (Davenport and Macalister, 1996); though Brewin and Brickle (2010) recorded higher diversity and abundance of invertebrates in cryptic habitats (such as rock crevices and under boulders).

Wells et al., (2011) undertook an intertidal and subtidal benthic macroalgal survey recording that a unique and diverse array of algal flora has become well established around the coast of South Georgia resulting in a high level of endemism.

Very little is known about the intertidal zone of the South Sandwich Islands. Some accessible boulder shores are present on several of the islands though these do not appear to have been surveyed (Rogers et al., 2015).

Subtidal areas around South Georgia are also poorly studied. Survey’s that have been undertaken are restricted to the northern coast of the island and report multi-storied algal communities including large kelp beds, calcareous encrusting red algae on many rock surfaces and a fauna that generally resembles Antarctic sub-tidal communities (Barnes et al., 2006). Only one fish species (Harpagifer georgianus) and two gastropod species (Margarella tropidophorides and M. steineni) have been reported as being endemic from subtidal habitats (Rogers et al., 2015).

In contrast the benthic shelf area around South Georgia has been relatively well studied, not least to support fisheries management controls (Agnew et al., 2007). Hogg et al. (2011) report that the South Georgian shelf is the most speciose region of the Southern Ocean recorded to date. Marine biodiversity was recorded as rich across taxonomic levels with 17,732 records yielding 1,445 species from 436 families, 51 classes and 22 phyla. Most species recorded were rare, with 35% recorded only once and 86% recorded 10 times. Its marine fauna is marked by the cumulative dominance of endemic and range-edge species.

The SGSSI marine protected area includes a series of restrictions on fishing within several zones in order to afford protection to benthic communities. This includes the designation of 10 benthic closed areas around South Georgia & the South Sandwich Islands (SGSSI, 2013).

2.1.4 Higher predators

The higher predator fauna of SGSSI is extremely rich and the islands host some of the largest and most diverse concentrations of these animals anywhere on Earth (Clarke et al., 2012). Rogers et al. (2015) report that SGSSI are exceptional for several reasons, notably:

- Large breeding aggregations of many species. South Georgia in particular is a highly important breeding site globally for: Antarctic fur seal (Arctocephalus gazella), southern elephant seal (Mirounga leonina), grey-headed albatross (Thalassarche chrysotoma), northern giant petrel (Macronectes halli), white-chinned petrel (Procellaria aequinoctialis), Antarctic prion (Pachyptila desolata) and the common diving petrel
(Pelecanoides urinatrix). South Georgia is also in the top three breeding sites globally for: king penguin (Aptenodytes patagonicus), Gentoo penguin (Pygoscelis papua), macaroni penguin (Eudyptes chrysolophus), wandering albatross (Diomedea exulans), black-browed albatross (Thalassarche melanophris), southern giant petrel (Macronectes giganteus), black-bellied storm petrel (Fregetta tropica) and South Georgia diving petrel (Pelecanoides georgicus). The South Sandwich Islands (specifically Zavodovski Island) hosts the largest Chinstrap penguin (Pygoscelis antarcticus) in the world;

- High proportions of the world population of many species of seabird and of some pinniped populations, and,
- The undisturbed nature of large discrete areas such as the Willis Islands, Annenkov Island, Cooper Island, Bird Island and all of the South Sandwich Islands.

2.1.4.1 Seabirds and penguins

Poncet (2005) reports that South Georgia holds one of the world’s most abundant and diverse seabird communities, whose total breeding population probably exceeds 30 million pairs.

There are six species of penguin, four species of albatross and 13 species of smaller petrel and related species, including nine burrow-nesting petrels. There is one land bird, an endemic passerine, the South Georgia Pipit (Anthus antarcticus), and there are five water-bird species including two species of waterfowl; the Yellow-billed (South Georgia) Pintail (Anas georgica georgica) and the Speckled Teal (Anas flavirostris), which is thought to be a relatively recent arrival from South America or the Falkland Islands. Three endemic subspecies/taxa have been recognised: the Yellow-billed (South Georgia) Pintail and the Imperial (South Georgia) Cormorant (Leucocarbo georgianus), which are confined to the island group, and the Antarctic (South Georgia) Tern (Sterna vittata).

Ten species of global conservation concern breed at South Georgia. These are the Endangered Grey-headed Albatross; Vulnerable Wandering Albatross, Macaroni Penguin and White-chinned Petrel, as well as the Near-threatened Black-browed Albatross, Light-mantled Albatross (Phoebetria palpebrata) and South Georgia Pipit (Clarke et al., 2012).

The South Sandwich Islands are host to 16 bird species: 13 seabirds and three water-birds, including an endemic sub-species of the Imperial (South Georgia) Shag, which is thought to be confined to the island group. One species is of global conservation concern, the Vulnerable Macaroni Penguin (Clarke et al., 2012).

The archipelago contains important breeding sites for a number of colonial seabirds, the most abundant being the Chinstrap Penguin, Adelie Penguin, Macaroni Penguin and the Southern (Antarctic) Fulmar, with at least 10,000 pairs estimated for each. It is the second most important global breeding site for Chinstrap Penguins (after the South Shetland Islands), with over one-third of the world’s population, and its populations of Snow Petrels, Cape Petrels and Southern (Antarctic) Fulmars are believed to be of global significance (Clarke et al., 2012).
2.1.4.2 Seals

The Antarctic fur seal (*Arctocephalus gazella*) was hunted to near extinction in the late 1800s / early 1900s. Following a cessation of sealing (at least for fur seals) in 1909, numbers have recovered. By the late 2000s, 95% of the world’s fur seal population were located at South Georgia with numbers thought to be in the region of 4 million individuals (Rogers et al., 2015).

Elephant seals (*Mirounga leonina*) were also harvested from the 1800s until as recently as the early 1960s. SGSSI hosts approximately half of the global population with individuals (mostly on South Georgia) estimated to number around 397,000 (Hindell et al., 2013).

Leopard seals and Weddell seals are also observed around South Georgia and a small breeding colony of Weddell seals has been reported in Larsen Harbour to the south of South Georgia. Weddell seals are also suspected to breed around the South Sandwich Islands (Rogers et al., 2015).

2.1.4.3 Cetaceans

Whale stocks were also heavily exploited from both shore-based and ship-based harvesting activities that occurred around SGSSI for over 60 years until as recently as the 1960s.

Whales that occur around SGSSI include: humpback whales (*Megaptera novaeangliae*), southern right whales (*Eubalaena australis*), blue whales (*Balaenoptera musculus*), sei whales (*Balaenoptera borealis*), fin whales (*Balaenoptera physalis*) and Antarctic minke whales (*Balaenoptera bonaerensis*), all of which were hunted to some extent, with blue whales being particularly heavily depleted.

Sightings and surveys in the region over the past 20 years suggest some increase in stocks and suggest two main feeding areas around South Georgia: one area on the northern slopes of Shag Rocks (to the west of the northern tip of South Georgia) and the second on the northern shelf and slopes of South Georgia (Moore et al., 1999).

2.2 Governance of SGSSI and policy context

2.2.1 Governance

Captain James Cook claimed South Georgia for Great Britain in 1775. Government arrangements for South Georgia were established by Letters Patent in 1843. The South Sandwich Islands were annexed by Great Britain by means of Letters Patent in 1908, which established the Falkland Island Dependencies; the Dependencies included both South Georgia & the South Sandwich Islands.
The now separate United Kingdom (UK) Overseas Territory of South Georgia & the South Sandwich Islands (SGSSI) was established in 1985 by Order in Council. Under the constitution of the Territory a Commissioner is afforded the power to make laws, appoint officers and establish courts. The Territory is administered by a small team based in Stanley in the Falkland Islands as well as a number of officers based at King Edward Point on South Georgia.

The Government of South Georgia & the South Sandwich Islands (G-SGSSI) is financially self-sufficient with revenue gained from fishing licences, tourist landing fees and stamp and other merchandise sales.

A series of laws are in place for SGSSI in the form of “Ordinances” (which are primary legislation) and “Orders” and “Regulations” (which are secondary legislation).

2.2.2 SGSSI Strategy and policy

In 2015, G-SGSSI published its overarching Strategy for the period 2016 to 2020 (GSGSSI, 2015). The Strategy was prepared in conjunction with the UK Foreign and Commonwealth Office and sets out an agreed vision for the Territory.

The Strategy states that G-SGSSI aspires to:

**World-class environmental management underpinned by high standards of governance.**

To achieve this aspirational goal, the Strategy sets out a series of ambitious, strategic objectives, which are:

- To manage the affairs of SGSSI and the surrounding 200 nautical mile Maritime Zone through efficient and transparent government
- To conserve the Territory’s environment, minimise human impacts and, where practicable, restore the native biodiversity and habitats
- To manage SGSSI fisheries to the highest international standards of operation, stewardship and sustainability
- To facilitate visits that are safe, responsible, environmentally-sensitive and contribute to sustainable management, creating future ambassadors for the Territory
- To preserve where practicable, and bring to a wider international audience, the heritage of South Georgia

A number of recent initiatives taken by G-SGSSI have made substantive progress towards these objectives, including for example the significant programme of eradication of non-native rodents and reindeer throughout South Georgia.

The overarching and strategic objectives outlined in G-SGSSI’s Strategy provide the policy context for this assessment of fuel use by vessels operating in the SGSSI maritime zone.
Under a series of headings, the 2016-2020 Strategy document identifies a series of more specific objectives, including a number that are directly relevant to this assessment:

- (1.2) Identify and mitigate against GSGSSI liabilities through effective risk management policies, including maintaining and exercising contingency plans.

- (2.8) Understand and, where possible, mitigate the risks from substances that have the potential to harm the environment, such as heavy fuel oil.

- (3.4) Continue raising standards in the fisheries and ensure best practice is adopted, including by developing a plan to phase out heavy fuel [and] [restrict] bunkering activity.

The strategic environmental assessment approach discussed in Section 1.2 above has deliberately been adopted for this study so as to ensure that the findings and recommendations are consistent with and, if accepted and implemented, will assist in delivering to the Strategy objectives of G-SGSSI.

2.2.3 Marine Protected Area

Additional context for this assessment is provided by the management plan for the SGSSI marine protected area (MPA; Figure 3). The MPA was originally designated in 2012, and substantively revised in 2013 by means of the South Georgia & South Sandwich Islands Marine Protected Areas Order (2013).

![Figure 3. The SGSSI MPA (Source: SGSSI Management Plan v2).](image-url)
The MPA encompasses the entire SGSSI Maritime Zone north of 60°S and an area of 1.07 million km².

The overarching objectives of the MPA as set out in the management plan are to:

- Conserve marine biodiversity, habitats and critical ecosystem function;
- Ensure that fisheries are managed sustainably, with minimal impact on associated and dependent ecosystems;
- Manage other human activities including shipping, tourism and scientific research, to minimise impacts on the marine environment;
- Protect the benthic fauna from the destructive effects of bottom trawling;
- Facilitate recovery of previously over-exploited marine species;
- Increase the resilience of the marine environment to the effects of climate change;
- Prevent the introduction of non-native marine species.

The MPA includes a series of no-take zones for fishing; a series of benthic-closed areas, and a seasonal restriction on the krill fishery, which is prohibited within the MPA between 1 November and 31 March.

The MPA management plan also records that G-SGSSI is considering restricting the use and carriage of heavy fuels in inshore waters around South Georgia & the South Sandwich Islands.

### 2.2.4 Additional Environmental Measures for the Territory

G-SGSSI has in place a series of additional measures to ensure the highest standards of environmental management and conservation across the Territory.

#### 2.2.4.1 Environmental Charter

In 2001, GSGSSI adopted an Environmental Charter, jointly with the UK Government that provides a framework for the development of environmental policies, as well as helping G-SGSSI to implement appropriate multilateral environmental agreements to which the UK is a party (http://www.gov.gs/environment/environmental-charter/).

Included within the Environmental Charter are the provisions that G-SGSSI will, *inter alia*:

- Ensure that environmental considerations are integrated within social and economic planning processes; promote sustainable use of natural resources within the territory.
- Ensure that environmental impact assessments are undertaken before approving major projects.
- Commit to open and consultative decision-making on developments and plans which may affect the environment; ensure that environmental impact assessments include consultation with stakeholders.
- Ensure that legislation and policies reflect the principle that the polluter should pay for prevention remedies; establish effective monitoring and enforcement mechanisms.
2.2.4.2 National Biodiversity Action Plan

Consistent with the Environmental Charter discussed above, the UK’s accession to the Convention on Biological Diversity (CBD) was extended to include South Georgia & the South Sandwich Islands in 2014. In response, and as required by the CBD, G-SGSSI developed and published a National Biodiversity Action Plan (NBAP) in 2016 (G-SGSSI, 2016).

The vision set out in the NBAP is:

To work in partnership with experts and stakeholders in the UK and the rest of the world to conserve the biodiversity and ecosystem function of the South Georgia & the South Sandwich Islands’ environment for the benefit of all human kind, and to facilitate responsible access, ensuring that the Territory remains at the forefront of cutting-edge environmental management best practice.

To achieve this vision, the NBAP sets out eight objectives, including to:

- Understand and, where possible, mitigate the risks from substances that have the potential to harm the environment such as heavy fuel oil and pollutants present in old whaling stations.

To achieve this objective the NBAP states that G-SGSSI will review the carriage and use of heavy fuel in the SGSSI Maritime Zone by visiting vessels by:

- Assessing the frequency with which vessels burning heavy fuel oil operate within the Territory;
- Developing, in consultation with stakeholders, a plan to phase out the burning and carriage of heavy fuel.

2.2.4.3 ACAP Implementation Plan

In 2004, the UK ratified the Agreement on the Conservation of Albatrosses and Petrels (ACAP), including on behalf of its South Atlantic Overseas Territories. The primary objective of ACAP is to maintain a favourable conservation status for albatrosses and petrels that it lists in its Annex 1.

To meet their obligations under ACAP each Party is required to develop an Action Plan, the framework of which is set out in Annex 2 to the Agreement. To assist in meeting its ACAP obligations, GSGSSI has prepared an ACAP Implementation Plan (G-SGSSI, 2017).

The ACAP Action Plan framework provides for the Parties to “endeavour individually and collectively to manage marine habitats so as to [inter alia] avoid pollution that may harm albatrosses and petrels”.

Individual species actions plans have also been developed for several ACAP species breeding on South Georgia.
2.2.4.4 Important Bird Areas

In 2012, South Georgia and (separately) the South Sandwich Islands were designated as Important Bird and Biodiversity Areas (IBAs) under criteria established by BirdLife International (Birdlife, 2017). South Georgia holds one of the world's most abundant and diverse seabird communities, whose total breeding population probably exceeds 30 million pairs across 31 species. Ten bird species that breed on South Georgia are of global conservation concern (Poncet, 2006).

2.2.4.5 Terrestrial Protected Areas

Following the completion of a multi-season rodent and reindeer eradication programme undertaken by the South Georgia Heritage Trust (SGHT) and G-SGSSI (see Section 2.2.4.6 below), the Government is in the process of progressing the compilation of temporal and spatial data on biodiversity and threats to the ecology throughout the Territory in order to undertake a spatial prioritisation analysis, which will direct the development of a network of terrestrial protected areas (G-SGSSI pers. com.).

To support the eradication programme visitors are only permitted to land at designated visitor sites (Figure 4); not least to allow careful monitoring of sites to ensure rodent-free status.

Requests to visit and undertake activities outside of these designated visitor sites are considered on a case by case basis and require a regulated activity permit. Access will not normally be permitted to a number of particularly pristine areas and sites which have historically been rodent-free. Due to their historic and enduring rodent-free status, certain islands including the Willis Islands, Bird Island, Annenkov Island and Cooper Island are considered to be of particular ecological importance.

Figure 4. Designated visitor sites (grey markers) along the northern coast of South Georgia. Source: South Georgia GIS http://sggis.gov.gs.
2.2.4.6 Non-native Species Eradications

Like all sub-Antarctic Islands, South Georgia’s native biodiversity has been impacted by invasive species including rats, mice, reindeer and (certain) plants (Frenot et al., 2005).

Since 2010 the South Georgia Heritage Trust has led and funded a major rodent eradication programme. In parallel G-SGSSI has led and funded a programme to eradicate the invasive reindeer from South Georgia.

All reindeer have now been removed from South Georgia. All areas of the island that were known to be infested with rodents have been treated and it is hoped that the island of South Georgia is rodent-free for the first time in over 100 years. It is anticipated that many of the ground-nesting seabirds that were unable to successfully breed on the mainland will return.

Monitoring continues to be undertaken to verify rodent-free status around the island or identify where additional baiting may need to be carried out.

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Collectively this suite of legal and administrative environmental arrangements put in place by G-SGSSI reflect the importance of the natural heritage of SGSSI; described by Rogers et al. (2015) as a region containing wildlife populations of immense global significance.

Rogers et al. (2015) attempted to assess the “non-use” value of the natural capital of SGSSI as a haven for the largest and most diverse populations of seabirds and marine mammals on Earth, and the most speciose marine ecosystem in the whole Southern Ocean. Combined with its wilderness, heritage and economic (tourism and fisheries) value, the Territory clearly holds tremendous worth. Rogers et al. noted the significant challenges in undertaking such valuation studies though concluded that the islands’ biodiversity was likely to constitute its overwhelming economic value. Drawing comparisons with the non-use value of Prince William Sound, estimated during court proceedings following the Exxon Valdez oil spill in 1989, Rogers et al. estimated that a non-use value for SGSSI would likely be measured in billions of US dollars.

The G-SGSSI Strategy, the MPA and the series of additional environmental and conservation designations and actions noted above, provide a comprehensive policy and management framework for high standards of environmental protection across the Territory commensurate with its global biological significance. Future policy decisions, such as those considered by this assessment related to fuel management, need to be taken in the context of, be consistent with and help to reinforce these very high standards and expectations.
2.3 Current vessel activity and fuel use

2.3.1 Vessel activity

Numerous vessels of differing types undertake a range of activities within the SGSSI maritime zone. This includes research vessels, tourist vessels (of different passenger capacity), naval vessels, fishing vessels (both trawlers and long-liners), resupply (or reefer) vessels, tankers, the G-SGSSI fishery patrol vessel, Pharos SG, and yachts.

The number of vessels operating in the SGSSI maritime zone varies from year to year, though vessels are present in the maritime zone all year round. Broadly this involves passenger and research vessels during the summer months and fishing and resupply vessels during the winter months; though there are periods of overlap in spring and autumn (Figure 5).

![Figure 5. Number of calls to KEP made by individual vessels of different type during 2016.](image)

Passenger vessels are the most frequent visitors to SGSSI. During the 2016 calendar year, 27 individual passenger vessels made a total of 75 separate visits to King Edward Point (KEP) (as well as potentially landing passengers at other designated visitor sites). This is similar to previous years when 65 separate ship visits (number of individual ships unknown) to KEP were recorded during the 2014/15 season (approximately October to April), and 70 during the 2008/09 season (number of individual ships unknown).

Only passenger ships which are members of the International Association of Antarctica Tour Operators (IAATO) are permitted to land at designated visitor sites (Figure 4).
Passenger vessels are normally required to make their first landing at Grytviken, adjacent to KEP in Cumberland East Bay (unless the permit holder has been briefed recently and meets criteria to land passengers first at other designated sites) in order to complete arrival formalities, receive briefings, complete biosecurity inspections and pay harbour and visitor fees. Passengers will then be afforded the opportunity to visit a number of designated visitor locations (in Cumberland Bay and elsewhere on the island), which involves the vessel operating close to shore and disembarking passengers by small inflatable boats or launches (Figure 6).

The number of fishing vessels prosecuting the toothfish, icefish and krill fisheries can vary significantly from year to year, depending upon a number of factors including set catch limits. During the 2016 fishing season (April to October) 20 vessels were licenced to fish or support fishing activity in the SGSSI maritime zone.

All fishing vessels and support vessels are required to call in to KEP for licensing purposes (Figure 7). Most of their time will be spent offshore in the fishing grounds, although they will occasionally seek shelter in coastal areas of South Georgia. Where fishing vessels can operate and their catch limits are controlled internationally through agreements reached (in the form of Conservation Measures) by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), and by G-SGSSI through the provisions of the SGSSI marine protected area (MPA) and conditions placed on fishing licences. Within these constraints, the precise areas of operation of fishing vessels will also be determined by the species being harvested (krill, toothfish or icefish) and the season.
Reefer vessels including tankers will support the krill trawler vessels. They are also required to report to KEP and transhipment of catches or fuel is only permitted within Cumberland East Bay (Figures 15 and 16).

Activities undertaken by research vessels will vary depending upon the nature of the research being supported. This could involve working close to shore in order to land terrestrial research teams, as well as coastal sampling and observation work, including from small boats, or working offshore conducting deeper water oceanographic or biological research and measurements.

British naval vessels will make occasional visits to South Georgia for training or patrol purposes, to support fisheries inspections or to support scientific research in the area (Figure 8).
The South Georgia fisheries patrol vessel, *Pharos SG* will spend up to 300 days in the SGSSI maritime zone undertaking observations, supporting research and undertaking inspections of fishing vessels (Figure 9).

![Figure 9. FPV Pharos SG at King Edward Point (Source: http://www.CCAMLR.org).](image)

### 2.3.2 Fuel use

Information on the types of fuel being carried or used on vessels operating within the SGSSI maritime zone is limited.

From surveys undertaken by G-SGSSI, it seems that the vast majority of passenger vessels, all research vessels and the G-SGSSI fisheries patrol vessel use distillate fuels (i.e. marine gas oil (MGO)). Consequently, use of heavier fuels appears to be confined to some fishing vessels.

During the 2016 fishing season a survey was also undertaken of fuel being carried and used by all vessels associated with fishing activity around SGSSI. Vessels were asked to declare the volume and type of fuel being used or carried when calling in to King Edward Point (KEP) in Cumberland East Bay (for licensing and inspection purposes, including for transhipping and / or bunkering). The data collected during the 2016 survey involved 20 separate vessels: 7 trawlers, 6 long-liners, 5 reefers and 2 tankers, and is summarised in table 1 and figures 10 and 11.
Table 1. Fuel types and volumes declared by vessels involved in fishing activities during the 2016 fishing season. The only HFO declaration is marked in red. All IFO declarations are marked in yellow.

<table>
<thead>
<tr>
<th>Fishing Vessel</th>
<th>Type of Vessel</th>
<th>Call number at Cumberland East Bay</th>
<th>Fuel Type</th>
<th>Quantity Cubic Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel_1</td>
<td>Fishing Longliner</td>
<td>1</td>
<td>MGO</td>
<td>342</td>
</tr>
<tr>
<td>Vessel_2</td>
<td>Fishing Longliner</td>
<td>1</td>
<td>MGO</td>
<td>510</td>
</tr>
<tr>
<td>Vessel_3</td>
<td>Fishing Longliner</td>
<td>2</td>
<td>MGO</td>
<td>355</td>
</tr>
<tr>
<td>Vessel_4</td>
<td>Fishing Longliner</td>
<td>1</td>
<td>MGO</td>
<td>366</td>
</tr>
<tr>
<td>Vessel_5</td>
<td>Fishing Longliner</td>
<td>1</td>
<td>MGO</td>
<td>247</td>
</tr>
<tr>
<td>Vessel_6</td>
<td>Fishing Longliner</td>
<td>1</td>
<td>MGO</td>
<td>1140</td>
</tr>
<tr>
<td>Vessel_7</td>
<td>Fishing Longliner</td>
<td>2</td>
<td>MGO</td>
<td>1100</td>
</tr>
<tr>
<td>Vessel_8</td>
<td>Fishing Longliner</td>
<td>3</td>
<td>not recorded</td>
<td>not recorded</td>
</tr>
<tr>
<td>Vessel_9</td>
<td>Fishing Longliner</td>
<td>4</td>
<td>HFO</td>
<td>360</td>
</tr>
<tr>
<td>Vessel_10</td>
<td>Fishing Longliner</td>
<td>5</td>
<td>MGO</td>
<td>780</td>
</tr>
<tr>
<td>Vessel_11</td>
<td>Fishing Longliner</td>
<td>1</td>
<td>MGO</td>
<td>906</td>
</tr>
<tr>
<td>Vessel_12</td>
<td>Fishing Longliner</td>
<td>2</td>
<td>MGO</td>
<td>370</td>
</tr>
<tr>
<td>Vessel_13</td>
<td>Fishing Longliner</td>
<td>3</td>
<td>MGO</td>
<td>335</td>
</tr>
<tr>
<td>Vessel_14</td>
<td>Fishing Longliner</td>
<td>4</td>
<td>MGO</td>
<td>1140</td>
</tr>
<tr>
<td>Vessel_15</td>
<td>Fishing Longliner</td>
<td>5</td>
<td>MGO</td>
<td>320</td>
</tr>
<tr>
<td>Vessel_16</td>
<td>Fishing Longliner</td>
<td>6</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_17</td>
<td>Fishing Longliner</td>
<td>7</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_18</td>
<td>Fishing Longliner</td>
<td>8</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_19</td>
<td>Fishing Longliner</td>
<td>9</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_20</td>
<td>Fishing Longliner</td>
<td>10</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_21</td>
<td>Fishing Longliner</td>
<td>11</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_22</td>
<td>Fishing Longliner</td>
<td>12</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_23</td>
<td>Fishing Longliner</td>
<td>13</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_24</td>
<td>Fishing Longliner</td>
<td>14</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_25</td>
<td>Fishing Longliner</td>
<td>15</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_26</td>
<td>Fishing Longliner</td>
<td>16</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_27</td>
<td>Fishing Longliner</td>
<td>17</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_28</td>
<td>Fishing Longliner</td>
<td>18</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_29</td>
<td>Fishing Longliner</td>
<td>19</td>
<td>MGO</td>
<td>311</td>
</tr>
<tr>
<td>Vessel_30</td>
<td>Fishing Longliner</td>
<td>20</td>
<td>MGO</td>
<td>311</td>
</tr>
</tbody>
</table>

Total Vol (m3) all fuels recorded: 41427
Average Vol (m3): 679.13
Max Vol (m3): 2310
Min Vol (m3): 5
The collected data reveal that the most of these vessels were also using or carrying only MGO. A proportion of the total volume of fuel declared (13%) was identified simply as “IFO”, with a more precise specification lacking.
All of the long-line fishing vessels (only one of which made more than one call into KEP) declared only MGO.

Of the seven trawlers that called into KEP, all but one made more than one call into KEP. Three trawlers declared only MGO at each visit. Four trawlers declared the use or carriage of both MGO and IFO (again with the actual grade unspecified on almost all occasions) with differing volumes on each call.

For example, trawler number seven made five separate calls to KEP and declared carriage or use of only MGO on four occasions, but on one occasion also declared carriage or use of 360m$^3$ of HFO. Trawler number eight made five separate calls into KEP and declared only MGO on three occasions, but also declared carriage or use of IFO (unspecified) on two occasions (355m$^3$ and 5m$^3$ respectively).

Trawler number 10 made seven visits to KEP. It declared only MGO on just two occasions and both MGO and IFO of varying volumes on each of the remainder of its calls (IFO was unspecified in all but one call when it declared 86m$^3$ of IFO30).

Trawler number 14 made three calls into KEP. On the first visit, it declared 800m$^3$ of IFO30 only. On its next two visits, it declared only MGO (839m$^3$ and 440m$^3$ respectively).

The data also reveals that for those vessels (all trawlers) that declared carriage or use of both MGO and IFO (of any grade), the first declaration made during their first call at KEP, in all but one case, was only for MGO. The exception was a trawler that declared IFO30 (only) during its first visit (and then MGO only on each of its next two visits).

It is possible (though not verified) that these trawlers had been operating south of 60° south (where the prohibition on carriage and use of fuels heavier than IFO180 applies) prior to moving into SGSSI waters for the start of the SGSSI krill season. They may then have taken on heavier (and cheaper) fuels either in Port Stanley or when bunkering in Cumberland East Bay.

In this regard, it is noted that all five reefer vessels and one of the two tanker vessels operating in the SGSSI maritime zone during the 2016 season declared carrying or using both MGO and IFO (of differing or unspecified grades). One of the two tankers made only one call to KEP and declared only MGO.

What the data suggest, though this has not been fully verified, is that at least for this one season, all fishing vessels appear to have the capability of operating on MGO.

It is not clear whether the reefer and tanker vessels were carrying heavier grade fuels only for bunkering purposes (i.e. to transfer to a trawler) or solely for their own use, or both.

A similar vessel fuel survey was undertaken by G-SGSSI between October 2008 and October 2009 (G-SGSSI, 2010). Direct comparisons with that survey and the survey undertaken in 2016 are difficult due to the differing ways in which the data was collected. The report of the 2008/09 survey refers simply to “HFO use” for example, but does not define what grades of
fuel are included in the term “HFO”.

Nonetheless, the 2008/09 survey records that 41% of all fishing vessels declared carriage of HFO. If it is assumed that the term HFO included all intermediate and heavy fuels, then this compares with a figure of just 22% for the 2016 season (Figure 10). To the extent that these two seasons of data can be compared, the more recent data would imply at least a reduced use of heavier fuel oils by the fishing industry.

Subject to decisions taken in light of this assessment, an opportunity exists to continue to collect data (in the form of declarations of types and volumes of fuel carried and used) from, at least the fishing vessels, if not all vessels that call into KEP. Even if this were continued for a few seasons only it would provide a monitoring check to verify implementation of actions taken following this assessment. If that were to be the case it is strongly suggested that adequate information is obtained from the vessels as to the grade of fuel being carried (if intermediate fuels continue to be permitted). **This is addressed as a recommendation in Section 7.**

2.4 Current ability to respond to incidents

It is widely accepted with the oil and gas industry that the speed with which response efforts can be mobilised significantly affects the extent to which the environment (ecosystems, habitats and species) are impacted (Walker, 2017).

The effectiveness of response action will vary significantly depending upon numerous factors including weather conditions and the location of the spill, as well as the availability of and ability to deploy response equipment, the training of personnel and the extent to which prior response planning has been undertaken.

G-SGSSI currently has no in situ capability to respond to a fuel spill event if one were to occur in the SGSSI maritime zone. No response equipment is held on South Georgia and currently the Territory has no prepared oil spill response plan³. This situation has a significant bearing on the assessment of fuel spill risks and places greater emphasis on the need to reduce the likelihood and consequences of a spill event occurring. This is further discussed in Section 6 and **addressed through a recommendation in Section 7.**

Were a fuel spill event to occur there would be a heavy reliance on any support that might be provided from other vessels operating in the area, as well as potential deployment of equipment

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³ It is noted that oil spill response plans have been prepared by the British Antarctic Survey (BAS) for their facilities at King Edward Point and Bird Island, and that some response equipment is held at each location. However, the response plans and the response equipment held by BAS have been designed only to respond to fuel spills that may occur during its own operations and only for the types and volumes of fuel used by BAS. BAS response plans and equipment have not been developed to deal with a medium to large scale spill from a vessel.
from the Falkland Islands or from South America; all of which could take days to weeks to organise.

The Falkland Islands Government has had a National Oil Spill Contingency Plan (NOSCP) in place since 1998 (updated in 2010), and which reflects the most likely type of spill that is expected, i.e. minor spills within harbours. Oil spill response equipment stored at FIPASS (Falkland Interim Port and Storage System) includes booms and oil recovery equipment for use on small to medium spills (Tier 1 and 2) from MGO to IFO/ HFO. Stanley Services Ltd., also possess limited specialised equipment to deal with a marine oil spill. The UK military port at Mare Harbour on East Falkland also holds some oil spill response equipment.

The extent to which such equipment on the Falkland Islands would be available to deploy to South Georgia is unknown.

The nearest oiled seabird rehabilitation facility is also in the Falkland Islands, and is run by Falklands Conservation. The facility deals with low numbers of seabirds, specifically oiled penguins and was developed in response to a review of the Islands’ ability to deal with oiled wildlife in 2010. Falklands Conservation, which runs the facility, states that the facility is able to respond to small-scale oil spills and has capacity to deal with up to 20 seabirds at any one time.

The transfer of large numbers of oiled birds from South Georgia to the facility on the Falkland Islands would be logistically challenging. It is 800 nautical miles or approximately five days from South Georgia to the Falkland Islands by vessel.

Ruoppolo et al. (2013) conducted a survey of national operators in the Antarctic, and concluded that national, fishing and tourism operators are manifestly unprepared for an oiled wildlife event in the Southern Ocean, and noted that a collective approach to addressing this shortfall is needed.

For the high north, considerable effort has gone into emergency preparedness and response planning for oil spill response in cold and remote locations. This has been driven, not least by the major hydrocarbon exploration and extraction industry that exists in the Arctic, which presents risks of much larger spills than are likely in the un-exploited Southern Ocean. Nonetheless, experience and expertise developed in the Arctic could be drawn upon to address deficiencies in preparedness and response in the Antarctic region (see for example EPPR, 2015).

2.5 Current environmental pressures

The impact of a fuel spill in the SGSSI maritime zone has not been realised, though the risk remains. But assessing the potential consequences of a spill needs also to account for existing pressures on the environment and ecology of SGSSI.
2.5.1 Climate change

Climate change is considered to be the most important threat to Antarctic and sub-Antarctic environments (Bennett et al., 2015). Climate change is not only a direct threat to the environment, it also exacerbates other environmental stressors. For example, rapid climate change on the Antarctic Peninsula to the south of South Georgia, in concert with increasing human activity, is exacerbating the risk of introducing non-native species (Chown et al., 2012).

Signals of change on South Georgia include significant glacial retreat across the island. In recent years, smaller mountain and valley glaciers have progressively receded and a number will soon disappear. Most larger tidally exposed and sea-calving valley and outlet glaciers have receded; some of these retreats have been dramatic (Gordon, 2008).

Climate change is predicted to have profound long-term effects on penguin species, not only through impacts on productivity regimes and food webs, but also through the spread and introduction of new diseases and toxic poisoning (Shumway et al. 2003) to hitherto unexposed penguin populations with probably low resistance (Trathan et al., 2014; Bollmer et al., 2007; Nims et al., 2008).

Given the significant dependence upon marine foraging for many of SGSSI’s birds and seals, changes in the marine environment are of particular concern. The Southern Ocean sea surface temperature is predicted to continue to warm and sea ice extent shrink as concentrations of atmospheric greenhouse gases increase (Turner et al., 2013).

The near surface waters of South Georgia are among the fastest warming on the planet with a mean increase of 0.98°C in January and 2.38°C in August determined for the top 100 m of the water column over the last 80 years (Whitehouse et al., 2008). Such changes are almost certainly affecting krill populations (Fielding et al., 2014).

Several top predator species are affected by fluctuations in these oceanographic variables. Population models combining projections for sea surface temperature and sea ice extent predict steep declines over a 50-year period for black browed albatross and snow petrels, both of which breed on South Georgia (Barbraud et al., 2011). A significant part of these predicted declines was considered likely to be due to reduced krill availability. Sea ice retreat in the Southern Ocean has already been linked to reductions in Antarctic krill (Euphausia superba) (Meyer, 2012) and is predicted to have consequences for krill dependent species (Siniff et al., 2008).

Ocean acidification, another threat linked to rising CO₂ levels, may lower hatch rates of krill (Kawaguchi et al., 2013) and cause shell dissolution in pteropods (Bednaršek et al., 2012), potentially inducing population collapses for these key mid-trophic-level organisms; and with potential consequences also for krill-dependent species.

The marine environment around South Georgia has been recorded as the most speciose region in the Southern Ocean, including many rare species. Marine invertebrate fauna is dominated by endemic and many range-edge species potentially at their thermal limits. Consequently, continuing sea temperature rises may result in the loss of some range-edge species and
extinction, at a global scale, of some of South Georgia’s endemic marine species (Hogg et al., 2011).

2.5.2 Non-native species

The rodent and reindeer eradication programmes undertaken on South Georgia appear to have been a great success (though final rodent surveys have yet to be undertaken; SGHT, 2016) and have removed significant pressures on several species, not least several breeding bird species.

A number of invasive plant and insect species remain throughout the island with potential consequences for native terrestrial biodiversity (Frenot et al., 2005). Efforts are underway to manage non-native plants, with the Government recently awarding a five-year contract for deployment of a weed management plan. There are no known established non-native marine species and a monitoring programme has been established to verify this (G-SGSSI pers. com.).

2.5.3 Other human activities

Fishing, tourism and research activity in and around SGSSI adds additional pressures on habitats and species.

In spite of the ongoing successes in reducing seabird bycatch within the SGSSI Maritime Zone to negligible levels, many of the South Georgia albatross and petrel populations continue to decline. Indeed, South Georgia currently includes some of the most rapidly declining albatross populations in the world (Varty et al., 2008).

Poncet et al. (2017) conducted surveys of three species of albatross (the wandering albatross, black-browed albatross and grey-headed albatross) in November 2014 to January 2015, repeating previous surveys conducted in the 2003/2004 season. They found numbers of wandering albatrosses breeding annually at South Georgia had decreased by 18%. Over the same period, black-browed and grey-headed albatrosses decreased by 19% and 43% respectively. These ongoing negative trends at South Georgia since the 1970s are of major conservation concern.

These declines are thought to be as a result of incidental mortality in long-line and trawl fisheries operating outside of the SGSSI maritime and CCAMLR region, particularly during migration and when not breeding (G-SGSSI, 2017). Poncet et al. (2017) note that more research is required to investigate the respective roles of bycatch and climate change in driving these population trends.

With increasing human activity in the region, concerns over disturbance effects on Antarctic and sub-Antarctic wildlife remain. In a recent reassessment of research on human disturbance to wildlife over the last three decades in the Antarctic and sub-Antarctic region, Coetzee and Chown (2015) found that (observable) animal behavioural changes do not necessarily reflect more cryptic (physiological), and more deleterious impacts, such as changes in physiology, or long-term changes in population trends. They advised that pedestrian approach guidelines in the region should be re-assessed as a result.
Such environmental stressors are insidious, ongoing and only variably measured and/or monitored. Any oil spill event, has the potential to further impact species already under stress and could be significantly deleterious to SGSSI biota (this is addressed further in Section 3.4).
3. Fuel and the marine environment

3.1 General

Globally, spills of hydrocarbons from vessels have decreased significantly in recent decades (Figure 12) as a consequence of improving vessel standards as well as improvements in standards of operation.

Much of this improvement has come about as a result of legislative, policy and operational responses to major pollution events such as the Exxon Valdez oil spill in Prince William Sound, Alaska in 1989. The tanker ran aground on Bligh Reef in March 1989 and released approximately 36,000 tonnes (over 40,000 m³) of Alaska North Slope crude oil. More than 2,000 km of coastline was oiled and large numbers of birds, seals and sea otters were killed directly (National Research Council, 2003). Despite the aggressive cleanup that occurred immediately after the spill, oil residues persisted for more than 13 years in sheltered habitats and along porous gravel beaches.

The Exxon Valdez oil spill as well as other large scale oil spill events have changed much about what is now done to prevent such spills, to be better prepared for response, and to select shoreline cleanup methods, as well as to understand the acute and long-term impacts of oil on a wide range of species, communities, and habitats.

The release of petroleum to the marine environment can take place in a wide variety of ways (e.g. natural seepage and at points of extraction, transportation and consumption), and the size
and impact of releases varies dramatically as each release involves a unique combination of physical, chemical, and biological parameters.

Petroleum entering the marine environment through spills or chronic releases, is eventually broken down or removed from the environment by natural processes or is diluted to levels well below concentrations of concern. However, from the time the material enters the environment until it is removed or sufficiently diluted, it poses a threat to the environment. The magnitude of that threat varies dramatically depending upon the size, composition, location, and timing of the release, the interactions of the introduced petroleum with various processes that affect the material after its introduction, and the sensitivity of the organisms that are exposed.

3.2 Heavy fuel oils in the marine environment

The chemical and physical characteristics of the fuel that is spilt will have a significant bearing on the environmental impacts that occur. Of particular concern in this regard are heavier, residual fuel oils.

The literature provides good evidence that the heavier or more viscous the fuel, the more significant are the implications for the environment as well as for clean-up, and that these implications can be more pronounced in cold water and cold weather conditions (Ansell et al., 2001).

Table 2 summarises the differing responses of fuel types to the physical processes that occur when they are exposed to the environment.

<table>
<thead>
<tr>
<th>Fuel type</th>
<th>Persistence</th>
<th>Evaporation</th>
<th>Emulsification</th>
<th>Dissolution</th>
<th>Oxidation</th>
<th>Horizontal transport</th>
<th>Vertical transport</th>
<th>Sedimentation</th>
<th>Shoreline stranding</th>
<th>Tar balls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>Days</td>
<td>H</td>
<td>NR</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Light distillates</td>
<td>Days</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Residual fuels</td>
<td>Months / Years</td>
<td>L</td>
<td>M</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

Key: H = high; L = low; M = moderate; NR = not relevant

Highly refined products exhibit well-defined and predictable characteristics since the distillation process results in products (such as gasoline) that contain a range of similar hydrocarbon compounds within a narrow distillation temperature band. Evaporation rates when spilt tend to be high, even in relatively cold environments, resulting in relatively rapid disappearance and lower environmental impacts.

Lighter distillate fuels have a low viscosity and spread more rapidly into thin sheens when spilt. They do not tend to form emulsions except under very cold conditions. They evaporate more slowly (compared to gasoline) and incompletely. As low-viscosity, moderately persistent oils, light distillates tend to disperse readily into the water column by even gentle wave action. Thus, they have the highest potential of any oil type for vertical mixing. There is also a greater
potential for dissolution to occur, from both surface sheens and droplets dispersed in the water column. The water-soluble fractions are dominated by two- and three-ringed poly-aromatic hydrocarbons (PAHs), which are moderately volatile and may affect aquatic biology. Thus, spills of light distillates have the greatest risk of impacting water-column resources. Light distillates are not very adhesive and do not adhere strongly to sediments or shoreline habitats. Loading levels on the shoreline are relatively low because of the thinness of sheens on the water surface and the low adhesion of stranded oil. The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation.

Residual fuel oils, such as intermediate and heavy fuel oils are more diverse. They consist of the viscous and tarry residues of crude oil refining with complex mixtures of heavy aliphatic and aromatic compounds, bitumens and asphaltenes. For use in vessels they are often blended with lighter fuels to meet viscosity specifications and engine / burner requirements. Consequently, the characteristics of heavy fuel oil will be determined by the crude oil from which it is derived, as well as the fuels with which it is blended.

Heavy fuel oils tend to lose only up to 10 percent of their volume via evaporation when spilt. Some products are so viscous that they cannot form emulsions, but many emulsify shortly after release. They show low natural dispersion because the oil is too viscous to break into droplets. These oils have the lowest water-soluble fraction; thus, loadings to the water column are generally low under slicks. Spills of heavy distillate fuels quickly break up into thick streamers and then fields of “tar balls” that are highly persistent and often difficult to spot by aerial observers. The heavy distillate can be transported hundreds of miles, eventually stranding on shorelines and posing significant impacts to birds and other marine animals. Because of their high density, these releases are more likely to sink after picking up sediment, either by mixing with sand in the surf zone or after stranding on sandy shorelines. Some heavy distillates are so dense that they are heavier than brackish or sea water and will not float when spilled (Ansell et al., 2001).

These variables in fuel characteristics also determine the bio-availability of toxic compounds in spilt fuel (see Sections 3.4.1 and 3.4.2).

The reason heavier residual fuels remain in use by vessels is that they have the principal advantage of being cheaper than refined fuels. A comparison of world fuel prices undertaken on 1 March 2017 is shown in table 3.

<table>
<thead>
<tr>
<th>Fuel type</th>
<th>Average price across 11 global bunker ports (USD / MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFO 380</td>
<td>327.27</td>
</tr>
<tr>
<td>IFO 180</td>
<td>364.23</td>
</tr>
<tr>
<td>MGO</td>
<td>542.00</td>
</tr>
</tbody>
</table>

Table 3. Average fuel price of three different fuel types on 1 March 2017. Source:http://shipandbunker.com/prices
The two main disadvantages of heavier residual fuels when compared to distillate fuels are the more polluting emission products during use (in particular sulphur products as well as black carbon) and the short and longer-term impacts that can arise if fuel is accidentally discharged to the environment.

3.3 Bunkering

Bunkering is the term used for the supply of fuel to ships. The term is generally applied to the process and logistics involved in transferring fuel on to a ship and storing the fuel in the ships tanks.

Bunkering can take place in port, either directly from the wharf (fuelling point or mobile tanker), from a fuelling barge, or at sea by ship-to-ship transfer. Ship-to-ship (STS) transfers can be undertaken with either both vessels underway or one ship moored alongside another at anchor.

For South Georgia & the South Sandwich Islands the closest port for bunkering is Stanley in the Falkland Islands. Main port access is restricted to the Falklands Interim Port and Storage System (FIPASS; Figure 13). This facility is made up of seven permanently moored barges providing approximately 300m of birthing face. Water depth for mooring ranges from about 5.7 to 7m per mooring location. This is a restricted harbour providing little access for vessels to unload or load and the congestion is compounded when vessels need to enter this port specifically for bunkering.

![Figure 13. FIPASS, Stanley, Falkland Islands.](image)

Bunkering at sea with two separate vessels increases the risk of accident or incident and can be dangerous, especially in rough weather conditions.

Fuel transfers involving tankers of 150 gross tonnage and above have been regulated on a statutory basis since the implementation of MARPOL, Annex 1, Chapter 8, which entered into force on 1 January, 2011. These ships are required to carry an STS (ship-to-ship) operations plan, which has been approved by their flag administration.
SOLAS Chapter VI Regulation 5.1 also requires that a Material Safety Data Sheet (MSDS) should be provided for oil products carried on board ships.

In addition to the IMO regulations, individual states and / or ports have their own regulatory regimes covering bunkering operations. Many vessel owners also have their own specific requirements, instructions and procedures related to such operations, which are laid out in the ship’s Safety Management System (SMS) and/or the Shipboard Oil Pollution Emergency Plan (SOPEP).

In a global context fuel spills during bunkering activity tend to be infrequent, small and mostly occur in ports and harbours. Data collected by the International Tanker Owners Pollution Federation (ITOPF) over the period 1974 to 2003 suggest that the vast majority of spills during bunkering operations were less than 7 tonnes and that bunkering spills were around 12% of all operational spills over the same period (Table 4).

<table>
<thead>
<tr>
<th>Operation</th>
<th>&lt; 7 tonnes</th>
<th>&lt; 7 Tonnes (%)</th>
<th>7-700 tonnes</th>
<th>7-700 Tonnes (%)</th>
<th>&gt; 700 tonnes</th>
<th>Total tonnes</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading / discharging</td>
<td>2772</td>
<td>61.9</td>
<td>301</td>
<td>80.7</td>
<td>17</td>
<td>3090</td>
<td>63.4</td>
</tr>
<tr>
<td>Bunkering</td>
<td>542</td>
<td>12.1</td>
<td>25</td>
<td>6.7</td>
<td>0</td>
<td>567</td>
<td>11.6</td>
</tr>
<tr>
<td>Other operations</td>
<td>1167</td>
<td>26.0</td>
<td>47</td>
<td>12.6</td>
<td>0</td>
<td>1214</td>
<td>25.0</td>
</tr>
<tr>
<td>Total</td>
<td>4481</td>
<td>373</td>
<td>17</td>
<td></td>
<td></td>
<td>4871</td>
<td></td>
</tr>
</tbody>
</table>

3.4 Spills in High Latitude Environments

3.4.1 Low temperature effects on spilt fuels

High latitude, cold water environments present additional factors that need to be taken into account in assessing the risk of marine fuel spills. Extreme weather, ice conditions and isolation can influence the risk of accidents and contamination, and may impede responses to any pollution incidents that occur (Brown et al., 2016).

Fuel contamination can persist for long periods of time in high latitudes. A small terrestrial spill in East Antarctica was observed to be still present after 10 years (Gore et al., 1999), and at the site of an historic spill at Cape Evans on Ross Island, concentrations of total petroleum hydrocarbons and polyaromatic hydrocarbon in soil samples were still high after 90 years (Blanchette et al., 2004).
Low temperatures coupled with the presence of ice can significantly reduce oil spreading, increase viscosity and reduce the evaporation rate of the volatile components of oils in polar waters (Fingas and Hollebone, 2003; Faksness and Brandvik, 2008b; Brandvik and Faksness, 2009); factors that are exacerbated further when heavier fuels are spilt (Ansell et al., 2001).

Whilst hydrocarbon solubility decreases at low temperatures, aromatic compounds become enhanced in seawater due to reduced evaporation (Payne et al., 1991). This water accommodated fraction (WAF) is considered to be a major contributor to ecological impacts of an oil spill as soluble compounds are bioavailable to marine organisms in the water column and therefore have the potential to cause toxic effects (Neff, 2002; Faksness and Brandvik, 2008).

Brown et al. (2016) observed differing partitioning behaviours in seawater at 0°C and 5°C among three fuels: Special Antarctic Blend diesel, SAB; marine gas oil, MGO; and intermediate grade fuel oil, IFO180. They observed that the initial total hydrocarbon content (THC) of the WAF was highest for SAB, but that the THC was most persistent in IFO180 WAFs and most rapidly depleted in MGO WAF, with depletion for SAB WAF strongly affected by temperature.

Biodegradation rates are also much slower in cold environments (Siron et al., 1995; McFarlin et al., 2014). Laboratory experiments also support much reduced hydrocarbon mineralization rates at low temperatures (Aislabie et al., 2006; Horel and Schiewer 2011).

A consequence of such factors may be prolonged exposure of marine organisms to hydrocarbons in Antarctic waters (Stark et al., 2003).

3.4.2 Impacts on High Latitude Marine Biota

Fuel spills in Antarctica and the Southern Ocean are very low compared to other regions of the world and the area is considered to be the least polluted region globally (Snape et al., 2008).

Most fuel transported to the region is for use at Antarctic or sub-Antarctic stations, or is used on board ships (including passenger vessels, fishing vessels, research and logistical resupply ships).

Southern Ocean biota can take longer to respond to contaminants than related temperate biota due to their lower metabolic rates, slower uptake kinetics and slower growth / development rates (Raymond et al., 2017).

The most significant fuel spill event to occur from a vessel in the Southern Ocean was in 1989, when the Bahia Paraiso ran aground in Arthur Harbour, off the coast of southwest Anvers Island (Antarctic Peninsula) spilling 600,000 litres (approximately 600m³) of diesel fuel Arctic (DFA; a relatively volatile mixture of diesel and jet fuel).

In the first few weeks after the spill, intertidal macroalgae, limpets, birds, sediments and shores within a few kilometres of the wreck were coated with spilt fuel (Kennicutt et al., 1991). Limpet populations were reduced by 50% within the first few weeks of the spill and had not
fully recovered a year after the spill (Kennicutt and Sweet, 1992). Observations and analytical data suggest that a major portion of the Arthur Harbour ecosystem was exposed to the spilt fuel though with varying levels of impact (Kennicutt et al., 1990; Penhale et al., 1997).

Birds breeding in the area were exposed depending upon their behaviour. Adult birds were exposed through foraging for krill and fish, and chicks were exposed to oiled parents and through receiving contaminated food. 80% of the Adelie penguins breeding in the area were exposed with an estimated 16% increase in mortality above normal rates, as a result of exposure to the spilt fuel (Fraser and Patterson, 1997).

However, measurements on subtidal and benthic environments in the vicinity of the spill demonstrated negligible effects (Kennicutt, 1990). Kennicutt and Sweet (1992) suggest that the combination of the volatility of the fuel, wind and surf action and tidal scouring and transport of bottom sediments were factors in reducing the residence time of the fuel and the length of exposure to the ecosystem.

In other cases, oil in Antarctic sediments has been shown to persist for long periods of time due to slow degradation rates and long-term persistence of degradation products (Thomson et al., 2006), with long-term impacts on Antarctic marine benthic communities (Stark et al., 2014).

Among Southern Ocean megafauna, penguins are particularly vulnerable to fuel spills because they swim low in the water, must surface regularly to breathe, are less able to detect and avoid petroleum than other seabirds, and often encounter discharges of petroleum when they are at sea (Garcia-Borboroglu et al., 2008; Trathan et al., 2014). Mortality of penguins from petroleum is a long-term and large-scale problem. Globally, oil pollution through shipwrecks and oil spills is considered likely to be the major anthropogenic-induced cause of death among penguins (Garcia-Borboroglu et al., 2008). Petroleum pollution has killed thousands of penguins in Africa, Australia, New Zealand, South America, and Antarctica. The Southwest Atlantic, although not well known for petroleum pollution problems, is a chronic source of petroleum discharge. Magellanic penguins (Spheniscus magellanicus) are killed during their winter migration between Argentina, Uruguay and Brazil, when they encounter petroleum (Boersma et al., 1990; Gandini et al., 1994).

In the high north, the 1989 Exxon Valdez oil spill in which 42,000m³ of crude oil was spilt, resulted in significant acute mortalities across several species including 1000-2800 sea otters, 250,000 seabirds and over 300 harbour seals (Petersen et al., 2003). Longer-term chronic exposures resulted in elevated mortalities in several species, including sea otter, fish and seaducks for years after the spill (Petersen et al., 2003). Sea otter numbers for example remained at half their pre-spill levels 11 years after the event compared to a doubling of numbers in nearby un-oiled Alaskan locations, possibly due to continued foraging on contaminated clams and mussels (Dean et al., 2000).
4. Assessing the risks of the carriage, use and transfers of fuel in SGSSI Maritime Zone

4.1 Introduction

In assessing the likelihood and consequences of oil spills, it is important to note that every oil spill is a unique event that is influenced by the specific circumstances and environmental conditions at the time of the spill (Etkin et al., 2017).

Factors that will determine the fate and impacts of fuels when they are accidentally discharged to the marine environment, and which need to be considered in scenario planning (Etkin et al., 2017) include the:

- type of fuel spilt and its properties, i.e. persistence, toxicity, evaporation rates;
- volume of fuel spilt;
- rate of discharge to the environment;
- physical conditions of the receiving environment, i.e. water and air temperature, currents, tides, wind and wave conditions, and, in high latitudes, ice conditions;
- location of the spill and its proximity to sensitive environments;
- sensitivity of the receiving environment, i.e. local flora, fauna, habitats and socio-economic resources, all of which may vary depending upon the time of year;
- ability to respond, and timeliness of response.

All of these factors are important when assessing risk associated with fuel spills.

Etkin et al. (2017) promote the use of modelling tools to simulate an array of spill scenarios and estimate the consequences of those scenarios. NOAA (2014) provides an example of taking such a modelling approach to assessing oil spill risk and environmental vulnerability in a high latitude location.

Whilst modelling is beyond the scope of this assessment, it is likely that such an approach could have benefits for quantifying better the potential environmental effects of fuel spills (of all types) from vessels (of all types) operating in the SGSSI maritime zone. A reasonable body of oceanographic, meteorological and biological data is available for the region that would support such modelling effort, and this may be worth considering in the future.

A constraint in this assessment is the availability of sufficient, relevant data and information on vessel activity, fuel use and incidents specific to SGSSI. To overcome this limitation the risk assessment used here is a qualitative assessment drawing on what information is available.
### Risk Assessment Matrix

<table>
<thead>
<tr>
<th>Occurrence</th>
<th>Frequency</th>
<th>Probability</th>
<th>Likelihood</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is expected to occur</td>
<td>Event every year</td>
<td>100% annual probability</td>
<td>Almost certain</td>
<td>High</td>
</tr>
<tr>
<td>Will probably occur at some time</td>
<td>Event every 1-5 years</td>
<td>20-100% annual probability</td>
<td>Likely</td>
<td>Medium</td>
</tr>
<tr>
<td>Might occur at some time</td>
<td>Event every 5-10 years</td>
<td>10-20% annual probability</td>
<td>Possible</td>
<td>Low</td>
</tr>
<tr>
<td>Could occur at some time</td>
<td>Event every 5-10 years</td>
<td>2-10% annual probability</td>
<td>Unlikely</td>
<td>Low</td>
</tr>
<tr>
<td>May only occur in exceptional circumstances</td>
<td>Event every 50-200 years</td>
<td>0.5-3% annual probability</td>
<td>Rare</td>
<td>Low</td>
</tr>
</tbody>
</table>

#### Insignificant
- Any impact to the environment is transient and likely to recover within a single season;
- Or covers a very small area;
- Or occurs on an already heavily impacted site.

#### Minor
- Any impact to the environment is likely to recover within 12 months;
- Or covers a small area;
- Or occurs at a site where some previous disturbance has occurred;
- Or one or two individuals of one or two species partially affected.

#### Moderate
- Any impact to the environment is likely to recover within 2 or 3 seasons;
- Or covers a moderate sized area (e.g. head or one side of a fjord);
- Or occurs at a site that has received very little if any previous impact, or is "recovering";
- Or several (a few 10s) individuals of just a few species moderately affected.

#### Major
- Any impact to the environment that is likely to persist for several years;
- Or covers a large area (e.g. a whole fjord or bay or length of coastline);
- Or occurs at a sensitive, previously impacted site;
- Or many individuals (many 10s) of several species affected;
- Or some rare or endangered species affected.

#### Catastrophic
- Any impact to the environment is likely to be persistent;
- Or covers a large area (e.g. a long stretch of coastline or more than one fjord / bay);
- Or occurs at a highly sensitive location such as within a protected area;
- Or many individuals (many 10s to 100s) of several species affected (e.g. a whole colony);
- Or many rare or endangered species affected.
To support the assessment approach used here (and consistent with the FSA methodology and AS/NZS HB 203: 2012 standard described in Section 1.3) a risk matrix has been prepared to support the characterisation of risk (Figure 14).

Risk analysis involves a consideration of the sources of risk (the hazards), their positive or negative consequences (in this case for the environment) and the likelihood that those consequences may occur. Factors affecting both the likelihood and the consequences need to be determined.

For this assessment, a five by five risk matrix has been prepared (Figure 14). Likelihood and consequence descriptions have been developed based on several sources; notably the UN FAO Guide to Qualitative Risk Analysis (UN FAO, 2017), the SCCM Guide to ISO 14001: Identifying and evaluating environmental aspects (SCCM, 2014) and DEFRA’s Guidelines for Environmental Risk Assessment and Management: Green Leaves III (DEFRA, 2011).

Likelihood ratings include: ‘Rare’, Unlikely’, ‘Possible’, ‘Likely’ and ‘Almost certain’, with occurrence, frequency and probability definitions provided.

Consequence ratings include: ‘Insignificant”, Minor’, ‘Significant’, ‘Severe’ and ‘Catastrophic’, with impact descriptions provided to outline the severity of each. A financial cost estimate is also placed against each of these consequence ratings. The sums involved are speculative only and attempt to outline the potential cost of responding to a fuel spill event and to assist in visualising the potential scale of such events against each consequence rating; even though undertaking a response may not be feasible in some circumstances (see Section 2.4).

4.1.1 Risk Assessment and Risk Tolerance

Once a risk score has been established, an assessment needs to be undertaken to determine its acceptability (or not). HB 203: 2012 describes the difference between “acceptability” and “tolerability” when it comes to assessing the nature and timeliness of interventions.

Tolerability refers to the willingness to live with a risk on the understanding that it is being properly controlled. Tolerating a risk does not mean that it is regarded as negligible or can be ignored. Instead it may require on-going monitoring and assessment to determine options for reducing the risk further.

Acceptability relates to risks that are not considered to require further treatment. An acceptable level of risk infers that action is not considered worthwhile and that any actions taken are unlikely to result in significant reductions in risk levels.

An organisation’s approach towards such factors is sometimes referred to as its ‘risk appetite’. To assist in determining the acceptability and tolerability of the identified risk levels to G-SGSSI, the criteria set out in table 5 have been developed.

The criteria can be used to prioritise actions that are needed and can also assist in devoting resources needed to implement the identified actions.
Table 5. Risk tolerance and response criteria used to determine the extent of intervention required by G-SGSSI.

<table>
<thead>
<tr>
<th>Risk tolerance and response</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Acceptable within the context of Government policy and the MPA. Ongoing monitoring and review of the activity may be required to ensure risks remain low.</td>
</tr>
<tr>
<td>Medium</td>
<td>Acceptable within the context of Government policy and the MPA. Management intervention will need to be initiated within the timeframe of 3 to 5 years to reduce risk level further.</td>
</tr>
<tr>
<td>High</td>
<td>Inconsistent with Government policy and/or the MPA, though may be tolerable under some circumstances. Regulatory and/or management intervention will need to be initiated within 1 to 3 years to reduce risk levels further.</td>
</tr>
<tr>
<td>Critical</td>
<td>Highly inconsistent with Government policy and/or the MPA and unlikely to be tolerable. Regulatory or management intervention will need to be initiated within 12 months to reduce risk levels.</td>
</tr>
<tr>
<td>Extreme</td>
<td>Unacceptable within the context of Government policy and/or the MPA. Immediate regulatory or management intervention will need to be initiated to cease or significantly modify the activity.</td>
</tr>
</tbody>
</table>
4.2 Risks Associated with the Carriage and Use of Heavy Fuel Oils

4.2.1 Introduction

Whilst there are some controls in place on vessel activity that takes place within the SGSSI maritime zone (for example fishing controls established through the MPA and the designation of specific sites at which passenger landings can occur from tourist vessels), there are currently no controls in place on the carriage or use of fuel on any vessels operating in the SGSSI maritime zone.

4.2.2 Hazard identification – *what might go wrong?*

Globally, there is a large body of data and information on shipping incidents and vessel-related pollution events. Until 2012, the IMO published an annual report of international shipping facts and figures related to trade, safety, security and the environment.

The most recent, 2012 report (IMO, 2012) provides an overview of the causes of fuel spills between 7 and 700 tonnes over the period 1970 to 2011. The data is based on spills from tankers, but is useful here as a guide to the primary causes (Figure 15).

![Pie chart](Image)

*Figure 15. Primary causes of fuel spills (7-700 tonnes) from tankers for the period 1970-2016 (Source: ITOPF, 2016).*
IMO (2012) record that most spills (from tankers) result from routine operations such as loading and discharging, which normally occur in ports or at oil terminals. The majority of these operational spills are small, with some 91% involving quantities of less than 7 tonnes. Accidental causes such as collisions and groundings generally give rise to much larger spills, with at least 84% of incidents involving quantities in excess of 700 tonnes being attributed to such factors.

The European Maritime Safety Agency’s annual report on maritime incidents that occur in the territorial waters of EU states (EMSA, 2016) provides a summary of marine casualty events over the period 2011 to 2015 (Figure 16). The EMSA report records that navigational issues (i.e. groundings / strandings, collisions and contacts) represent 50% of all casualties with a ship over this period.

![Figure 16. Marine casualty events that have occurred in European waters or among vessels flagged to EU states between 2011 and 2015 (Source: EMSA, 2016).](image)

EMSA (2016) also record the contributing factors that gave rise to casualty events (Figure 17) recording that of 880 accidental events analysed during investigations, 62% were attributed to human error.
Based on this global information, a fault tree can be constructed to identify scenarios, which if they eventuated, have the potential to result in fuel (of any type) being released to the environment from a vessel operating within the SGSSI maritime zone. These are shown in the fault tree below (Figure 18).
It is possible that such a fault tree could be traced back further to identify potential root causes. For example, with regard to human error factors, root causes that could lead to poor watch keeping or poor navigation could include inadequate training and supervision, or inadequate safety standards being maintained on-board. Root causes contributing to equipment failure or a fire on a vessel could include inadequate maintenance and inspection regimes. All such factors have the potential to contribute to the ultimate outcome of fuel being spilled to the environment. However, for the purposes of this assessment, which is focussed particularly on the risks posed by heavy fuel oil, the underlying causes identified in figure 18 provide an appropriate starting point.

It is also noted that the grounding of a vessel, a collision with ice or sinking at sea may not always result in the release of fuel to the environment, though these are the most likely circumstances that would result in a vessel’s hull and/or fuel storage tanks being compromised allowing fuel to be released.

Any vessel operating in the SGSSI maritime zone could find itself in difficulty for a number of reasons, with the outcome of fuel being released to the environment. The risk posed to the environment of such an event will be a combination of the likelihood and consequences, each of which are influenced by a number of factors as discussed in Sections 4.2.3 and 4.2.4.

4.2.3 Likelihood of occurrence – how likely is it to happen?

A common approach to determining the likelihood of fuel spills occurring is the use of historical incident data (Etkin et al., 2017). Generally, such information is readily obtainable and can be easily analysed. However, caution needs to be exercised in taking such an approach in that past events may not adequately reflect future probabilities. As noted in Section 3.1, fuel spills to the environment have reduced significantly over time as a result of improved vessel design, construction, crew training and operation.

For the maritime zone of SGSSI, historical data have been challenging to find and it has not been possible to build an accurate account of past vessel incidents and spill occurrences with a high degree of confidence.

Nonetheless, vessel incidents do occur within the SGSSI maritime zone. Testament to the challenging maritime conditions around South Georgia are a number of historic (early 20th century) wrecks around the coast of South Georgia island.

Of the information that is available, there have been a number of more recent vessel incidents within the SGSSI maritime zone (Table 6). At least one vessel incident has occurred in each of the last three decades, with an incident occurring approximately every five years since 1994. Some spilt fuel was reported in some of these cases, though none of the incidents appear to have resulted in any significant releases of fuel.
Table 6. Summary of vessel incidents in the South Georgia maritime zone 1998 to present (various sources).

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Type</th>
<th>Location</th>
<th>Year</th>
<th>Incident</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Friosur V</strong></td>
<td>Fishing vessel – long liner</td>
<td>Approximately 26 nm to the northeast of Cumberland Bay</td>
<td>1994</td>
<td>Fire on board. 2 lives lost. Vessel escorted to Grytviken and then towed back to Chile. No pollution reported.</td>
</tr>
<tr>
<td><strong>Sudur Havid</strong></td>
<td>Fishing vessel – long liner</td>
<td>170 miles northwest of South Georgia</td>
<td>1998</td>
<td>Took on water in heavy seas. Equipment failure (pumps) caused the vessel to list and sink. 17 lives lost.</td>
</tr>
<tr>
<td><strong>Lyn</strong></td>
<td>Fishing vessel – long liner</td>
<td>Discovery Bay, Cumberland East Bay</td>
<td>2003</td>
<td>Ran aground during a storm event. Unable to be removed. Some spilt fuel reported, type unknown. Salvage company removed majority of remaining fuel (Figure 19).</td>
</tr>
<tr>
<td><strong>Viking Bay</strong></td>
<td>Fishing vessel – long liner</td>
<td>King Edward Point, Cumberland East Bay</td>
<td>2003</td>
<td>Dragged anchor during a storm event and ran aground. Re-floated within 24 hours. No pollution reported (Figure 20).</td>
</tr>
<tr>
<td><strong>Moresko 1</strong></td>
<td>Fishing vessel – long liner</td>
<td>Greene Peninsula, Cumberland East Bay</td>
<td>2003</td>
<td>Ran aground during a storm event. Unable to be removed. Some spilt fuel reported, type unknown (Figure 21).</td>
</tr>
<tr>
<td><strong>Viking Bay</strong></td>
<td>Fishing vessel – long liner</td>
<td>Unknown</td>
<td>2008</td>
<td>Hit a small iceberg in heavy seas resulting in a small amount of damage to the top of the bow. No pollution.</td>
</tr>
<tr>
<td><strong>In Sung 22</strong></td>
<td>Fishing vessel – long liner</td>
<td>60 nm east of South Georgia</td>
<td>2009</td>
<td>Fire on board. Vessel was towed to Cumberland Bay and then north to Montevideo, but sank in bad weather 180 miles north of South Georgia. Some debris reported after the sinking but no oil pollution recorded.</td>
</tr>
<tr>
<td><strong>MV Plancius</strong></td>
<td>Passenger vessel</td>
<td>Within the SGSSI maritime zone</td>
<td>2012</td>
<td>Suffered reduced propulsion within the SGSSI maritime zone and took shelter in Cumberland Bay. No damage to the vessel or pollution occurred as a result of the incident.</td>
</tr>
</tbody>
</table>

Figure 20. Long-line vessel Viking Bay aground on Genny Beach May 2003 (Source: Dr. Sue Dowling; http://sartma.com/artc_206_SG_9.html)
An additional, though indirect indicator of the probability of vessel-related pollution events occurring is observations of oiled wildlife in and around South Georgia.

Reid (1995) provided the first published observation of oiled seabirds at Bird Island (off the northwestern tip of South Georgia). Six sightings of oiled Gentoo penguins were recorded during July and August 1993. The oil contaminating the birds was reported to be of a thick tarry consistency, consistent with a heavier fuel oil. Although derived from circumstantial evidence Reid concluded (at the time) that the most likely cause of the oil was from fishing vessels operating in the vicinity of the Willis islands, though the cause of the discharge into the sea was unknown.

It is noted that controls on fishing activity have changed markedly since 1995, not least with the recent introduction of the MPA and closed areas within 12nm of land. As such Reid’s conclusions may not hold in the current context; though oiled wildlife continues to be observed.

British Antarctic Survey scientists based at Bird Island and more recently at King Edward Point undertake routine observations for fishing gear, marine debris and oil associated with seabirds, which are reported annually to CCAMLR. The reports show observations of oiled birds of several species almost every year between 1993 and 2014 (Figure 22). Species affected vary from year to year but across the period of observations included grey-headed albatross; black-browed albatross; wandering albatross; southern giant petrel; snow petrel; king penguin; chinstrap penguin, and Gentoo penguin.

Of the 59 individuals observed over the 22-year period, the species most affected was the wandering albatross with 16 oiled individuals (27%) observed between 1994 and 2009. The year in which most oiled birds were observed in a single observation period was 2009 with 16 individuals of 3 species being recorded. It is noted that two Antarctic fur seals were also recorded with oil contamination at Bird Island in 2009 (CCAMLR, 2016).
These observations of oiled birds do not identify the source of the oil, nor the type of fuel contaminating the birds. It is probable that the contaminating oil was released from vessels and encountered by the birds at sea; largely because of the limited land-based sources of pollution and that most of the oiled birds forage at sea. However, despite past clean-up efforts, some HFO residues in tanks located in the derelict whaling stations are known to exist and may act as local sources. These are being investigated (GSGSSI pers. com.).

If released from vessels, it remains unknown whether the fuel that caused the oiling of birds was deliberately or accidentally discharged. Sources of oiling from vessels may be accidental or deliberate discharge of oil or oily water from multiple use ballast tanks, from dirty bilge water, or from waste oil produced during oil separation and filtering. The latter is typically produced when bilge water becomes contaminated with fuel oil or lubricant, the contaminant is separated using an oily water separator, and the resulting waste not kept aboard\(^4\).

It is also important to note that some (though not all) of the contaminated birds range widely when foraging and contamination may have occurred outside of the SGSSI maritime zone.

Nonetheless, these reasonably frequent observations of oiled birds indicate an on-going exposure of wildlife to oil in the environment.

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\(^4\) It is noted that Annex 1 to MARPOL regulates the treatment of engine room bilge water and ballast and tank cleaning waste. Discharge into the sea of oil or oily mixtures (as defined) are prohibited by the regulations of Annex 1, except under certain conditions.
Additional factors that will have a bearing on the probability of an incident occurring are the duration (or residence time) of a vessel’s presence within the SGSSI maritime zone as well as the predominant area of activity (i.e. coastal or offshore).

Table 7 provides an assessment of the residence time in the SGSSI maritime zone for vessels operating there, based on the average duration of stay in the maritime zone and the average number of vessels in recent seasons (source G-SGSSI).

**Table 7. Approximate average number of vessel days and areas of activity in the SGSSI maritime zone (MZ) by type of vessel (based on 2016 data).**

<table>
<thead>
<tr>
<th>Location</th>
<th>Long line fishing vessels</th>
<th>Trawler fishing vessels</th>
<th>Reefer vessels</th>
<th>Tankers</th>
<th>Passenger vessels</th>
<th>Research vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Briefly coastal – Mostly &gt;12nm offshore</td>
<td>Briefly coastal – Mostly &gt;12nm offshore</td>
<td>Coastal</td>
<td>Coastal</td>
<td>Mostly coastal (passenger landings/cruising)</td>
<td>Coastal and offshore (research dependent)</td>
</tr>
<tr>
<td>Seasonal presence</td>
<td>April to October</td>
<td>April to October</td>
<td>April to October</td>
<td>April to October</td>
<td>October to April</td>
<td>Mostly November to April</td>
</tr>
<tr>
<td>Residence time (Average stay in MZ x Average No. of vessels)</td>
<td>110 x 6 = 660 vessel days</td>
<td>100 x 7 = 700 vessel days</td>
<td>10 x 5 = 50 vessel days</td>
<td>4 x 2 = 8 vessel days</td>
<td>5 x 65 (visits, not vessels) = 325 vessel days</td>
<td>14 x 2 = 28 vessel days</td>
</tr>
</tbody>
</table>

Vessel activity in the SGSSI maritime zone is year-round, given that no alternative means of accessing the island are available, though the duration of stay and the area and season of operation varies between vessels.

On average, within a 12-month period vessels associated with the fishing industry (both fishing and support vessels) spend approximately 1,418 vessel days in the maritime zone, of which trawlers have the longest residence time (approximately 700 vessel days). This compares to approximately 325 vessel days for passenger vessels.

However, passenger vessels although large in number (approximately 65 per season), will spend only a short amount of time in the maritime zone (approximately 5 days per visit). In contrast, fishing vessels, particularly the trawlers, although small in number will spend much longer operating within the SGSSI maritime zone (several weeks).

Given that fishing vessels, and trawlers in particular, appear to be the only vessels using heavier fuel oils, some indicative information on area of operation of these vessels has been compiled.

The following summary is based on Automatic Identification System (AIS) data transmitted from fishing vessels and compiled by Global Fishing Watch (http://globalfishingwatch.org). Data about a vessel’s identity, type, location, speed, direction and more is broadcast using the
AIS. This is collected via satellites and terrestrial receivers and despite some occasional false readings, provides a good picture of vessel activity around South Georgia Island.

The following figures are provided to indicate vessel fishing activity, movements and general proximity to land with a view to informing the risk analysis.

Figure 23. General patterns of fishing behaviour for krill and toothfish long-liners (March 2016 to March 2017).


Figure 23 shows the general behaviour of fishing vessels during the period 15 March 2016 to 15 March 2017. Noting that the krill vessels tend to fish in shallower water in restricted and well-defined regions. Vessels fishing for Patagonian toothfish work in deeper water around the South Georgia slope.

Figure 24. Fishing vessel tracks around South Georgia for the three-year period March 2014 to March 2017.
Figure 24 shows fishing vessel tracks in the region of South Georgia over a three-year period from 16 March 2014 to 15 March 2017. It is important to note in this figure that there is a considerable amount of vessel traffic moving in and out of Cumberland Bay (both Cumberland East and Cumberland West), and a high density of traffic along the northern coast of the island.

Figure 25 shows an expanded view of the northern coast of the island and Figure 26 provides a close view of Cumberland Bay. Due to the requirement for vessels to enter Cumberland Bay for licensing and inspection purposes, the volume of traffic into and out of the Bay is markedly higher than elsewhere on the island.

Figures 24 and 25 also show that fishing vessels rarely go close to the south coast of South Georgia, compared to much closer general proximity to the northern coast.

Note also the proximity (particularly of krill fishing vessels) to Gold Harbour and Iris Bay to the south-east of the northern coast of South Georgia (Figure 27). This area is likely used as an area of shelter during winter storm events; though is in proximity to a number of identified vulnerable sites.

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Figure 25. Fishing vessel tracks around South Georgia for the three-year period 16 March 2014 to 15 March 2017 - an expanded view showing Northern coast of the island.

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5 Where there are obvious errors such as tracks crossing land these are a function of the variable completeness, accuracy and quality of the underlying AIS data as broadcast by vessels. Data collection by satellite or terrestrial receivers may introduce additional errors through missing or inaccurate data.
Figure 26. Fishing vessel tracks around South Georgia for the three-year period 16 March 2014 to 15 March 2017 - an expanded view showing the Cumberland Bay area.

Figure 27. Fishing vessel tracks around South Georgia for the three-year period 16 March 2014 to 15 March 2017 - an expanded view showing the Gold Harbour and Iris Bay region.

In the context of vessels operating close to shore, either for making approaches to Cumberland Bay or for the purposes of taking shelter during storm events, the quality and availability of nautical charts may also have an influence on the likelihood of an incident occurring, such as a grounding. Some coastal areas around South Georgia have been reasonably well surveyed and charted, whilst others have not. Figure 28 provides an overview of the current availability of British Admiralty charts for the waters around South Georgia. As can be seen, accurate and up-
to-date charts are available for the majority of areas frequented by vessels, including Cumberland Bay. Several, though not all, of the bays along the north coast of the island have been surveyed and charted. However, there are sections of the South Georgia coast that have not been surveyed and charted. Only parts of Iris Bay have been surveyed in some detail, and Royal Bay has not been surveyed in detail at all. None of the south coast of the island, nor waters around Annenkov Island have been surveyed and charted in any detail.

The risk of an incident occurring will be increased for vessels operating (e.g. sheltering) in waters close to shore where charting is poor or non-existent.

Additional human factors that will affect the likelihood of an incident occurring relate to training, experience and the level of implementation of safety standards, though such factors have not been assessed as part of this study.

Additional technical factors that will affect the likelihood of an incident occurring include vessel age and quality as well as equipment and vessel maintenance regimes. Again, these factors have not been assessed as part of this study.
### Likelihood assessment

Vessel incidents have occurred in the SGSSI maritime zone (at least one per decade in the last three decades). Oiled birds (though low in numbers) are observed with reasonable frequency - though it is acknowledged that the source of oil in these cases cannot be identified, nor whether oil is released deliberately or accidentally into the environment.

Vessel activity within the SGSSI maritime zone is relatively high with vessels present throughout the year. Residence time for some vessels has potential to influence the likelihood of incidents and is longest for fishing vessels.

Other factors such as safety of operations; vessel age and quality as well as human factors such as training and experience, will also affect likelihood of an incident occurring, though such factors have not been assessed in this study.

Based on these considerations, the likelihood of an incident occurring is assessed as being **possible** using the risk matrix in figure 14.

### 4.2.4 Consequences for the environment – *how bad could it be?*

As discussed in Section 3.2, once fuel is released to the environment as a result of a vessel incident, there are several factors that will determine its fate and the impacts it has on the environment, including:

- type of fuel spilt and its properties, i.e. persistence, toxicity, evaporation rates;
- volume of fuel spilt;
- rate of discharge to the environment;
- physical conditions of the receiving environment, i.e. water and air temperature, currents, tides, wind and wave conditions, and, in high latitudes, ice conditions;
- location of the spill and its proximity to sensitive environments, i.e. offshore or close to shore;
- sensitivity of the receiving environment, i.e. local flora, fauna, habitats and socio-economic resources, all of which may vary depending upon the time of year;
- ability to respond, and timeliness of response.

To adequately characterise the fate and impacts of spills in the SGSSI maritime zone, would require computer modelling so as to account for this array of variables and for the potential combination of variables. Such an approach is beyond the scope of this assessment.
Nonetheless, it is possible to descriptively characterise the consequences of a spill event using known information about the SGSSI environment (Section 2.1) and the behaviour of fuels in cold water environments (Sections 3.2 and 3.4).

Of primary concern, and relevant to this assessment is the type of fuel spilt. As documented in Section 3.4, heavier fuel oils pose a higher risk to the marine and coastal environments and wildlife of SGSSI than do lighter distillate fuels. Lighter fuels evaporate quickly and more completely, and wind and wave action will act on the spilt fuel to dissipate it more readily. Heavier fuels will persist longer (particularly in colder environments), can be transported over longer distances, and breakdown into products that can have higher levels of toxicity.

How close to the SGSSI coast a spill occurs will have a significant bearing on the fate and impacts it may have. A spill some distance from shore has a far great chance of dissipating before it can impact coastal environments of SGSSI. Of greater concern will be a fuel spill closer to shore with potential to impact both the coastline as well as species (birds and seals) migrating to and from foraging grounds.

Most of the SGSSI megafauna depends upon the marine environment for food. Seabirds, penguins and seals will forage widely within and beyond the SGSSI maritime zone, increasing the risk of exposure even to a spill event that occurs some distance offshore.

From a location perspective, it is noted that virtually all vessels operating in the SGSSI maritime zone will make at least one visit to Cumberland East Bay for the purposes of inspection, paying visitor or fisheries licence fees, or for transhipping / refuelling. This concentration of vessel traffic (figure 25) increases the likelihood of an event occurring in or within the vicinity of Cumberland Bay and increases the exposure of the marine and coastal environment and associated species in this area.

In relation to fishing vessels, some mitigation from the likelihood of an incident occurring close to shore is provided by the 12nm no fishing zone around South Georgia and offshore islands and (to some extent) the 3nm no fishing zone around the South Sandwich Islands enforced through the MPA management plan. Whilst these exclusion zones are primarily in place for fisheries management (and by-catch mitigation) purposes, they provide the additional benefit of keeping fishing vessels offshore in the event that an incident and fuel spill occurs.

The time of the season will also influence the consequences of a spill event. Whilst some wildlife is present on South Georgia all year round, a spill event occurring in the early part of the breeding season (September to December for seabirds; Poncet and Crosbie, 2005 and Figure 29) increases the risk of exposure to both adults and young with potential detrimental consequences for breeding success, and longer-term, chronic effects on the population over subsequent seasons.

Vessel data collected during 2016 suggest that fishing vessels (those carrying heavier fuels) are still present in the maritime zone in September and October (Figure 5). A heavier fuel spilt from a fishing vessels at this time of year has the potential to persist in the environment for months with consequences for wildlife through the main breeding period.
As discussed in Section 2.1, much of the coastal area of South Georgia and several of the South Sandwich Islands can be regarded as “vulnerable” to pollution impact due to the presence of endemic or globally threatened species, or areas of high biodiversity (Poncet et al., 2017; Clarke et al., 2012; Rogers, et al., 2015).

Even so, in considering the potential impact of a fuel spill, some coastal areas are potentially more vulnerable to exposure than others. The south-eastern tip of South Georgia including Cooper Island has numerous established breeding colonies of penguins. Much of the southern coast of South Georgia provides habitat for the endemic South Georgia pipit, and Southern Giant petrels.

There are fur seal breeding beaches in Cumberland Bay and a King penguin colony at ‘Penguin River’, in Cumberland East Bay. Giant Petrels nest on Greene and Barff peninsulas and numerous burrowing petrels and prions occur throughout the bay. The north-western tip of South Georgia including Bird Island and Willis Island provide habitat for both South Georgia pipit as well as some of the largest colonies of Macaroni penguins in the maritime zone, and in the case of Bird Island includes long-established research and monitoring programmes.

A fuel spill event causing contamination to such locations has potential to be catastrophic and would be extremely challenging and costly to attempt any form of clean-up. Localities such as these could be considered to be “highly vulnerable”.

An attempt to summarise the combination of variables that would determine the fate and impact of a vessel fuel spill in the SGSSI maritime zone is provided in figure 30.
Considering a spill of three different fuel types, the figure assesses the potential consequences of a spill based on distance from shore, vulnerability of the receiving environment, meteorological conditions (which is taken to include the effects of wave action) and season.

Whilst this is only a qualitative assessment, and provides nothing more than an overview, it serves to reinforce the point that all such factors will influence the consequences of a fuel spill.

Noting the environmental effects of heavier fuel oils discussed in Section 3, a worst-case scenario would be the rapid release of a large volume of a residual fuel oil close to a highly vulnerable location, in relatively calm conditions in the early part of the breeding season. Such a scenario would be considered “catastrophic” (marked red in figure 30A) using the risk matrix at figure 14. Even so, the persistence of heavier fuel oils in the marine environment suggests that even in rougher conditions outside of the main breeding season a spill close to shore is likely to have significantly detrimental impacts on highly vulnerable locations.

The scenario of least concern would be a release of marine gas oil some distance from shore in the winter period and during relatively rough conditions. Such a scenario would be rated as “minor” using the risk matrix at figure 14 (marked in blue in figure 30B). It is noted however that even a spill of MGO at certain locations and certain times of the year would not be without its impacts which could potentially be significant to severe (Figure 30B).

By way of comparison the same assessment was made on the basis of a spill of IFO180 – an intermediate fuel which may still permitted for use in Antarctic waters (provided it meets the IMO specification). Brown et al. (2016) have demonstrated that this fuel type still displays higher levels of persistence and toxicity in the marine environment compared to a lighter distillate fuel. As described in figure 30C, a spill of this fuel type under certain conditions has the potential to cause severe to catastrophic impacts.

4.2.4.1 Additional or indirect consequences

As well as direct impacts on the environment and biota, a fuel spill event, particularly a spill of more persistent heavier fuels, is likely to have indirect reputational and financial consequences for G-SGSSI.

As noted in Section 2.2.2 above, G-SGSSI has made clear its strategy of “world-class environmental management underpinned by high standards of governance”, to be achieved through: efficient and transparent government; conserving the Territory’s environment; minimising human impacts; managing SGSSI fisheries to the highest international standards, and facilitating safe, responsible and environmentally-sensitive tourism.

An oil spill event would naturally detract (potentially significantly) from these visible and well-promoted objectives. The aftermath of a significant environmental event can often be perceived as a ‘breach of trust’ or ‘recreancy’ which the literature defines as "the failure of experts or specialized organizations to execute proper responsibilities to the broader collective with which they have been implicitly or explicitly trusted" (Freudenburg, 2000).
Tangible impacts of an oil spill on Governmental interests are likely to arise through effects on tourism, fishing and science.

SGSSI is currently, and has been for some decades, much visited by tourists attracted by the wealth of wildlife set in spectacular, largely un-impacted scenery (Clarke et al., 2012). SGSSI’s relatively unspoiled environment (noting of course the impacts associated with the whaling and sealing era), make it a highly desirable tourism location and thus a strategic asset that produces tangible benefits in terms of revenue for the Government. Tourism, including landing fees, harbour duties and additional spending by tourists (e.g. philatelic and other merchandise purchases) makes up around 21% of the Government’s annual revenue (Rogers et al., 2015).

A significant spill event, particularly of a more persistent fuel type, has the potential to impact upon the Territory’s reputation and desirability as a tourist location. The impact of fuel spills on tourism behaviours and perceptions have been well documented in other situations. For example, the sinking of the Don Pedro merchant ship in 2007 near the island of Ibiza is a good example of the extreme sensitivity of the tourism sector to oil spills. Despite the limited scale of the spill (only 20 tonnes), its minimal ecological impact, and the rapid deployment of personnel and equipment to contain it, the accident nonetheless caused significant economic damage to the island’s tourism sector (Cirer-Costa, 2014). The effects of the (much larger) Deepwater Horizon oil spill in the Gulf of Mexico in 2010 also had an impact on tourism to the region for several years (Susskind et al., 2015; Ritchie et al., 2013).

The Deepwater Horizon spill also resulted in the closure of fisheries over large areas of the Gulf of Mexico, which were only reopened when seafood test results showed safe levels for eating (Upton, 2011). The effects of an oil spill on commercially harvested species in the SGSSI maritime zone are challenging to predict and will depend upon numerous variables including the bioavailability and bioaccumulation of breakdown products; though it is possible that deeper water species (toothfish and mackerel icefish) may be less affected than shallower water krill. Nonetheless, an offshore spill event has the potential at least for short term disruption to fishing activity, and potentially some loss of revenue.

SGSSI is an important location for scientific research. British Antarctic Survey (BAS) scientists at King Edward Point undertake strategic research that assists GSGSSI in the management of its fisheries, including research into the biology and ecology of both the targeted resource species as well as dependent and by-catch species. BAS also undertakes important offshore biological and oceanographic research to improve understanding of South Ocean dynamics and responses to climate and oceanic change.

Additional research at Bird Island focuses on long-term monitoring of seabird and seal population dynamics.

Much of this research supports the UK’s input to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).
A significant oil spill event has the potential to impact on the value of SGSSI as a globally important location for scientific research and to disrupt long-term data sets.

**Consequence assessment**

The fate and impacts of fuel released to the environment will be determined by several variables and the combination of those variables that are present at the time of the spill. In the absence of computer modelling, which is beyond the scope of this assessment, it is only possible to infer consequence through potential scenarios that may eventuate.

The worst-case scenario would be a spill of heavy fuel in proximity to a highly vulnerable location on South Georgia early in the breeding season. The persistence and toxicity of heavier fuel oils however suggests that this fuel type is of environmental concern if spilt at any time of the year.

Additional consequences of a significant and persistent fuel spill include an impact on the G-SGSSI’s reputation, with potential short and long-term disruption to tourism, fishing and research activities.

Using the risk matrix in figure 14 and based on these considerations:

- the consequence of a worst-case scenario of a spill involving heavier fuel oils (e.g. IFO380 and heavier) is assessed as being “catastrophic”;
- the consequence of a worst-case scenario involving IFO180 (an intermediate fuel still permitted in Antarctic waters provided it meets prescribed specifications) is assessed as being “severe / catastrophic”;
- the consequence of a worst-case scenario involving MGO is assessed as being “significant / severe”.


<table>
<thead>
<tr>
<th>Fuel type</th>
<th>Distance from shore</th>
<th>Sensitivity of receiving environment</th>
<th>Meteorological conditions</th>
<th>Season</th>
<th>Consequence rating</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Rapid release of full volume carried of heavy fuel (IFO380, HFO)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;12nm offshore</td>
<td>Highly sensitive</td>
<td>Rough</td>
<td>Summer</td>
<td>Severe - Significant</td>
</tr>
<tr>
<td></td>
<td>&lt;12nm offshore</td>
<td>Sensitive</td>
<td>Calm</td>
<td>Summer</td>
<td>Significant - Severe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Winter</td>
<td>Severe - Significant</td>
</tr>
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<td></td>
<td></td>
<td>Winter</td>
<td>Severe - Significant</td>
</tr>
<tr>
<td><strong>B. Rapid release of full volume carried of light fuel (MGO)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;12nm offshore</td>
<td>Highly sensitive</td>
<td>Rough</td>
<td>Summer</td>
<td>Minor - Significant</td>
</tr>
<tr>
<td></td>
<td>&lt;12nm offshore</td>
<td>Sensitive</td>
<td>Calm</td>
<td>Summer</td>
<td>Significant - Severe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Winter</td>
<td>Significant - Severe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Winter</td>
<td>Significant - Severe</td>
</tr>
<tr>
<td><strong>C. Rapid release of full volume carried of intermediate fuel (IFO180)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;12nm offshore</td>
<td>Highly sensitive</td>
<td>Rough</td>
<td>Summer</td>
<td>Severe - Catastrophic</td>
</tr>
<tr>
<td></td>
<td>&lt;12nm offshore</td>
<td>Sensitive</td>
<td>Calm</td>
<td>Summer</td>
<td>Severe - Catastrophic</td>
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<td>Winter</td>
<td>Severe - Catastrophic</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Winter</td>
<td>Severe - Catastrophic</td>
</tr>
</tbody>
</table>

Figure 30. Qualitative assessment of the environmental consequences of three different fuel types spill under a variable combination of conditions.
4.2.5 Risk evaluation

The likelihood of a vessel incident occurring with the potential to cause a significant fuel spill is considered to be “possible”. Vessel incidents have occurred with an approximate frequency of every five years since 1994 and even though no significant release of fuel did occur, each incident had the potential to result in a situation that could cause fuel to be released to the environment.

The consequence of fuel being spilt to the marine environment around SGSSI is hard to predict given the number of variables that would combine to determine the fate and impacts of the spilt fuel. The type of fuel spilt has a significant bearing on the potential consequences and the heavier and more viscous the fuel, the more significant the consequences are likely to be.

The consequence rating for heavier fuels (i.e. IFO380 or higher) in a worst-case scenario spill is assessed as being “catastrophic” with an overall consequence rating of “severe to catastrophic”.

Using the risk matrix in figure 14 a possible and severe or catastrophic event provides an overall risk evaluation of “critical”.

Using the risk tolerance table (Table 5), this level of risk is highly inconsistent with Government policy and/or the MPA, with regulatory or management intervention required within a short, possibly 12-month timetable so as to reduce the risk to a more acceptable level.

Options for achieving this are discussed in Section 6 below.

*****

Whilst this study is focussed on the potential impacts of heavy (residual) fuels, by way of comparison it is noted that the consequence rating for lighter fuels (i.e. marine gas oil) in a worst-case scenario spill is assessed as being significant with an overall consequence rating of “minor to significant”.

Using the risk matrix in figure 14 a possible and minor / significant event provides an overall risk evaluation of “medium to high”.

Using the risk tolerance table (Table 5), this level of risk falls between being acceptable and inconsistent with Government policy and/or with the MPA. It is suggested that in the most part this level of risk is likely to be tolerable, though some aspects may still need to be reviewed within a one to three-year timeframe so as to identify options for reducing risk levels further.
4.3. Risks Associated with Bunkering activity

4.3.1 Introduction

Bunkering is a permitted activity at South Georgia, though it is restricted to an anchorage point off Dartmouth Point in Cumberland East Bay. Approximately 15-20 bunkering events take place each year (Figures 31 and 32).

Reefer vessels and tankers will visit South Georgia for short periods of time, though may sometimes spend a few weeks in the maritime zone supporting several vessels.

Information on the types and volumes of fuel transferred are not recorded, though the information collected during a 2016 survey of fishing vessels suggests that MGO, as well as some residual fuels (recorded as IFO and HFO) are transferred to the fishing vessels (see data discussed in Section 2.3 above).

Figure 31. A long-line fishing vessel refuelling from a reefer in Cumberland East Bay, July 2010.
4.3.2 Hazard identification – what might go wrong?

Published (peer reviewed) literature on safe management of bunkering activities could not be found during this assessment. Instead literature available through the maritime industry, including maritime insurers provided a useful source of information on hazards associated with bunkering. The following is drawn from articles published by Skuld (a Norwegian based marine insurer [www.skuld.com]), The Standard Club, a specialist marine and energy insurer and member of the International Group of Protection and Indemnity (PandI) clubs ([http://www.standard-club.com](http://www.standard-club.com)) and a maritime information source, Marine Insight ([www.marineinsight.com](http://www.marineinsight.com)).

Ship-to-ship bunkering activity can be hazardous. Gathered information suggests that there are three common causes of spills during ship-to-ship bunkering: vessel collision, equipment failure and human error.

Collision between vessels can occur for several reasons including:

- Incorrect approach angle between the maneuvering vessel and the mother ship;
- The maneuvering ship approaching at excessive speed;
- Failure to appreciate wind and sea state conditions;
- The mother ship failing to control excessive swinging while at anchor and / or the maneuvering ship failing to appreciate the swing;
- Miscommunication between the vessels during maneuvering.
Equipment failure could include an array of issues, including:

- Engine failure of either vessel, particularly during mooring or unmooring;
- Failure of mooring lines e.g. through excessive motion – a particular risk during ship-to-ship transfer;
- Failure or leakage of hoses;
- Failure of pressure release valves (with the attendant risk of tank explosion);
- Failure of pumps or valves.

Human error may include inattention, poor judgment or failure to follow procedures, poor communication, inexperience, and / or lack of training. In many cases incident investigations have revealed that the root cause is more often due to poor onboard practices and that one or more of the following commonly occur in bunker oil spills:

- failure to agree a loading rate with the bunker barge or shore loading facility;
- failure on the part of the bunker barge or shore facility provider to stick to the agreed loading rate;
- failure on the part of the vessel’s crew to check that the bunkers are being loaded at the agreed rate and if they are not, failure to request the loading barge to slow down;
- failure to monitor the tank(s) into which the bunkers are being loaded;
- failure to respond to an alarm indicating that the tank is nearly full.

Out of all of these, most bunker spills result from an overflow of the tanks.

These hazards are equally present for fuel transfer operations conducted in Cumberland East Bay, as they would be for fuel transfers conducted in any port. An additional hazard for operations being conducted in Cumberland East Bay would be a tanker or reefer vessel running aground as a consequence of factors discussed in Section 4.2.2 above i.e. human error or equipment failure or a severe weather event resulting in a collision (e.g. with ice) or grounding.

4.3.3 Likelihood of occurrence – *how likely is it to happen?*

A measure of risk control is provided by the fact that bunkering activities are conducted at one location in South Georgia waters (near Dartmouth Point in Cumberland East Bay) and that this is a relatively sheltered and charted location. This will have some effect in reducing the likelihood of an incident occurring during bunkering activities; at least from a general vessel safety perspective.

Other factors that will have an influence on the likelihood of a fuel spill during bunkering activities in Cumberland East Bay will include: the rigour and effectiveness of maintenance and inspection regimes on-board the mother ship and receiving vessels, particularly of equipment
involved in bunkering activities; both vessels having in place established procedures for regulating the transfer of fuel and the extent to which those procedures are followed. These factors were unable to be assessed during this study.

Whilst fisheries support vessels (reefers and tankers) are always boarded by G-SGSSI Government Officers based at KEP (for purposes of collecting harbour and/or transhipment fees), no direct monitoring or assessment of bunkering activities is currently conducted.

The frequency of bunkering events (15-20 per year) has an effect on any assessment of the likelihood of a spill occurring. This is a reasonably high number of annual events, each one of which presents an opportunity for a spill to occur. However, to date there have been no recorded incidents that have occurred during vessel bunkering activities in Cumberland East Bay that have resulted in fuel being released to the environment.

In a global context, spills during bunkering activity account for around 12% of spill events of 7 to 700 tonnes (see Table 4, Section 3.3).

Consequently, it would appear appropriate to apply a low likelihood rating to this activity and a rating of “unlikely” i.e. a 2 – 10% annual probability or a 10 to 50-year event (using the risk matrix at figure 14), would seem appropriate.

**Likelihood assessment**

Despite a relatively high number of bunkering events per season, the fact that to date there have been no recorded fuel spill events associated with bunkering activity in Cumberland Bay, suggests a low likelihood of occurrence.

The likelihood of a spill in Cumberland East Bay as a direct result of bunkering activities is therefore rated as “unlikely”.

**4.3.4 Consequences for the environment – how bad could it be?**

Cumberland East Bay has been subject to significant human activity for more than a hundred years, not least through 60 years of whaling activity centred at Grytviken between 1904 and 1966. There are a number of vessel wrecks in the bay including of vessels associated with the whaling era (Figure 33) and with more recent activities (Figure 19).
Run off from the derelict whaling station including leaks from fuel tanks, has resulted in localised chronic pollution in the immediate nearshore and benthic environments (Cripps, 1992).

Cumberland East Bay has been well studied through several decades of research facilitated by the British Antarctic Survey. Studies have included: benthic fauna (Barnes et al., 2006); fish ecology and physiology (Morris and North, 1984; North and Ward, 1990); zooplankton composition (Ward, 2004); megafauna (Elephant seals; McCann, 1981) and geochemistry (Geprags et al., 2016).

The area also holds significant scientific research value, through the availability of on-shore infrastructure to support scientific studies at King Edward Point, as well as the environmental and geographical conditions of the Bay itself (see for example Schmidt et al., 2016 and Geprags et al., 2016). As evidence of its ongoing research value, a new species of planarian (flatworm) was discovered in the Bay in 2014 (Volonterio and Brewin, 2014).

There are a number of Gentoo penguin colonies in the Bay, on the western side of Barff Peninsula, several Elephant seal haul-out and breeding beaches, including on Dartmouth Point and the eastern and western sides of Greene Peninsula.

A number of visitor sites are established and regularly used in Cumberland East Bay, including on Greene Peninsula (Figure 4 and South Georgia GIS http://www.sggis.gov.gs). The gravesite of Sir Ernest Shackleton, situated opposite King Edward Point, holds significant visitor interest and heritage value.
A number of smaller protected areas had previously been designated around Cumberland East Bay including the whole ice-free area at the head of Morraine Fjord and several small islets on the western coast of Barff Peninsula (South Georgia GIS http://www.sggis.gov.gs; though as noted in Section 2.2.4.5 the protected areas network across SGSSI is currently under review (G-SGSSI pers. com.)). The shallow benthic fauna in Morraine Fjord was described as an “exceptional community” during a coastal survey of several bays and fjords around South Georgia Island (Barnes et al., 2006).

Several seal, penguin and whale species are frequently observed in the waters and around the shore of the bay. Cumberland East Bay is not a particularly important habitat for rare or endangered species although observations of such species are not uncommon in the Bay.

Accordingly, although parts of Cumberland East Bay have suffered a degree of impact from past human activity, such impacts tend to be highly localised. Away from these sites, Cumberland East Bay holds a range of environmental, scientific, conservation and historic values.

Consequently, a spill of fuel (particularly a spill of a heavy fuel oil) has the potential to have a significant impact on the values of the area. Given the location of the bunkering anchorage, off Dartmouth Point there is a high risk of any spilt fuel being transported south and remaining trapped in Morraine Fjord and along the eastern side of Greene Peninsula.

A worst-case scenario would be a large volume release of a heavier fuel oil into Cumberland East Bay in early spring, just ahead of the breeding season. Of the fuel volumes declared by reefer and tanker vessels during the 2016 survey (Section 2.3.2) the largest volume of fuels carried was 4,371m$^3$ by a reefer vessel - a mixture of 2,061m$^3$ of IFO (unspecified) and 2,310m$^3$ of MGO.

A spill of this size would be more than seven times the amount of fuel spilt in the Bahia Paraiso incident on the Antarctic Peninsula in 1989 (see Section 3.4.2), and would have the potential to remain resident in the Fjords of Cumberland Bay, without the effects of significant flushing (which was the case with the Bahia Paraiso incident). A long residence time would create a situation for high acute and chronic impacts on the environment.

Further, as discussed in Section 2.4, G-SGSSI currently has no (or at best extremely limited) ability to respond to fuel spill incidents that occur within Cumberland Bay or more broadly with the maritime zone. Mobilising a response from elsewhere (e.g. the Falkland Islands) would take days to weeks before any on-site clean-up could occur. The nature of any fuel spill response equipment carried by tanker, reefer and fishing vessels undertaking bunkering activity in Cumberland East Bay, and which may assist in mitigating some impacts, is unknown.

The type of fuel being transferred will also affect the consequence rating if spilled. As discussed in Section 4.2 heavier residual fuels will have a more significant environmental impact than lighter distillate fuels. As noted in Section 4.3.1 above data on the types and volumes of fuel transferred during bunkering activities are not available.
The indirect consequences, such as the impacts on the reputation of G-SGSSI and its revenue as discussed in Section 4.2.4.1, would apply equally to a spill event that occurred in Cumberland Bay as a result of bunkering activity.

<table>
<thead>
<tr>
<th>Consequence assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Areas of Cumberland Bay bear the legacy of past human activities and demonstrate chronic levels of pollution. However, such impacts are highly localised. More broadly, Cumberland East Bay holds important environmental, scientific, conservation and heritage values.</td>
</tr>
<tr>
<td>A large-scale fuel spill would have potential to be trapped in the Bay with potentially significant acute and chronic impacts on a number of species and values.</td>
</tr>
<tr>
<td>The consequence of such a spill, were it to eventuate is therefore rated as “severe”.</td>
</tr>
</tbody>
</table>

4.3.5 Risk evaluation

The likelihood of a spill event occurring as a direct consequence of bunkering activity in Cumberland East Bay seems to be relatively low. None appear to have occurred to date and the sheltered nature of the anchorage at which bunkering occurs helps to mitigate some of the hazards and reduce the likelihood of a spill event occurring. The overall likelihood would therefore appear to be “unlikely”.

Nonetheless, were a spill to occur it has potential to have significant consequences for the values of Cumberland Bay, not least due to very local wildlife concentrations and the potential to reside in Cumberland Bay for a long period of time with on-going chronic impacts. The consequence is therefore rated as “severe”.

Using the risk matrix in figure 14 an unlikely but severe event provides an overall risk evaluation of “high”.

Using the risk tolerance table (Table 5), this level of risk is inconsistent with Government policy and/or with the MPA, and requires regulatory and/or management intervention to be initiated within a one to three-year timeframe so as to reduce risk levels further.

Options for achieving this are discussed in Section 6 below.
5. Other Relevant National and International Management Measures

5.1 Management measures in place by G-SGSSI

Fuel used by vessels operating in the SGSSI maritime zone is currently not directly managed by G-SGSSI, though some legal instruments and management measures are pertinent.

5.1.1 Fuel Declarations

The Territory’s Customs (Declaration and Clearance) Ordinance 2016 requires a person in command of a vessel entering the Territory to declare specified details about the vessel including the type and volume of fuel being carried.

5.1.2 Fishing Licence Conditions

Fishing activity is managed under the Fisheries (Conservation and Management) Ordinance 2000 as amended. Conditions placed on all fishing licences include:

- a prohibition on the discharge of oil or fuel products or oily residues into the sea, except as permitted under Annex I of MARPOL 73/78;
- the requirement to have in place a fire plan and a contingency plan;
- the requirement for vessels operations to be compliant with the provisions of the Torremolinos Protocol of 1993 relating to the Torremolinos International Convention for the Safety of Fishing Vessels 1977. A statement from the UK Maritime and Coastguard Agency (MCA) or an MCA-approved inspector to confirm their compliance with the Torremolinos Protocol must be provided.

5.1.3 Transhipment Conditions

Conditions placed on transhipments, including ship-to-ship transfer of fuel under the Fisheries (Transhipment and Export) Regulations 1990 (as amended), also place a prohibition on the discharge of oil or fuel products, and stipulate that such transhipments can only take place at anchor in Cumberland East Bay. Transhipping vessels are also required to have in place an approved fire plan and contingency plan. Discharging vessels are also required to declare the type and volume of fuel to be transhipped.

5.1.4 Passenger Vessels

Recognising the limited emergency response capabilities on South Georgia (particularly in response to oil spills), G-SGSSI took decisions in 2008/09 and 2009/10 to, not permit visits by vessels carrying more than 500 passengers and to only permit IAATO vessels to visit locations outside of Grytviken.
These measures were intended to mitigate the risks of an environmental impact from a large cruise ship, particularly if carrying HFO. The measures were also intended to align with IAATO policy and recognise that IAATO vessels should have high standards of safety management including oil spill response procedures under MARPOL Annex 1 (Regulations 37.1 and 37.2).

5.2 International Measures


Part XII of the United National Convention on the Law of the Sea (UNCLOS) deals with protection and preservation of the marine environment. Article 192 generally provides that “States have the obligation to protect and preserve the marine environment”. This general obligation is established as customary international law and supplemented by other duties under environmental law. Article 193 also provides that exploitation of natural resources should be in accordance with “the duty to protect and preserve the marine environment.” Article 194 provides that “States shall take, individually or jointly as appropriate, all measures consistent with the Convention that are necessary to prevent, reduce and control pollution of the marine environment from any source”. Such measures are required to minimise to the fullest extent possible: the release of toxic, harmful or noxious substances; pollution from vessels, and pollution from installations and devices.

Article 211(3) provides for States to establish particular requirements for the prevention, reduction and control of pollution of the marine environment as a condition for the entry of foreign vessels into their ports or internal waters provided that due publicity to such requirements is communicated.

Article 211(4) provides for Coastal States to exercise their sovereignty within their territorial sea, by adopting laws and regulations for the prevention, reduction and control of marine pollution from foreign vessels.

Article 211(1) provides for States to establish international rules and standards to prevent, reduce and control pollution of the marine environment from vessels. To meet this obligation the International Maritime Organisation (IMO) has established the International Convention and Protocol for the Prevention of Pollution from Ships (MARPOL - see below), and the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC - see below).

Article 211(6) provides for States to propose the adoption of “special mandatory measures” in cases where they believe such measures are required to prevent pollution from vessels, because of particular oceanographic and ecological conditions. On the basis of this article, the IMO has implemented procedures for the designation of ‘Particularly Sensitive Sea Areas’ (PSSA - see below).
5.2.2 International Convention for the Prevention of Pollution from Ships (MARPOL)

In 1973, the IMO adopted the International Convention for the Prevention of Pollution from Ships (MARPOL), which has been amended by Protocols of 1978 and 1997. The objective of this convention is to preserve the marine environment in an attempt to completely eliminate pollution by oil and other harmful substances and to minimize accidental spillage of such substances.

There are six annexes to MARPOL, which cover:

- Annex I – Regulations for the prevention of pollution by oil
- Annex II – Regulations for the control of pollution from noxious liquid substances in bulk
- Annex III – Prevention of pollution by harmful substances carried by sea in packaged form
- Annex IV – Prevention of pollution by sewage from ships
- Annex V – Prevention of pollution by garbage from ships
- Annex VI Prevention of air pollution from ships

Under Annex I to MARPOL all ships of 400 gross tonnes or greater must carry a shipboard oil pollution emergency plan (or SOPEP). For oil tankers, the vessel weight reduces to 150 gross tonnes for the requirement to carry a SOPEP.

SOPEPs must contain all information and operational instructions as required by the “Guidelines for the development of the Shipboard Oil Pollution Emergency Plan” developed by IMO (Resolution MEPC.85(44) 2000).

The SOPEP sets out the plan for the master, officer and the crew of the ship to follow in response to various oil spill scenarios that could occur on the vessel.

SOPEPs generally contain the following elements:

- Reporting requirements including: when to report, the information to be provided and to whom reports are to be sent;
- Steps to be taken in response to operational spills including the duties of each crew member at the time of a spill;
- Steps to be taken in response to casualty events (such as grounding; fire/explosion; collision etc.) including the duties of each crew member at the time of a spill;
- Information to assist the master in coordinating local response action e.g. with port authorities;
- Maps plans and drawings showing the layout of tanks and relevant fuel pipes etc.;
- The location of the SOPEP locker and an inventory of the contents of the locker;
- Additional (non-mandatory) information as required such as, training and drill procedures, record keeping procedures etc.
5.2.3 International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)

The International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) 1990, requires parties to establish measures for dealing with pollution incidents, either nationally or in co-operation with other countries.

Ships are required to carry a shipboard oil pollution emergency plan. Operators of offshore units under the jurisdiction of Parties are also required to have oil pollution emergency plans or similar arrangements which must be co-ordinated with national systems for responding promptly and effectively to oil pollution incidents.

Ships are required to report incidents of pollution to coastal authorities and the convention details the actions that are then to be taken. The Convention calls for the establishment of stockpiles of oil spill combating equipment, the holding of oil spill combating exercises and the development of detailed plans for dealing with pollution incidents.

Parties to the convention are required to provide assistance to others in the event of a pollution emergency and provision is made for the reimbursement of any assistance provided.

5.2.4 Particularly Sensitive Sea Areas

IMO has developed guidelines to assist with the designation of particularly sensitive sea areas (PSSA): IMO resolution A.982(24) Revised guidelines for the identification and designation of Particularly Sensitive Sea Areas (PSSAs). These guidelines include criteria to allow areas to be designated a PSSA if they fulfil a number of criteria, including: ecological criteria, such as unique or rare ecosystem, diversity of the ecosystem or vulnerability to degradation by natural events or human activities; social, cultural and economic criteria, such as significance of the area for recreation or tourism; and scientific and educational criteria, such as biological research or historical value.

When an area is approved as a PSSA, specific measures can be used to control the maritime activities in that area, such as routeing measures, and strict application of MARPOL discharge and equipment requirements for ships; whether such measures would extend to controls on fuel types used in the PSSA is not clear, though not unlikely.

To date 16 PSSAs have been designated including for example, the Galapagos archipelago, the Canary Islands, and the Great Barrier Reef / Torres Strait.

5.2.5 Antarctic Regulations under MARPOL

In 2009 the IMO added a new Regulation to MARPOL Annex I (Regulations for the prevention of pollution by oil) to protect the Antarctic from pollution by heavy-grade oils, with a new chapter 9 on Special requirements for the use or carriage of oils in the Antarctic area – defined as south of 60° South.
The new Regulation 43 prohibits both the carriage in bulk as cargo and the carriage and use as fuel, of: crude oils having a density, at 15°C, higher than 900 kg/m³; oils, other than crude oils, having a density, at 15°C, higher than 900 kg/m³ or a kinematic viscosity, at 50°C, higher than 180 mm²/s; or bitumen, tar and their emulsions (Appendix 2)⁶. The Regulation entered into force in 2011.

An exception is in place for vessels engaged in securing the safety of ships or in a search-and-rescue operation.

5.2.6 Ship-to-ship Fuel Transfers

Fuel transfers involving tankers of 150 gross tonnage and above have been regulated on a statutory basis since the implementation of MARPOL, Annex 1, Chapter 8, which entered into force on 1 January, 2011. These ships are required to carry an STS (ship-to-ship) operations plan, which has been approved by their flag administration.

The STS operations plan should be developed taking into account the information detailed in relevant guidance material identified by the International Maritime Organization (IMO), i.e.:

- The IMO Manual on Oil Pollution, Section I, Prevention, as amended (IMO Manual) and,

The Plan is required to be in the working language of the ship and may also be incorporated into an existing Safety Management System (SMS).

According to Regulation 41, Paragraph No. 3 of MARPOL Annex I Chapter 8 "Any oil tanker subject to this chapter and engaged in STS operations shall comply with its STS operations Plan."

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⁶ The regulation lists several technical specifications that qualify a fuel as a Heavy Grade Oil. Some IFO-180 meets the specifications as a crude oil that has a density at 15°C higher than 900 kg/m³ (and is therefore prohibited), but some IFO-180 blends have a lower density and these are still allowed to be used.

As noted elsewhere in this report, IFO is a residual fuel oil that has been cut with a lighter oil such as marine gas oil or diesel, and in the event of a spill of IFO the lighter oils will evaporate or rapidly disperse leaving the heavier oils and a spill that has essentially the same properties as a heavy fuel oil spill.
5.2.7 Emission Controls

IMO has been addressing issues related to vessel emissions for several decades. Annex VI to the MARPOL Convention (adopted in 1997) deals with the Prevent of Air Pollution from ships and seeks to control airborne emissions of SO\textsubscript{x}, NO\textsubscript{x}, ozone depleting substances and particulate carbon.

Annex VI entered into force on 19 May 2005 and a revised Annex VI with significantly strengthened requirements was adopted in October 2008 and entered into force in July 2010.

The regulations place a global limit on sulphur content in fuel with tighter restrictions for designated emission control areas (ECA\textsuperscript{7}) (Table 8).

<table>
<thead>
<tr>
<th>Sulphur content limits outside an ECA</th>
<th>Sulphur limits inside an ECA</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5% m/m prior to 1 January 2012</td>
<td>1.5% m/m prior to 1 July 2010</td>
</tr>
<tr>
<td>3.5% m/m on and after 1 January 2012</td>
<td>1.0% m/m on and after 1 July 2010</td>
</tr>
<tr>
<td>0.5% m/m on and after 1 January 2020 (subject to an on-going review by IMO on fuel availability to meet this requirement)</td>
<td>0.1% m/m on and after 1 January 2015</td>
</tr>
</tbody>
</table>

These provisions have already had, and are likely to have further impact on the extent to which heavy fuel oils, which are high in sulphur content, are used.

5.2.8 CCAMLR

The 1980 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) was agreed under the auspices of the Antarctic Treaty. CCAMLR entered into force in 1982. The objective of the convention is the conservation of Antarctic marine living resources, where the term conservation is taken to include rational use. CCAMLR’s decision making body – the Commission – takes decisions in the form of Conservation Measures to regulate the harvesting of target species within the Convention Area. A permanent Secretariat based in Hobart, Tasmania supports the implementation of the Convention and Conservation Measures taken by the Commission.

The Convention Area covers the vast majority of the South Ocean south of the Antarctic convergence. This includes the waters around South Georgia.

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\textsuperscript{7} Established ECAs are: Baltic Sea area; North Sea area; North American area and United States Caribbean Sea area.
CCAMLR currently has no measures in place aimed at controlling the type of fuel used by fishing vessels. CCAMLR Conservation Measure 10-09 (2011) requires flag states to notify the Secretariat at least 72 hours in advance of any transhipment activities taking place in the Convention Area. Information to be provided includes details of the vessel and its location as well as details of the type and amount of catches and/or other goods, such as food stores and fuel, involved in the transhipment.

Relevant non-binding Resolutions adopted by the Commission include:

- Resolution 20/XXII on ice-strengthening standards in high latitude fisheries, which urges CCAMLR Members to licence to fish in high-latitude fisheries only those of their flag vessels with a minimum ice classification standard of ICE-1C;
- Resolution 34/XXXI on enhancing the safety of fishing vessels in the Convention Area which, encourages Members to: input to the IMO on further development of the mandatory code for ships operating in Polar waters; consider ratifying the Cape Town Agreement as soon as practicable, and consider and implement appropriate measures to enhance the safety standards of those fishing vessels which they license to operate in the Convention Area.

5.2.9 Polar shipping code

After many years of development, the IMO’s Polar Shipping Code (the Code) entered into force on 1 January 2017. The Code only applies to vessels that intend to operate within the Arctic and Antarctic areas defined as:

- Arctic: In general north of 60° but limited by a line from Greenland; south at 58° – north of Iceland, southern shore of Jan Mayen – Bjørnoya – Cap Kanin Nos.
- Antarctic: South of 60° south.

The safety part of the Polar Code applies to ships certified under SOLAS, i.e. cargo ships of 500 GT or more, and to all passenger ships. Ships constructed on or after 1 January 2017 shall comply with the safety part of the Code at delivery. Ships constructed before 1 January 2017 shall comply with the safety part of the Polar Code by the first intermediate or renewal survey, whichever occurs first, after 1 January 2018.

The environmental part of the Code applies to all ships certified under MARPOL Annexes I, II, IV and V respectively. Existing and new ships certified under MARPOL shall comply with the environmental requirements by 1 January 2017. This means that fishing vessels (that carry MARPOL certificates) also have to comply with the environmental part of the code (part II), even if they do not carry any SOLAS certificates.

The Code covers the full range of design, construction, equipment, operational, training, search and rescue and environmental protection matters relevant to ships operating in the waters surrounding the two poles, though it does not deal with the types of fuel that can be use or carried in these regions.
The Code includes mandatory measures covering safety (part I-A) and pollution prevention (part II-A) and recommendatory provisions for both (parts I-B and II-B).

The Code will require ships intending to operating in the defined waters of the Antarctic and Arctic to apply for a Polar Ship Certificate, which would classify the vessel as Category A ship (ships designed for operation in polar waters at least in medium first-year ice, which may include old ice inclusions); Category B ship (a ship not included in category A, designed for operation in polar waters in at least thin first-year ice, which may include old ice inclusions); or Category C ship (a ship designed to operate in open water or in ice conditions less severe than those included in Categories A and B).

The issuance of a Polar Ship Certificate requires an assessment, taking into account the anticipated range of operating conditions and hazards the ship may encounter in the polar waters. The assessment will include information on identified operational limitations, and plans or procedures or additional safety equipment necessary to mitigate incidents with potential safety or environmental consequences.

Ships will need to carry a Polar Water Operational Manual, to provide the Owner, Operator, Master and crew with sufficient information regarding the ship's operational capabilities and limitations in order to support their decision-making process.

The chapters in the Code each set out goals and functional requirements on:

Part I
- ship structure;
- stability and subdivision;
- watertight and weathertight integrity;
- machinery installations;
- operational safety;
- fire safety / protection;
- life-saving appliances and arrangements;
- safety of navigation;
- communications;
- voyage planning;
- manning and training;

Part II
- prevention of oil pollution;
- prevention of pollution form from noxious liquid substances from ships;
- prevention of pollution by sewage from ships, and
- prevention of pollution by discharge of garbage from ships.

In general terms the Polar Shipping Code has potential to have an indirect (and positive) impact on the risk of oil spills from vessels operating in ice-covered waters of the Antarctic. As vessels are adapted or built to the required standards an increase in safety and operations can be
expected. For example, the Code provides that (for category A and B ships with a capacity less than 600 m³) all oil fuel tanks shall be separated from the outer shell by a distance of not less than 0.76 m (unless the individual tanks are 30m³ or less), which will reduce the risk of a spill even if the outer hull is damaged or punctured (e.g. by ice).

But as noted above, the Code does not deal with the types of fuel that can be carried or used (see instead Section 5.2.5 above), nor does it apply to waters around SGSSI, nor does Part I of the Code (dealing with design, equipping, manning and operating of vessels) apply to fishing vessels.

5.2.10 Torremolinos Convention and Cape Town Agreement

The Torremolinos International Convention for the Safety of Fishing Vessels was adopted in 1977. The Convention was the first-ever international convention on the safety of fishing vessels, recognising the great differences in design and operation between these vessels and other types of ships. The Convention included safety requirements for the construction and equipment of new, decked, seagoing fishing vessels of 24 metres in length and over, including those vessels also processing their catch.

In the 1980s, it became clear that the 1977 Torremolinos Convention was unlikely to enter into force, largely for technical reasons. The 1993 Torremolinos Protocol was adopted in April 1993, to update, amend and absorb the parent Convention. In the 2000s, IMO began reviewing the options available to tackle the lack of sufficient ratifications to bring this treaty into force. In 2012, a new agreement was adopted: the Cape Town Agreement of 2012 on the Implementation of the Provisions of the 1993 Protocol relating to the Torremolinos International Convention for the Safety of Fishing Vessels, 1977.

In ratifying the Cape Town Agreement, Parties agreed to amendments to the provisions of the 1993 Protocol, so that they can come into force as soon as possible thereafter.

The Cape Town Agreement has yet to enter into force.

5.2.11 FAO and ILO guidelines

Of indirect relevance to this assessment it is worth noting that IMO has developed, in collaboration with the Food and Agriculture organization (FAO) and the International Labour Organization (ILO), a number of non-mandatory instruments aimed at improving safety on fishing vessels. These include the FAO/ILO/IMO Document for Guidance on Fishermen's Training and Certification and the revised Code of Safety for Fishermen and Fishing Vessels, 2005, and the Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels, 2005 (see: http://www.fao.org/fishery/safety-for-fishermen/51553/en/).
5.2.12 Arctic Considerations

Under the Polar Shipping Code ships are encouraged not to use or carry heavy fuel oil in the Arctic, but this is a non-mandatory provision.

In October 2016, IMO’s Marine Environment Protection Committee (MEPC) agreed to add new work on the regulation of HFO in the Arctic to its program, and set a deadline for completion of this work in order to phase out use of HFO in the Arctic by 2020.
6. Risk Mitigation Options

Having assessed the risks associated with the carriage and use of heavy fuel oil and of bunkering operations in the SGSSI maritime zone, the next step is to consider approaches that might be taken to mitigate the identified risks. In doing so it is appropriate to recall the policy context established by G-SGSSI (set out in Section 2.2) and to ensure that potential mitigation measures will assist in meeting or moving towards the Government’s stated policy objectives and goals.

Potential mitigation options set out below are also assessed with regard to their potential impact on vessels operating in the SGSSI maritime zone, and options for implementation are also considered. In each case the effect that the proposed intervention is likely to have on the overall risk rating is also considered.

6.1 Carriage and Use of Heavy Fuel Oil

<table>
<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Critical</th>
<th>Extreme</th>
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</table>

The risk associated with a spill event involving vessels carrying or using heavier fuel oils in the SGSSI maritime zone has been assessed as “critical” (a “possible” likelihood with “major” consequences). This level of risk is considered to be highly inconsistent with Government policy and/or with the MPA, and requires regulatory and/or management intervention to be initiated within a short timeframe (ideally within 12 months) so as to reduce the risk to a more acceptable level.

Management intervention options to achieve this outcome are considered below.

6.1.1 Do Nothing

This response would involve no change to existing practices. Heavier fuels would still be used by some vessels operating in the SGSSI maritime zone.

Some monitoring of fuel types and volumes could continue to be undertaken so as to assess any change in the overall volumes of heavier fuels being used, and in the anticipation that changes elsewhere (i.e. controls introduced through IMO as well as more modern vessels being introduced to the fishery) would eventually, though unpredictably lead to a phasing out of heavier fuels.

6.1.1.1 Advantages

This would be a no cost, business-as-usual approach requiring no legislative or administrative change to current practices.
6.1.1.2 Disadvantages

Doing nothing would make no impact on the risk profile associated with heavy fuel use by vessels operating in the SGSSI maritime zone. Whilst there would be no immediate negative impact on the natural heritage of SGSSI, the lack of risk mitigation would expose wildlife and ecosystems already under pressure (and increasing climate change pressures) to un-necessary and ongoing additional risk.

6.1.1.3 Alignment with G-SGSSI policy

As recorded in Section 2.2, G-SGSSI has made repeated indications regarding its intent to work towards the phasing out of heavy fuel use in SGSSI waters. Doing nothing would be highly inconsistent with Government policy and with its stated objectives, not least the Government’s stated intent to continue raising standards in the fisheries and ensure best practice is adopted, including by developing a plan to phase out heavy fuel [and restrict] bunkering activity (objective 3.4, G-SGSSI, 2015).

6.1.1.4 Impacts on industry

There would be no financial or operational implications for the industry from taking a business-as-usual approach.

6.1.1.5 Options for introduction

No change to current practices would be required.

6.1.1.6 Residual risk rating

| Low | Medium | High | Critical | Extreme |

Doing nothing would have no effect on the overall risk rating related to a spill of heavier fuel oil, which would remain as critical.
6.2 Restricting the Carriage and Use of Heavy Fuel Oil in the SGSSI maritime zone

Taking no action to address the risks posed by a spill of heavy fuel oil is clearly inconsistent with current Government policy and therefore unacceptable for the reasons set out in Section 6.1.1 above. Taking some form of action to restrict the carriage and use of heavier fuel oils (to be defined) within the SGSSI maritime zone is proposed to be the preferred option.

Consequently, two factors need to be addressed:

- the specification of fuel that is considered to be unacceptable for carriage and use in SGSSI waters, and
- the mechanism by which restrictions should be introduced.

Of these, the factor that will have the most impact on reducing the risk rating will be the specification of fuel that is selected as being the benchmark, as this will have a significant bearing on the environmental consequences if fuel is released. For example, imposing a restriction on the use of any fuel type other than a light distillate fuel (i.e. MGO), will reduce the environmental consequences far more than if some intermediate fuels continue to be used.

6.2.1 Specification of Heavy Fuel

In developing and implementing controls to regulate the carriage and use of heavy fuel oils in the SGSSI maritime zone, a clear definition or specification of fuel that is prohibited will be required.

6.2.1.1 Use MARPOL Annex Chapter 9 definition

An obvious starting point would be the definition included in Regulation 43 adopted by IMO under Annex I to MARPOL (Appendix 2) which for the Antarctic Treaty Area (south of 60° south) prohibits both the carriage in bulk as cargo and the carriage and use as fuel, of:

- crude oils having a density, at 15°C, higher than 900 kg/m³;
- oils, other than crude oils, having a density, at 15°C, higher than 900 kg/m³ or a kinematic viscosity, at 50°C, higher than 180 mm²/s;
- or bitumen, tar and their emulsions

The Regulation came into force in 2011.

Crude oils are very unlikely to be carried in SGSSI waters, as are bitumens and tars and their emulsions. However, the definition for fuel oils is useful as a specification for controlling fuel use in SGSSI waters.
6.2.1.1 Advantages

Using this specification would be consistent with controls in place further south, and with provisions established by IMO.

This specification will be well known to the majority of (fishing and passenger vessel) operators and will ensure ease of operation for vessels that frequently travel between the Antarctic Treaty Area and SGSSI waters.

It is unlikely that implementing controls using this specification will meet with much opposition.

6.2.1.2 Disadvantages

It is currently difficult to judge the full extent of the impact (or benefits) on the overall risk rating if this specification were to be used. The fuel declarations provided by fishing vessels during the 2016 season (Table 1 and Figures 10 and 11) provide little detail as to whether or not the fuel carried meets the specification of IMO Regulation 43. If all the IFO-labelled fuel declared in 2016 failed to meet the Regulation, then using this specification would have a significant impact and reduce non-compliant fuel by around 22% (based on the 2016 data).

Significantly improved monitoring would be required to better understand the specifications of the various fuel types being used and thus the benefits of using this specification.

6.2.1.3 Alignment with G-SGSSI policy

Using this specification and implementing controls to enforce it would align well with G-SGSSI policy. It would be a proactive means to meeting the Government’s overarching strategy of “world-class environmental management underpinned by high standards of governance”. It would also assist in meeting the Government’s objectives to: facilitate visits that are safe, responsible, and environmentally sensitive (strategic objective; G-SGSSI, 2015); manage SGSSI fisheries to the highest international standards of operation, stewardship and sustainability (strategic objective; G-SGSSI, 2015); mitigate risks from substances that have the potential to harm the environment, such as heavy fuel oil (Strategy objective 2.8; G-SGSSI, 2015), and raising standards in the fisheries and ensure best practice is adopted, including by developing a plan to phase out heavy fuel (Strategy objective 3.4; G-SGSSI, 2015).

6.2.1.4 Impacts on industry

Using this specification would likely have few implications for the majority of vessels operating in the SGSSI maritime zone. As noted above the specification will be known to and understood by the majority of (fishing and passenger vessel) operators and will ensure ease of operation for vessels that frequently travel between the Antarctic Treaty Area and SGSSI waters.
The potential impacts on reefers and tankers is less clear. As noted elsewhere, it is not clear if reefers and tankers carry heavier fuels for their own use or only for transhipping to other (fishing) vessels.

6.2.1.1.5 Residual risk rating

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Critical</th>
<th>Extreme</th>
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The actual means by which fuels to this specification might be controlled are discussed below. But if brought into effect, this will eliminate the heaviest and most environmentally harmful fuels from the SGSSI maritime zone and thus mitigate impacts on the ecological values of SGSSI. Whilst the fuel specification itself will have no effect on the likelihood of a spill event occurring, by reducing the consequences to the environment the overall risk rating will be reduced. The fuels being used in the SGSSI maritime zone would generally be far less persistent in the environment and recovery times will be increased.

However, as noted elsewhere, some blended fuels containing residual fuel components may still be used and meet the specification. If spilt, the lighter fraction tends to evaporate or dissipate relatively quickly leaving the heavier fractions to act as heavy fuel oils and persist longer.

Overall, it is assessed that using this specification will reduce the risk rating to “medium to high”, depending upon the compliant fuel options chosen by operators.

*****

6.2.1.2 Prohibit the carriage and use of all residual and intermediate fuel oils.

Consideration might be given to using a more prohibitive fuel specification that exceeds the requirements of IMO Regulation 43 and prohibits the carriage and use of all residual and intermediate fuels; effectively permitting the use of only MGO (as defined by ISO 8217). As noted earlier, marine diesel oils and other intermediate fuels are a blend of heavier residual fuels and lighter distillate fuels and still contain percentages of residual fuels. In the event of a spill, the lighter fractions will often evaporate quickly, leaving the longer chain hydrocarbons to behave as a heavier fuel.

6.2.1.2.1 Advantages

Using a higher specification would have a significant effect on the risk posed by fuel spills in SGSSI waters by significantly reducing the environmental consequences of spilt fuel.

This would align well with Government policy.

Using a much stricter control is not without precedent. The Norwegian Government has introduced a regulation for the archipelago of Svalbard (under the Svalbard Environmental Protection Act) that provides that: “ships calling at national parks shall not use or have on board
fuel other than the quality of DMA in accordance with ISO 8217 Fuel Standard8 (see: 
http://www.sysselmannen.no/en/Shortcuts/Ban-on-heavy-fuel-oil/); though these controlled
areas are all within the territorial sea (12nm) of the island group.

6.2.1.2.2 Disadvantages

The misalignment with the IMO standard in place south of 60° south may not be helpful, and as
noted below, some vessels that would ordinarily transit between SGSSI and the Antarctic
Treaty Area, may be unable to meet a stricter fuel requirement and be forced to cease
undertaking activities in SGSSI waters. This would have an impact on revenue though the
extent of this cannot be quantified at this stage.

6.2.1.2.3 Alignment with G-SGSSI policy

Using a much higher specification and implementing controls to enforce it would strongly align
with G-SGSSI policy. It would be highly consistent with the Government’s overarching
strategy of “world-class environmental management underpinned by high standards of
governance”.

It would also meet the Government’s objectives to: facilitate visits that are safe, responsible,
and environmentally sensitive (strategic objective; G-SGSSI, 2015); manage SGSSI fisheries to
the highest international standards of operation, stewardship and sustainability (strategic
objective; G-SGSSI, 2015); mitigate risks from substances that have the potential to harm the
environment, such as heavy fuel oil (Strategy objective 2.8; G-SGSSI, 2015), and raising
standards in the fisheries and ensure best practice is adopted, including by developing a plan to
phase out heavy fuel (Strategy objective 3.4; G-SGSSI, 2015).

6.2.1.2.4 Impacts on industry

Imposing a much stricter standard would likely have an impact on both the fishing fleet as well
as on passenger vessels. Whilst accurate information on fuels used by vessels operating in the
SGSSI maritime zone is currently not available, it is likely that a (currently unknown) number
of vessels (including fishing vessels, reefers and tankers as well as some passenger vessels)
may be unable to meet a much stricter fuel requirement and be forced to cease activities in the
SGSSI maritime zone.

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8 NB: passenger vessels were given five years to adapt to the lighter marine diesel fuel DMA.
6.2.1.2.5 Residual risk rating

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By whatever means it might be introduced (see below), using a stricter specification on the fuel types that can (or cannot) be used in SGSSI waters would have a significant effect on the level of risk posed by fuel spills in SGSSI waters. Whilst the likelihood of a spill event occurring would not change, the environmental consequences of spills of lighter distillate fuels are far less and could be as low as “minor”. This would be likely to reduce the overall risk rating to “medium”.

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6.2.2 Measures for restricting the carriage and use of heavy fuel oil

It is important that measures for introducing a control on the carriage and use of fuel by vessels operating in the SGSSI maritime zone are practicable, defensible and consistent with international law (see Section 5.2.1 in particular).

The following options would seem to meet these requirements to varying extents.

*Note: For the purposes of assessing the risk benefits of the various control measures discussed below, it is assumed that the specification of fuel to be controlled will be as defined by IMO Regulation 43, i.e. a prohibition on oils, other than crude oils, having a density, at 15°C, higher than 900 kg/m³ or a kinematic viscosity, at 50°C, higher than 180 mm²/s.*

6.2.2.1 A condition on fishing licences

The data and information that was available for this assessment suggests that heavy fuel oil is carried and/or used almost exclusively by fishing vessels (trawlers) as well as by reefers and tankers that are supporting those fishing vessels (see Section 2.3). One control option would therefore involve placing a condition on fishing licences to prohibit the carriage and use of heavy fuel oils (to be defined).

Consultation with industry to assess the implications would seem appropriate as a first step to implementing any such change. This would provide a more accurate understanding of the implications and assist in identifying options for implementation, particularly with regard to timing. Consultation could be undertaken during the 2017 fishing season, with a view to implementation of any changes in 2018.

6.2.2.1.1 Advantages

This approach is consistent with UNCLOS Article 62(4) which provides for nationals of other States fishing in the exclusive economic zone [to] comply with the conservation measures and with the other terms and conditions established in the laws and regulations of the coastal State.
This would be a relatively straightforward option to implement, through an administrative change to fishing licence conditions.

It would have some impact on the risk profile by removing the majority of the most hazardous fuels from the SGSSI maritime zone.

Those fishing vessels operating in the Antarctic Treaty Area will be familiar with controls in place through IMO and already complying with the requirement.

Implementing such a control may also achieve management options related to bunkering activity (see Section 6.2.2 below), in that it would potentially eliminate the transhipment of heavier fuel oils.

6.2.2.1.2 Disadvantages

Taking such a targeted approach towards fishing vessels may not be considered equitable, and leaves open the potential for other vessels to enter SGSSI waters carrying or using heavier fuel oils, including reefers and tankers (even if not supplying heavy fuel oils to fishing vessels), and potentially the occasional passenger vessel.

The extent to which conservation measures and terms or conditions applied under UNCLOS Article 62(4) can relate to non-fishing matters (such as fuel use) may be open to challenge; though this would likely be defensible on the grounds that such an approach is consistent with IMO provisions south of 60° south, and for the purposes of protecting the globally important ecological values of the area.

There may be some impact on revenue if some fishing vessels are forced to leave the fishery as a consequence of being unable to comply with the control.

6.2.2.1.3 Alignment with G-SGSSI policy

This management option would align well with G-SGSSI policy. It would be a proactive means to: manage SGSSI fisheries to the highest international standards of operation, stewardship and sustainability (strategic objective; G-SGSSI, 2015); mitigate risks from substances that have the potential to harm the environment (Strategy objective 2.8; G-SGSSI, 2015), and raising standards in the fisheries and ensure best practice is adopted, including by developing a plan to phase out heavy fuel (Strategy objective 3.4; G-SGSSI, 2015).

6.2.2.1.4 Impacts on industry

This option should come as no surprise to the fishing industry. It has been a long-signalled intent of G-SGSSI (Section 2.2) and recorded as an objective in several documents.

Most operators and vessels are likely to be familiar with the prohibition from working in the Antarctic Treaty Area and will already be meeting the requirements south of 60° south.
It is possible that some trawler vessels may only operate north of 60° south and would be therefore be disadvantaged if they are only capable of using heavier fuels.

It is noted that all reefers and tankers operating during the 2016 season also declared the carriage or use of heavier fuels at some point during the season. It is not clear whether such fuel was only intended for transferring to receiving trawlers, or whether it was required for use by the reefers / tankers themselves. The impact on these supply / transhipping vessels is therefore hard to assess.

6.2.2.1.5 Residual risk rating

| Low | Medium | High | Critical | Extreme |

Implementing this approach has the potential to remove the majority of (though perhaps not all) heavier fuels from SGSSI waters.

Whilst the likelihood of a spill event occurring would remain the same, the consequences of any fuel being spilt would potentially reduce to “minor or moderate” (any heavy fuel component that was spilt would still be likely to persist in the environment). This would provide a residual risk rating (using the risk matrix in figure 14) of “medium to high”.

******

6.2.2.2 A control imposed on all vessels entering SGSSI internal waters

Rather than targeting only fishing vessels, a control could be established to prohibit the carriage and use of heavy fuel oil (to be defined) by all vessels entering the internal waters of SGSSI.

This might be achieved by means of an Order (prohibiting the importation of heavy fuel oils) made under Section 7 of the 2016 Customs Ordinance of the Territory.

Consultation with industry (both fishing and tourist) to assess the implications would seem appropriate as a first step to implementing any such change. This would provide a more accurate understanding of the implications and assist in identifying options for implementation, particularly with regard to timing. Consultation could be undertaken during the 2017 fishing season and 2017/18 tourist season, with a view to implementation of any changes during 2018 or 2019 (noting the requirement to communicate such a control to the IMO (see Section 6.2.2.2.1 below)).

6.2.2.2.1 Advantages

Such an approach would be entirely consistent with UNCLOS Article 211(2) which provides for States to adopt particular requirements for the prevention, reduction and control of pollution of the marine environment as a condition for the entry of foreign vessels into their internal
waters, provided that due publicity is given to such requirements, including communication of them to the competent international organization (i.e. IMO).

This would provide a blanket coverage to the vast majority of vessels operating in SGSSI waters, in that they enter internal waters (which includes Bays) for the purposes of inspection, receiving licences, paying fees, or receiving briefings.

It would have a marked effect on the risk profile and greatly reduce the risks posed by spills of heavy fuel oils and would align with Government objectives.

Implementing such a control would also achieve the option set out in Section 6.3.2.2 below, in that it would also eliminate the transhipment of heavier fuel oils.

6.2.2.2.2 Disadvantages

There are likely to be few disadvantages from implementing this option, other than some potential impacts on some vessels which may be forced to cease activities in SGSSI waters if they are unable to comply with the control. This may result in a loss of some revenue; though this is anticipated to be minor.

Implementing such a control should be notified widely including to the IMO in accordance with UNCLOS Article 211(2). This may introduce a delay in implementation; though this is unlikely to be a lengthy process (the requirement is for notification not approval).

Vessels transiting through the SGSSI maritime zone would not be caught by such a control measure in that they would be exercising the right of innocent passage as defined by UNCLOS. But, perhaps with the exception of some yacht traffic and occasional research vessels, such vessels are likely to be very few. The SGSSI maritime zone does not lie on any major maritime transport route.

6.2.2.2.3 Alignment with G-SGSSI policy

This management option would align well with G-SGSSI policy. It would be a proactive means to: facilitate visits that are safe, responsible, and environmentally sensitive (strategic objective; G-SGSSI, 2015); manage SGSSI fisheries to the highest international standards of operation, stewardship and sustainability (strategic objective; G-SGSSI, 2015); mitigate risks from substances that have the potential to harm the environment, such as heavy fuel oil (Strategy objective 2.8; G-SGSSI, 2015), and raising standards in the fisheries and ensure best practice is adopted, including by developing a plan to phase out heavy fuel (Strategy objective 3.4; G-SGSSI, 2015).

6.2.2.2.4 Impacts on industry

Establishing such a control measure should not come as a surprise to operators. It has been a long-signalled intent of G-SGSSI (Section 2.2) and recorded as an objective in several documents.
Most operators and vessels are likely to be familiar with the prohibition from working in the Antarctic Treaty Area and will already be meeting the requirements south of 60° south.

It is possible that some trawler vessels and some passenger vessels may only operate north of 60° south and would therefore be disadvantaged if they are only capable of using heavier fuels.

It is noted that all reefers and tankers operating during the 2016 season also declared the carriage or use of heavier fuels at some point during the season. It is not clear whether such fuel was only intended for transferring to receiving trawlers, or whether it was required for use by the reefers / tankers themselves. The impact on these supply / transhipping vessels is therefore hard to assess.

6.2.2.2.5 Residual risk rating

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Implementing this approach would have a higher chance of removing virtually all heavier fuels (as specified) from SGSSI waters (noting the fact that this approach would not capture vessels exercising the right of innocent passage through the EEZ).

Whilst the likelihood of a spill event occurring would not change, the consequences of any heavier fuel being spilt would also reduce to “minor or moderate.” This would provide a residual risk rating (using the risk matrix in figure 14) of “medium to high”. In this case, compared to option 6.2.2.1 above, there might be a slightly reduced risk, in that a more holistic approach is being taken to capture more vessels. As such the risk rating might be more weighted towards “medium” than “high”.

*****

6.2.2.3 Establish a Particularly Sensitive Sea Area - PSSA

As discussed under Section 5.2.4 above, IMO has established several (currently 16) PSSAs around the world, under the provisions of UNCLOS Article 211(6). A PSSA is an area that needs special protection through action by IMO because of its significance for recognized ecological, socio-economic, or scientific attributes where such attributes may be vulnerable to damage by international shipping activities. At the time of designation of a PSSA, an associated protective measure, which meets the requirements of the appropriate legal instrument establishing such measure, must have been approved or adopted by IMO to prevent, reduce, or eliminate the threat or identified vulnerability.

The criteria and procedures for proposing a PSSA are set out in IMO Resolution A.982(24).

Developing a proposal for submission should be straightforward. SGSSI is likely to meet several ecological criteria (e.g. uniqueness or rarity; representativeness; diversity, productivity.
and naturalness) as well as scientific and educational criteria (e.g. the importance of the area for research).

The UK Government (as the IMO State member) would need to submit the proposal on behalf of G-SGSSI.

IMO’s Marine Environment Protection Committee (MEPC) takes the lead on reviewing PSSA proposals and may require a technical advisory group to be established to advise it on the proposal. Other IMO committees may also be asked for advice.

If approved, a PSSA should be identified on charts and the proposing Member Government should ensure that any associated protective measures are implemented in accordance with international law as reflected in UNCLOS. Flag states are required to take all appropriate steps to ensure that ships flying their flag comply with the associated protective measures adopted to protect the designated PSSA.

6.2.2.3.1 Advantages

If this option were pursued and was successful, it would provide robust endorsement of the natural ecological and research values of SGSSI, as well as international backing for control measures that would apply to all vessels operating in the maritime zone. This could include controls on the carriage and use of heavy fuel oils, though this would need to be tested further.

If established, the associated protective measures would be enduring, and could be added to or modified over time through re-application to IMO.

Such an approach would be wholly consistent with G-SGSSI policy and stated Government objectives.

This option would have a significant impact on the risk levels and (would have the potential to) eliminate the carriage and use of all heavy fuel in the SGSSI maritime zone.

6.2.2.3.2 Disadvantages

The process could be lengthy (it is not known how long IMO would take to review and decide upon a proposal) and would be without any guarantee of success.

The option is not without its political risks and any proposal submitted to the IMO may invoke objections.

6.2.2.3.3 Alignment with G-SGSSI policy

This option would align strongly with the headline statement in the Government’s Strategy of achieving “world class environmental management underpinned by high standards of governance”.
It would also assist in meeting other stated Government objectives including to: facilitate visits that are safe, responsible, and environmentally sensitive (strategic objective; G-SGSSI, 2015); manage SGSSI fisheries to the highest international standards of operation, stewardship and sustainability (strategic objective; G-SGSSI, 2015); mitigate risks from substances that have the potential to harm the environment, such as heavy fuel oil (Strategy objective 2.8; G-SGSSI, 2015), and raising standards in the fisheries and ensure best practice is adopted, including by developing a plan to phase out heavy fuel (Strategy objective 3.4; G-SGSSI, 2015).

6.2.2.3.4 Impacts on industry

As noted above, putting in place controls to phase out the use of heavy fuel oil has been long-signalled by G-SGSSI, and should come as no surprise to operators. Putting a proposal to IMO to establish a PSSA, would also provide further opportunity to alert operators to potential new restrictions on fuel use.

If the PSSA proposal were successful and introduced restrictions on fuel use, it is possible that some vessels that do not operate south of 60° south would be disadvantaged if they are only capable of using heavier fuels.

6.2.2.3.5 Residual risk rating

| Low | Medium | High | Critical | Extreme |

Establishing a PSSA for the SGSSI maritime zone may not affect the likelihood of a spill event occurring (though the status of a PSSA may have the incidental benefit of heightening the awareness of vessel operators to the importance of the area with a concomitant improvement in safety behaviours!). However, controls on the carriage and use of heavier fuel oils would potentially reduce the consequences for the environment to “minor or moderate”, reducing the overall risk rating to “medium or high.” As with 6.2.2.2 above this might be weighted more towards “medium” given the catch-all approach of a PSSA designation.

6.2.2.4 HFO Levy

This approach would see the introduction of a levy or tax on vessels carrying fuels heavier than a defined grade (for example, any fuel that falls into the specification of IMO Regulation 43). This could be imposed as cost per tonne of fuel carried per day of stay in the SGSSI maritime zone. The intent would be to provide an incentive for using lighter fuels, and could be introduced as a preliminary to options 6.2.2.1 or 6.2.2.2 above.

This option is not without precedent. Taxes on fuels (importation and use) are routinely imposed by many jurisdictions often with higher levies placed on heavier fuel oils. For example, oil tankers visiting New Zealand ports will pay a “capability levy” of 17.56 cents per
tonne of “persistent fuel carried” compared to 7.41 cents for “non-persistent fuels carried” (see: http://www.maritimenz.govt.nz/fees/).

Such an option could be introduced through an initial notification to vessel operators that a new levy was being introduced in the following season or two.

A new tax, which this would in effect be, may require a legislative change and could be effected through an Order or Regulation under the Customs Ordinance.

6.2.2.4.1 Advantages

If implemented this option would provide a clear signal of intent on behalf of G-SGSSI in its desire to remove heavier fuels from use in the maritime zone.

It would provide some additional revenue that could make a contribution towards oil spill response equipment, training and the development of an oil spill response plan (option 6.1.5 above). However, this would likely not bring in a significant amount of revenue given that very few vessels appear to be using fuels that exceed IMO Regulation 43 (which would be an obvious definition to choose in the first instance); though this has yet to be fully assessed.

6.2.2.4.2 Disadvantages

A fuel levy would not in itself reduce the risk profile for heavy fuel use in the SGSSI maritime zone, unless it had the desired effect of forcing vessels to move away from heavier fuels to meet the required standard and avoid the levy.

A clear definition of heavy fuel oil would need to be prescribed (as noted IMO Regulation 43 would be a useful starting point) against which the levy would be charged. However, to assess whether or not to apply the charge would require detailed information to be provided by vessels, likely coupled with fuel testing to assess compliance. This could be costly and time consuming.

6.2.2.4.3 Alignment with G-SGSSI policy

Although it would provide a signal of intent and commitment on the part of the Government, it would not necessarily assist in meeting key objectives and targets. Vessels / operators could simply choose to pay the levy, with no change in the risk profile.

6.2.2.4.4 Impacts on industry

The levy would result in additional and immediate extra costs for vessels unable to comply with a specified fuel standard. The extent of this impact would depend upon the fuel specification being used.
6.2.2.4.5 Residual risk rating

The potential benefits of this option on the risk profile are hard to judge. Vessel operators may simply choose to pay the levy, which would have no effect on the risk profile. However, if used to provide incentive alongside other measures discussed above it may assist in reducing the overall risk rating.
6.3 Bunkering Activities

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The risk of a fuel spill event associated with bunkering activities undertaken in Cumberland East Bay have been assessed as “high”. This level of risk is considered to be inconsistent with Government policy and/or with the MPA, though it may be tolerable under some circumstances. Ideally, regulatory and/or management intervention should be initiated within a one to three-year timeframe so as to reduce risk levels further.

Five response options are considered below.

6.3.1 Do Nothing

This response would involve no change to existing practices or control procedures. Vessels would be allowed to continue to undertake bunkering (and other transhipment) activities at the designated anchorage point in Cumberland East Bay, under existing control measures to the extent that they are in place.

6.3.1.1 Advantages

This “business-as-usual” option has no administrative or legislative impact, and no associated costs.

6.3.1.2 Disadvantages

The risks associated with bunkering activities remain. Although a spill event from bunkering activities is assessed as being unlikely, the consequences for the environment and wildlife in Cumberland East Bay could be severe; particularly so if more persistent, heavy fuel oil is spilt.

6.3.1.3 Alignment with G-SGSSI policy

Such an approach would not be aligned with stated policy objectives of G-SGSSI not least objective 3.4 in the G-SGSSI Strategy which aims to continue raising standards in the fisheries and ensure best practice is adopted, including by developing a plan to phase out heavy fuel [and restrict] bunkering activity (G-SGSSI, 2015).

6.3.1.4 Impacts on industry

The “do nothing” or business-as-usual option would have no operational or financial impacts on the industry.
6.3.1.5 Options for introduction

No change to existing regulatory or management provisions would be required if this option were to be pursued.

6.3.1.6 Residual risk rating

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The “do nothing” option will have no effect on the overall risk rating which would remain as “high”.

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6.3.2 Restricting bunkering activities in Cumberland East Bay

Taking no action to address the risks posed by a spill event associated with bunkering activities is inconsistent with current Government policy and taking some form of action to reduce the risk further is likely to be the preferred option.

Means of achieving this outcome are considered below.

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6.3.2.1 Enhanced Management and oversight

This response would involve developing and implementing tighter management controls and establishing more rigorous scrutiny of bunkering activities so as to ensure that bunkering operations were conducted as safely as possible and to consistently high standards, so as to keep the risk of spills occurring as low as possible. This could involve a range of measures including:

- the prior submission and assessment of a bunkering or ship-to-ship operations plan or similar by vessels involved in bunkering activities (both delivery and receiving vessels);\(^9\);
- the prior submission and assessment of a vessel’s SOPEP (see also footnote 6);
- a review of oil spill response equipment carried by vessels, with minimum response equipment requirements established through hortatory or mandatory measures;
- the collection of detailed information on types and volumes of fuel carried and the types and volumes of fuel to be transferred;

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\(^9\) It is noted that STS operations plans (and SOPEPs) are required to be available in the operational language of the vessel, which may not always be English. Consideration might be given to requiring vessels wishing to bunker in Cumberland Bay to make available their STS operations plan in English.
• spot checks on compliance with operations plans by SGSSI Government Officers during bunkering operations (e.g. 50% of all vessels assessed per season, and all vessels transferring heavier grade fuels).

Ship-to-ship operations plans can vary between vessels and operators in terms of their detail and requirements. An example template of an operations plan prepared by the American Bureau of Shipping (ABS) is provided at Appendix 3.

Consideration might be given to developing an incentive towards best (or preferred) practice. Instead of applying a fixed fee to bunkering activities, bunker fees could instead be determined by a number of factors such as vessel age, oil spill preparedness of the vessel, and the type and volume of fuels being transferred.

The options that have been outlined above, could be implemented through administrative measures.

Currently only fishing vessels (almost exclusively trawlers) undertake bunkering activities. As such, new (or improved) conditions on relevant fishing and transhipment licences could be added requiring submission of ship-to-ship fuel transfer operations plans and/or SOPEPs. For example, the current conditions for transhipments and approved support / reefer vessels simply require the submission of “a contingency plan”, with no qualification as to the expected standard of such plans. This could be improved, not least in respect of tanker vessels, so as to make clear the requirement to comply with Chapter 8 of Annex I to MARPOL.

Some of the additional resource requirement involved in assessing the quality of SOPEP or ship-to-ship operations plans could be offset by seeking specialist technical support. It is noted for example that current fishing licences require fishing vessels to be compliant with the provisions of the Torremolinos Protocol of 1993 (relating to the Torremolinos International Convention for the Safety of Fishing Vessels 1977) and that a statement from the UK Maritime and Coastguard Agency (MCA) or an MCA-approved inspector to confirm their compliance with the Torremolinos Protocol must be provided.

With advance notice to operators, and some additional training provided for G-SGSSI officers, enhanced scrutiny of bunkering activities could be introduced as early as the 2018 fishing season.

6.3.2.1.1 Advantages

A number of elements have been outlined under this general heading of “enhanced management”, all of which will require some, though not a prohibitive amount of effort to implement.

Taking a more rigorous approach to overseeing bunkering activity would not have a direct impact on revenue as bunkering fees would continue to be charged and could be adjusted to account for any additional overheads.
Making bunkering activity a particular focus for better controls, would provide G-SGSSI with an improved understanding of and confidence in bunkering processes.

6.3.2.1.2 Disadvantages

Potentially, there could be extra staff time involved in reviewing submitted documentation and in monitoring compliance on-board vessels, which would increase the administrative costs for G-SGSSI.

There may also be benefit in providing dedicated training of officers to improve their understanding of SOPEP and STS plans and how to undertake compliance monitoring against them. This would also involve additional time and expense.

6.3.2.1.3 Alignment with G-SGSSI policy

Such an approach would represent a change over current practices, which would align with G-SGSSI’s stated objectives to: manage SGSSI fisheries to the highest international standards of operation, stewardship and sustainability (GSGSI Strategy); identify and mitigate against GSGSSI liabilities through effective risk management policies, including maintaining and exercising contingency plans; understand and, where possible, mitigate the risks from substances that have the potential to harm the environment, such as heavy fuel oil, and continue raising standards in the fisheries and ensure best practice is adopted, including by developing a plan to phase out heavy fuel [and] [restrict] bunkering activity.

6.3.2.1.4 Impacts on industry

Some of the elements outlined above may have some impact on vessels and operators undertaking bunkering activities in Cumberland East Bay. If not already in place, ship-to-ship operations plans and SOPEPs would need to be developed by reefer and tanker vessel operators as well as by receiving fishing vessel operators, submitted for assessment and regularly reviewed and updated. These documents may not be available in English and would need to be translated.

If criteria for bunker fee licences were developed, some vessels may see an increase in the cost of bunkering in Cumberland East Bay.

Operationally, however there would likely be limited disruption to current practices.

6.3.2.1.5 Residual risk rating

| Low | Medium | High | Critical | Extreme |

Great scrutiny of bunkering activities does have the potential to reduce the risk of a fuel spill occurring. Improved controls may reduce both the likelihood of a spill occurring (though this
has already been assessed as “unlikely”) as well as the consequences (e.g. through the implementation of well-prepared and practiced response procedures which could minimise the volumes of spilt fuel).

Greater oversight and increased confidence that bunkering activities were being conducted to a consistently high standard could reduce the overall risk rating to “medium” (i.e. “unlikely” likelihood and “moderate” consequence on the risk matrix at figure 14).

*****

6.3.2.2 Prohibition on bunkering HFO

As identified in this assessment, heavier fuel oils pose a particular risk to the globally significant natural environment values of SGSSI. As a means of directly mitigating those risks, a management option would be to allow bunkering to continue (possibly with enhanced controls as discussed above), but to prohibit any transfers of heavy fuel oils (where heavy fuel oils would need to be defined). Such an approach has direct links to management option 6.2.2.2 above.

Whether this approach is considered as a stand-alone action or in conjunction with 6.2.2 below, consultation with industry to assess the implications would seem appropriate. Consultation could be undertaken during the 2017 fishing season which would provide a much clearer picture of the implications for fishing vessels. The implementation of any changes could then be introduced in 2018.

As noted above, a definition of heavy fuel oils would need to be decided upon.

Options for enforcement could include adding a prohibition on ship-to-ship transfer of heavy fuel oils as a condition on fishing and/or transhipment licences or by means of a legislative change (possibly by an Order made under the provisions of the Fisheries (Conservation and Management) Ordinance 2000).

6.3.2.2.1 Advantages

Such an approach would likely have a significant beneficial impact on the risk profile for bunkering activities, in that it would eliminate the risk of heavy fuel oils being accidentally released to the environment during ship-to-ship transfers.

It could be considered as part of a staged approach to reducing further the risks of bunkering, by eliminating the highest risk fuel in the first instance.

It would be relatively straightforward to implement and monitor through vessel declarations and on-board monitoring and fuel sampling.
6.3.2.2 Disadvantages

Some risk would remain from allowing bunkering activities to continue, though this could be further managed with improved management measures implemented in accordance with 6.1.2 above.

It would potentially require additional compliance checks and fuel sampling to be undertaken by SGSSI Government Officers, though this should not be too burdensome.

This option may have some (as yet unquantified) impact on revenue gained from bunkering activities, if some vessels chose to bunker heavier fuels elsewhere (e.g. Stanley or on High Seas).

6.3.2.2.3 Alignment with G-SGSSI policy

This management option would align well with G-SGSSI policy. It would be a proactive means to: mitigate risks from substances that have the potential to harm the environment (Strategy objective 2.8; G-SGSSI, 2015); restrict bunkering activity (Strategy objective 3.4; G-SGSSI, 2015), and seek the highest international standards of operation of the fisheries (strategic objective; G-SGSSI, 2015).

6.3.2.2.4 Impacts on industry

The volumes and types of heavier fuel oils that are transferred during bunkering activities in Cumberland East Bay is currently unknown, though it seems likely that this does occur. It is also not clear whether some vessels can only operate on heavier fuels (including heavier blended fuels) or whether this is a preference due to the lower price of such fuel.

Nonetheless, such a measure, if introduced, is likely to have an impact on some, though not all trawler vessels.

Some companies with vessels that can only operate on heavier or prohibited intermediate fuels may be disadvantaged and required to seek alternative bunkering options such as in Stanley or on the high seas.

6.3.2.2.5 Residual risk rating

<table>
<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Critical</th>
<th>Extreme</th>
</tr>
</thead>
</table>

Whilst the likelihood of a spill occurring may not be affected by this approach, it would have an impact on the potential consequences of a spill if one were to occur. By eliminating the environmental exposure to persistent and more toxic fuels, the environmental consequences would be reduced, possibly with only “minor to moderate” consequences.

As a result, the overall risk rating could be reduced to a “low to medium” rating.
6.3.2.3 Prohibition on bunkering all fuels

An outright prohibition on ship-to-ship transfer of fuel, of any type could be introduced.

Given the significance of such a change in policy, consultation with the industry would seem appropriate, including on options for introduction. A prohibition may be delayed for a fixed period of time to allow industry time to adjust (say 2 or 3 seasons), or phased in over time, perhaps by reducing the total number of fuel transhipments per vessel per season over a number of seasons.

As above, options for enforcement could include adding a prohibition on ship-to-ship transfer of fuel as a condition on fishing of transhipment licences or by means of a legislative change (possibly by an Order made under the provisions of the Fisheries (Conservation and Management) Ordinance 2000).

6.3.2.3.1 Advantages

Once introduced, this option would have an immediate and significant impact on the risk profile, by eliminating all fuel spill hazards associated with ship-to-ship transfer of fuels in Cumberland Bay.

An outright prohibition may have the added benefit of reducing some administrative overheads in managing and overseeing bunkering activity by G-SGSSI officers.

6.3.2.3.2 Disadvantages

An outright prohibition on bunkering would require fishing vessels to seek alternative locations for refuelling during the fishing season. This could result in vessels seeking to refuel on the high seas outside of the SGSSI maritime zone. If such activity occurred within the CCAMLR Convention Area, then the notification requirements of Conservation Measure 10-09 (2011) would still apply.

Whilst this would clearly reduce the fuel spill consequences for SGSSI, it may increase the safety risks for the vessels concerned. A particular concern that may arise as a result of implementing this option would be that vessels choose to transship and refuel outside of the Convention Area.

There would be some loss of revenue in those cases where vessels were paying for bunkering alone. Presumably, transhipment of catch would still occur and so not all transhipment fees would necessarily be lost.
6.3.2.3.3 Consistency with G-SGSSI policy

This management option would align well with G-SGSSI policy. It would be a proactive means to mitigate risks from substances that have the potential to harm the environment (Strategy objective 2.8; G-SGSSI, 2015); to restrict bunkering activity (Strategy objective 3.4; G-SGSSI, 2015) and seek the highest international standards of operation of the fisheries (strategic objective; G-SGSSI, 2015).

6.3.2.3.4 Impacts on industry

Impacts on fishing vessels, trawlers in particular could be significant. It would force vessels to seek alternative refuelling options either on the high seas outside of the SGSSI maritime zone, or to undertake return trips to the Falkland Islands for refuelling; which would impose a financial burden on the vessels as well as reducing the time available for fishing.

As noted above it may also have the undesirable consequence of encouraging refuelling to take place on the high seas outside of the SGSSI maritime zone, (so that vessels avoid having to transit to and from Port Stanley) with the potential to increase some safety risks for the vessels.

6.3.2.3.5 Residual risk rating

<table>
<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Critical</th>
<th>Extreme</th>
</tr>
</thead>
</table>

An outright prohibition on ship-to-ship transfer of fuel would eliminate the risk of a fuel spill event occurring as a direct result of this activity.

*****

6.3.2.4 Fuel Spill Response Training and Equipment

If bunkering in Cumberland East Bay is to continue to be permitted, even for a fixed period of time, consideration might be given to investing in developing a fuel spill response strategy and/or plan as well as in fuel spill response equipment to be stationed at King Edward Point; at least to provide some response capability to spill events that happen within Cumberland Bay.

This could involve seeking specialist advice in the development of a response plan and tailoring response equipment and training to the plan.

Such an approach to responding to spills in Cumberland Bay could be beneficial even if bunkering is prohibited at some point. Vessel traffic in and out of Cumberland Bay is likely to remain high (it was noted as a vessel traffic “hotspot” in Section 4.2.3) and the risk of an incident occurring resulting in the loss of fuel remains.

Response options outside of Cumberland Bay could also be considered as part of the development of a response plan, recognising the significant challenges of mounting any form of
response action in more remote parts of South Georgia\textsuperscript{10}. There may be merit in linking this to a habitat sensitivity survey discussed in Section 4.2.4 above, to assist in developing response actions (where feasible) to environmental sensitivities.

A project scope would need to be prepared and specialist advice sought for assisting with the development of a fuel spill response plan for SGSSI, with associated purchase of equipment and training for staff.

Irrespective of any other measures taken as a result of this study, action on this option could begin at any time.

6.3.2.4.1 Advantages

This would be a responsible approach and demonstrate commitment by the Government towards mitigating the impacts of a spill if one were to occur. The oil and gas industry identifies swift response action with reduced impacts - though this is not measureable and would always depend upon the location and the conditions at the time of the spill.

6.3.2.4.2 Disadvantages

Developing such an approach would not in itself reduce the risk profile for fuel spills around South Georgia, though as noted above, effective response may mitigate some impacts where equipment deployment was feasible and proved to be effective; possibly more so than doing nothing.

There would need to be a capital investment made in seeking specialist assistance, providing training to staff and purchasing response equipment, and on-going operational costs in maintaining both equipment and training currency.

6.3.2.4.3 Alignment with G-SGSSI policy

This approach would align with Government policy and demonstrate its commitment to best practice approaches to mitigating risks to the environment, in particular G-SGSSIs stated objective of identifying and mitigating against G-SGSSI liabilities through effective risk management policies, including maintaining and exercising contingency plans (objective 1.2; G-SGSSI, 2015).

6.3.2.4.4 Impacts on industry

There would be no impact on industry as a result of this option being implemented.

\textsuperscript{10} Given the more remote and potentially more hostile conditions, it is suggested that attempting to deploy fuel spill response equipment around the South Sandwich Islands would be unrealistic, potentially dangerous and with little if any environmental benefit.
6.3.2.4.5 Residual risk rating

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Critical</th>
<th>Extreme</th>
</tr>
</thead>
</table>

Whilst the capability to respond to a fuel spill event will not have any impact on the likelihood of a spill occurring, there may be some benefit in mitigating the consequences of some spills in some circumstances i.e. those situations where response equipment could be deployed quickly and proved effective in constraining the area of impact.

It is suggested however, that the challenging and changeable weather and environmental conditions at South Georgia (Rogers et al., (2015) report a maximum of 30 gales a year recorded annually), may have an impact on the effectiveness of any response action. For this reason, it is suggested that implementing this option would have only a modest impact on the risk level of a spill from bunkering activity with a reduction from “high” to “medium / high”.
7. Summary and Recommendations

In global terms the marine and terrestrial ecology of SGSSI is exceptional. Accordingly, the Government of the Territory has outlined its strategic intent of achieving “world class environmental management underpinned by high standards of governance”, and set out a series of targeted objectives to that end.

Currently the Government has no direct controls in place to manage the hazards associated with the carriage and use of heavier fuels oils by vessels operating within the SGSSI maritime zone. Some controls are in place to manage the hazards associated with bunkering activity in that it is only permitted within Cumberland East Bay, but there are no additional restrictions specifically addressing the hazards associated with bunkering including controls on the types of fuel that can be bunkered.

The risk of a spill event associated with the carriage and use of heavier fuel oils has been assessed as being ‘critical’; a combination of a ‘possible’ likelihood and potentially ‘major’ consequences for the environment. This level of risk is considered to be highly inconsistent with Government policy and/or the provisions of the MPA and is considered to be intolerable. Ideally, for this level of risk regulatory or management intervention will need to be initiated within 12 months so as to reduce the risk to a more acceptable level.

The risk of a spill event associated with bunkering activity has been assessed as being ‘high’; a combination of an ‘unlikely’ likelihood but potentially ‘major’ consequences for the environment, if a large spill of heavier fuels was spilt in Cumberland East Bay. This level of risk is considered to be inconsistent with Government policy and/or the MPA, though may be tolerable under some circumstances. Ideally, regulatory and/or management intervention will need to be initiated within 1 to 3 years to reduce the risk level further, if practicable.

This report has also noted that an oil spill event, particularly involving heavier fuel oils, is likely to have both reputational and financial implications for G-SGSSI. An oil spill event would significantly detract from the Government’s policy of “world-class environmental management underpinned by high standards of governance” and potentially undermine a series of initiatives that have been taken in recent years to works towards that outcome (i.e. the designation of the MPA and rodent and reindeer eradication programmes).

Implications that could arise as a result of a major pollution event could include a reduction in tourism numbers and a disruption to fishing activity with potential loss of revenue as a consequence. An oil spill event also has potential to interrupt globally significant scientific research and data sets.

Whilst the issue of carriage and use of heavy fuel oils by vessels is, to an extent, under ongoing scrutiny by the international community (through the IMO), the current effort is unlikely to achieve the stated objectives of G-SGSSI in a timely manner. As such, given the risk levels that have been assessed here, it is suggested that achieving GSGSSI policy objectives is far more likely through direct action on the part of the Government, than awaiting developments internationally.
A series of practicable and defensible management and regulatory options that are consistent with international law have been identified with the aim of managing the hazards and reducing the level of risk.

In considering options to better control the carriage and use of heavier fuel oils, a definition will be required and two options are proposed: the definition used by IMO to prohibit the carriage and use of heavy fuel oils in the Antarctic Treaty Area, or a much stricter definition that would essentially restrict fuel use in the SGSSI maritime zone to a marine gas oil (for example a DMA grade using ISO 8217); the latter have a greater impact on the risk rating than the former.

A series of measures for introducing these controls were explored. With regard to the carriage and use of heavy fuel oils these included:

- Doing nothing;
- Putting a condition on fishing licences to prohibit the carriage and use of heavy fuels oils (as defined);
- Putting in place a control on all vessels entering SGSSI internal waters to prohibit the carriage and use of heavy fuel oils (as defined) – perhaps by means of an Order under the Customs Ordinance;
- Seeking IMO designation of the SGSSI maritime zone as a particularly sensitive sea area, which could include controls on the carriage and use of heavy fuel oils by vessels entering the designated PSSA;
- Introducing a heavy fuel oil levy for vessels carrying and using heavy fuel oil (as defined) – possibly based on the volumes and the duration of stay in the SGSSI maritime zone.

With regard to bunkering activity identified control options included:

- Doing nothing;
- Enhancing the management and oversight of bunkering activity including greater scrutiny of ship-to-ship operational plans and oil spill response plans as well as compliance monitoring of bunkering activity, and improved data collection;
- Prohibiting the bunkering of heavier fuel oils (as defined) – either as a condition on fishing and/or transhipment licences or by means of an Order under the Fisheries (Conservation and Management) Ordinance;
- Prohibiting the bunkering of all fuels in SGSSI waters - either as a condition on fishing and/or transhipment licences or by means of an Order under the Fisheries (Conservation and Management) Ordinance;
- Establishing a fuel spill response plan and providing training and response equipment for officers based at KEP.

In identifying a way forward, it is noted that doing nothing is unlikely to be tenable. G-SGSSI has signalled its intent to act, through its strategy document and in designating the SGSSI MPA. Further, the identified risk levels are sufficiently high to require response measures to be initiated in the short to medium term.
Recommendation 1. It is recommended that GSGSSI initiate action to address the risk associated with the carriage and use of heavy fuel oil in SGSSI waters and with bunkering activity. Ideally, action should be initiated in the short-term i.e. the next 12 to 24 months.

It is noted that the proposed management options identified above are not mutually exclusive. For example, prohibiting the carriage and use of HFO on all vessels entering internal waters will also achieve the outcome of prohibiting the bunkering of HFO. Further, a number of the management options could be introduced in parallel or in a staged approach. For example, improving the scrutiny and oversight of bunkering activity could be initiated alongside any controls introduced on heavy fuel oils.

In defining heavy fuel oil, for the purposes of enforcing control measures, moving immediately to a prohibition on all heavy and intermediate fuel oils is likely to have too great an impact on vessels operating in the maritime zone. Significantly improved data collection is needed so as to provide a more complete profile of fuel use in SGSSI waters before the consequences of such a move can be adequately assessed. Using the definition of heavy fuel oil that is established in IMO Regulation 43, which prohibits the carriage and use of ‘oils having a density at 15°C higher than 900 kg/m³ or a kinematic viscosity at 50°C higher than 180 mm²/s’ south of 60° south is an obvious first step and will minimise disruption to vessels operating in both areas. It will also be consistent with currently accepted international controls. However, the option of implementing more stringent controls in the future should not be ruled out (see below).

Recommendation 2. It is recommended that, in the first instance, G-SGSSI adopt as its definition of heavy fuel oil the definition used by IMO to prohibit the carriage and use of heavy fuel oil in the Antarctic Treaty Area (Chapter 9 of Annex 1 to MARPOL (Regulation 43). See Annex 2 of this report).

Recommendation 3. It is recommended that G-SGSSI take steps to improve the collection of data on the types and volumes of fuel being used by vessels operating in the SGSSI maritime zone (using specifications of ISO 8217) so as to inform future decisions on controlling fuels used in the SGSSI maritime zone.

With a definition of heavy fuel oil established, consideration needs to be given to the measure by which it can be enforced. Currently heavier fuel oils appear to be used exclusively by fishing vessels and placing conditions on fishing licences to prohibit the carriage and use of heavy fuel oils (as defined) would be an option to consider. UNCLOS Article 62(4) provides for nationals of other States fishing in the exclusive economic zone to comply with the conservation measures and with the other terms and conditions established in the laws and regulations of the coastal State.

However, a more equitable approach that seeks to apply the standard to all vessels is likely to be more defensible and sensible from a management perspective. UNCLOS Article 211(2) provides for States to adopt particular requirements for the prevention, reduction and control of pollution of the marine environment as a condition for the entry of foreign vessels into their internal waters.
Recommendation 4. It is recommended that G-SGSSI considers implementing a prohibition on the carriage and use of heavy fuel oils (as defined) by all vessels entering its internal waters. This could be achieved by means of an Order made under section 7(1)(a) of the Customs Ordinance 2016.

UNCLOS Article 211(2) also obliges States to provided due publicity to such requirements, including communication of them to the competent international organization (the IMO). It is therefore appropriate, and in keeping with G-SGSSI intentions, to consult with operators and industry on the proposed approach. If G-SGSSI agrees with this option, a consultation paper could be prepared on the basis of this assessment and circulated to interested parties at the earliest opportunity.

Recommendation 5. It is recommended that G-SGSSI prepares a consultation paper on the basis of this assessment, setting out its intended approach and circulates to all interested parties at the earliest opportunity.

Feedback provided through the consultation process will assist in determining the implications for vessels and operators and hence the timing of implementation of the new control measures.

Recommendation 6. Prior to implementing such a control, it is recommended that G-SGSSI work with the UK Government to notify international partners of the change, including through the IMO as appropriate (UNCLOS Article 211(2) refers).

A prohibition on the carriage and use of HFO if introduced as recommended, will have the associated benefit of eliminating the bunkering of heavy fuels oils (as defined), and to an extent reducing the risk associated with this activity. This eases the need perhaps to take any further steps in relation to bunkering at least in the medium term.

Nonetheless, there is merit in further improving the level of scrutiny applied to bunkering activities to ensure best practice is being followed. This could include improved scrutiny of documented bunkering procedures, oil spill response plans and compliance monitoring against such documented procedures.

Recommendation 7. It is recommended that G-SGSSI considers improving the level of scrutiny of bunkering activities in Cumberland East Bay, through a range of measures including: the requirement for vessels to provide their ship-to-ship operations plans, oil spill response plans (including equipment held on-board to respond to spills), and undertaking compliance monitoring against such plans.

As noted in this report implementing such an approach may require additional specialist advice to review documentation, as well as training for officers in conducting compliance checks.

Recommendation 8. In implementing Recommendation 7, it is recommended that G-SGSSI give consideration to seeking specialist advice on bunkering standards as well as providing training for its Government Officers in undertaking compliance checks against such standards.
There is currently no (or, at best, very limited) oil spill response capability on South Georgia, and the extent to which reefer vessels or tankers (or fishing vessels) carry response equipment themselves is unknown. Whilst meteorological and other environmental conditions around South Georgia may present challenges to the deployment of response equipment, there may also be occasions when such equipment provides an opportunity to restrict the spread of a spill, or recover a certain percentage of any spilt fuel.

Consideration could also be given to documenting the spill response procedures in a national oil spill response strategy or plan, and in providing relevant training to officers prior to deployment to KEP.

**Recommendation 9.** It is recommended that G-SGSSI seek specialist advice in the development of a national oil spill response strategy or plan, and in parallel explore opportunities for developing an oil spill response capability at KEP including stationing oil spill response equipment and providing relevant training to its Government Officers.

Recommendation 1 to 9 above can all begin to be effected in the relatively short-term and will contribute to mitigating the risks associated with fuel spills in the SGSSI maritime zone – not least with respect to spills of heavier fuel oils.

There are however additional options that have been identified in this assessment, which can be pursued in slower time, and which would continue to seek to raise the standards for vessels operating in the SGSSI maritime zone, not least by seeking to phase out all heavier and intermediate fuels.

There are perhaps three aspects to this: ongoing and improved data and information collection; exploring options to impose the desired standards, and engaging with operators in keeping with the Government’s strategy of efficient and transparent governance.

Data on fuel carried and used by vessels in the SGSSI maritime zone is at best patchy and there is a case for continuing and improving the data collection process, not only to inform future control measures that might be taken, but also to assess compliance against the controls recommended above. The collection of more detailed information by requiring vessels to report the fuels they are carrying against the ISO 8217 standard will be extremely helpful.

**Recommendation 10.** To assess compliance with introduced controls, as well as to inform future management options, it is recommended that G-SGSSI improve the quality of data collected from vessels on the fuels they are carrying by requiring vessels to report against the ISO 8217 standard.

It is understood that fuel samples are taken from vessels under certain circumstances. There is considerable value in continuing this practice from a compliance perspective. To assist with compliance monitoring, consideration might also be given to sending a portion of the samples for laboratory testing (using the testing standards set out in ISO 8217) for verification purposes.
Recommendation 11. It is recommended that G-SGSSI continue the practice of collecting fuel samples from vessels and that consideration be given to testing a proportion of these for verification and compliance purposes.

The ecological and scientific values of SGSSI are without doubt globally significant. These values, coupled with the Government of the Territory’s policy standards and stated objectives, provide a compelling case for ensuring the highest standards of operation by vessels entering and operating within the maritime zone. Seeking to apply standards to the types of fuel carried and used by vessels is an important component of this. The risk posed to the marine environment and to wildlife by spills of heavy fuel oils, is inconsistent with the recognised values and the Government’s current policy and requires action to be initiated sooner rather than later to reduce the risk.

In the short term putting in place controls that align with standards in effect south of 60° south is highly appropriate. But there is a compelling case for considering applying even higher fuel standards in the medium term and to working with vessel operators and industry to achieve that objective.

If G-SGSSI wishes to move towards phasing out the carriage and use of all residual fuels including intermediate fuels throughout the maritime zone, then seeking to establish the maritime zone as a particularly sensitive sea area (PSSA) through the IMO is likely to be the most robust option. The area is very likely to meet PSSA criteria on ecological as well as scientific merit. PSSA designation would have the benefit of being able to apply controls on all vessels operating within and transiting through the maritime zone, including potentially setting standards on fuels carried in the area. Further work will need to be done to more fully explore this option than has been possible in this assessment, including discussions with the UK Government (which is the IMO Member State).

Recommendation 12. It is recommended that G-SGSSI explores further the opportunity to seek ‘particularly sensitive sea area’ status, through the IMO, for the SGSSI maritime zone with a view to further raising the standards of fuel used by all vessels operating throughout the SGSSI maritime zone.

Ongoing dialogue with vessel operators, perhaps with the fishing industry in particular, will be important so as to establish mutual interests in operating vessels to the highest standards in the SGSSI maritime zone. This should include exploring options for modernisation of the fishing fleet over time. In this regard, establishing certain fuel standards in the short-term (as set out in Recommendations 4 and 5 above) and signalling intent to move towards higher standards of fuel use, will provide an incentive for operators to charter, modify or purchase vessels that can comply with the established standard.

If PSSA status is not pursued, then this would still not rule out tighter controls on fuel standards being implemented through the mechanism set out in Recommendation 4 above. This might be documented as a medium-term objective for the Government.
By way of further incentive to achieve a shift towards vessels operating only on lighter (MGO type) fuels, a levy applied to vessels using heavier fuels (perhaps based on the fuel type used and the duration of stay in the SGSSI maritime zone) might also be considered. This option might even be pursued sooner, if there was likely to be any reason for delay in implementing Recommendations 2, 4 and 5 above.

Recommendation 13. It is recommended that G-SGSSI continues to explore options for further raising the standard of fuel used by vessels operating within the SGSSI maritime zone, by seeking to phase out the carriage and use of all residual fuels. Achieving this will require ongoing dialogue with industry and vessel operators, setting a clear objective and timeline and identifying opportunities such as a fuel levy to help incentivise operators to move towards the desired standard.
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Appendices
### Table 1 — Distillate marine fuels

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unit</th>
<th>Limit</th>
<th>Test method reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinematic viscosity at 40 °C</td>
<td>mm²/s</td>
<td>max.</td>
<td>5.500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>min.</td>
<td>1.400</td>
</tr>
<tr>
<td>Density at 15 °C</td>
<td>kg/m³</td>
<td>max.</td>
<td>890.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>min.</td>
<td>890.0</td>
</tr>
<tr>
<td>Detergent index</td>
<td>—</td>
<td>min.</td>
<td>45</td>
</tr>
<tr>
<td>Sulfur</td>
<td>mass %</td>
<td>max.</td>
<td>1.00</td>
</tr>
<tr>
<td>Flash point</td>
<td>°C</td>
<td>min.</td>
<td>43.0</td>
</tr>
<tr>
<td>Hydrogen sulfide</td>
<td>mg/kg</td>
<td>max.</td>
<td>2.00</td>
</tr>
<tr>
<td>Acid number</td>
<td>mg KOH/g</td>
<td>max.</td>
<td>0.5</td>
</tr>
<tr>
<td>Total sediment by hot filtration</td>
<td>mass %</td>
<td>max.</td>
<td>—</td>
</tr>
<tr>
<td>Oxidation stability</td>
<td>g/m³</td>
<td>max.</td>
<td>25</td>
</tr>
<tr>
<td>Carbon residue: micro-method on the 10 %</td>
<td>mass %</td>
<td>max.</td>
<td>0.30</td>
</tr>
<tr>
<td>Carbon residue: micro-method</td>
<td>°C</td>
<td>max.</td>
<td>— –16</td>
</tr>
<tr>
<td>Pour point (upper)</td>
<td>°C</td>
<td>max.</td>
<td>— –6</td>
</tr>
<tr>
<td>Appearance</td>
<td>—</td>
<td>—</td>
<td>Clear and bright</td>
</tr>
</tbody>
</table>

---

* a 1 mm²/s = 1 cSt.
* b Notwithstanding the limits given, the purchaser shall define the maximum sulfur content in accordance with relevant statutory limitations. See Annex C.
* c Purchasers should ensure that this pour point is suitable for the equipment on board, especially if the ship operates in cold climates.
* d If the sample is not clear and bright, the total sediment by hot filtration and water tests shall be required, see 7.4 and 7.6.
* e If the sample is not clear and bright, the test cannot be undertaken and hence the oxidation stability limit shall not apply.
* f If the sample is not clear and bright, the test cannot be undertaken and hence the lubricity limit shall not apply.
* g This requirement is applicable to fuels with a sulfur content below 500 mg/kg (0.050 mass %).
* h If the sample is dyed and not transparent, then the water limit and test method as given in 7.6 shall apply.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unit</th>
<th>Limit</th>
<th>Category ISO-F-</th>
<th>Test method reference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>RMA</td>
<td>RMB</td>
</tr>
<tr>
<td>Kinematic viscosity at 50 °C⁰</td>
<td>mm²/s</td>
<td>max.</td>
<td>10.00</td>
<td>30.00</td>
</tr>
<tr>
<td>Density at 15 °C</td>
<td>kg/m³</td>
<td>max.</td>
<td>930.0</td>
<td>960.0</td>
</tr>
<tr>
<td>CCAI</td>
<td></td>
<td>max.</td>
<td>850</td>
<td>860</td>
</tr>
<tr>
<td>Sulfur⁰</td>
<td>mass %</td>
<td>max.</td>
<td>Statutory requirements</td>
<td>see 7.2 ISO 8754 ISO 14596</td>
</tr>
<tr>
<td>Flash point</td>
<td>°C</td>
<td>min.</td>
<td>60.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Hydrogen sulfide</td>
<td>mg/l</td>
<td>max.</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Acid number¹</td>
<td>mg KOH/g</td>
<td>max.</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Total sediment aged</td>
<td>mass %</td>
<td>max.</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Carbon residue: micro method</td>
<td>mass %</td>
<td>max.</td>
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* This category is based on a previously defined distillate DMC category that was described in ISO 8217:2005, Table 1. ISO 8217:2005 has been withdrawn.

1 mm²/s = 1 cSt.

² The purchaser shall define the maximum sulfur content in accordance with relevant statutory limitations. See 0.3 and Annex C.

⁰ See Annex H.

ⁱ Purchasers shall ensure that this pour point is suitable for the equipment on board, especially if the ship operates in cold climates.

---

ISO 8217:2012 appendices – C and D: ISO 8217:2012 (E)

Addition of a new chapter 9 to MARPOL Annex I

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee (the Committee) conferred upon it by international conventions for the prevention and control of marine pollution,

NOTING Article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the “1973 Convention”) and article VI of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the “1978 Protocol”) which together specify the amendment procedure of the 1978 Protocol and confer upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 Protocol (MARPOL 73/78),

HAVING CONSIDERED draft amendments to Annex I of MARPOL 73/78,

ADOPTS, in accordance with Article 16(2)(d) of the 1973 Convention, the amendments to Annex I of MARPOL 73/78 concerning the addition of a new chapter 9 on Special requirements for the use or carriage of oil in the Antarctic area;

DETERMINES, in accordance with Article 16(2)(f)(iii) of the 1973 Convention, that the amendments shall be deemed to have been accepted on 1 February 2011 unless, prior to that date, not less than one third of the Parties or Parties the combined merchant fleets of which constitute not less than 50 per cent of the gross tonnage of the world’s merchant fleet, have communicated to the Organization their objection to the amendments;

INVITES the Parties to note that, in accordance with Article 16(2)(g)(ii) of the 1973 Convention, the said amendments shall enter into force on 1 August 2011 upon their acceptance in accordance with paragraph 2 above;

REQUESTS the Secretary-General, in conformity with Article 16(2)(e) of the 1973 Convention, to transmit to all Parties to MARPOL 73/78 certified copies of the present resolution and the text of the amendments contained in the annex, and

REQUESTS FURTHER the Secretary-General to transmit to the Members of the Organization which are not Parties to MARPOL 73/78 copies of the present resolution and its annex.
ANNEX

AMENDMENTS TO MARPOL ANNEX I TO ADD
CHAPTER 9 – SPECIAL REQUIREMENTS FOR THE USE OR
CARRIAGE OF OILS IN THE ANTARCTIC AREA

A new chapter 9 is added as follows:

“CHAPTER 9 – SPECIAL REQUIREMENTS FOR THE USE OR CARRIAGE OF OILS IN THE ANTARCTIC AREA

Regulation 43
Special requirements for the use or carriage of oils in the Antarctic area

1 With the exception of vessels engaged in securing the safety of ships or in a search and rescue operation, the carriage in bulk as cargo or carriage and use as fuel of the following:
   .1 crude oils having a density at 15°C higher than 900 kg/m³;
   .2 oils, other than crude oils, having a density at 15°C higher than 900 kg/m³ or a kinematic viscosity at 50°C higher than 180 mm²/s, or
   .3 bitumen, tar and their emulsions,
   shall be prohibited in the Antarctic area, as defined in Annex I, regulation 1.11.7.

2 When prior operations have included the carriage or use of oils listed in paragraphs 1.1 to 1.3 of this regulation, the cleaning or flushing of tanks or pipelines is not required.”
Appendix 3 Template STS operations plan

STS Transfer Operations Plan
For compliance with MARPOL Annex I, Chapter 8
Revision 3

SHIP NAME: ***
IMO NUMBER: ***
Foreword

The sections in this template shaded yellow are for Guidance or description for the purpose of preparation of the STS Plan only. The user is to delete the contents of these sections or may in their place insert specific requirements that may pertain to the vessel for which the template is being developed. Furthermore, words and sentences with yellow shading are to be deleted. The entire document with or without shading is editable. The only linked fields are the contents of the footer and other locations which indicate the vessel’s name and IMO number.

This document is a template to assist the shipowner/operator/designer in preparing ship-specific Ship-to-Ship Transfer Operation Plan (STS plan), demonstrating compliance with the requirements of MARPOL Annex I, Chapter 8: “Prevention of Pollution during Transfer of Oil Cargo between Oil Tankers at Sea”, Regulations 40, 41 and 42.

Furthermore, this STS Plan template and format has been developed taking into account the guidance contained in the best practice guidelines for STS operations as identified by the International Maritime Organization (IMO) in the following two documents:

- © IMO’s “Manual on Oil Pollution, Section I, Prevention” as amended (IMO Manual), and

Users should be aware that the contents are subject to revision and amendments from time to time, and that partial extracts may be misleading. ABS cannot accept any responsibility for material that may be incomplete or out of date or otherwise in error. In any case where a difference exists between a reproduced version and IMO’s and/or the aforementioned STS Guide’s current, authentic text, the current, authentic text will prevail.

The images and the sections detailing the IMO’s Manual on Oil Pollution and those from the CDI/ICS/OCIMF/SIGTTO “Ship-to-Ship Transfer Guide for Petroleum, Chemicals and Liquefied Gases”, 2013 (STS Guide) are copyright presentations. These may only be used specifically and only in this ABS STS Transfer Operation Plan Template by the user. The STS Plan must be approved by either the relevant flag Administration for the vessel or by a classification society authorized by the vessel’s flag Administration for MARPOL Annex I certification. As ABS is authorized by more than 100 Countries for MARPOL Annex I certification, the completed template should be submitted to an ABS Engineering Office for review.

Disclaimer

This document has been developed solely as guidance for the shipowner/operator/designer preparing a Ship-to-Ship Transfer Operation Plan (STS plan) as required by the relevant sections of MARPOL Annex I. Users should refer to the applicable sections of MARPOL as necessary. Users are also urged to consult with their local ABS engineering office should more detailed interpretations be required. Any variation between applicable regulations and the information provided in this document is unintentional, and, in the case of such variations, the requirements of the regulations govern. This guidance does not constitute advice by ABS and may not be relied upon to create a contractual right or benefit enforceable by any person.
Preparation of the STS Plan

Hint:

Turn on the “Show bookmarks” option: Click “File” tab, then “Options”, then “Advanced”, go to the ‘Show document content’ section, and check “Show bookmarks” checkbox.

On the cover page of the STS plan

1) Insert the ship's name and IMO number. Make sure that the modifications are within the bookmark brackets shaded in yellow.

2) Click “File” tab, then “Print” (without printing), then go back to the main document to continue editing. Then all the occurrences of ship name and IMO number will be updated.

3) All the subsequent pages where the ship's name and IMO number are required will be automatically filled in.

4) On completion change the yellow shading to “No Color”

Part A, Section 1 is to include all ship specific details and the Appendices any other STS transfer operation related documentation with supplementary information concerning good practices, liabilities, vessels specific and relevant equipment. Similarly Part B Appendix I is to include vessel specific plans and procedures.

It is imperative that the user of this template tailors its contents to comply with the Flag the vessel flies in addition to the required compliance measures set forth in:

- MARPOL Annex I, Chapter 8: “Prevention of Pollution during Transfer of Oil Cargo between Oil Tankers at Sea”, Regulations 40, 41 and 42.
- IMO “Manual on Oil Pollution, Section I-Prevention” 2011,
- and the guidance detailed in the

“Flag Administrations may have additional requirements for the STS Plan. Please consult with the local ABS Engineering Office”.

Deviation of STS Plans from Established Guidelines

This STS plan template includes the latest guidelines. A vessel’s STS plan should not deviate from these guidelines in principle.

However, additional policies and procedures and instructions that are in line with these guidelines are expected to and may be inserted where appropriate. The checklist in the appendices of this document may be supplemented in addition with ship specific checklist that may be required to address particular items that have not been considered by the sample checklist. Supplemental Checklist to not require approval. Additions to the contents of the included Checklist may be permissible but not deletions.
Notes

Objectives of an STS Plan

- The STS plan being ship specific, includes all the necessary information and procedures that are required for the safe execution of STS operations.
- The STS plan is a subset of the vessel’s Safety Management System (SMS). Therefore, the objectives of the vessel’s ISM would also be applicable to the STS plan.

Renewal and Approval of an STS Plan

- When the vessel’s flag is changed, the STS plan is subject to be reapproved by the new flag administration.
- If the company of a vessel changes, since the STS plan is part of the SMS, it is expected to reflect the current tanker operator’s specific policies and procedures.
- Whenever a vessel is purchased second hand or a DOC management changes, a new and updated STS plan is to be prepared and approved by the flag administration or its authorized RO thereof.
- An exemption for the need for a re-approval could be considered for cases wherein, the flag of the vessel does not change and the DOC of the handing over company is identical to the DOC of the taking over company, both the companies having the same policies and procedures.
- An STS plan may require re-approval if the applicable guidelines change.

In all the above situations confirmation from the tanker vessel’s Flag Administration is to be obtained on the procedure the vessel’s shipowner intends to follow.

Service Provider’s Familiarity of the Vessel’s STS Plan

- As applicable and in association with the IMO Oil Pollution Manual / 6.2.1.2 the vessel’s qualified POAC must have a thorough knowledge of the STS plan and it would be therefore beneficial to submit the STS plan to the service provider prior to the preparation of the Joint Plan of Operation.

Copies and Locations of a Vessel’s Approved STS Plan

- Copies of the STS plan should be available on the bridge, cargo control room and at the engine control room. See Part A/Section 2/6.2.4.2.
- For the sake of consistency, amendments should be reflected in all three copies.
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STS TRANSFER OPERATIONS PLAN  

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