GUERNSEY HYDROCARBONS SUPPLY PROGRAMME

Statement of Requirements

Prepared for

States of Guernsey

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CH2M HILL UK Limited
Elms House, 43 Brook Green
London
W6 7EF

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Executive Summary

This report provides a high level description of the hydrocarbons supply chain to the island of Guernsey. It details issues and risks in the supply chain that have impacted on or may in future affect the safe, and secure supply of hydrocarbons to Guernsey. Through an assessment of these issues and risks, the report develops a set of requirements which the future supply chain solutions should achieve in order to support the Guernsey Hydrocarbons Supply Programme vision:

> A safe and secure hydrocarbon supply delivering socio-economic value to Guernsey.

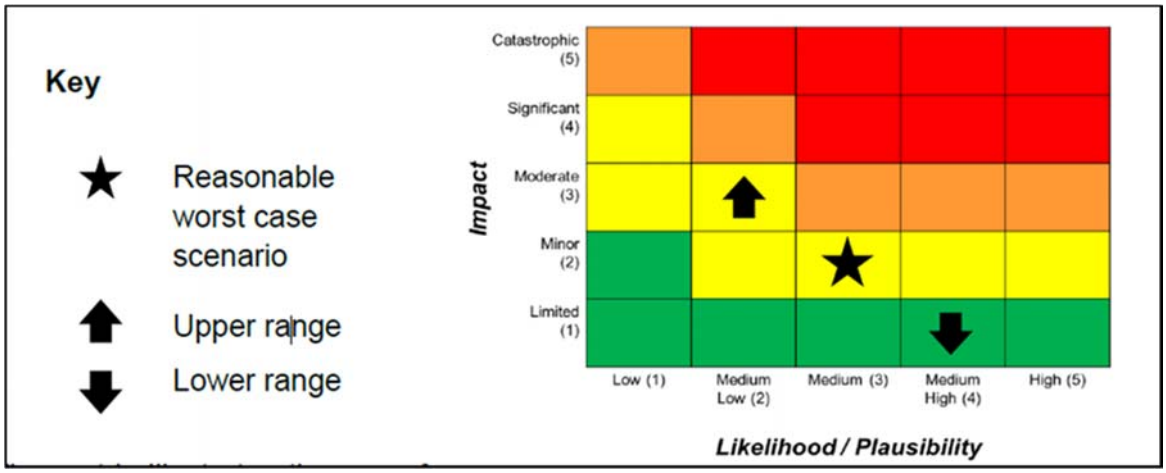
This executive summary sets out the key requirements, while the body of the report provides the evidence and methodology used to develop the requirements.

Generic Requirements

The following requirements apply to all elements of the supply chain.

- Future solutions need to allow for continued importation of all the currently supplied fuels,
- Future supply chains should be adaptable to cope with the forecast decline in fuel demand in the range 20-50% by 2050,
- Future supply chains should allow for total hydrocarbon imports in the range 40,000 to 80,000 MT (tonnes) by 2050,
- Where possible, a diversity of supply and suppliers should be maintained,
- While it is expected there will be a premium to be paid on the price of hydrocarbon supply to Guernsey in comparison to larger markets in UK and Europe, future supply solutions should aim to minimise this,
- Any major new infrastructure should have a design life in excess of 25 years,
- Any new infrastructure should be considered in relation to potential synergies with other States of Guernsey capital projects.

As noted in the Evaluation Criteria Report (684723-CH2-SOC-00-RP-0002/GHSP-1A-DI-CH2-D1-002) the objective will be to develop future supply chain solutions which are in line with the States of Guernsey risk appetite. Risks are described in terms of a Reasonable Worst Case Scenario (RWCS), upper (more impactful/less likely) and lower (less impactful/more likely) ranges and plotted on a risk matrix as below:



The risk appetite considered acceptable for the hydrocarbons supply chain requires solutions in which:

- The RWCS and Upper Range risk scores are orange,
- The RWCS is yellow or green (irrespective of upper range),
- Planning strategies are included to limit impact if RWCS risk score is orange.

Requirements of Refineries/Fuel Storage and Distribution Terminals

Fuel for Guernsey will continue to be purchased from refineries and/or fuel storage and distribution terminals. The assessment of risks in the supply chain from refineries has demonstrated a need to ensure:

- Guernsey has access to fuel supplies from several sources,
- Long term supply contracts are encouraged to assist in security of supply,
- There is close liaison with refineries/fuel suppliers regarding the vessels/vehicles collecting the fuels to ensure they are always accepted,
- Continuing access to non-bio fuels is maintained at competitive prices.

Requirements of Transportation

Hydrocarbons will need to be transported to Guernsey by some means. Future supply chains may include fuel tanker vessels as at present, multi-fuel tankers and/or other methods such as unitised or pipeline transport.

If clean fuel is to be delivered by fuel tanker vessels, alternatives to the Sarnia Cherie and Sarnia Liberty will be required before they reach their end of service life. With a typical service life of 25 years this is currently expected to be in 2028.

If LPG is to continue to be delivered by gas tanker vessel, alternatives to the current B-Gas fleet are required urgently. With a typical service life of 20-25 years and a B-Gas company policy not to retain vessels beyond 25 years, the current fleet would all life expire between now and 2021.

If HFO is to continue to be delivered by tanker vessel, alternatives to the JayneeW will be required when it reaches the end of its service life. With an anticipated service life of 30 years, this would be 2026.

If new vessels are to be used to import fuel to St Sampson's Harbour, they will need to comply with Guernsey Harbour's requirements for high angled rudders, bow thrusters, maximum length and loaded draft.

If other methods of transportation are proposed they should be combined with appropriate on Island storage in order to realise additional benefits in risk reduction.

Requirements of Upload Facilities

Future hydrocarbon imports to Guernsey may continue through St Sampson's Harbour and/or St Peter Port or a potential new facility.

If St Sampson's Harbour is to continue in use, navigation will remain difficult and any solution should include a mechanism to secure future availability of suitably qualified and experienced pilots capable of bringing vessels into the port in a safe manner.

If a new facility is proposed:

- it should allow for the use of non-NAABSA vessels,
- it should allow for the use of a larger range of vessel sizes than currently in use,
- consideration should be given to allowing for import of all hydrocarbon products,
- potential locations on the north and east coast of Guernsey should be considered,
- the potential to expand the facilities to other uses such as cruise should also be considered.

Requirements of On Island Storage Facilities

The current volume of storage on Island appears adequate to support the existing supply chain. Any future solution should seek to maintain at least the current security of supply that is achieved through existing storage capacity. This does not necessarily mean that the same storage capacity is required for future solutions, as:

- demand for hydrocarbons is forecast to decrease in future,
- methods of import may change, so that frequency and parcel size may allow a different optimum storage capacity and may allow/require different stockholdings.

The operation of the existing on Island storage has a number of inherent risks, in particular relating to potential, but unlikely fire and explosion scenarios. Potential treatments should examine options to reduce these risks. However it is unlikely these risks or their impact can be substantially reduced unless the location of the on Island storage is moved or the properties around the existing storage are relocated. Therefore it is recognised that without such changes the improvements may not reach the ultimate objectives of the acceptable risk appetite.

If a new storage location, or relocation of businesses and homes are considered they should be designed to provide a significant risk reduction in order to balance the cost of this activity.

Requirements of the on-Island Distribution Network

The current distribution system on Island has not been examined in this study. Falling demand may impact on the viability of some distribution arrangements. If changes in the future supply chain are

likely to significantly affect the current distribution system/arrangements, further work may be required to examine the impact, in order to ensure it is still able to meet the users' needs.

Next Steps

This Statement of Requirements will be taken with the data and information gathered during the Hydrocarbons Supply Programme in order to develop a long list of options and then to evaluate the options in order to select a preferred option/way forward to achieve the programme vision. This will be reported in the Overall Supply Chain Report Selection of Preferred Option (684723-CH2-SOC-00-RP-0006).

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Acronyms and Abbreviations

AvGas	Aviation Gas
CCNR	Central Commission for Navigation on the Rhine
CIFL	Channel Island Fuels Limited
Clean Fuels	For the purpose of the report, taken to mean petroleum spirit, aviation fuels, kerosene and diesel. Excludes HFO and LPG
DPZ	Development Protection Zone
Dwt	Dead Weight Tonnage
EU 28	The 28 countries which are members of the European Union
EURACOM	European Risk Assessment and Contingency Management
GEL	Guernsey Electric Limited
GHSP	Guernsey Hydrocarbon Supply Programme
HFO	Heavy Fuel Oil
IAPH	International Association of Ports and Harbours
ICS	International Chamber of Shipping
IEG	International Energy Group (owners of Guernsey Gas)
ISGOTT	International Safety Guide for Oil Tankers and Terminals
ITT	Invitation to Tender
LOA	Length Overall
LPG	Liquid Petroleum Gas
mCD	Metres Chart Datum
MoU	Memorandum of Understanding
NAABSA	Not Always Afloat But Safely Aground
OCED	Office *of the* Committee *for* Economic Development
OCIMF	Oil Companies International Marine Forum
PIANC	Permanent International Association of Navigation Congresses
PMSC	Port Marine Safety Code
PwC	Price Waterhouse Coopers
QRA	Quantified Risk Assessment
RORO	Roll On Roll Off
RUBIS	RUBIS Group (owner of Fuel Supplies (C.I.) Ltd)
SIRE	Ship Inspection Report Programme
SOC	Strategic Outline Case

SoG	States of Guernsey
SOP	Strategic Outline Programme
Spring tide	a tide just after a new or full moon, when there is the greatest difference between high and low water
UKC	Under Keel Clearance

SECTION 1

Purpose

The Guernsey Hydrocarbon Supply Programme vision has been defined as:

> A safe and secure hydrocarbon supply delivering socio-economic value to Guernsey.

This document provides a Statement of Requirements for the Guernsey hydrocarbons supply chain that sets out what is required of each element of the supply chain in order to provide a safe and secure supply.

1.1 Background

The key requirements of the supply chain have been developed from the starting point of the Critical Success Factors identified by the States of Guernsey (SoG) in the Invitation to Tender (ITT) for the Guernsey Hydrocarbon Supply Programme (GHSP) as reproduced below.

Table 1.1: SoG Critical Success Factors (Source: SoG ITT for Guernsey Hydrocarbon Supply Programme)

Investment Objective	Critical Success Factor Measure	Measure
Security of supply	On-Island fuel storage maintained above defined strategic levels in line with the security of supply strategy to mitigate against disruption in event of delays in delivery	98% of the time
Reliability of supply	Fuel available when required and without rationing	Always
Value for money	Optimal (economic and strategic) solution implemented to secure supplies	Achieved at a whole-life cost equal or less than comparable facilities in other jurisdictions. All elements are competitively tendered.
Minimizing safety risks to the Island	Reduce number of households and businesses within Development Protection Zone (DPZ) around the fuel storage tanks Reduce number of households and businesses within unloading berth blast zones	80% reduction 80% reduction

In undertaking early stakeholder engagement it was confirmed that a risk based approach to developing requirements and later in assessing options would be required in order to provide a robust and sufficiently flexible approach that could balance the investment objectives and outcomes. The approach adopted to identifying, assessing and treating the risks is consistent with the guidelines set out by EURACOM 2011(European risk assessment and contingency planning methodologies for interconnected energy networks), as well the States of Guernsey risk management procedures, which themselves are based on 2017 UK Government guidance on national risk assessment methodologies[1].

[1] Provided to CH2M by States of Guernsey Risk Officer

1.2 Document Structure

The document is structured as follows:

Section 2	Presents a description of the existing hydrocarbon supply chain.
Section 3	Considers the future demand for hydrocarbons in Guernsey by reference to report 684723-PWC-SOC-00-RP-0001.
Section 4	Provides a discussion of the anecdotal and factual evidence of issues in the current supply chain which have occurred.
Section 5	Covers the risks in the supply chain which have been identified but are yet to materialise.
Section 6	Assesses the performance of each of the current supply chain components is against the evaluation criteria presented in report 684723-CH2-SOC-00-RP-0002.
Section 7	Sets out the requirements for each element of the supply chain on the basis of the acceptable risk.

1.3 Next Steps

This Statement of Requirements will be taken with the data and information gathered during the Hydrocarbons Supply Programme in order to develop a long list of options and then to evaluate the options as described in this report in order to select a preferred option/way forward to achieve the programme vision. This will be reported in the Overall Supply Chain Report Selection of Preferred Option (684723-CH2-SOC-00-RP-0006).

SECTION 2

Existing Supply Chain Description

2.1 Supply Chain Components

The hydrocarbon supply chain to Guernsey can be characterised by the following components:

- Refineries/fuel storage and distribution terminals - from the refinery/fuel storage and distribution terminal to the point at which the product leaves the refinery/fuel storage and distribution terminal property limit (e.g. port limit in the case of shipping, road network in the case of road transport etc).
- Transport – from (onshore/offshore) port limit to port limit in the case of shipping or landfall points at either end of a pipeline.
- Uploading – from (onshore/offshore) port limit (or landfall point in the case of a pipeline) until the product enters the tanks.
- On Island Storage – storage facilities on Guernsey.
- Distribution – from the on island storage facilities to the end user (i.e. power station, petrol stations, airport etc).

Each of these components is described in further detail in the following sections.

2.2 Refineries/Fuel Storage and Distribution Terminals

Hydrocarbons are sourced from a number of northern European refineries, either directly or through fuel storage and distribution/resale companies. The choice of refinery/reseller is a combination of hydrocarbon product availability, location and commercial arrangements. A summary of the current sources that supply hydrocarbon products to Guernsey are presented in Table 2.1.

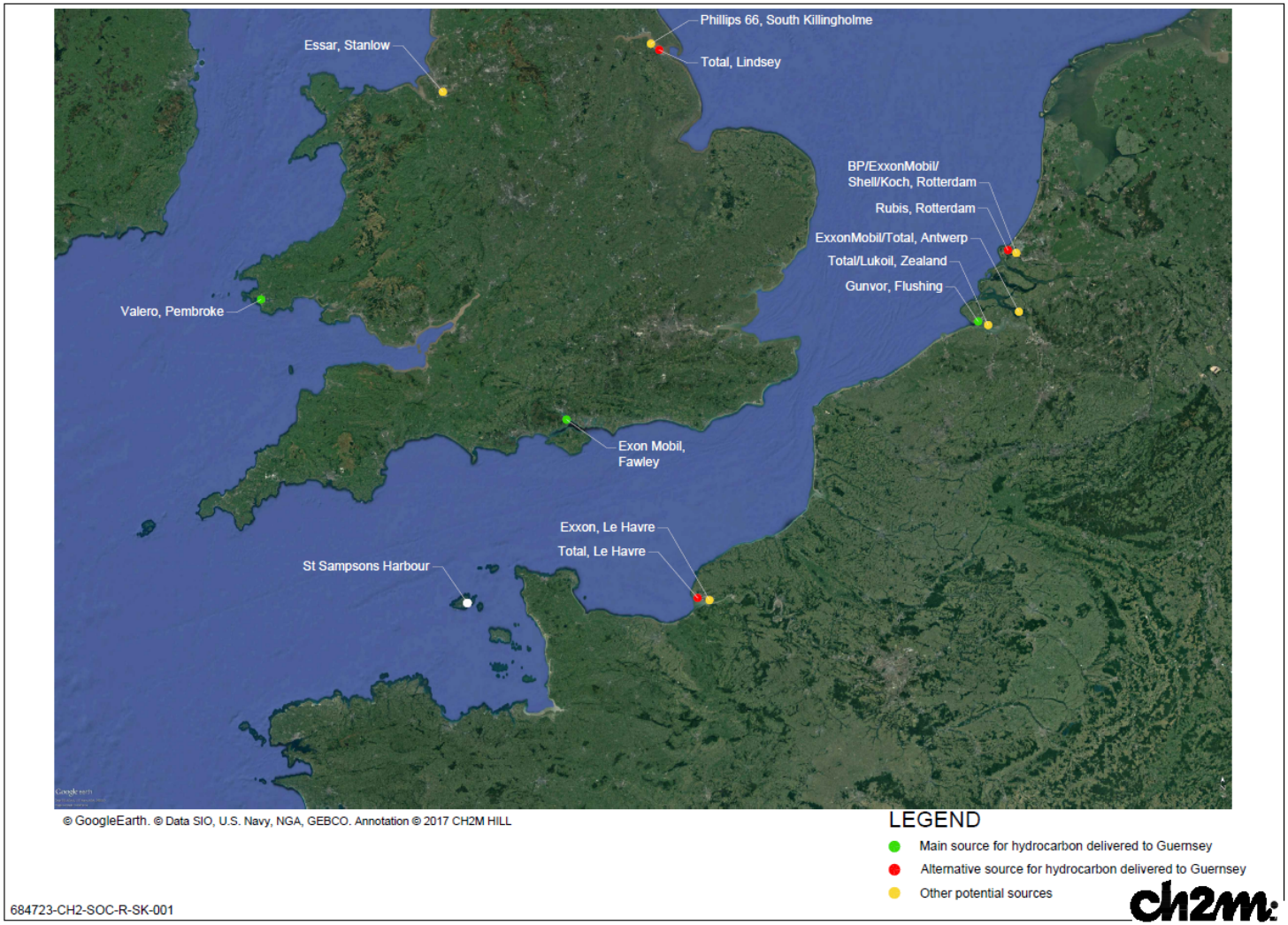
Table 2.1: Refineries/Fuel Storage and Distribution Terminals Supplying Guernsey

Refinery	Hydrocarbon Product	Importer
Gunvor, Flushing, Netherlands	LPG	Guernsey Gas (International Energy Group)
ExxonMobil, Fawley, Southampton	Heavy Fuel Oil	Guernsey Electric Limited
Valero, Pembroke, Wales	Petrol / Diesel / JetA1 / Avgas / Kerosene	Fuel Supplies (C.I) Ltd [RUBIS Group] Channel Island Fuels Limited (CIFL)

In addition to the sources identified above, a limited volume of hydrocarbons are sourced from alternative refineries and fuel storage and distribution/resale companies in northern-west Europe and the UK. These are typically purchased to test alternative supply sources or to take advantage of market pricing.

The locations of the refineries serving Guernsey and the main locations of other refineries in north-west Europe are shown in Figure 2.1.

Figure 2.1: Major Coastal Refinery Locations in North West Europe



2.3 Transportation

The majority of hydrocarbons arriving in Guernsey are transported from the refineries/terminals in bulk using specialist fuel tanker vessels. The liquefied petroleum gas (LPG) fleet currently calling at St Sampson's Harbour is all over 20 years old. The primary heavy fuel oil tanker serving Guernsey is 21 years old. The petroleum tankers (Sarnia Cherie and Sarnia Liberty) purchased by the States of Guernsey in 2008 deliver the bulk of the clean products and are 11 years old. A summary list of hydrocarbons vessels which have called at St Sampson Harbour in the last 3 years[2], together with their key parameters, is presented in Table 2.2.

[2] Data from Guernsey Harbours

Table 2.2: Hydrocarbon Vessels calling at St Sampson's Harbour 2014-2016

Vessel Type	Dwt (t)	LOA (m)	Beam (m)	Draft (m)	Capacity (m3)	Ship Name	Operator	Year Built	Age in 2017 (yrs)	Number of deliveries to St Sampson's Harbour		
										2014	2015	2016
Tanker (HFO)	2,800	75.00	12.50	4.90	2,080 (HFO)	Jaynee W	Whitakers	1996	21	18	11	16
Tanker (HFO)	2,965	84.95	15.00	6.30	2,682 (HFO)	Whitchampion	Whitakers	2003	14	2	0	0
Tanker (petroleum)	3,392	79.90	16.00	5.51	3,650	Sarnia Cherie	James Fisher Everard	2006	11	23	25	22
Tanker (petroleum)	3,515	79.90	16.00	5.50	3,650	Sarnia Liberty	James Fisher Everard	2006	11	2	0	2
Tanker (petroleum)	750	53.00	7.90	3.10	794	Rix Merlin	Rix Shipping Ltd	2005	12	4	1	0
Tanker (LPG)	2,004 2,004	73.60 73.60	14.00 14.00	4.95 4.95	1,760 1,760	B Gas Linda B Gas Lydia	B Gas AS B Gas AS	1992 1993	25 24	2 4	1 2	8 3
Tanker (LPG)	2,003 2,003	73.60 73.60	14.00 14.00	4.95 4.95	1,760 1,760	B Gas Laura B Gas Lotta	B Gas AS B Gas AS	1992 1992	25 25	2 3	0 2	0 0
Tanker (LPG)	2,347 2,347	74.00 74.00	14.12 14.00	4.80 4.80	1,971 1,970	B Gas Champion B Gas Commander	B Gas AS B Gas AS	1995 1996	22 21	1 1	5 3	2 1

2.4 Upload Facilities

Currently all of the hydrocarbon upload facilities are located within St Sampson's Harbour. The harbour was constructed in 1880 and has not changed significantly in terms of plan area since then. An impounded marina for small boats was constructed in 2005. The marina is situated to the western end of the harbour basin. The commercial berths have not had any significant improvements in the recent past.

At present the port is typically only accessible during spring tides[3] for the commercial vessels delivering hydrocarbons. With the exception of the Rix Merlin (an infrequently used vessel due to its small capacity) vessels have a draft in excess of 4.5m and therefore need a high spring tide to clear the Crabiere Rock on the entrance to St Sampson's Harbour. For the fuel vessels delivering most of the hydrocarbons to St Sampson's Harbour there are approximately 24-27 tidal windows[4] per year during which they can enter the port. These tidal windows around spring tides allow a vessel to enter the port on one high tide, discharge typically within 6 hours and depart approximately 12 hours after entering the port, on the following high tide.

The approach to St Sampson's Harbour is difficult to navigate. There are strong currents exceeding 5 knots across the harbour mouth, strong prevailing winds, often poor visibility and the presence of rock outcrops and other fixed obstacles either side of the approach. All commercial vessels with a length in excess of 25m require mandatory assistance by local pilots through the Guernsey Harbour Master. The maximum vessel length normally permitted into St Sampson's Harbour is 80m, though longer vessels up to 85m length have on occasion been permitted entry at the discretion of the Guernsey Harbour Master.

There are currently two main berth frontages in operation for commercial vessels:

- North Pier – comprises Berth 1A/1B – though only one fuel vessel can berth at any one time.
- South Commercial Quay - comprises Berth 2A/B/C - though only one fuel vessel can berth at any one time.

Figure 2.2 is an annotated aerial photo of St Sampson's Harbour showing the location of the berths relative to each other and the hydrocarbon storage facilities.

[3] A tide just after a new or full moon, when there is the greatest difference between high and low water

[4] Period of tides when the operations can occur

Figure 2.2: Annotated Aerial Photo of St Sampson's Harbour (Image Source: DigiMap via SoG Licence: G168)

The commercial berths in St Sampson's Harbour are used by the vessels delivering hydrocarbons and by a small number of other vessels as follows:

- Bulk (Cement) – MV Ronez.
- Bulk (aggregate) – various chartered as required.
- Bulk (Scrap) – various chartered as required.

The use of the two main berth frontages are as presented in Table 2.3.

Table 2.3: St Sampson's Harbour – Usage of North Pier and South Commercial Quay

Facility	User
North Pier	Guernsey Electricity Ltd (GEL) for the import of Heavy Fuel Oil (HFO) Channel Island Fuels Ltd (CIFL) for import of clean products (excluding aviation fuels) Ronez Ltd/ Annandale / Norman Piette Ltd /for the import of bulk solids/ aggregates Guernsey Recycling for the export of scrap materials (ferrous and non-ferrous)
South Commercial Quay	Guernsey Gas (International Energy Group) [IEG] for the import of liquefied petroleum gas (LPG) Fuel Supplies (C.I) Ltd [RUBIS Group] for the import of clean products Ronez Ltd for the import of cement

The hydrocarbon uploading process at the North Pier and South Commercial Quay is documented in the 2010 Halcrow Group Limited *Future Harbour Requirements Study.* The uploading process has remained largely unchanged since 2010 and is described in Appendix A using edited extracts from the 2010 report. GEL and CIFL use the north pier for upload as their on island storage is located to the north of the harbour. Likewise IEG and RUBIS Group use the South Commercial Quay as their on island storage is located to the south of the harbour.

2.5 Storage Facilities

There is no centralised storage facility in Guernsey for hydrocarbon products. The fuel importers have their own on island storage facilities which are located mainly to the North and South of St Sampson's Harbour. There is some localised on island storage of aviation fuel at the airport. The primary LPG storage is on the south side of the port in underground storage tanks. A subsurface pipe runs from the LPG storage to the gasification plant at Le Bouet.

A summary of the storage capacity and location is presented in Table 2.4.

Table 2.4: Summary of On Island Storage Facilities

Description	Location	Key Parameters	Operator	Storage Capacity *
Fuel Storage (GEL)	North of St Sampson's Harbour	2 main clusters of tanks, tanks vary in size typically hold 2,000t to 3,000t each	Guernsey Electricity Limited	13,000t HFO 1,000t Diesel
Fuel Storage (Clean products)*	North of St Sampson's Harbour	1 main cluster of tanks	Channel Island Fuels Limited	6,135 m^3 (approx. 4,900t)
	South of St Sampson's Harbour	1 main cluster of tanks	Fuel Supplies (C.I) Ltd [RUBIS Group]	8,827 m^3 (approx. 7,100t)
LPG Storage	South of Port	1 main cluster (underground)	Guernsey Gas	1,600t
LPG Bottles	South of Port	1 bottling area	Guernsey Gas	Unknown
LPG Storage	Le Bouet	Gas "production" plant	Guernsey Gas	Unknown
* Fuel storage volumes provided for clean products provided in cubic meters with approximate tonnage, as actual tonnage varies with split of product, due to density differences				

The storage locations in the vicinity of St Sampson's Harbour are presented in Figure 2.2.

2.6 Distribution

Distribution of clean products (petrol/diesel/kerosene) to customers and forecourts are made in 4- and 6-wheeler rigid tankers. There are thirty seven forecourts in Guernsey from which petroleum products are sold to consumers. The premises are licenced by Guernsey Health & Safety Executive for the storage of a specified (which varies) volume of petroleum products.

Gas is distributed by three primary mechanisms:

- through the gas pipe network, after makeup with air at the Guernsey Gas production plant at Le Bouet,
- by tankers as bulk supplies of LPG to customers with their own storage tanks,
- bottled gas in smaller containers distributed to various outlets around the Island.

HFO is used only by GEL and transported from the North Pier to GEL storage tanks through underground heat traced pipework and from GEL's storage tanks to its generators by its own local pipe network.

Aviation fuel is distributed from the St Sampson Terminal, operated by Fuel Supplies (CI) Limited (RUBIS Group) to the airport via road transport. There is localised storage of aviation fuel at the airport.

SECTION 3

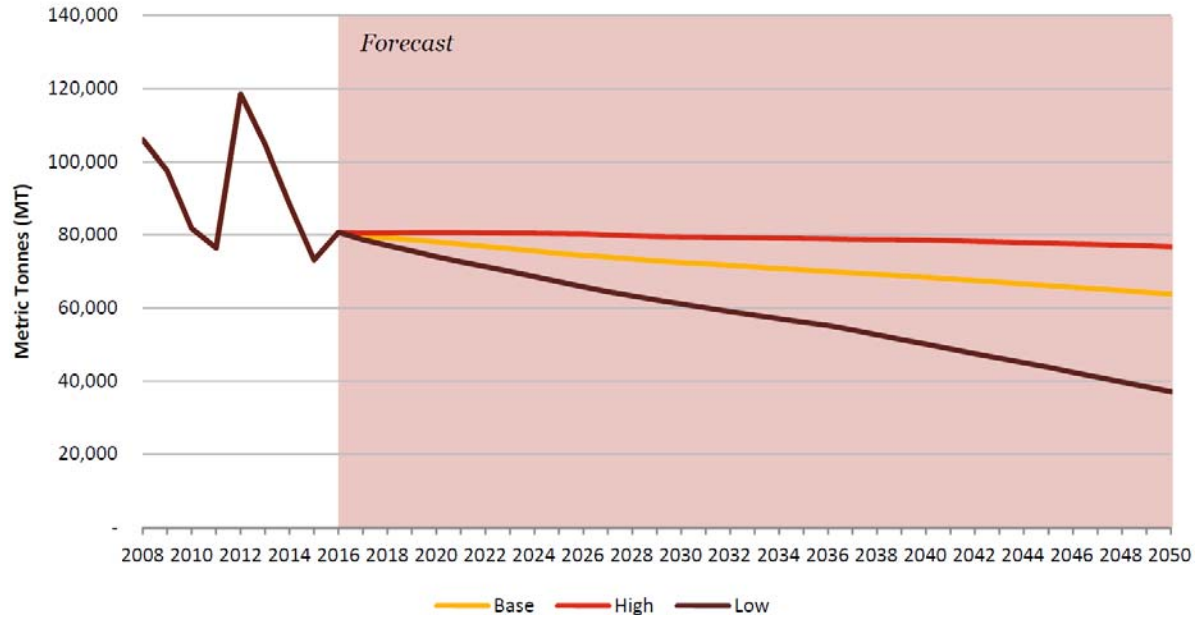
Future Hydrocarbon Demand

3.1 Summary

As part of the SOC a hydrocarbons forecast demand study has been prepared by PwC (684723-PWC-SOC-00-RP-0001 / GHSP-1A-D1-PWC-D1-004). This study forecasts a declining hydrocarbon demand in Guernsey under all scenarios considered.

The base case shows a volume decline of -21% in total between 2016 and 2050, the low case a decline of -54% while the high case is essentially flat. Historical demand volatility is driven primarily by HFO demand for GEL.

Figure 3.1: Guernsey Hydrocarbon Demand Forecast (Figure 1.1 from 684723-PWC-SOC-00-RP-0001)



3.2 Drivers

These demand forecasts are driven primarily by:

- A broadly flat population.
- An economy that is forecast to grow slowly but without any structural changes in the mix of economic activity conducted on the island.
- Increases in fuel efficiency across most segments, in particular the road transport and heating markets.
- Gradual electrification in some segments, most notably the uptake of electric vehicles.

The base case described in 684723-PWC-SOC-00-RP-0001 shows a slower rate of decline than experienced historically on the assumption that efficiency improvements are unlikely to be maintained at the same rate over such an extended period.

3.3 Discussion

PwC note that the declining trend is in line with current industry expectations for hydrocarbon demand in developed economies, which is expected to trend down after reaching 'peak demand' in 2007. The largest uncertainties in the forecast are:

- The rate of uptake of electric vehicles. Absent of any government policies, uptake will be due to market forces such as consumer preferences and product pricing/ performance. In a small market such as Guernsey, consumer attitudes towards electric vehicles is likely to be the dominant factor.
- GEL's demand for HFO for on-island generation. The proportion of electricity that is generated on island, rather than supplied via interconnector, is influenced by factors including government policy, fuel prices, the reliability of the current interconnector, and the possibility of new interconnectors. This means that a wide range of potential scenarios is possible.
- The relative shares of heating oil, LPG and electricity for residential and commercial heating. The share of each fuel has been stable historically but over the forecast period a range of factors could have an impact, in particular the relative pricing of each alternative.

The forecast scenarios recognise that climate change is leading to milder winters and are all based on existing States of Guernsey policies. Changes in policy (such as a drive for more renewable energy or improved building insulation requirements) could have a significant impact on the use of hydrocarbons on the island, potentially reducing hydrocarbon demand faster than shown in the low case scenario.

The options for dealing with future hydrocarbon supply to Guernsey will therefore need to recognise both the falling demand overall and the potential for a change in the fuel mix, together with the possibility of an accelerated reduction in demand should Island policy change in favour of reducing hydrocarbon demand.

SECTION 4

Issues in the Existing Supply Chain

4.1 Summary of Key Issues

Issues within the existing supply chain which have led to fuel import difficulties are discussed below. This section deals with issues which have occurred, rather than risks which may materialise but have not yet done so. In the following sections we have identified examples of issues that demonstrate challenges within the supply chain which have existed over an extended period. The list is illustrative but not exhaustive.

The risks are dealt with in Section 5 of this report.

Here we summarise our view of the key issues identified in the following subsections and cross reference the sources of information leading to their identification. While there may be mitigation measures in place in respect of some of these issues, they remain relevant to determining the key requirements of any future supply chain solutions which are to be developed and considered through this Hydrocarbons Programme.

- The current supply chain has unique challenges related to tidal restrictions and a requirement for fuel vessels to sit on the seabed whilst unloading [see 4.2.1 and 4.2.3].
- There are significant challenges in navigating vessels safely into St Sampson's Harbour and evidence of occasions when this has not been completed without incident [see 4.2.3.2].
- In common with similar island communities such as Jersey and the Isle of Man pre-tax fuel costs in Guernsey are expected to be higher than in the UK. This is in part due to the shipping costs and relatively small market, possibly exacerbated by the limited range of vessels that can use St Sampson's Harbour to deliver the fuel [see 4.2.2].
- In order to help to secure the supply of clean fuels, the States of Guernsey purchased two fuel tankers in 2009, following a period in 2008 when on Island stocks ran low and there were concerns regarding future availability of vessels able to deliver to St Sampson's Harbour [see 4.2.2 and 4.2.3.2].
- The States of Guernsey has a Memorandum of Understanding (MoU) with the clean fuel suppliers to report when their on Island stocks fall below 20 days. Through this mechanism, States of Guernsey has recorded periods in the past when stocks were below 20 days for more than a week at a time and on occasion below 10 days. The available records suggest there have been few such events since 2011 [see 4.2.4.1].
- There are a limited number of pilots who can safely bring vessels into St Sampson's Harbour and the pilots noted recent attempts to recruit additional pilots had not been successful [see Appendix B3].

Further details of the evidence for identification of the key issues is provided below and where relevant, extracts from the sources are provided in Appendix B.

4.2 Information Sources

4.2.1 From the Strategic Outline Programme (SOP)

The Hydrocarbon Supply Strategic Outline Programme (SOP) [Version 2.1, 7 April 2014] includes statements in the Executive Summary and in the Business Need sections regarding the existing supply chain. They note the unique challenges, tidal restrictions which mean specialised vessels are

required which can rest on the seabed, and occasions when missed deliveries resulted in the island coming close to running out of fuel.

Our review of oil and gas product deliveries in North West Europe has failed to identify any locations where similar operations currently involve unloading of oil and gas products from vessels which are grounded on a hard sea-bed.

Considering similar island communities which receive regular oil and gas deliveries, the Scottish Islands, Jersey and the Isles of Scilly use always afloat berths. Our experience in working with other small and remote communities including, St Helena, Ascension Island and the Falklands is that they all use always afloat berths. This may be due in some cases to the smaller tidal range[5] or smaller populations than found in Guernsey, which allow less frequent fuel deliveries and therefore alternative delivery mechanisms. For example, fuel deliveries on Ascension Island use of floating hoses deployed from shore which allow the fuel tankers to remain afloat in deeper water some distance from the jetty.

This supports the SOP view that the Guernsey supply chain includes some unique challenges particularly in relation to unloading fuel vessels whilst they are aground.

4.2.2 Evidence from previous reports

There are many previous reports that comment on the risks in the supply chain but few of these reports document specific issues that have arisen. Examples from two reports and the 2009 Billet D'Etat that do contain evidence, are discussed below.

In a 2008 report "Security of supply: Imports of Liquefied Petroleum Gas" ([redacted]), the fuel suppliers noted some minor issues with product quality for fuels delivered from Fawley Refinery in Southampton. It was however noted that these were infrequent (once every 2-3 years) and resolved within 2-3 days on each occasion. Commenting on LPG supplies, the report stated that there had been only been one missed tidal window in the past 10 years with no impact on stocks of LPG in Guernsey.

It should be noted that the petroleum tankers Sarnia Cherie and Sarnia Liberty were purchased by States of Guernsey in 2008 to help secure petroleum product deliveries to the island. This followed the decision in October 2008 by the owners of the two vessels capable of serving Guernsey to apply for bankruptcy protection and the decision by the Administrator to place the tankships on the market. The Billet D'Etat IV 2009 notes in section 8.8 that between January and October 2008, only one vessel was supplying petroleum product to the Island. During this period supplies of fuel in Guernsey ran low on occasions and informal calming measures were introduced by the distributor companies to prevent fuel running out completely.

The vessel ownership is now with JamesCo 750 Ltd (a States of Guernsey Trading Asset) and on long term bare boat charter to James Fisher Everard (JFE). The Sarnia Cherie is the main vessel used to service the Channel Islands, but the Sarnia Liberty could also be used. The Sarnia Liberty is used to fulfil a contract in the Scottish Islands, and some other work is undertaken for other North West European trades. The ships could be used to trade internationally[6].

The report notes issues with the shipping contracts with JFE which the fuel importers felt lead to higher costs on their fuel imports. These concerns are mainly due to fixed costs per voyage combined with a strategy to vary the load on vessels (and thus the vessel draft[7]) in order to ensure they can meet a delivery window. The delivery window is related to finding a suitable tidal height and therefore water depth in the approaches and in the harbour to bring the vessels in. This leads to

[5] Tidal range is the vertical height difference between one high tide and the subsequent low tide

[6] Information on vessel use based on record of phone call with JFE 23 March 2017

[7] Vessel draft is the vertical distance between the waterline and the bottom of the hull, i.e. the depth of water it requires to float

sub-optimal loads being delivered, but does help to ensure tidal deliveries are not missed. While fixed voyage costs are not uncommon in marine deliveries, the variation of load to meet varying draft restrictions in order to maintain delivery within a tidal window is less common.

In contrast to the situation regarding the clean fuel tankers, the Billet D'Etat IV 2009 notes (section 1.5) that for HFOand LPG imports, there were (at that time) a suitable arrangements and variety of vessels available for the import and storage of sufficient quantities HFO and LPG to meet the Island's requirements.

4.2.3 From Stakeholder Meetings

A series of meetings was held with some key stakeholders in the hydrocarbon supply chain at the outset of this work during the week beginning 12 December 2016. These meetings were designed to collate data for the preparation of the demand study and to provide inputs to support development of the evaluation criteria and the statement of requirements. In particular, the stakeholders were asked to identify issues within the current supply chain that had/have impacts on safety and security of supply and risks that may also have such impacts. A summary of the meetings is provided in report 684723-CH2-SOC-00-RP-0004 Summary of Stakeholder Meetings 12/12/2016-16/12/2016 and the key issues (risks which have materialised) noted by the stakeholders in the meetings are outlined in Appendix B.

Below we consider the key issues identified by stakeholders in context for each element of the supply chain.

4.2.3.1 Refineries/Fuel Storage and Distribution Terminals

The fuel suppliers commented that not all northern European refineries/fuel storage and distribution terminals could provide all of the product types required on Guernsey. While this does appear to be the case, there are currently a number of options for all products. Our research identified several other UK and coastal north-west European refineries outside the current supply chain providing a range of products (see Table 4.1). From their published summary of products, all of the UK refineries appear to be able to supply all of the products required in Guernsey, though this has not been independently verified.

Table 4.1: Refineries in UK and NW Europe outside existing Guernsey supply chain

Company	Name	Location
UK REFINERY TERMINALS		
Essar	Stanlow	Ellesmere Port, Mersey Estuary
Petroineos	Grangemouth	Firth of Forth
Phillips 66	South Killingholme	Humber
Total	Lindsey	Humber
OTHER NW EUROPEAN REFINERY TERMNALS		
Total	Gonfreville L'Orche / Normandy	Le Havre, France
Total/ExxonMobil	Antwerp	Belgium
Gunvor/Shell/BP and others	Rotterdam	Netherlands
Total/Lukoil	Vlissingen	Netherlands
Phillips 66	Whitegate	Cork, Ireland

There are also a number of UK and European fuel storage and distribution terminals including for example, those operated by; Greenergy (UK), Gunvor (Belgium), Inter Terminals (UK), Odfjell, Vitol and Vopak (Netherlands). Further discussion of suppliers outside the existing supply chain is provided when discussing options in the Overall Supply Chain Report Selection of Preferred Option (684723-CH2-SOC-00-RP-0006).

Fuel importers to Guernsey noted that the vessel size and therefore the hydrocarbon parcel size (of about 2,000 MT) is small in comparison to typical parcel sizes handled at Fawley and Pembroke. They note that this has on occasion led to delays in loading the Guernsey bound vessels while other larger

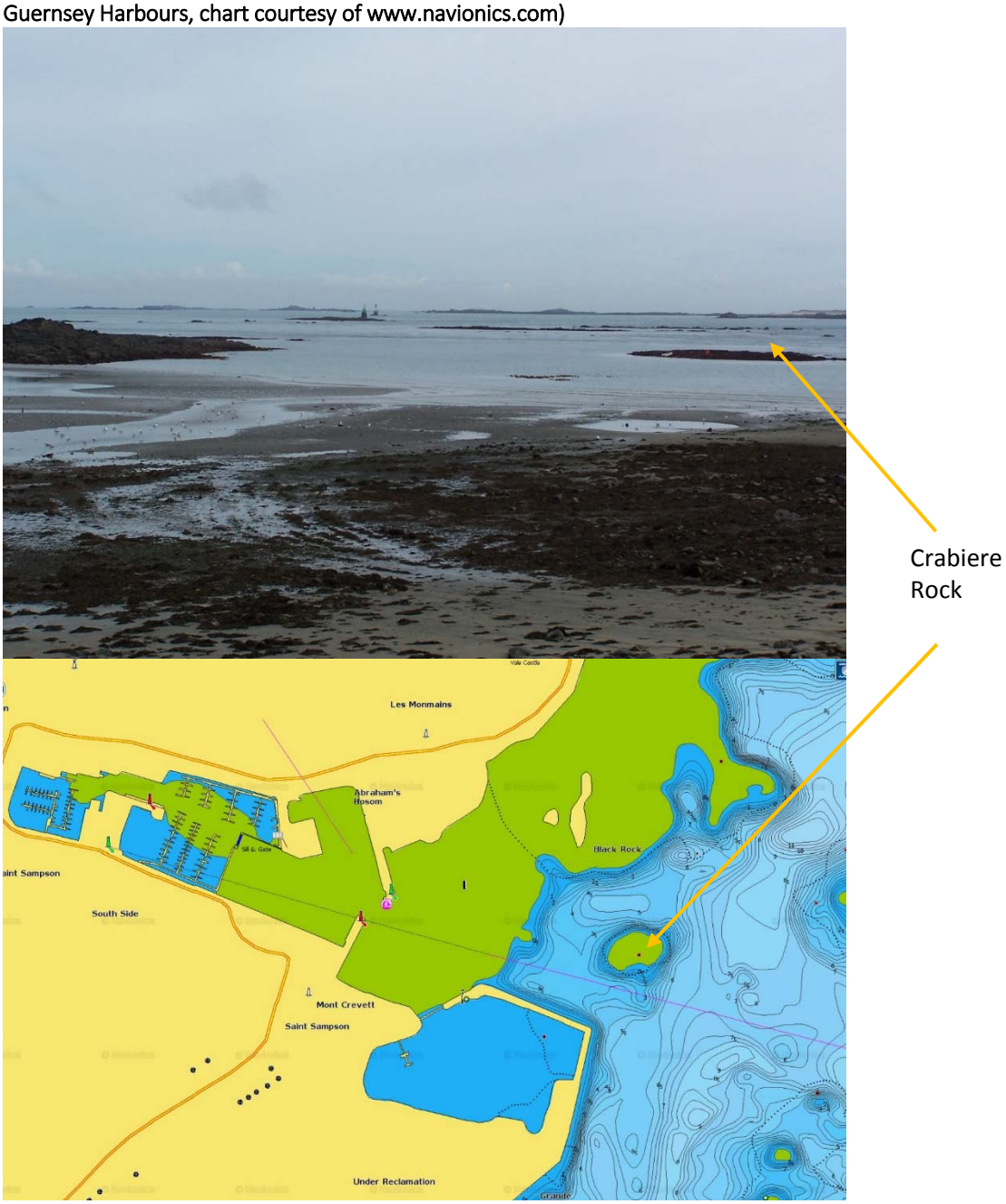
vessels are loaded in preference. We have not been able to verify this with specific examples including dates and delay periods. Consequently we have not been able to determine whether these alleged issues have had any impact on fuel stocks on the Island. Delays at refineries due to weather have been noted. For example on 15 and 16 March 2017 the Sarnia Cherie was delayed at Pembroke due to fog and as a result was light loaded in order to allow a later arrival in Guernsey and access to St Sampson's Harbour on a smaller tidal range than originally planned.

4.2.3.2 Transportation and Upload

As noted in section 4.2.1 the current supply chain requires the use of NAABSA vessels. The States of Guernsey bought two such vessels in 2009 for clean products as the view within the States of Guernsey at the time was that the Island was vulnerable to disruption to supply due to: tidal and weather restrictions in using St Sampson's Harbour, an "extremely short supply" of double hulled tankships suitable for St Sampson's Harbour, limited vessel availability and delays in vessel approvals in 2008. However, as described in Billet D'Etat IV 2009 a further significant concern was that in October 2008, the owners of the two vessels capable of servicing Guernsey applied for bankruptcy protection and the vessels were put up for sale on the open market. The purchase of the two vessels by JamesCo 750 Ltd (a States Trading Asset Company) and subsequent long term bare boat charter to James Fisher Everard (JFE) has provided Guernsey with access to suitable vessels for clean products supply since 2009. In discussions with JamesCo 750 Ltd (see Summary of Stakeholder Meetings 12122016 - 16122016 684723-CH2-SOC-00-RP-0004), it was noted that JamesCo 750 Ltd considers the vessel life expectancy to go at least through to 2028 and does not currently have a mandate or any plans to replace these two vessels. Furthermore JamesCo 750 Ltd does not consider the risks that the vessels will be refused loading at refineries as they age to be high, given that they attend the refineries regularly and are maintained to a high standard.

Many of the stakeholders, including the fuel suppliers, pilots, and Guernsey Harbours commented on the challenges of bringing vessels into St Sampson's Harbour. These relate mainly to the high tidal currents, narrow approaches, significant rock outcrops (see Figure 4.1) and narrow harbour entrance in relation to vessel size.

Figure 4.1: Entry to St Sampson's Harbour showing Crabiere Rock. Tide level 0.5mCD (Image courtesy of Guernsey Harbours, chart courtesy of www.navionics.com)



Guernsey Harbours provided evidence, presented in Table 4.2, of issues relating to vessels navigating the approaches to and from St Sampson's Harbour.

Table 4.2: Documented Evidence of Vessel Issues Navigating Approaches to St Sampson's Harbour

Date	Description
11/1/2017	B Gas Linda (LNG) – engine control problems on berthing. Berthed safely.
4/5/2016	MV Ben Varrey (bulk cargo) – Pilot error. Vessel collided with Longue Hougue reclamation on its way to berth. Vessel damaged, no pollution. Pilot suspended
8/4/2016	Ronez (bulk cargo) – master of vessel left anchorage and navigated to dangerous location en route to St Sampson's Harbour without pilot. Pilot boarded with difficulty and brought vessel under control and berthed safely.
14/1/2016	Jaynee W (HFO) – master protested at condition of 1N berth St Sampson's Harbour [outcome unknown – no information provided]
13/1/2016	Jaynee W (HFO) – bow thruster fixed and a plan for two shipments (of HFO) in 1 spring tide period was made, to allow for 3 week absence during vessel refit
18/10/2014	Amadeus (bulk cargo) - vessel berthed with defective bow thruster, against port requirements
12/3/2014	Sarnia Cherie/Jaynee W – vessels delayed in berthing as berth bed not prepared in time. Damage caused by vessel berthing movements on previous tides.
24/2/2014	MT Whitchampion (HFO) – special dispensation required from Harbour Master to bring in larger vessel outside normal operating standards
17/1/2014	Sarnia Liberty/ Jaynee W/Martin (bulk cargo) – berthing slot congestion managed through co-operation between parties and Harbour Master's direction
21/12/2013	Jaynee W/Islay Trader (bulk cargo) – berthing congestion managed through cooperation and Harbour Masters' direction
5/12/2009	Sigas Champion – Starboard quarter made contact with North Pier head at St Sampson's Harbour upon its departure. No damage to pier and minor cosmetic damage to vessel. Root cause identified as inadequate Pilot/Master exchange prior to departure from the berth in order to discuss passage and clarify concerns
27/1/ 2008	It was noted that damage had been caused to the seabed of berth 2S during the berthing and unberthing of MT Vedrey Tora. Damage was subsequently repaired by JCB following examination at the expense of the vessel owner.
4/3/2007	Vessel Jaynee W – entering St Sampson's harbour (laden with HFO), the Master became concerned by an apparent rumble that he believed indicated that the vessels was in shallower water than expected. The Master reduced the engine speed, although he and the Pilot were immediately able to confirm that their position and UKC were correct and as expected. However, the reduction in speed would have resulted in the vessel being set further to the north, and this combined with a fresh SE wind meant that the angle of approach was inappropriate for the weather, wind and tide conditions. Vessel made contact with Longue Hougue breakwater, resulting in some scoring of the vessel's plating.
29/1/2006	Near stranding of Sigas Commander – entering St Sampson's harbour (laden with butane/ propane). Wind squall from starboard quarter following previously being fine on the port quarter. Corrective actions taken with no effect. Engine set to full astern to avoid collision with Black Rock and crew alerted to standby anchors. Vessel eventually backed into clear water and entered Harbour without further incident. No damage sustained. Instrument readings and the uncharacteristic response of the vessel suggested that there may have been a fault with the propeller pitch control.

During further stakeholder meetings in January 2017 a former Guernsey Harbour Master and a former pilot made reference to the following incidents involving vessels using St Sampson's Harbour. We have not been able to identify these incidents within Guernsey Harbours' records.

- An incident involving a car landing on the deck of an LPG carrier after driving off the quay wall at St Sampson's Harbour (circa 1988).
- A vessel caught fire after discharge and on departure from harbour. The pilot continued to take the vessel out of the harbour to reduce risk to St Sampson's Harbour in the event that the fire progressed. The fire was contained and vessel was able to continue its voyage.

- A previous Harbour Master introduced a requirement for 1m under keel clearance (up from 0.5m) for all berthing operations due to problems with bed scour when berthing with 0.5m UKC. This prevented vessels getting onto berth at suitably regular intervals as tidal constraints became too great. In consequence the fuel storage (diesel/kerosene) fell below 10 days stock. It was later mitigated by reverting to 0.5m UKC and requiring Pilots/Masters to restrain use of high propeller speeds during berthing.
- The Jaynee W was berthed with excessive use of its bow thruster which damaged the bed of the berth. The Jaynee W was subsequently damaged when she settled on the bed of the berth.
- On one occasion during 1992/93 there was a period when on island storage of one of the fuel types imported ran critically low. This led to the berthing of a vessel on the seaward side of the St Sampson's Harbour southern harbour arm (not a NAABSA berth). Flexible hoses were used to make the connection to the manifold on the South Commercial Quay.

4.2.4 Other Documented Evidence

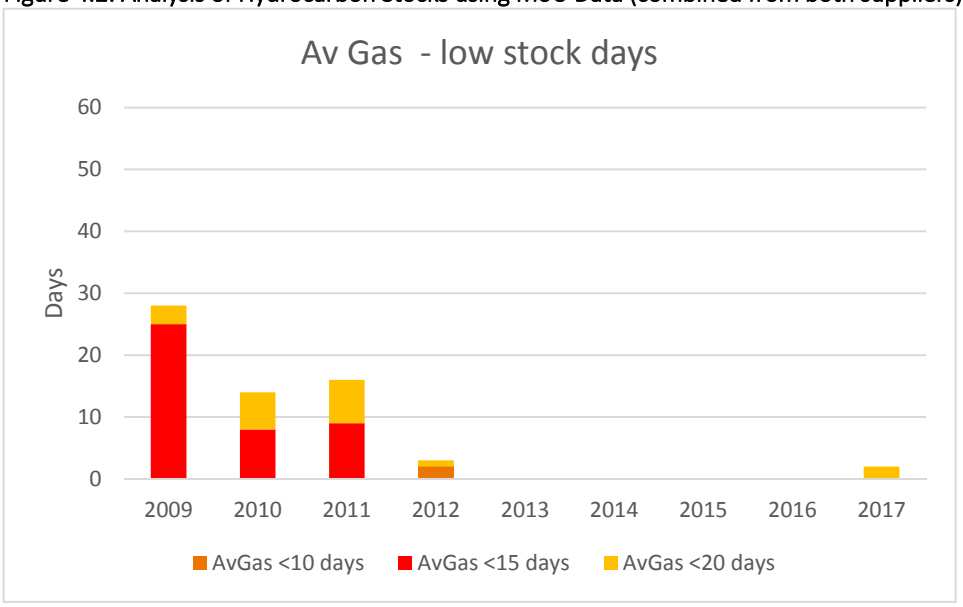
4.2.4.1 Emergency Powers (Supply of Fuel) Regulations 2008

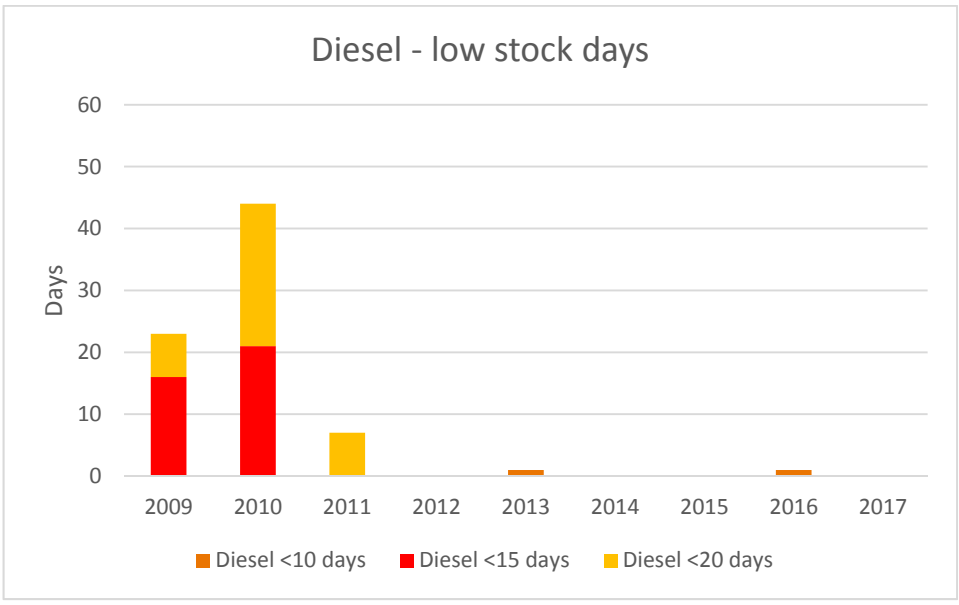
During 2008 plans were developed to implement the Emergency Powers (Supply of Fuel) (Bailiwick of Guernsey) Regulations 2008 following problems in the supply of fuel to the island. This included preparations for the declaration of a State of Emergency, appointment of a Fuel Commissioner, fixing fuel prices and restriction of fuel supplies to permitted vehicles and/or persons. The preparations included development of notices to be posted at petrol stations and permits for vehicles/persons who would be able to purchase fuel. This situation arose when the clean fuel vessels Vedrey Tora and Vedrey Thor experienced problems in passing inspections. Available information shows that critically low on Island stocks of some fuels were recorded from May 2008 through to at least August 2008 (though see also Section 4.2.2 which indicates low stocks occurred at times from January to October 2008). It appears that the potential fuel crisis was averted through management of fuel supplies, substitution of some fuels (e.g. downgrading Jet A1 to Kerosene and downgrading Super gasoline to PU50) and eventually the purchase by States of Guernsey of the clean fuel vessels (then renamed Sarnia Cherie and Sarnia Liberty).

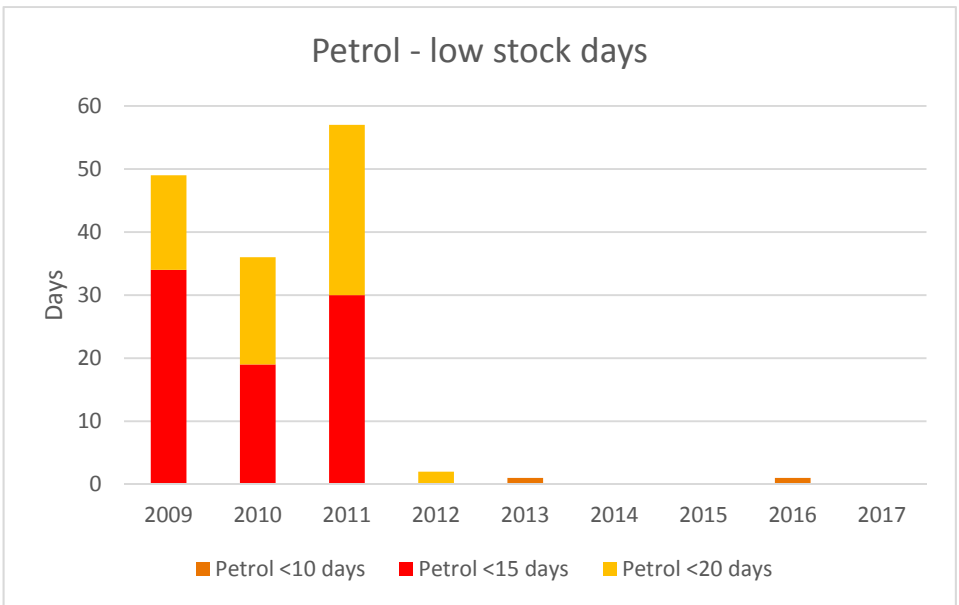
4.2.4.2 Stockholdings 2009 - 2017

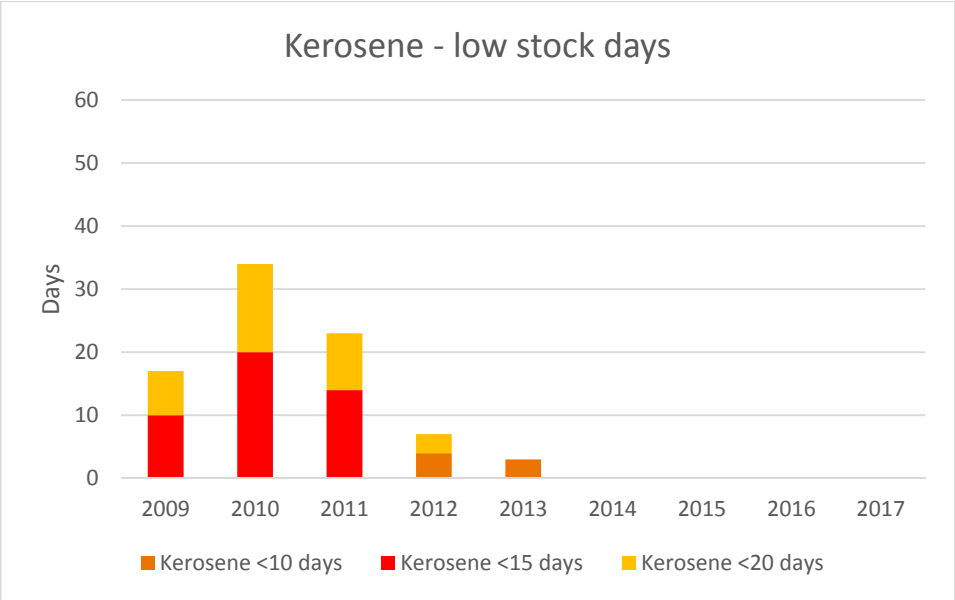
The fuel suppliers, RUBIS and Channel Island Fuels Limited each entered into voluntary agreements with the States of Guernsey in 2009 to support the management of fuel supplies on the Island. These Memoranda of Understanding (MoUs) now form part of the States of Guernsey Emergency Plan – Fuel (Rationing), version 7 Feb 2014. These MoUs require the fuel suppliers to advise the States of Guernsey when fuel stock levels on Island fall below 20 days of supply. Records of some of these events from 2009 to end Jan 2017 have been provided by the States of Guernsey Office *of the* Committee *for* Economic Development (OCED) and are summarised in Figure 4.2. The OCED have advised the Hydrocarbons Programme that the notification process detailed within the MOU was not intended to be recorded in a live document for monitoring business as usual but a tool to be used to alert the CCA of an issue should stocks run low. It has been noted by the OCED that these records may be incomplete due to a lack of available resources to maintain the records within the OECD and thus we consider the number of days of low stock are likely to be an under estimate of the real situation.

Figure 4.2: Analysis of Hydrocarbon Stocks using MoU Data (combined from both suppliers)









The available data shows that during the period 2009 – 2011 there were a number of occasions when fuel stock levels were below the 20 day trigger level; up to 57 days in 2011 for petrol, but less for other products. The data further shows that after 2011 there was a dramatic reduction in number of days of low stock. The reason for this change is attributed (by OCED) to the completion of a storage tank refurbishment/replacement programme by CIFL which was ongoing in the period 2009-2011. We note however, from stakeholder meetings with RUBIS, that some additional tank refurbishment and replacement was ongoing during 2014 and 2015. Since 2012 (when OCED advised the storage has been fully back online), the available data indicates that there have been a total of 5 or fewer low stock days for AvGas, Petrol and Diesel over the period (5 years and 1 month from 2012 to end Jan 2017) and 10 days for kerosene.

4.2.4.3 Vessels Waiting at Anchor

Guernsey Harbours have provided information relating to hydrocarbon vessels waiting at anchor for the years 2009 – 2016 inclusive. There are instances of hydrocarbon vessels waiting at anchor for a period prior to berthing in St Sampson's Harbour. There are possible demurrage costs associated with the vessels being at anchor. However, the details of commercial arrangements and associated costs are commercially sensitive and determined by confidential agreements between the parties to the agreements. If demurrage costs are due when vessels are at anchor this may result in an increase in cost of hydrocarbon products to the consumer.

No link between vessels at anchor and low stock levels has been identified.

SECTION 5

Risks in the Existing Supply Chain

5.1 Summary of Risks Identified

Various sources have been used to develop an understanding of the potential risks to the supply chain which are present but have not (yet) occurred. In the following sections we have identified examples of risks that demonstrate the types of risk within the supply chain which have been recognised over an extended period. Below we present our view of the risks, distilled from and referenced to the various sources below. The list is illustrative but not exhaustive.

- A range of risks exist within the hydrocarbon supply chain serving Guernsey. These risks have been recognised for many years and at least since 1985. [see 5.2.1 and 5.2.2] Our view is that most of these long standing risks remain today and the time horizon for several is now much closer.
- We believe that within the Guernsey Hydrocarbons supply chain, the risks with the most significant potential impacts on loss of life, property damage and environmental impact in Guernsey are related to loss of containment of the hydrocarbons from the fuel vessels and/or storage facilities. The potential impacts are most severe in the event that the containment loss results in an explosion. This is reflected in the planning controls within the Island Development Plan. [see 5.2.2.9]
- A long held view is that the continuing use of drying (NAABSA) berths in St Sampson's Harbour is at risk due to a potential change in legislation or refusal of the refineries to load vessels using NAABSA berths [see 5.2.2 and 5.2.3]. While we recognise these risks, we also note [see 5.2.4.1] that although current practice makes the use NAABSA berths for hydrocarbon transfer uncommon, we know of no plans to change industry guidance to discourage/ban the use of such berths.
- The previous section noted that the current fleet of tankers serving Guernsey has a limited life span. Several sources have identified risks that modern fuel tankers in the market and being built are too large to serve St Sampson's Harbour. Our view is that the evidence for this is clear [see 5.2.4.2]
- The Guernsey Pilots noted that several of the current pilots are close to retirement. It is the responsibility of the Guernsey Harbour Master to ensure pilotage is available [see 5.2.3.3].

Further information on the risks summarised above is provided in the following sections and supported with more details in Appendix C.

While there may be mitigation measures in place in respect of these risks, they remain relevant to determining the key requirements of any future supply chain solutions which are to be developed and considered through this Hydrocarbons Programme.

5.2 Information Sources

5.2.1 From the Strategic Outline Programme (SOP)

The Hydrocarbon Supply Strategic Outline Programme (SOP) [Version 2.1, 7 April 2014] includes statements in the Executive Summary and in the Business Need sections identifying risks within the existing supply chain. The document notes that many of the risks have been recognised for some time and initially led to a view that a deep-water berth was the most likely solution. However, it goes on to acknowledge that the uploading facility is only part of the whole supply chain and that other risks exist elsewhere within that supply chain.

5.2.2 Risks identified in previous reports

The risks of bringing fuels into St Sampson's Harbour have long been recognised in Guernsey, as evidenced by several Billet D'Etat including the examples noted below. Our view is that these risks remain valid.

5.2.2.1 Billet D'Etat XX 1988

Billet D'Etat XX 1988 noted that as far back as 1985 there was a view that an always afloat berth outside of St Sampson's Harbour was likely to be the long term solution for fuel import to the Island in order to mitigate the risk of increasing fuel vessel size which was apparent in the market at that time. Our view is that an always afloat berth is one potential option that should be considered as part of this Programme.

5.2.2.2 Billet D'Etat XV 1999

Within Appendix A of Billet D'Etat XV 1999 the Guernsey Harbours Marine Operations Review noted several risks in relation to St Sampson's Harbour which it considered might materialise by 2020. These included: no new tankers which would replace the existing fleet, a trend for larger vessels which would not fit into St Sampson's Harbour and a risk that future legislation may prevent fuel (in particular LPG) vessels from using NAABSA berths. There was also reference to the lack of evidence that other communities similar to Guernsey used NAABSA berths for fuel imports. All of these risks remain apparent today, though (despite contacts with PIANC, SIGTTO and ISGOTT) we have found no evidence of an imminent or planned ban on the use of NAABSA berths for fuel vessel operations.

There are many ports and harbours in the UK and worldwide which have NAABSA berths for commercial vessels. In the UK these are mainly small ports/harbours often in estuary settings. Worldwide, the NAABSA berths are used mainly for loading/offloading bulk carriers. Our research has not identified any locations where NAABSA berths are used for the import of hydrocarbons on a basis similar to that in Guernsey.

5.2.2.3 Board of Administration Report 1999

A 1999 report Board of Administration – Harbour of St Sampson – Land Reclamation and Redevelopment of Deepwater Berths noted several of the above risks. The report commented specifically on the high consequence, but low probability of property damage, injury and death associated with the storing volatile fuels at St Sampson's Harbour.

5.2.2.4 Security of Supply report, 2008

A number of risks in the LPG supply chain were noted in the report "Security of supply: Imports of Liquefied Petroleum Gas" ([redacted]). In particular it noted that an explosion at the gas plant would likely have the biggest impact, with and estimated risk of a single fatality in the range 1 x10^{-5} year to 1 x 10^{-6} a year (considered just tolerable by UK HSE for such sites).

5.2.2.5 Billet D'Etat IV 2009

The Billet D'Etat IV 2009 published in January described the Policy Council decision for the Security of Fuel Supplies and Purchase of Tankships. In addition to the issues mentioned in section 4.2.2 this document noted further risks in the supply chain including future weather risks (not climate change), combining with limited availability of vessels and the potential that the existing clean fuel vessels might be sold for service outside NW European waters and would not be available to deliver fuels to Guernsey.

5.2.2.6 Future Harbour Requirements report 2010

The Future Harbour Requirement Study (Halcrow Group Limited, 2010) included stakeholder interviews and discussions around the use of St Peter Port and St Sampson's Harbour. It made specific note of the significant risks in the hydrocarbons supply chain, particularly with the use of St Sampson's Harbour which it noted does not comply with any international guidance on width of

access and turning areas for manoeuvring and berthing petroleum vessels. This report recommended construction of a new deep water facility in Belle Greve Bay in order to mitigate the risks and provide greater security of supply.

We note that recommendations for the design and operation of ports/harbours contained within UK and international standards and guidance issued since the Halcrow 2010 report was published, still leaves St Sampson's Harbour non-compliant with best practice. This can be seen for example in the following documents:

- PIANC Report 116, 2012 Safety Aspects Affecting the Berthing Operations of Tankers to Oil and Gas Terminals.
- PIANC Report 121, 2015 Harbour Approach Channels Design Guidelines.
- PIANC Report 153, 2016 Recommendations for the Design and Assessment of Marine Oil and Petrochemical Terminals.

5.2.2.7 Supply Chain Logistics report 2013

A confidential report "Petroleum Product Supply Chain Logistics & Economics" ([redacted]) notes the emerging risks related to bioethanol and biodiesel which have been echoed by some of the stakeholders. The risks relate to potential supply side issues for non-bio products and operational and cost issues throughout the supply chain in delivering bio fuels to Guernsey.

5.2.2.8 Assessment of Major Hazards report 2015

The UK Health and Safety Laboratory (HSL) assessed the extent of the potential vapour clouds that might extend from the RUBIS and CIFL fuel tanks and uploading facilities as a result of potential tank overfill or loading line puncture/leak scenarios. This work was carried out to support a review of land use planning around the tanks (see below) and was in line with assessments carried out in the UK around similar facilities, following the explosion at the Buncefield storage facility in 2005. The assessment noted that explosion of vapour clouds around such facilities dominate the risks associated with loss of containment.

5.2.2.9 Island Development Plan 2016

Within the Island Development Plan (2016) which sets out land use planning guidance for the whole of Guernsey is a section covering development near major hazards. The only major hazards on Guernsey which are mentioned in The Plan are those associated with potential (but unlikely) explosions of the fuel loading and storage facilities in and around St Sampson's Harbour which are described above (see 5.2.2.8.)

5.2.3 Risks identified in Stakeholder Meetings

As noted previously a series of meetings was held with some key stakeholders in the hydrocarbon supply chain at the outset of this work. The stakeholders were asked to identify issues within the current supply chain that had/have impacts on safety and security of supply and risks that may also have such impacts. A summary of the meetings is provided in report 684723-CH2-SOC-00-RP-0004 Summary of Stakeholder Meetings 12/12/2016-16/12/2016] and key risks noted in the meetings are outlined below. As stated in the introduction to this section, these are risks which have not (yet) occurred rather than issues which have occurred.

5.2.3.1 Refineries/Fuel Storage and Distribution Terminals

The fuel suppliers noted a risk that as the age of the fleet of vessels that serve Guernsey increases, refineries may elect not to load the vessels with product. They commented that given the limited number of vessels available to serve Guernsey, due to NAABSA requirements and vessel length restrictions, a decision by refineries not to load vessels represents a significant risk. Clearly the vessel operators work to mitigate this risk through regular maintenance, inspections and appropriate

documentation. Furthermore, data from Clarksons (a major international shipping services company headquartered in London) shows (see Figure 5.1),that the owners of the main refineries currently serving Guernsey; ExxonMobil (Fawley) and Valero (Pembroke) have differing policies regarding restrictions on the age of vessel they will load. While Valero is quoted to have a 20 year age limit, ExxonMobil has no age limit but does require vetting in line with the Ship Inspection Report Programme (SIRE) developed by Oil Companies International Marine Forum (OCIMF).

Figure 5.1: Vessel Age Restrictions at Refineries (source CIFL)

Clarksons Platou

Chemical Majors Age Restrictions

Major	Restrictions
Chevron	25 Years for Lube Oils, chemicals & LPG (28 Years in special cases)
ExxonMobil	No Age Restriction (Provided SIRE/CAP)
P66	20 Years (Will consider older ships with established partners)
Shell Chemicals	No Age Restriction (Provided SIRE/CAP)
Statoil	20 Years
Neste Oil	20 Years
Greenergy	20 Years
Lukoil	15 Years (Will consider older ships with established partners)
ENI	20 Years
Valero	20 Years
Cepsa	18 Years (20 Years if in regular CEPSA trade but quite rare)
INEOS	24 Years +5K DWT, 25 Years sub 5K DWT
BP	20 Years +5K DWT, 25 Years sub 5K DWT
Dow Chemical	CDI Only
Total	15 Years
Borealis	20 Years (Will consider 23 Years for established partners)
Repsol	15 Years or younger is preference

October 2016 | www.clarksons.com

With a limited number of refineries in the current supply chain (see 2.2), stakeholders noted a risk that an incident at a refinery resulting in it being unable to supply Guernsey could cause a delay in getting fuel to Guernsey from another source. Again the fuel companies have some mitigation strategies in place to manage this risk, including identification of potential alternative suppliers.

Several stakeholders commented on the risk that NAABSA berth usage might be outlawed or that refineries might chose not to load NAABSA vessels due to concerns over reputational risk from potential environmental incidents. See section 5.2.4.1 for a full discussion of this risk.

5.2.3.2 Transportation

Several stakeholders commented on the risks associated with the age of the current vessel fleet, their NAABSA requirements and the declining number of vessels of a suitable size being built. Further discussion of this is provided in section 5.2.4.2.

Stakeholders also noted the risks inherent in marine transportation from the refinery/fuel storage and distribution facility to Guernsey and the potential this had to delay vessels such that they might miss the allotted tidal window for offloading. While there is no evidence available of this risk materialising to date (see section 4.2.4.3) it remains a credible risk.

CIFL noted potential future risks associated with the need to import bio-fuels/bio-fuel components which could add cost and complexity to the operations (see also 5.2.2.7).

5.2.3.3 Upload

Stakeholders noted that St Sampson's Harbour has a number of uses including the provision of berths and pipework for fuel imports. They noted that any incident within the harbour or harbour approaches that resulted in the closure of the harbour or one or more fuel import berths, could have a major impact on the ability to provide hydrocarbons to Guernsey. They suggested a number of possible causes including:

- failure of quay walls, due to age or vessel collision damage.
- stranding or sinking of a vessel in the harbour entrance.

Though there has been damage to the berths, we note that these other risks have not yet materialised, but remain credible and inherent risks of marine terminals, not unique to Guernsey or St Sampson's Harbour.

The Guernsey pilots noted that a pilot is required to bring any hydrocarbons vessel into St Sampson's Harbour[8] and that many of the current pilots are close to retirement. We note that the Pilotage (Guernsey) Law, 1966 (as subsequently enacted in the Pilotage Ordinance, 1967 (and several Pilotage (Amendment) Ordinances 1984-2015)) includes a duty on pilots as follows: "the general pilots shall be responsible to the Pilotage Board for maintaining a constant, regular and efficient service for the compulsory pilotage of vessels in accordance with the provisions of the Law and of this Ordinance". The "Master Pilot" (elected annually from the general pilots) is responsible to the Pilotage Board for "the organisation and efficiency of the pilotage service" and the general pilots are responsible for provision of two pilot boats (at least one readily available). This legislation currently requires that "a general pilot shall retire on attaining the age of sixty-five years" however, at a meeting of the Pilotage Board in November 2015 it was agreed to remove reference to age of retirement and instead to require that a valid medial certificate be held by General Pilots. This matter has been referred to the Law Officers.

5.2.4 Other Documented Risks

5.2.4.1 Industry Best Practice / Standards / Guidelines on use of NAABSA berths

A number of previous reports and several participants in the current supply chain have noted the risks associated with the use of drying berths and NAABSA vessels at St Sampson's Harbour. Several have pointed to the fact that it is now a very unusual practice for hydrocarbon vessels in Europe. Some have suggested that the practice may in due course be ruled out through legislation in other jurisdictions which may impact on the Guernsey supply chain. Nevertheless there are currently no legislative constraints preventing this practice.

However, several industry bodies publish good practice guidance for the operation of hydrocarbon supply vessels and terminals which have a presumption that vessels will normally be kept afloat while offloading.

For example, the OCIMF guide to Marine Terminal Management and Self-Assessment updated in December 2014 (https://www.ocimf-mtis.org/Microsite/Index) shows a clear expectation to keep vessels afloat during discharge as noted in Appendix C of this report.

The International Safety Guide for Inland Navigation Tank-barges and Terminals (OCIMF/CCNR, 2010) and the International Safety Guide for Oil Tankers and Terminals (OCIMF/ICS/IAPH, 2006) include the following information on operation of NAABSA berths:

"A limited number of ports that have significant tidal ranges allow tankers to operate when they are unable always to remain afloat while alongside the cargo handling berth. This type of operation is

[8] The Pilotage Ordinance, 1967 (and Pilotage (Amendment) Ordinance 1992) which enacts the Pilotage (Guernsey) Law, 1966 requires the Pilotage Board (comprising several members including the Harbour Master) to licence and examine pilots before they can operated in Guernsey pilotage zones. The legislation also prevents the granting of a special pilotage licence to the master or mate of a vessel for the special pilotage of that vessel entering or leaving St Sampson. Thus every vessel using St Sampson requires a general pilot.

considered exceptional and should only be permitted following a comprehensive risk assessment and the implementation of all safeguards identified to deliver a safe operation."

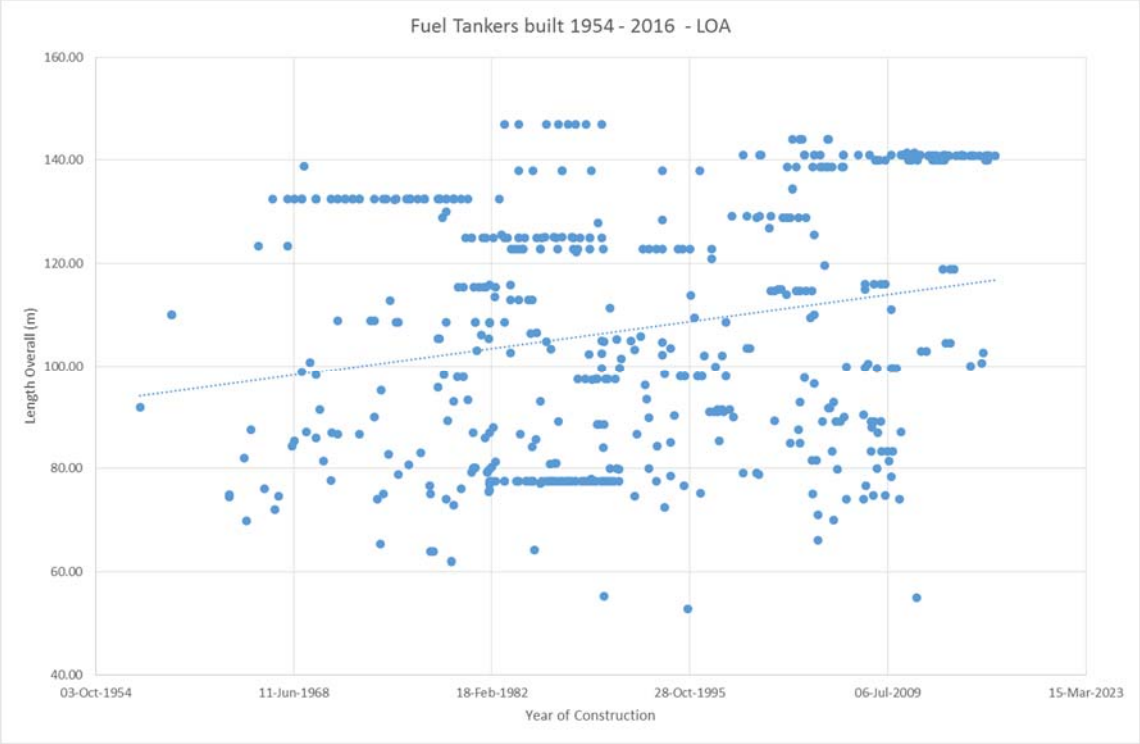
Further details are provided in Appendix C of this report.

5.2.4.2 Fuel Tanker Vessel Availability

Several of the stakeholders and previous reports and Billet D'Etat refer to the market trend for increasing size of fuel tankers, driven by economies of scale. This is seen as a risk to the current supply chain as vessels larger than 80m could not be accommodated within the normal operations in St Sampson's Harbour.

Our review of the World Fleet Register (from Clarksons Research Services Ltd.) of product tankers (for HFO and clean fuel cargos) in the 2,000 to 10,000 DWT range[9] shows a trend for increasing vessel DWT and lengths for newer tankers (see figure 5.2 below). The list includes over 650 vessels covering the world fleet. With the exception of one 55m and one 99.8m LOA tanker built in 2011, all the vessels built since 2010 are in excess of 100m LOA and would therefore not fit into St Sampson's Harbour.

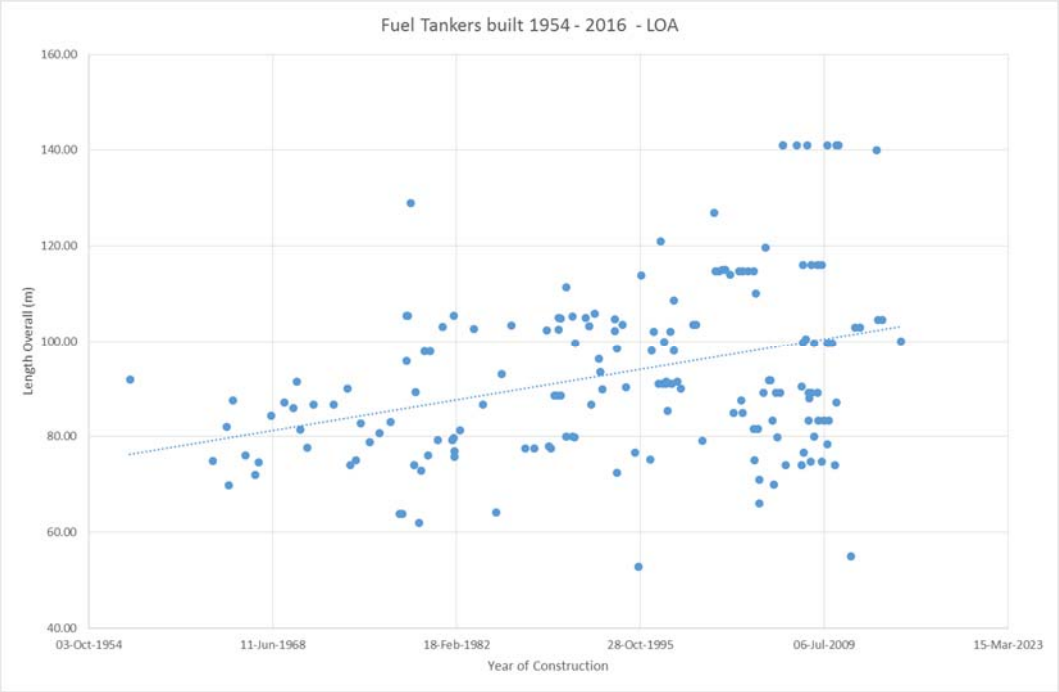
Figure 5.2: Fuel Tankers – Year of Construction vs Length (global fleet)



A similar picture is seen if we consider only the European (EU28) built fleet of fuel tankers (see Figure 5.3). This data supports the view that vessels of dimensions suitable to operate within the existing supply chain and berth at St Sampson's Harbour are not being built for the world or EU28 markets.

[9] Most tankers in the current Guernsey supply chain are in the 2,000 – 3,500 DWT (see section 2.3)

Figure 5.3: Fuel Tankers – Year of Construction vs Length (EU 28 fleet)



Considering vessels which might replace the Sarnia Cherie or Sarnia Liberty when they come to the end of their life, we might reasonably examine vessels constructed after them, i.e. since 2006. For vessels up to 80.0m LOA there are only ten built since 2006 as shown in Table 5.1.

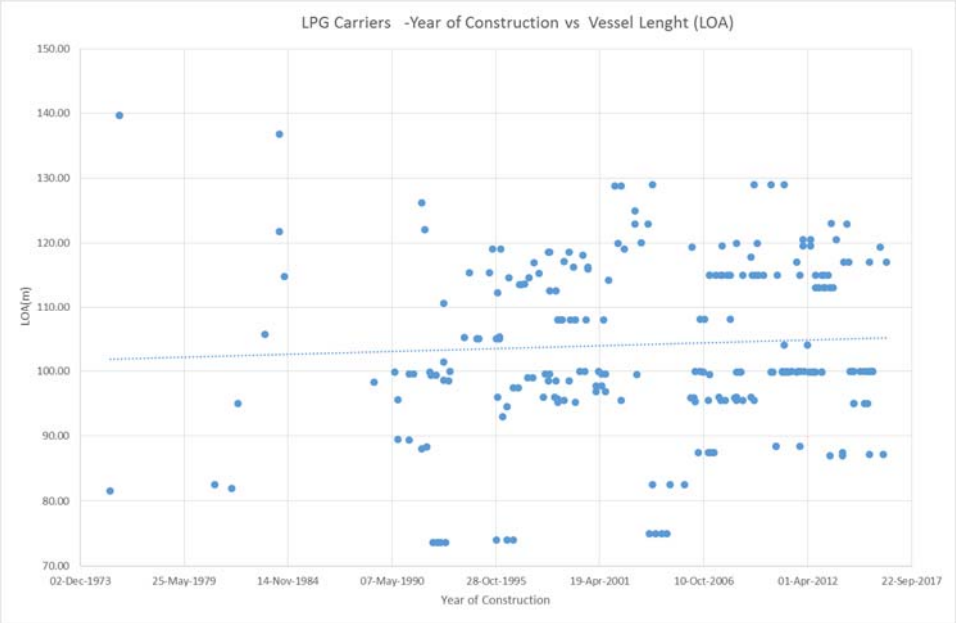
Table 5.1: Product tankers 80.0m in length or less built since 2006

Name	Designed for NAABSA	Draught (m)	LOA (m)	Year Built
Sarnia Cherie	*Yes*	*5.51*	*79.90*	*2006*
Sarnia Liberty	*Yes*	*5.50*	*79.90*	*2006*
Capraia	No	4.00	74.00	2007
Santa Rita	Unknown	4.20	74.70	2008
Greenoil	Unknown	5.80	76.60	2008
Lizrix	Yes	5.10	76.50	2008
Fox Luna	Unknown	6.40	79.96	2008
San Francesco	Unknown	4.44	74.70	2009
Eviapetrol III	Unknown	5.10	78.32	2009
Whitnavigator	Yes	4.50	69.70	2010
Giglio	Unknown	4.40	74.08	2010
Unex III	Unknown	5.25	55.00	2011

While we have not been able to establish whether these each of these vessels are able to operate on NAABSA berths it is clear that there is a small number of vessels of this size and a limited supply of new vessels being introduced to the market. Our view is that this substantiates the risks identified above.

The LPG carriers are a different class of vessel with different characteristics to the product tankers described above. However there is a similar, though less marked trend for increasing vessel length with year of construction as shown in Figure 5.4 (world fleet). The picture for the EU 28 fleet is very similar to the world fleet, as 90% of the vessels listed have EU 28 ownership. It should also be noted that LPG carriers of 80.0m or less have not been constructed since 2004.

Figure 5.4: LPG Carriers – Year of Construction vs Length (global fleet)



Of the 11 LPG carriers which are 80m or less, seven are already used within the Guernsey hydrocarbons supply chain. The remaining four, while less than 80m in length have a greater draft than those in use at present (Table 5.2). The 6.5m draft would preclude the use of these remaining four vessels in St Sampson's Harbour.

Table 5.2: Vessels in the global fleet which might enter St Sampson's Harbour based on LOA

Name	In current Guernsey Supply Chain	Draught (m)	LOA (m)	Built Date
B Gas Laura	Yes	5.64	73.60	01-Jul-1992
B Gas Linda	Yes	5.64	73.60	01-Oct-1992
B Gas Lotta	Yes	5.64	73.60	01-Dec-1992
B Gas Lydia	Yes	5.64	73.60	01-Mar-1993
B Gas Champion	Yes	4.81	74.00	01-Nov-1995
B Gas Commander	Yes	4.81	74.00	01-Jun-1996
B Gas Crusader	Yes	4.81	74.00	01-Oct-1996
Ceska	No	6.50	75.00	01-Dec-2003
Maddy	No	6.50	74.94	01-Apr-2004
Marte	No	6.50	75.00	01-Aug-2004
Venere	No	6.50	75.00	01-Nov-2004

Our view is that this proves conclusively that the LPG vessels currently used in the Guernsey are the only ones currently available to service the Island through St Sampson's Harbour. Furthermore it seems unlikely that there are market drivers for construction of similar vessels in the future.

SECTION 6

Performance of the Existing Supply Chain

6.1 Approach

As previously discussed, the evaluation of the current supply chain has been carried out using a risk based methodology in order to determine if any of the individual components of the supply chain have risks beyond the acceptable limits of the States of Guernsey. An overview of this process is provided in this section. A fuller description is presented in report 684723-CH2-SOC-00-RP-0002 Evaluation Criteria.

The steps required in the risk assessment process are defined as:

- Step 1 - Identify the risks
- Step 2 - Analyse the risks
- Step 3 - Evaluate the risks
- Step 4 - Treat the risks

In this document only the first three steps of the process will be presented as the purpose of this phase of the project is to establish the need for treatment rather than cataloguing what the potential treatments are.

6.1.1 Step 1 – Identifying the risks

Risks were identified in consultation with stakeholders and experience from the broader oil and gas industry. This risk assessment is designed to be a strategic risk assessment tool to support options appraisal and is therefore pragmatically selective. It is not designed to capture every risk that Guernsey could face regarding hydrocarbons, but instead focuses on scenarios that are representative of the wider risk landscape and which inform our understanding of the common consequences Guernsey could face.

Risk descriptions have to strike a balance between being sufficiently generic to encourage consideration of a range of possibilities but specific enough to be meaningful for planning and options appraisal purposes.

To ensure risks are broadly comparable the risk assessment uses a Reasonable Worst Case Scenario (RWCS) for each risk. The RWCS is defined as a challenging yet plausible manifestation of the risk.

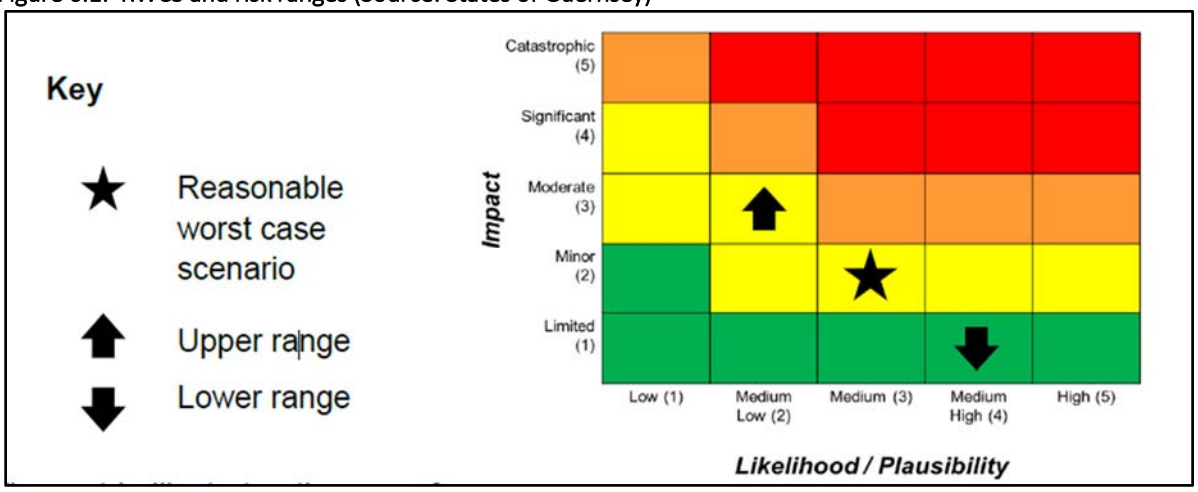
The primary outcome of the RWCS is described for each risk. The outcome description specifies the event to an extent that makes it possible to assess the impact and likelihood. This includes specific assumptions made for the purpose of outlining the RWCS such as the location or other factors that specifically influence the impact or likelihood of the event.

A number of key risk scenarios have been defined for each of the individual components of the supply chain.

6.1.2 Step 2 – Analysing the risks

Each risk was assessed to determine the likelihood and impact of the RWCS but also a lower range and an upper range, as illustrated in Figure 6.1.

Figure 6.1: RWCS and risk ranges (Source: States of Guernsey)



The lower and upper ranges demonstrate alternative manifestations of that risk scenario which have been considered in the process of identifying a RWCS. Including ranges with greater and lesser impacts / recurrence rates provides greater transparency with regards to planning and places greater emphasis on agility and scalability when assessing potential treatments/options to mitigate the risk.

The likelihood is expressed on a 1-5 scale (Table 6.1). For clarity, the scale is defined explicitly in terms of probabilities but the extent to which it is actually possible to apply these probabilities in the likelihood assessments will vary considerably.

Table 6.1: Likelihood Definition (Source: States of Guernsey)

Score	Descriptor	Interpretation	Percentage chance over 5 years	Chance over 5 years
1	Low	It is extremely unlikely that the event will occur as there is nearly no experience of it in the sector.	Between a 0.005% and 0.05% chance	Between a 1 20,000 and 1 in 2,000 chance
2	Medium-low	The event is unlikely to occur as experience of it is very limited in the sector.	Between a 0.05% and 0.5% chance	Between a 1 in 2,000 and 1 in 200 chance
3	Medium	It is likely that the event will occur as similar events have been reported in the sector.	Between a 0.5% and 5% chance	Between a 1 in 200 and 1 in 20 chance
4	Medium-high	It is very likely that the event will occur in the supply chain as most of the sector has already suffered such events.	Between a 5% and 50% chance	Between a 1 in 20 and a 1 in 2 chance
5	High	The event will happen in the supply chain in the close future.	More than a 50% chance	More than a 1 in 2 chance

Impact assessments are based on both quantitative evidence and qualitative judgement. The impact assessment covers five dimensions, each measured on a scale of 0-5. The five dimensions cover impacts on: finance, reputation, continuity of service, health and safety, regulatory compliance. The scoring scales (0-5) are designed to identify order of magnitude differences with the scale, duration and severity of incidents increasing as the scale increases. So the scoring scale runs from

No Impact (0) to Catastrophic (5) with impact definitions for each of the five dimensions, as illustrated in Table 6.2.

Table 6.2: Impact Definition (Source: States of Guernsey)

Impact Score		**Financial** (loss of revenue, customer compensation during the period of the incident for any part or element of the supply chain)	**Reputation**	**Continuity of Service**	**Health & Safety**	**Regulatory**
5	**Catastrophic**	Greater than £5million	Sustained national adverse media attention	Fuel rationing for more than 1 week	Multiple fatalities from a single occurrence	Breakdown in relationship with International Regulator
4	**Major**	£1million to £5million	One off national adverse media attention	Fuel rationing for up to 1 week	A fatality or serious disability or life threatening health effect	Breach of regulation or legislation with severe costs / fine
3	**Moderate**	£100,000 to £1million	Sustained adverse local media and / or social media attention	<5 days strategic volumes remaining in the tank and fuel rationing being considered	A lost time injury (>3 days) or serious injury (reportable) or irreversible health effect	Breach of legislation or code resulting in fine or rebuke by Court or Regulator
2	**Minor**	£5,000 to £100,000	One off adverse local media and / or social media attention	5 to 10 days strategic volumes remaining in the tank	A minor injury (medical treatment <3 days lost time) or reversible health effect or restriction to Work Activity	Breach of legislation or code resulting in a compensation award
1	**Insignificant**	Less than £5,000	Internal Matter	10 to 20 days strategic volumes remaining in the tank	A slight injury (first aid) or slight health effect	Breach of legislation or code resulting in no compensation or loss
0	**No impact**	No financial loss	No reputational damage	>20 days strategic volumes remaining in the tank	No injury or health effect	No regulatory or code breach

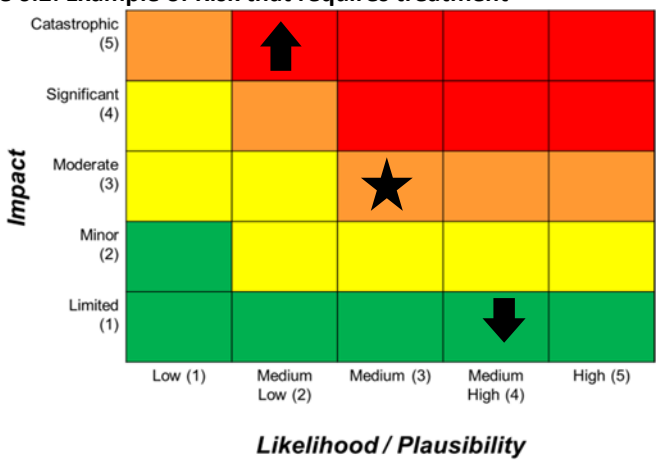
An 'Overall Impact Score' is the collective result of the five dimensions listed above and thus measures the degree to which the impacts of a scenario cross-cut all five. This is calculated using the highest score of the five dimensions given above.

6.1.3 Evaluating the risks

Having assessed the risks according to the methodology set out in the previous section, the risks can be ranked for evaluation. The following method will be employed to determine which risks require mitigation:

- Risks where the RWCS is “red” require treatment.
- Risks where the RWCS is “orange” but the Upper Range is “red” require treatment.
- All risks with RWCS of “orange” should consider planning strategies to limit the impact of the risk if removing the cause of the risk is not viable.

Figure 6.2: Example of Risk that requires treatment



Key

★ Reasonable worst case scenario (RWCS)

⬆ Upper range ⬇ Lower range

With the objective of reducing risk scores to the desired levels i.e.:

- The RWCS and Upper Range risk scores are orange,
- The RWCS is yellow or green (irrespective of upper range),
- Planning strategies are included to limit impact if RWCS risk score is orange.

6.2 Outcome of the risk assessment

A risk assessment workshop was carried out in Guernsey to evaluate the risks that had been previously identified by the project team and also as part of the stakeholder engagement process.

The risks were linked to each part of the supply chain:

- Refining/Storage and Distribution Facilities (R)
- Transport (T)
- Upload (U)
- On Island Storage (S)
- Distribution (D)

Workshop attendees were: [redacted] (SoG Programme Director), [redacted] (SoG Programme Business Change Manager), [redacted] (SoG Project Manager), [redacted] (SoG Programme Support Office), [redacted] (SoG Risk Executive), [redacted] (CH2M

Programme Manager), [redacted] (CH2M Technical Expert), [redacted] (CH2M Project Engineer). Each person provided their own score for likelihood and impact for the RWCS and the median score was used.

Table 6.3 provides a summary of the output from the risk workshop. Appendix D includes a complete description of each risk, including the overall outcome description, the potential causes, the confidence in the assessment, linked and compound risks, a specific definition of the RWCS, examples of the risk and commentary on the scoring of the RWCS and upper and lower risk ranges.

The table below shows that there were five major sources of high risks identified:

- Shipping risks
- Harbour access risks
- Explosion risks at St Sampson's Harbour
- Inadequate fuel stock available on Island
- Part of the supply chain becoming unviable for private enterprise.

These are described further in the following sections.

6.2.1 Shipping risks

A number of the highest risks to the current hydrocarbon supply chain relate to shipping the product and in particular the reliance on NAABSA berths in St Sampson. The reasons for this are as follows:

- There are very few NAABSA vessels in the world fleet capable of servicing St Sampson's Harbour in Guernsey due to the vessel size and specific manoeuvrability constraints.
- There are currently no controls in place that mandate that these vessels call at Guernsey other than market forces (i.e. the premium that Guernsey pays in order to guarantee supply).
- There are currently no future plans or contracts in place to require JamesCo 750 Ltd or other shipping suppliers to replace the vessels once they reach their end of life. There are no external market drivers for shippers to build such vessels as demand for them is very limited (most ports can accommodate larger vessels, few ports have drying berths for fuel import and the extra material needed to strengthen the hulls and allow engines to operated when not afloat reduces fuel carrying capacity and increases transport cost per litre of fuel).

Currently, these risks are known by the States of Guernsey but no controls are in place to treat the risk. Due to the imminence of these risks being realised formal treatment plans need to be put in place to address the risks in the short term and as part of any longer term solutions.

6.2.2 St Sampson's Harbour Access Risks

The risk of collision or damage to vessels on entering or leaving St Sampson's Harbour also rated very high in the risk assessment. This is due to the well-recognised challenges of bringing vessels into the harbour and evidence of previous incidents which have been less impactful than the RWCS envisaged in this assessment.

6.2.3 Explosion related risks

A number of risks relate to explosions or fires starting at the shipping or storage facilities in the vicinity of St Sampson's Harbour. In most cases the likelihood of the events are very low and are typical of risks inherent in transporting and storing hydrocarbons. However, due to the high consequence of such events occurring (e.g. destruction of storage tanks, long term closure of the port, loss of life, reputational damage etc.) these risks need to be reduced in order to meet the evaluation criteria.

However, the risks should also be investigated further to determine whether any practical means can be found to reduce the risk should any solutions involve continuing the use of the current facilities. This may include either reducing the likelihood of the risk occurring by increasing safety measures or by reducing the impact.

6.2.4 Inadequate fuel stock available on Island

Continuity of fuel supply on the Island is achieved when fuel stocks on the Island can always meet demand. There are no legal requirements on private fuel suppliers to maintain any minimum stock levels. Thus they, and the States of Guernsey are vulnerable to delays in re-stocking which might arise for various reasons. This risk has been rated very high as the consequences potentially include fuel rationing and sustained adverse media attention. Future solutions should treat this risk to reduce the likelihood or its impact.

6.2.5 Private sector exit from supply chain

During the risk assessment workshop it was recognised that many of the "perceived" controls currently in place rely on market forces to be maintained. The demand study, however, has shown that it is likely that the future demand will decrease significantly. Possible consequences of this may be that either fuel becomes more expensive due to higher relative overheads of operation and/or that some of the suppliers pull out of the market or require some form of intervention from the States of Guernsey in order to continue operations.

This may not only impact on the fuel price but also the level of investment put into the infrastructure such as the storage facilities.

Therefore it is recommended that when treatments are proposed for the various risks highlighted in Table 6.3, consideration should be given to how a falling demand might impact the effectiveness of the treatment.

6.2.6 Summary

As noted above, a full description of each risk is provided in Appendix D. Below is presented the summary risk scoring from the risk workshop. For each risk, the overall score for the RWCS is presented, along with scores for the upper and lower ranges and the confidence level with which each RWCS was assessed at the workshop.

Table 6.3: Summary of risk assessment outcome

Num	Ref	Risk Descriptions	Overall	RWCS		Upper		Lower		Confidence
			Score	Lik	Imp	Lik	Imp	Lik	Imp	
1	A	Adverse Weather on route or in Guernsey	High	3	3	1	5	5	1	High
2	B	No Vessel Available	Very High	5	5			5	2	High
3	C	No Pilot Services	Medium	2	3	1	5	2	2	High
4	D1	Refineries refuse to load due to age or condition	High	3	3	2	5	3	1	High
5	D2	Refineries refuse to load NAABSA vessels	High	1	5			1	3	High
6	E	Reduced availability of non-bio fuels	High	3	3	1	5	5	2	Low
7	F	Vessel collision/damage on approach, entry/exit or during discharge	Very High	2	5			3	2	High
8	H	Damage, fire or explosion at storage facilities	Very High	2	5			3	2	High
9	I	Inadequate Fuel Socks available	Very High	2	5			3	2	Low
10	K	Inadequate on Island Storage capacity	High	3	3	2	5	5	1	Low
11	O	Berth Unavailable	Medium	4	1	2	3	5	1	very high
12	P	Contaminated or out of specification fuel enters on island storage and/or distribution network	Medium	3	2	1	4	3	1	low
13	R	Delay at refinery	Medium	5	2	1	3	5	1	high
14	T	Part of supply chain becomes commercially unviable/no longer provided by the private sector	Very High	3	4	1	5	3	3	low
15	U	Damage to manifolds at upload facilities	Medium	3	2	2	3	3	1	low
16	V	HSE incident at uploading or storage facilities	High	3	3	2	4	4	2	high

Note: for Risk T the UPPER score rates "orange" while the RWCS rates "red" as the UPPER score has a very low likelihood (1) and thus cannot be rated more than "orange" (as seen in the risk matrix Figure 6.1)

SECTION 6

Statement of Requirements

This section provides a list of requirements which the Guernsey hydrocarbons supply chain should aim to achieve in order to ensure it can meet the Hydrocarbon Programme vision:

> A safe and secure hydrocarbon supply delivering socio-economic value to Guernsey.

7.1 Generic Requirements

The following requirements apply to all elements of the supply chain.

- Future solutions need to allow for continued importation of all the currently supplied fuels.
- Future supply chains should be adaptable to cope with the forecast decline in fuel demand in the range 20-50% by 2050.
- Future supply chains should allow for total hydrocarbon imports in the range 40,000 to 80,000 MT (tonnes) by 2050.
- Where possible, a diversity of supply and suppliers should be maintained.
- While it is expected there will be a premium to be paid on the price of hydrocarbon supply to Guernsey in comparison to larger markets in UK and Europe, future supply solutions should aim to minimize this premium.
- Any major new infrastructure should have a design life in excess of 25 years.
- Any new infrastructure should be considered in relation to potential synergies with other States of Guernsey capital projects.

As noted in the Evaluation Criteria Report (684723-CH2-SOC-00-RP-0002/GHSP-1A-DI-CH2-D1-002) the risk objective will be to develop future supply chain solutions which are in line with the States of Guernsey risk appetite. This has been identified as solutions in which:

- The RWCS and Upper Range risk scores are orange,
- The RWCS is yellow or green (irrespective of upper range),
- Planning strategies are included to limit impact if RWCS risk score is orange.

7.2 Refineries/Fuel Storage and Distribution Terminals

Fuel for Guernsey will continue to be purchased from refineries and/or other fuel suppliers. The assessment of risks in the supply chain from refineries has demonstrated a need to ensure:

- Guernsey has access to fuel supplies from several sources.
- Long term supply contracts are encouraged to assist in security of supply.
- There is close liaison with refineries/fuel storage and distribution terminals regarding the vessels/vehicles collecting the fuels to ensure they are always accepted.
- Continuing access to non-bio fuels is maintained at competitive prices.

7.3 Transportation

Hydrocarbons will need to be transported to Guernsey by some means. Future supply chains may include fuel tanker vessels as at present, and/or other methods such as unitised or pipeline transport.

If clean fuel is to be delivered by fuel tanker vessels, alternatives to the Sarnia Cherie and Sarnia Liberty will be required before they are life expired. With a typical service life of 25 years this is currently expected to be in 2028.

If LPG is to continue to be delivered by gas tanker vessel, alternatives to the current B-Gas fleet are required urgently. With a typical service life of 20-25 years and a B-Gas company policy not to retain vessels beyond 25 years, the current fleet would all life expire between now and 2021.

If HFO is to continue to be delivered by tanker vessel, alternatives to the JayneeW will be required when it reaches the end of its service life. With an anticipated service life of 30 years, this would be 2026.

If new vessels are to be used to import fuel to St Sampson's Harbour, they will need to comply with the Harbour's requirements for high angled rudders, bow thrusters, maximum length and loaded draft.

If other methods of transportation are proposed they should be combined with appropriate on Island storage in order to realise additional benefits in risk reduction.

7.4 Upload Facilities

Future hydrocarbon imports to Guernsey may continue through St Sampson's harbour and/or St Peter Port or a potential new facility.

If St Sampson's Harbour is to continue in use, navigation will remain difficult and any solution should include a mechanism to secure future availability of suitably qualified and experienced pilots capable of bringing vessels into the port in a safe manner.

If a new facility is proposed:

- it should allow for the use of non-NAABSA vessels for the reasons outlined in 6.2.1.
- it should allow for the use of a larger range of vessel sizes than currently in use.
- consideration should be given to allowing for import of all hydrocarbon products.
- potential locations on the north and east coast of Guernsey should be considered.
- the potential to expand the facilities to other uses such as cruise should also be considered.

7.5 On Island Storage Facilities

The current volume of storage on Island appears adequate to support the existing supply chain. Any future solution should seek to maintain at least the current security of supply that is achieved through existing storage capacity. This does not necessarily mean that the same storage capacity is required for future solutions, as:

- demand for hydrocarbons is predicted to decrease in future.
- methods of import may change, so that frequency and parcel size may allow a different optimum storage capacity and may allow/require different stockholdings.

The operation of the existing on Island storage has a number of inherent risks, in particular relating to potential, but unlikely fire and explosion scenarios. Potential treatments should examine options to reduce these risks. However it is unlikely these risks or their impact can be substantially reduced

unless the location of the on Island storage is moved or the properties around the existing storage are relocated. Therefore it is recognized that without such changes the improvements may not reach the ultimate objectives of the acceptable risk appetite.

If a new storage location, or relocation of businesses and homes are considered they should be designed to provide a significant risk reduction in order to balance the cost of this activity.

7.6 Distribution

The current distribution system on Island has not been examined in detail in this study. Falling demand may impact on the viability of some distribution arrangements. If changes in the future supply chain are likely to significantly affect the current distribution system/arrangements, further work may be required to examine the impact, in order to ensure it is still able to meet the users' needs.

Appendix A

St Sampson's Harbour Description of Upload facilities

The following edited extracts from 2010 Halcrow Group Limited *Future Harbour Requirements Study* describe the key elements of the upload facilities at St Sampson's Harbour.

North Pier

A combination of seabed and tide levels means the vessels using the North Pier during the unloading operation, 'bottom-out', i.e. the hull of the vessel rests on the seabed. These berths are referred to as NAABSA berths (Not Always Afloat But Safely Aground).

This type of unloading operation has a number of associated specific safety risks. In particular, should an accident occur, e.g. fire on board, whilst the vessel has "bottomed out", the vessel cannot be removed from the port and firefighting has to be undertaken using the fire mains shore side facilities and the Guernsey Fire Service. In addition, the vessel is accessible to third parties from the foreshore, which makes the implementation and enforcement of a secure perimeter difficult.

The berth is prepared, using an excavator, prior to vessels berthing to ensure the seabed is level ready to take the hull of the vessel. This maintenance of the seabed alongside the quay wall is critical to minimise the risk of damaging visiting vessels.

The turnaround time for the unloading of HFO is approximately 12hours. The product is pumped via heated pipelines to Guernsey Electric's storage tanks adjacent to the power station.

HFO for power generation is imported via the North Pier in parcel sizes of 2,000t using two vessels with a capacity of 3,300t and 3,500t respectively. The delivery vessels are the maximum size permitted by the Harbour Master.

CIFL now import clean products through the North Pier. The products are delivered in fuel tankers typically using one of the States of Guernsey owned tankers, the Sarnia Cherie or Sarnia Liberty. The products are piped to a storage facility just north of St Sampson's Harbour. Typical parcel size is 2,000t.

Figure A.1: North Pier, St Sampson's Harbour (Image courtesy of Guernsey Harbours)

South Commercial Quay

LPG products are imported in 1,200t capacity double hull vessels. The vessels are operated by B GAS and serve Guernsey and Jersey. The typical parcel size for Guernsey is 500t - 600t.

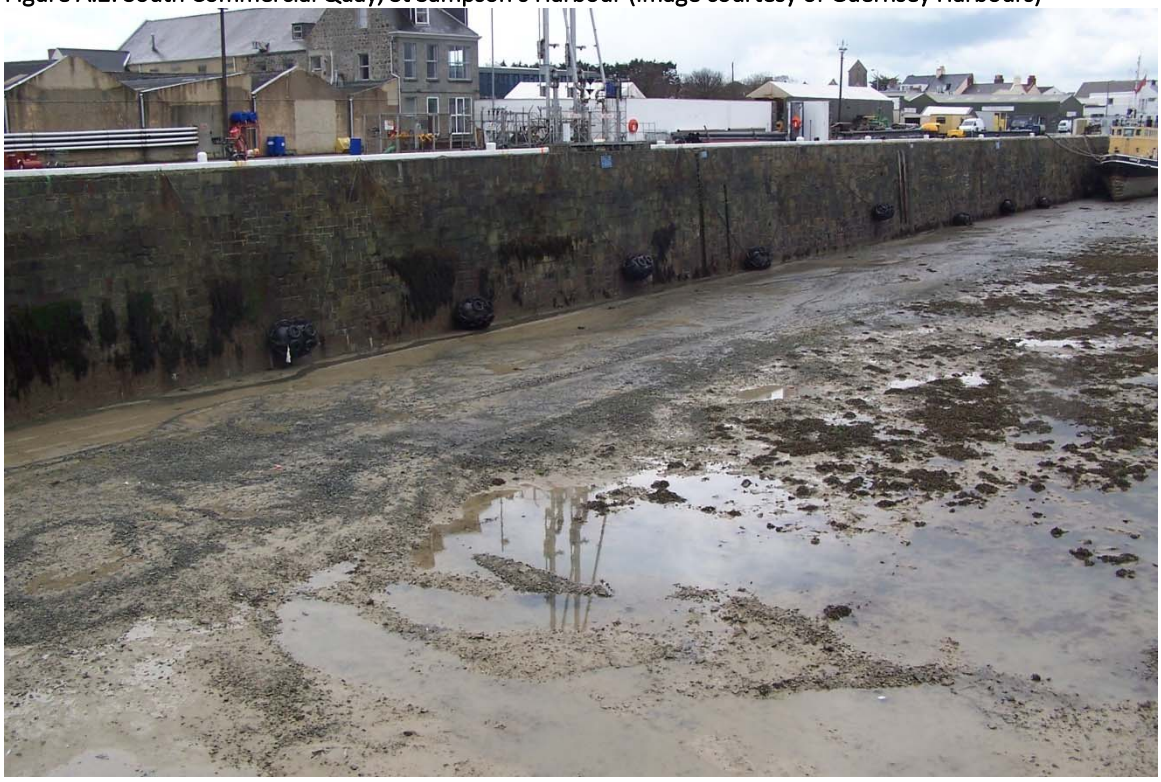
The LPG product vessels berth against the South Commercial Quay and "bottom-out" during discharge, which is similar to the fuel tanker based operation. As previously noted, the "bottoming out" operation has significantly higher risks associated with it then the standard practice of discharge. The higher risk may be compounded by the fact that the fire main water storage tanks and other LPG storage tanks are approximately 250m from the berth which may potentially be affected during an accidental explosion at the berth. LPG and petroleum fuels are both flammable products and an explosion is likely to impact on the resident population.

The risks associated with this the unloading and storage of LPG at St Sampson were reviewed as part of the Quantified Risk Assessment (QRA) in 1993 by Marine Hazards Advisory Unit (MHAU). The results of the QRA are summarised in the 1998 Marine Operations Review which concluded the following:

"relocation of the gas berth to a more easterly location would not significantly reduce the risk to the population in the event of an explosion or fire…….However, St Sampson's Harbour is one of few Ports in Europe where tankers dry out completely. This increases difficulties in the event of a fire in that the vessel cannot be moved to a safe position, there is need to boundary cool the complete hull (i.e. above and below the normal waterline) and there is no sea water suction for the ships fire main. The latter point has been overcome by the provision of shore side fire main pressure. Overall is it undesirable for any ship to bottom out and for tankers the risk assessment is bound to be significantly higher than for vessels afloat."

The RUBIS group imports fuels at the South Commercial Quay in typical parcel sizes of 2,200t. The fuel vessels 'bottom out' during discharge similar to the LPG carriers.

Figure A.2: South Commercial Quay, St Sampson's Harbour (Image courtesy of Guernsey Harbours)



Appendix B

Sources of information on Issues identified within the existing hydrocarbons supply chain

B1 Strategic Outline Programme (SOP)

The Hydrocarbon Supply Strategic Outline Programme (SOP) [Version 2.1, 7 April 2014] includes the following statements regarding the existing supply chain.

From the Executive Summary

"The way the fuels are uploaded onto the Island has some unique elements and challenges. These include a harbour with; an approach with strong tidal currents, strict limits on ship length and draught, access only during spring tides, a narrow harbour mouth, berths which dry out, discharge facilities relatively close to residential properties and a need to use specialized tankships which can rest on the harbour bed."

From the Business Need

"There are a number of problems with, and threats to, the current arrangements. Firstly the restricted access to St. Sampson's harbour has resulted, on occasion, in a number of planned shipments not being able to berth with the result that the Island has almost run out of some fuels."

B2 Evidence from previous reports

There are many previous reports that comment on the risks in the supply chain but few of these reports document specific issues that have arisen. Examples from two of the few reports that do contain evidence, are discussed below.

In a 2008 report Security of supply: Imports of Liquefied Petroleum Gas" ([redacted]), the fuel suppliers noted some "*product quality issues with a frequency of every 2 to 3 years for all islands fed by Fawley...but all of these have been minor issues that have been fully resolved within 2 to 3 days*."

The report notes no significant delays with vessel nominations and that "*there has only been one instance of a missed tidal window in the past 10 years and that event had no impact upon stocks of LPG held in Guernsey.*"

It should be noted that the petroleum tankers Sarnia Cherie and Sarnia Liberty were purchased by States of Guernsey in 2008 to help secure petroleum product deliveries to the island. The ownership is now with JamesCo 750 Ltd (a States Trading Asset Company) and on long term bare boat charter to James Fisher Everard (JFE). The Sarnia Cherie is normally used to provide deliveries to Guernsey but is also used for other contracts servicing Jersey, Alderney, The Isle of Man and for Total Oil in some French operations. A confidential report, "Petroleum Product Supply Chain Logistics & Economics" ([redacted]) noted that the Sarnia Liberty is normally:

"*engaged on the Scottish Highlands and Islands voyages.....It is a contractual term within the bare-boat charter between Jamesco750 Limited and JFE that the second vessel cannot be traded by JFE outside north-west European waters. This is to ensure the ready availability of a back-up vessel, if a major problem befalls the vessel delivering to Guernsey*."

The same report included interviews with JFE, JamesCo and the fuel importers, RUBIS and Channel Island Fuels Limited. The report notes issues with the shipping contracts with JFE which the fuel importers felt lead to higher costs on their fuel imports. These concerns are mainly due to fixed costs per voyage and a strategy to vary the load on vessels (and thus the draft) in order to ensure they can

meet a delivery window. This leads to sub-optimal loads being delivered, but (as noted by JFE) does help to ensure tidal windows are not missed. By way of example, the report quotes a range of cargo sizes from as little as 561 tonnes to as much as 2,954 tonnes, with a range between upper and lower quartile of about 1,000 tonnes. This variation in cargo size leads to a large variation in cost per litre of fuel delivered to the island.

B3 From Stakeholder Meetings

The following is a summary of the issues identified by Stakeholders in the meetings held with them during December 2016.

Table B.1: Supply Chain Issues - Refineries

Issue	Description
Products not available at Northern Europe refineries	Hydrocarbon product types used on Guernsey are not available at all refineries in Northern Europe, only at some of them.
Product loading delay at refineries	The NAABSA vessels used to transport hydrocarbon product to Guernsey are relatively small (LOA < 80m) due to length restrictions at St Sampson's Harbour. The hydrocarbon parcel sizes are in turn small c.2,000t. There have been instances when vessels have been scheduled to be loaded at refineries and have been knocked back by the refinery due to a larger vessel requiring loading. The delays in product loading can have a significant impact on the vessel schedule – ultimately resulting in the vessel missing the tidal window at St Sampson's Harbour.

Table B.2: Supply Chain Issues - Transportation

Issue	Description
Availability of NAABSA vessels	The supply of hydrocarbons to Guernsey is typically via NAABSA vessels through St Sampson's Harbour (a small volume of hydrocarbon product is imported via St Peter Port Harbour via RORO). The continued availability of NAABSA vessels capable of using St Sampson's Harbour (length / beam restrictions) is a risk the supply chain. The existing supply chain requires owners of NAABSA vessels to continue to provide these vessels. This was addressed in 2009 when the States of Guernsey purchased two NAABSA vessels because of the concern that the two vessels may be deployed elsewhere in the world and would thus not be available to support fuel deliveries to Guernsey.
Weather impacts during transit	Adverse weather during the transit of hydrocarbon to Guernsey may impact on the delivery of the product and could have a significant impact on the vessel schedule – ultimately resulting in the vessel missing the tidal window at St Sampson's Harbour. There is anecdotal evidence for this having occurred, but no documented evidence has been identified at this time.

Table B.3: Supply Chain Issues – Upload Facilities

Risk	Description
Tidal Restrictions	Access to St Sampson's Harbour is limited to spring tides due to depth limitations on approaches to St Sampson's Harbour - Figure 3.3.1. The limited number of available tides per month introduces an issue in the supply chain which needs careful management.
Navigation within Port Waters	The approaches to St Sampson's Harbour are difficult to navigate given the metocean conditions and depth limitations. Favourable weather combined with favourable tides are required for safe passage into St Sampson's Harbour. The Guernsey Pilots noted one occasion when a pilot was unable to bring a vessel in the harbour safely, resulting in it making contact with the Longue Hougue reclamation.
Availability of Pilots	Due to the difficult approaches to St Sampson's Harbour there is a requirements for Pilotage by local pilots. The availability of pilots experienced in the transit of vessels into St Sampson's Harbour is critical to the supply chain. It is understood that recruitment of new Pilots to Guernsey has been attempted in the recent past and has been unsuccessful due to the cost of living versus income.

Appendix C

Sources of information on Risks identified within the existing hydrocarbons supply chain

From the Strategic Outline Programme (SOP)

From the Executive Summary

"For a host of reasons this [current] arrangement is not sustainable. It creates significant vulnerabilities in the short-and medium-term whereby a single event could result in the supply mechanism being severely disrupted.

This risk has long been recognized and has led to the production of initial designs for a deep water berth outside of St Sampson's harbour. Such a facility would address many of the known risks and improve reliability as access would not be limited to spring tides and bespoke ships.

It is however recognized that this is not just about constructing an uploading facility. The arrival of a tankship into the harbour is but one element in a chain which includes the oil refineries from where the cargo has been collected, the sea transport, the berthing/uploading facilities, the land based storage tanks and finally the distribution arrangements to houses, forecourts, power station etc. If any of these breakdown the whole system is at risk of failing with potentially catastrophic implications for the local economy and community.

The separate components are inextricably linked, as for example, the amount that can be uploaded is limited to the size of the fuel storage tanks."

From the Business Need

"…there are legislative and commercial pressures which could rule out the use of drying berths in the future. The issues of the drying berth are principally safety and security. It is beneficial for a fuel vessel to remain afloat so that in the event of a fire, the hull will be cooled by the surrounding water and if mobile, it can be moved as far as practical away from areas of population. Of equal importance is the ability for the vessel to move away from the berth in the event of a fire on the shore which could otherwise affect the vessel."

Risks identified in previous reports

The risks of bringing fuels into St Sampson's Harbour have long been recognised in Guernsey, as evidenced by several Billet D'Etat including the examples noted below:

Billet D'Etat XX 1988 page 803

"In 1985, the States of Guernsey approves the Board's policy letter with regard to Safety Improvements associated with the discharge of oil and gas at South Side, St Sampson's Harbour. The Board made it clear at the time that its proposals were only a temporary measure until more satisfactory arrangements could be made for facilities to be constructed which would enable vessels carrying volatile fuels to discharge their cargoes outside of St Sampson's Harbour."

"The Board is also looking to the future with regard to the size of vessels which service the Island with fuels. The small coastal ships are no longer being built. As these vessels age, they are being replaced with larger tankers which require deeper water. These modern tankers are not designed to settle on the sea-bed. They must therefore remain afloat at all times. If the Island cannot provide facilities for the new generation of vessels it will find it increasingly difficult and expensive to acquire its fuel supplies."

Billet D'Etat XV 1999 – contains in Appendix A "Guernsey Harbours Marine Operations Review" which noted the following risks in relation to St Sampson's Harbour:

- *The present facilities in St Sampson's Harbour are capable of handling the islands fuel and bulk cargo import well into the next century" but notes a number of uncertainties that could cause significant difficulties before the year 2020:*
  - *No identified modern tankers to replace the ageing fleet used to import HFO, oil and petroleum products*
  - *The trend if future shipping will inevitably lead to larger vessels which will increase the difficulty of operating into St Sampson's Harbour*
  - *Future legislation may prevent LPG and oil tankers from bottoming out*
  - *The limited size of vessels capable of using St Sampson's Harbour will inevitably increase costs of imports in real terms*
  - *Ships will inevitably get bigger so this will mean greater bunching around the spring tides and increased pressure on all concerned.*

A further section of the same report notes that "*There are many ports in the UK where tankers have to wait for the tide before departing… including…. Avonmouth…Falmouth... Cardiff.....However none of the offshore communities similar to Guernsey operate a berth where the vessel takes the ground during discharge*". The report notes ports in island communities including Stornoway, Douglas, Cowes and St Hellier which all have significant tidal ranges, but operate without NAABSA berths.

A **1999 report Board of Administration** – Harbour of St Sampson – Land Reclamation and Redevelopment of Deepwater Berths noted the following:

- tidal restrictions on tankers accessing St Sampson's Harbour

- high berth demand on Spring tides at St Sampson's Harbour , not only from fuel tankers, but bulk cargo vessels

- adverse weather is not uncommon in winter leading to delays

The report also states that *"if St Sampson is not developed then existing risks, albeit small, of death or injury to persons and destruction or damage to property during discharge of volatile fuels will remain as at present".*

A number of risks in the LPG supply chain were noted in the report "**Security of supply: Imports of Liquefied Petroleum Gas**" ([redacted]. In particular it notes that "*the single point failure to cause maximum effect on the distribution of mains gas on Guernsey would be an explosion or fire at the production plant*." The report goes on to note that Guernsey Gas carried out modelling as part of a QRA which estimated the "*probability of a single fatality lies in a numerically statistical range between the range 1 x10-5 year to 1 x 10-6 a year. These are within UK Health & Safety Executive guidelines for the maximum tolerable level of risk for COMAH designated sites.*"

Finally, the report comments on alternative importation as follows "*It should be noted that supplies of LPG could be imported on a road tanker. Guernsey Gas practices this alternate supply route annually, but the reader should note that whilst an "on-off" is eminently feasible, a longer term supply using this methodology would create immense logistical problems*."

The **Billet D'Etat IV 2009** published in January described the Policy Council for the Security of Fuel Supplies and Purchase of Tankships. This document noted the following

"*that since the beginning of 2008 and until recently stocks of petroleum products held locally have been well below those levels considered prudent from a strategic viewpoint. Furthermore, the Island has been vulnerable to disruption to supply due to a combination of the following factors:*

• The significant limitations placed on delivery of stocks by the tidal nature of St Sampson's Harbour;

• Ever more stringent industry regulations that now require the use of special double-hulled tankships, which in a form suitable for St Sampson's harbour, are in extremely short supply;

• The availability during 2008 of only one suitable vessel to serve the Islands;

• Delays in the process of approving the vessel for use by one of the two importing oil companies;

• The consequent reduction in the number of visits by the vessel;

• The use of just one of the two storage depots available thereby reducing on-Island stocks;

• Challenges to regular deliveries during the limited tidal windows at St

Sampson's by weather, technical and operational problems; and

• The decision in October by the owners of the two vessels capable of serving Guernsey to apply for bankruptcy protection and the decision by the Administrator to place the tankships on the market.

2010, Halcrow Group Limited, **Future Harbour Requirement Study** noted the following in relation to current operations "*The risks associated with the import of petroleum products at St Sampson cannot be under estimated. The physical dimensions of the harbour do not comply with any international guidance in respect to width of access and turning circles in relation to the vessels that currently use it for the import of petroleum products. The necessity to import larger volumes of product to meet increasing demand over recent decades has seen vessel size increase to the size they are now, which is considered the maximum that could use the harbour*".

The report went on to conclude, "*The requirement for deepwater facilities at St Sampson is a must to mitigate safety and security of supply concerns. It is recommended that a single bulk liquid facility is constructed offshore to the south of Longue Hougue reclamation site in Belle Greve Bay. The relocation of bulk solid operations is not considered necessary however, consideration should be given to providing quayside storage for bulk solids.*

Implementation of a scheme to relocate bulk liquid facilities from within St Sampson will take significantly longer [than other work proposed in the report]. *It is anticipated that up to 5 years maybe required for the planning, consultation and design. The existing facilities will continue to function however the risk relating to safety, security and security of supply will remain until new facilities are operational. It is recommended that the studies required to plan the new facility are commenced such that a new facility is in operation as soon as practicably possible."*

A confidential report "**Petroleum Product Supply Chain Logistics & Economics**" ([redacted] notes the emerging risks related to bioethanol and biodiesel as noted below.

Bioethanol

"*Most UK refineries will be producing a Blendstock for Oxygenated Blending [BOB] gasoline, which will be blended with 100%, denatured ethanol at the road-loading rack to produce on-specification E5 bioethanol petrol in the road tanker for delivery to petrol forecourts. We have no knowledge of any other methodology to "produce" E5 other than by blending at the loading rack.*

Transportation in sea tanker of blended E5 bioethanol is not being undertaken from any UK refineries. Pure ethanol is highly hydroscopic, and will seek out and combine with any water or other contaminant present. The only current solution to make E5 gasoline available on any island community would be to transport 100% fossil fuel or BOB gasoline by tankship, and bring the denatured ethanol by road tanker or ISO-container on open deck car ferry. Blending facilities would then have to be built on Guernsey to inject the ethanol into the petrol at the loading rack immediately before transportation

by road tanker to the garage forecourt. Such handling will thus require additional investment by both CIFL and RUBIS in the new blending and injection facilities."

There are also knock on issues for garage forecourts storing ethanol, particularly if they have a low throughput and the report notes concerns it this respect from the Scottish Government Critical Infrastructure Resilience Unit.

Biodiesel

"*Biodiesel is manufactured from, amongst others, oil seed rape, waste cooking oil and palm oil. Normally, biodiesel refers to a vegetable oil- or animal fat-based diesel fuel consisting of long-chain methyl, propyl or ethyl esters, and is produced by chemically reacting these vegetable oils or animal fats with an alcohol, usually methanol, to produce fatty acid esters, and is often referred to as Fatty Acid Methyl Ester [FAME].*

The different chemical composition of FAME raw materials can mean a variance in terms of stability and degradability characteristics. FAME can absorb water and hold high levels in suspension, thereby rendering the cargo on ship off-specification. There can also be microbiological growth, which may lead to filter blocking and corrosion. FAME can also adsorb onto the walls of tanks and de-adsorb into subsequently carried products, causing problems for multi-product pipelines and tankship tank compartments.

This last issue is a major concern for Guernsey. Tankships carrying different products on a voyage and then subsequent voyages risk inadvertently contaminating Jet fuel cargoes with traces of FAME. As the EN590 specification allows for FAME to be present in the fuel, carrying Jet-A1 on the next voyage in the compartment that has previously contained FAME-additised diesel is ***not*** *recommended. The Joint Industry Group (JIG) standards for airport refuelling operations globally, require testing for the presence of FAME where multi-product transportation systems (usually pipelines) have been used to supply Jet-A1. JIG's test limits currently specify testing for FAME presence at less than 5 ppm or 0.0005% by volume, if the fuel is to be accepted for aviation purposes. Best practice recommendations suggest flushing tank compartments with a buffer load of non-FAME material – home heat kerosine or gasoline – before loading with Jet fuel; alternatively steam cleaning may be considered equivalent to this procedure.*

Clearly, these issues are of great concern to RUBIS, who is the importer of Jet-A1 for the airport, and affect not only the tankship compartments, but also the shore pipeline between the South Commercial Quay and the Bulwer Avenue tank farm. Whilst the testing regime of Jet fuel at all points of the supply chain is not new, the increasing use of biodiesel with FAME content will only heighten the testing regime, which in turn will increase costs of course."

In a report by the UK Health and Safety Laboratory (HSL) titled **Assessment of Major Hazards at Two Fuel Terminals on Guernsey** (MH/14/192, January 2015) they made and assessment of the extent of the potential vapour clouds around the RUBIS and CIFL fuel tanks and loading jetties as a result of potential tank overfill scenarios. This work was in line with assessments carried out in the UK around similar facilities, following the explosion at the Buncefield storage facility in 2005. In that incident and in more recent cases in Jaipur, India (2009), San Juan, Puerto Rico (2009) and Punto Fijo, Venezuela (2012) large vapour clouds spread significant distances in calm conditions before exploding. The assessment was carried out using the FABIG Technical Note 12 (current recommended practice) and considered tank overfilling and spray releases from the partial severance of the loading lines as potential causes of containment loss. The report noted that explosion of vapour clouds around such facilities dominate the risks associated with loss of containment. The Development Proximity Zones (DPZ), and three 'consultation' zones: inner, middle and outer are determined in the report. These represent different levels of impact from the simulated explosions and are used *inter alia* to inform planning decisions, as noted below.

The **Island Development Plan** (2016) sets out land use planning guidance for the whole of Guernsey. Sections IX.13 – IX.15 discuss development around or near major hazards. The report notes the Development Proximity Zones and Consultations Zones developed by HSL around the RUBIS and CIFL fuel unloading and storage sites at Bulwer Avenue, St Sampson and Northside, Vale respectively. The DPZ's are 75-100m from tank centres/unloading points and the outer zones up to 320m from the tank centres/unloading points. The Island Development Plan includes a map of the Major Hazards Public Safety Zone developed from the above and describes how proposals for development will be considered within each zone. In summary this requires careful consideration of developments within all zones, particularly developments which might introduce more people into the zones. Furthermore there is a presumption against developments which would significantly increase the number of people living, working or congregating within the DPZ.

Risks identified in Stakeholder Meetings

As noted previously a series of meetings was held with some key stakeholders in the hydrocarbon supply chain at the outset of this work. The stakeholders were asked to identify issues within the current supply chain that had/have impacts on safety and security of supply and risks that may also have such impacts. A summary of the meetings is provided in report 684723-CH2-SOC-00-RP-0004 Summary of Stakeholder Meetings 12/12/2016-16/12/2016] and key **risks** noted in the meetings are outlined below:

Table C.1: Supply Chain Risks - Refineries

Risk	Description
Refusal to load vessels	The decision by a refinery to load a vessel is dependent on various factors. These include both the age of the vessel, the vessel type and maintenance records. There is a risk that as the age of the fleet of vessels that serve Guernsey increases, refineries elect not to load the vessels with product. Given there are limited vessels that can serve Guernsey, due to NAABSA and length restrictions, a decision by refinery's not to load vessels is a significant risk.
Incident at refinery	An incident at a refinery resulting in product not being available could cause a delay to obtaining product from alternative suppliers.
Legislative change in relation to NAABSA operations	Should there be a legislative change that outlaws the use of NAABSA operations refineries may elect not to load NAABSA vessels. While there is no known change in legislation pending or planned, it remains an unusual method for offloading petroleum product vessels as is uncommon in Europe.
Reputational risk for refineries	Should there be an incident at another NAABSA facility refineries may elect to load NAABSA vessels due to reputational risk.

Table C.2: Supply Chain Risks - Transportation

Risk	Description
Availability of NAABSA vessels	The supply of hydrocarbons to Guernsey is typically via NAABSA vessels through St Sampson's Harbour (a small volume of hydrocarbon product is imported via St Peter Port Harbour via RORO). The continued availability of NAABSA vessels capable of using St Sampson's Harbour (length / beam restrictions) is a risk the supply chain. The existing supply chain requires owners of NAABSA vessels to continue to provide these vessels. When the current vessels life expire, there are currently no known plans by the States of Guernsey, the shipping companies or the market more widely
Breach of commercial arrangements	A breach of commercial agreements for the transport of hydrocarbon to Guernsey may impact on the delivery of the product and could have a significant impact on the vessel schedule – ultimately resulting in the vessel missing the tidal window at St Sampson's Harbour.
Accident / incident during transit	An accident / incident during the transit of hydrocarbon to Guernsey may impact on the delivery of the product and could have a significant impact on the vessel schedule – ultimately resulting in the vessel missing the tidal window at St Sampson's Harbour.

[redacted] commented on the potential future issues of importing bio fuels. They currently import exclusively bio-free fuels and would need to continue to source these products from what they viewed as a likely decreasing source of supply if bio free fuels remained acceptable in Guernsey. Alternatively, they could be faced with having to import ethanol separately in bulk, in order to meet any bio-fuel requirements imposed by Guernsey regulators. This would add cost and complexity to their operations as ethanol required specially carriage, storage and blending process/procedures.

Table C.3: Supply Chain Risks – Upload Facilities

Risk	Description
Legislative change in relation to NAABSA operations	Should there be a legislative change that outlaws the use of NAABSA operations this would have a significant impact on the import of hydrocarbon product. An alternative import mechanism would need to be implemented. While there is no known change in legislation pending or planned, it remains an unusual method for offloading petroleum product vessels as is uncommon in Europe.
Closure of St Sampson's Harbour	Should there be an incident that forces the closure of St Sampson's Harbour there may be a significant impact on the supply chain. Events that could force the closure could include failure of the infrastructure (quay wall), vessel collisions with infrastructure causing damage and/or sinking of vessel within the port / port approaches requiring salvage.
Availability of Pilots	Due to the difficult approaches to St Sampson's Harbour there is a requirements for Pilotage by local pilots. The availability of pilots experienced in the transit of vessels into St Sampson's Harbour is critical to the supply chain. Many of the current pilots are close to retirement and there is no known plan in place to replace them *.
Fire / Explosion at Manifold	Should there be a fire / explosion at the manifold and the tide is low then the incident would have to be fought at the berth. There is no opportunity for the vessel to be taken out to sea / away from the berth.

* Note that the UK Port Marine Safety Code (a non-mandated code that applies to all UK ports, berths, terminal and marinas) which reflects best operational practice, includes the requirement for the Port Authority to provide a pilotage service if required in the interests of safety. It also requires that Harbour authorities should "exercise *control over the provision of the service, including the use of pilotage directions, and the recruitment, authorisation, examination, employment status, and training of pilots.*" The UK Pilotage Act 1987 has similar provisions.

Other Documented Risks

Industry Best Practice / Standards / Guidelines on use of NAABSA berths

A number of previous reports and several participants in the current supply chain have noted the risks associated with the use of drying berths and NAABSA vessels at St Sampson's Harbour. Several have pointed to the fact that it is now a very unusual practice for hydrocarbon vessels in Europe. Some have suggested that the practice may in due course be ruled out through legislation. Nevertheless there are currently no legislative constraints preventing this practice.

However, several industry bodies publish good practice guidance for the operation of hydrocarbon supply vessels and terminals which have a presumption that vessels will normally be kept afloat while offloading.

For example, the Oil Companies International Marine Forum (OCIMF) guide to Marine Terminal Management and Self Assessment updated in December 2014 (https://www.ocimf-mtis.org/Microsite/Index) shows a clear expectation to keep vessels afloat during discharge as noted below.

Terminals with draft limitations and significant tidal variations should have procedures in place where discharging or loading over-the-tide operations are to be permitted.

These procedures should be developed based on the output of a risk assessment and should be agreed by all involved parties prior to the arrival of the vessel.

Terminal procedures for over-the-tide operations would typically address:

- *Measures to ensure that vessels remain safely afloat at all stages of the operation*
- *compliance with under keel clearance requirements*
- *contingency measures*
- *assurance that terminal and vessel's equipment critical to the operation (e.g. transfer pumps, main engine) is fully operational.*

The vessel should be advised of the minimum water depth limitation. Consideration should be given to the effect of trim and list on under keel clearance.

Discharging Over-the-Tide

When vessels are intending to discharge over the tide, the following criteria should be met:

- *The vessel should provide a detailed discharge plan which will achieve the draft reduction necessary*

- *the vessel's pumping capacity and the terminal's reception capability should be confirmed as being sufficient to achieve the under-keel clearance in the time available with a contingency allowance*
- *the vessel's arrival at the berth should be timed as soon as possible after low water as the under-keel clearance requirements allow.*

To minimise any delays to the transfer operation:

- *Terminals should undertake all necessary preparations for the transfer*
- *shore authorities (Customs, Immigration, etc.) may need to be briefed on the operation to minimise any delays to the transfer*
- *ullages and temperatures and other custodial measurements may need to be taken before the vessel berths*
- *vessel's pumps should be available for immediate use on completion of berthing.*

The International Safety Guide for Inland Navigation Tank-barges and Terminals (OCIMF/CCNR, 2010) and the International Safety Guide for Oil Tankers and Terminals (OCIMF/ICS/IAPH, 2006) include the following information on operation of NAABSA berths

"A limited number of ports that have significant tidal ranges allow tankers to operate when they are unable always to remain afloat while alongside the cargo handling berth. This type of operation is considered exceptional and should only be permitted following a comprehensive risk assessment and the implementation of all safeguards identified to deliver a safe operation.

The type of operation that may be undertaken varies from the tanker taking the ground for a brief period during its stay at the berth, to the tanker being completely out of the water. In both cases, the following points are amongst those that need to be addressed:

- *The seabed should be proved to be flat with no protuberances or high spots present that could result in local or general stresses on the hull.*
- *The slope of the seabed should not result in any excessive upthrust on the tanker's structure or cause any loss of stability when the tanker takes the ground.*
- *The tanker's hull strength should be sufficient to take the ground without excessive stress being placed on the structure. This may require the tanker's design and scantlings to be augmented to allow it to take the ground safely or dry out.*
- *The operation should not result in the tanker losing any of its essential services, such as cooling water for the machinery or its fire-fighting capability. This may require the incorporation of special design features into the tanker.*
- *As it will not be possible to remove the tanker from the berth in the event of an emergency, port operations will need to address specific emergency procedures and the provision of appropriate fire-fighting equipment.*
- *Contingency plans will need to address the possibility of structural failure on the tanker and the special nature and size of any resultant pollution".*

Appendix D

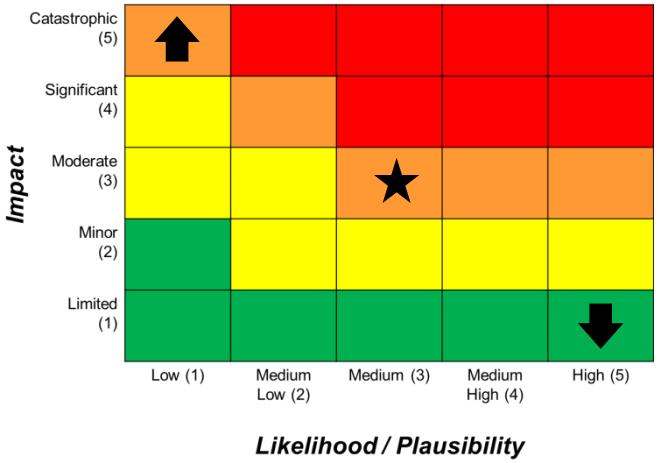
Risk Descriptions and Scoring

RISK SUMMARY

Adverse Weather on route or in Guernsey

Ref – A (T3 and U3)

Overall Assessment = High



Key

★ Reasonable Worst Case Scenario (RWCS)

▲ Upper range ▼ Lower range

Outcome Description

Vessel misses one or more tidal window for the delivery of HFO, gas, kerosene, avgas, petrol or diesel due to adverse weather on route or in Guernsey.

The impact of the loss of a single delivery of a fuel type is unlikely to affect fuel stock supplies to the point of disruption of island life and the economy. The compound impact would increase if multiple successive tidal windows are missed.

Impact is also likely to be variable depending on stock levels held by the fuel importers, the time of year and demand for fuels.

Confidence Levels

High confidence in the overall assessment. This is a long-established risk that is relatively well known and understood. The overall assessment is based on a relatively large body of knowledge and/or evidence in this area.

Linked and *Compound* Risks

C No pilot service available
F Vessel collision/damage on approach, entry/exit or during discharge
I Inadequate stock levels maintained on island
R Delay at refinery

Relevant Risk Groupings

Refinery
Transportation
Upload

Impact scores (RWCS)

Financial	2
Reputation	2
Continuity of Service	3
Health & Safety	0
Regulatory	0

Specific Assumptions

The most likely cause of missing the delivery schedule is bad weather either on route or at the Port. The Reasonable Worst Case Scenario (RWCS) is based on weather delays resulting in missing two consecutive tidal windows (i.e. 30 day delay). Missing one tidal window is not likely to impact in terms of critical island fuel supplies of clean products as it is assumed that if one supplier has missed a delivery, the other supplier will have received its cargo in the previous window and therefore have high stock levels. The RWCS assumes that multiple deliveries could be made in the third tidal window to replenish on island stock holding.

Missing a second consecutive tidal window would start the fuel rationing plan on island as stock levels for both suppliers would be close to strategic stock levels.

Other fuel products (HFO and gas) are imported by single suppliers.

Civil Contingency Authority will meet and consider commencing fuel rationing and use of Ro-Ro and Lo-Lo to receive fuel on island.

It is assumed that missing two windows would result in commencement of fuel rationing, and to miss a third window would see on island stocks depleted.

Background

St Sampson's harbour was constructed in 1880 and is a drying port. The harbour entrance can be exposed during strong winds and is subject to high tidal currents across the approaches, as well as the hazard of rock outcrops limiting the amount of safely navigable waters, and poor visibility in and around the area in periods of poor weather.

St Sampson's harbour is the primary entry point for hydrocarbon products onto the island. Both the North Pier and the South Commercial Quay have facilities for discharging tankers.

The fuel vessels delivering products to the island can only enter the harbour when there is sufficient depth of water for them to enter and berth. The height of tide and therefore depth of water varies on a fortnightly basis, peaking with a spring tide when the most water is available.

As a result of the depth of water required for existing fuel vessels to deliver, the tidal window is between 8 to 10 days (four to five days either side of a spring tide) for St Sampson's Harbour.

The term "demurrage" originated in vessel chartering and referred to the period when the charterer remained in possession of the vessel after the period normally allowed to load and unload cargo (lay time). By extension, demurrage refers to the charges that the charterer pays to the ship-owner for its extra use of the vessel. Officially, demurrage is a form of liquidated damages for breaching the lay time as it is stated in the governing contract (the charter party). The demurrage sometimes causes a loss to the seller as it increases cost of the total freight. Demurrage charges are applied to vessels that are unable to unload their cargo at St Sampson's due to delay.

Roll-on/roll-off (RoRo) ships are vessels designed to carry wheeled cargo, such as cars, trucks and trailers that are driven on and off the ship. This is in contrast to lift-on/lift-off (LoLo) vessels, which use a crane to load and unload cargo.

An alternative option to allow the ship to enter the Harbour is to reduce the amount of fuel carried, reducing the vessel's draft and therefore the amount of water required for berthing. This however makes the journey less cost effective per litre of fuel delivered.

Historic examples:

There are no historic examples of having missed two consecutive tidal windows (RWCS).

Likelihood

The likelihood of this event to happen has been scored as “medium” as it is likely that the event will occur as similar events have been reported in the supply chain. Weather delays in general are not uncommon.

Likelihood Score = 3

Financial Impact

The financial impact includes the costs linked to demurrage. Costs involved could be in the region of £10,000 per day. It is highly unlikely that the ship would stay on demurrage for the duration of 2 tidal windows as the ship would be re-tasked to offload in Jersey for example so the ship could be on demurrage for between 2 and 10 days. I Increased costs would likely be reflected in the overall business model of the fuel importers.

Financial Impact Score = 2

Reputation Impact

The reputation impact has been estimated as being minor, causing at maximum a one off adverse local media and/or social media attention. As long as rationing is not implemented the media attention should remain low.

Reputation Impact Score = 2

Continuity of Service Impact

The continuity of service has been scored as moderate, with less than 5 days strategic volumes remaining in the tank. At this point the States would have to be ready to implement the rationing plan.

Continuity of Service Impact Score = 3

Health and Safety Impact

No injury or health effect.

Health and Safety Impact Score = 0

Regulatory Impact

No regulatory or code breach.

Regulatory Impact Score = 0

Longer Term Impacts

None

Vulnerability Assessment

Weather cannot be controlled, although reasonable forecasting can minimise the risk of lost sailings.

Challenging access to the port compounds weather impact as further restrictions can be placed upon vessels entering the harbour.

Vessel specifications required to access the harbour are stringent, reducing the fleet available.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The more likely scenario is believed to be caused by bad weather either on route or at the Port. The lower risk would be for 1 tidal window to be missed. Assuming that there is sufficient fuel to avoid any requirement for rationing and that the power cable is available for electricity provision, thus not requiring significant HFO imports for on-island power generation.

More impactful, less likely scenario (upper range on the range diagram)

The less likely scenario is believed to be caused by bad weather either on route or at the Port. The upper range risk would be for 3 consecutive tidal windows to be missed (very unlikely) and would mean that rationing would be required for > 7 days. Emergency measures such as fuel by Ro-Ro or Lo-Lo would need to be implemented.

Linked and Compound Risks

C No pilot service available – limited availability of pilots to bring vessels into St Sampson harbour could make this Adverse Weather risk more likely.

F Vessel collision/damage on approach, entry/exit or during discharge – this Adverse Weather risk could also lead to vessel damage on entry/exit to the harbour

I Inadequate stock levels maintained on island

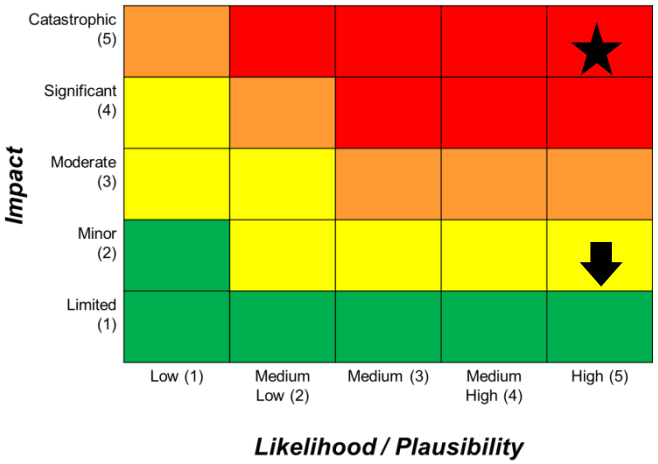
R Delay at refinery – a delay at the refinery would likely increase the risk of missing a tidal window

RISK SUMMARY

No vessel available

Ref – B (T1, T2, T5, T6 and T7)

Overall Assessment = Very High



Key

★ Reasonable worst case scenario (RWCS)

Upper range Lower range

Outcome Description

No NAABSA certified vessels within size constraints are available due to one or more of the following reasons:

- Break down of the primary vessel used
- No vessels available to charter ie all engaged elsewhere
- Reduced size of NAABSA certified "fleet" results in reduced availability
- All vessels have life expired
- Demand for NAABSA outstrips supply/availability
- Commercial rates impact availability in the short term

Confidence Levels

High confidence in the overall assessment based on a large body of knowledge of the issue and includes evidence of a high quality informed by consistent relevant expert judgments.

Linked and *Compound* Risks

D1 Refineries refuse to load due to age or condition
D2 Refineries refuse to load NAABSA vessels
F Vessel collision/damage on approach, entry/exit or during discharge within Supply Chain
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

Relevant Risk Groupings

Transportation

Impact scores (RWCS)

Financial	5
Reputation	5
Continuity of Service	5
Health & Safety	3
Regulatory	0

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) is that without direct intervention by the States of Guernsey, there will be no NAABSA certified vessels available for shipping products that are suitable for servicing St Sampson when the current fleet life expires. This would result in no fuel available to the Island. An alternative solution would then need to be found which would likely result in an extended period of fuel rationing and increase in cost of fuel.

For the RWCS there is no vessel replacement programme in place to cover the ship life expiry, based on discussions with members of the current supply chain.

It is known that current operator's fleets are likely to diminish as:

- Some operators have fleet management policies that say that they will not own ships beyond a certain age;
- There is limited appetite from operators to invest to build vessels of the suitable size and type;
- No evidence of any new vessels of the required size and type have been made recently.

The lower case assumes that there would be a delay in sourcing an alternative vessel due to it undertaking other duties.

Background

St Sampson's harbour is the primary entry point for hydrocarbon products onto the island. Both the North Pier and the South Commercial Quay have facilities for discharging tankers.

However, due to the characteristics of the harbour, fuel tankers are required to dock at drying-out berths due to the length of time required for vessels to discharge their cargo being longer than that which available during a single tide. The practice is unusual, and there is evidence to suggest that the current fleet of ships available in the market that meet the requirements in terms of size and the ability to safely dry out is reducing.

To safeguard supply of clean fuels to the Bailiwick, the States of Guernsey purchased in December 2008, two NAABSA tanker ships to operate through St Sampson's, recognising a threat that the vessels might be re-assigned after the company that owned them filed for bankruptcy. The dimensions of the present tanker fleet are at the maximum limit for operations within the harbour, and there is no current means to modify the harbour.

NAABSA is an abbreviation for; "Not always afloat but safely aground". This clause is sometimes incorporated into Charter parties in order to accept calling at ports where a vessel may rest at the bottom during loading / discharging, usually due to extreme tidal variations. Lloyds Register has a NAABSA class notation for insurance purposes, defined as "bottom strengthened for loading and unloading aground".

The two States owned clean fuel vessels are on long term bare boat charter to a shipping company (James Fisher Everard) who use them for various activities, including delivery of fuel for their customers to Guernsey, Jersey, the Isle of Man, some locations in France and the Scottish Islands.

HFO, gas and clean products are each delivered using specific vessels capable of carrying the fuel type. Analysis suggests that ship operators tend to use the same ship for deliveries to the Channel Islands where possible, but do have the option to use at least one alternative vessel in the event of mechanical or other failure.

The fleet of vessels delivering clean fuels, HFO and LPG to Guernsey is aging: all LPG vessels are more than 20 years old, all other vessels are more than 10yrs old) and there is currently no specific replacement programme in place for any of the vessels in the current supply chain. It has to be noted that fewer vessels meeting the specified criteria (NAABSA, size, manoeuvrability) are naturally (i.e.

without intervention from the States of Guernsey) available within the open private sector market and no new vessel of this size and type is currently being commissioned.

At some point the current vessels will no longer be able to deliver fuels to Guernsey. This may be for a variety of age related reasons including: retirement from the fleet or sale by the vessel owners, removal from service by the vessel owners, refusal of refineries to load vessel due to age or inspection/certification issues. Discussions with ship owners have suggested that there are no fixed plans to replace the vessels like for like.

It is assumed that a 2/3 year period would be necessary to build a new vessel.

Historic examples:

The States decided in 2008 to buy what it understood to be the only two vessels available to supply Guernsey with clean fuel at a time when the company owning the vessels went into liquidation. The States took this measure to help ensure vessels would continue to be available to supply Guernsey. To date, no similar actions have been deemed necessary in respect of HFO vessels or LPG vessels.

Discussions held with ship owners have suggested that vessels are usually retired at an age between 20 and 25 years.

Likelihood

The judgement of likelihood has been based on the view that the event will happen in the supply chain in the close future due to the absence of specific replacement plan for any of the vessels and the observed market conditions of no similar vessels having been built in recent years. It is believed that this event has more than 50% chance to occur in the five next years at least for the LPG and primary HFO vessels. For the clean fuel carriers the timescale is a little longer, but based on available evidence, they will be unable to load at their current supplier (Valero's Pembroke refinery) once they are more than 20 years old (in 9 years).

Likelihood Score = 5

Financial Impact

The financial impact of not being able to get clean fuel on island is estimated as catastrophic i.e. greater than £5 million loss.

It includes the cost of implementing an alternative supply route and the costs of using Ro-Ro, Lo-Lo systems which may not be able to meet the fuel demand for the island.

The socio economic impact is also taken into account as the island could face a loss of businesses which might follow from a loss of confidence in security of fuel supply or a rationing of fuels on the Island, and the possibility that fuels will become premium products for end users.

Financial Impact Score = 5

Reputation Impact

The reputation impact would be catastrophic as the situation would attract a sustained local and national adverse media attention.

Reputation Impact Score = 5

Continuity of Service Impact

It is believed that in the case of this event occurring, a fuel rationing would be implemented for more than 1 week.

Continuity of Service Impact Score = 5

Health and Safety Impact

The incident could result in a lost time injury (>3 days) or serious injury (reportable) or irreversible health effect as a result of the fuel rationing and/or the challenges from implementing a new fuel import mechanism in a short timescale. Secure supply of fuel is critical to keep services running e.g. hospital, power generation, fire and ambulance.

Health and Safety Impact Score = 3

Regulatory Impact

No regulatory or code breach

Regulatory Impact Score = 0

Longer Term Impacts

Long term (12+ weeks / 6+ tidal windows) lack of availability would significantly impact the Island's ability to operate, cause damage to the economy and island life and would be likely to require significant funding to establish long term alternative supply chain.

Vulnerability Assessment

The main vulnerabilities are linked to the short timescale left to find a solution and the fact that there is a lack of alternatives in the market as no vessels are currently being built that meet the specific criteria required to enter St Sampson's Harbour as there is limited requirement for these size and type of vessels elsewhere..

There is also fragility inherent to the mitigating measure of alternative routes, as Ro-Ro and Lo-Lo systems have limitations and may not be able to cover the total on-island needs for fuel.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The more likely scenario is believed to be that vessels are only temporarily unavailable as they are on charter to other locations or in dry dock. This would result in a medium term delay of delivering hydrocarbons to the Island while other vessels are sourced to cover the temporary shortage. This would involve missing only one tidal window and no impact on fuel availability.

More impactful, less likely scenario (upper range on the range diagram)

See RWCS.

Linked and Compound Risks

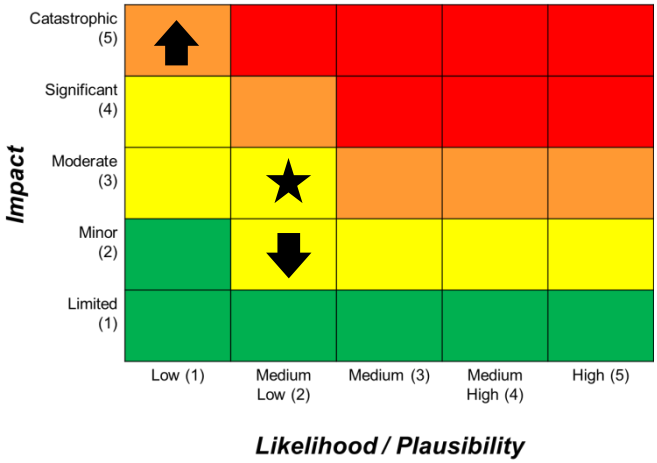
D1 Refineries refuse to load due to age or condition
D2 Refineries refuse to load NAABSA vessels
F Vessel collision/damage on approach, entry/exit or during discharge within Supply Chain
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

RISK SUMMARY

No pilot service available

Ref – C (U7)

Overall Assessment = Medium



Key

★ Reasonable Worst Case Scenario (RWCS)

▲ Upper range ▼ Lower range

Outcome Description

All deliveries into St Sampson's Harbour require pilot services. Currently there are 5 pilots in Guernsey. Several factors may lead to pilots services being unavailable or increase the probability of experiencing temporary or complete loss including:

- industrial action,
- a reduction in the number of pilots reducing resilience in the service
- inability to recruit or train
- insufficient succession planning
- temporary loss due to illness and/or resource planning
- an inability for one or more pilots to maintain medical certificate/requirements

The consequence escalates depending on the period of time pilots are unavailable and the length of time taken to establish either an alternative fuel supply route or an alternative method to safely bring fuel vessels into St Sampsons.

Confidence Levels

High confidence in the overall assessment based on a large body of knowledge of the issue and includes evidence of a high quality informed by consistent / relevant expert judgements.

Linked and *Compound* Risks

A Adverse Weather on route or in Guernsey
F Vessel collision/damage on approach, entry/exit or during discharge
O Berth unavailable
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

Relevant Risk Groupings

Transportation

Impact scores (RWCS)

Financial	2
Reputation	2
Continuity of Service	3
Health & Safety	0
Regulatory	0

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) is that all the vessel calls are not covered due to an insufficient number of pilots being available because of diverse factors e.g. illnesses or industrial action. This will result in a lack of continuity in shipping leading to 2 consecutive tidal windows being missed.

It is believed that it will be possible to secure pilotage services after 2 tidal windows missed.

Background

Manoeuvring into and inside St Sampson Harbour is difficult due to environmental factors (strong tidal currents, wind, waves and limited tidal windows in which to operate) the narrow and rocky approaches and the small physical dimensions of the harbour entrance and manouvring area inside the harbour. Navigating vessels into and within the harbour require an experienced pilot and good relationships between the pilot and the captain.

Pilotage of vessels into and out of the Port of St Sampson is compulsory and is carried out by General Pilotage.

The General Pilotage Service is currently operated by Pilots who are self-employed, but act in unison to operate the Pilotage Service as required by law. The General Pilots are based at St Peter Port and St Sampson's Harbours and operate a 24-hour service. There are Pilot boats based at both Harbours.

There are currently 5 self-employed pilots in Guernsey with a leave cycle and on-call rostering planning in place.

There is currently no succession planning in place - the recruitment to date has been based on recruiting self-employed pilots but an alternative model could be used, such as recruitment directly by Guernsey Harbours.

The training to date has been by peer review but alternative training is being started.

The Guernsey Pilotage Board is responsible for ensuring that pilotage services are available in Guernsey.

Historic examples:

Previous attempts by Pilots to recruit on a self-employed basis have proved difficult due in part to the high cost of living

Likelihood

The current RWCS is considered relatively unlikely given the existing number of pilots, however it is noted that there are threats due to the existing aging demographic of pilots and currently limited succession planning.

There are currently four pilots who operate a planned leave and working roster.

Currently periods of unplanned leave is seen to be the highest risk, such as days lost through illness.

Likelihood has been scored as a medium-low. This event is unlikely to occur as experience of it is very limited in the sector.

Likelihood Score = 2

Financial Impact

The costs involved for the RWCS are believed to be between £5,000 and £100,000, which relates to possible demurrage initial and then the compound effects of missing two tidal windows.

Financial Impact Score = 2

Reputation Impact

The reputation impact has been estimated as being minor, causing at maximum a one off adverse local media and/or social media attention.

Reputation Impact Score = 2

Continuity of Service Impact

The continuity of service has been scored as moderate, with less than 5 days strategic volumes remaining in the tank. At this point the States would have to be ready to implement the rationing plan. This is on the assumption that two tidal windows will have been missed.

Continuity of Service Impact Score = 3

Health and Safety Impact

No injury or health effect.

Health and Safety Impact Score = 0

Regulatory Impact

No regulatory or code breach.

Regulatory Impact Score = 0

Longer Term Impacts

None - assuming that a long term plan for providing an always available supply of suitably experienced/qualified pilots has been developed by Guernsey Harbours.

Vulnerability Assessment

There is currently no defined succession planning or training programme in place.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The less impactful but more likely scenario is believed to be caused by pilotage occasionally unavailable due to a lack of coverage. This would result in an occasional tide missed leading to increased demurrage at £10,000 per day (expect total cost per annum to be in the range of £50,000 to £100,000).

More impactful, less likely scenario (upper range on the range diagram)

The more impactful but less likely scenario is believed to be caused by there being no pilots available for an extended period. This would result in no vessel calls to St Sampson's for the extended period (more than 3 tidal windows) leading to rationing and emergency scenario.

Linked and Compound Risks

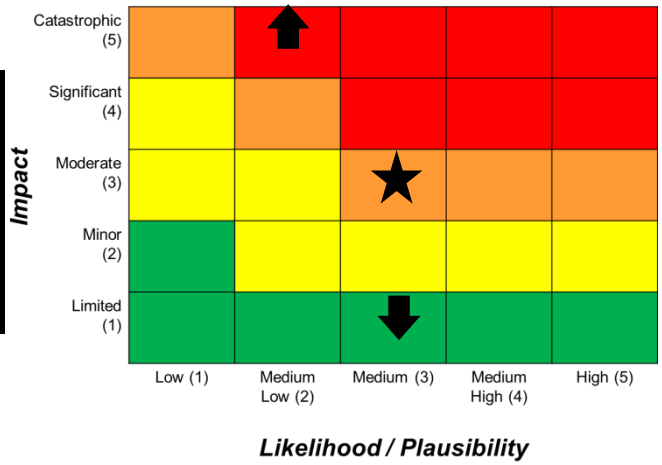
A Adverse Weather on route or in Guernsey
F Vessel collision/damage on approach, entry/exit or during discharge
O Berth unavailable
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

RISK SUMMARY

Refineries refuse to load due to age or condition

Ref – D1 (R2, R3, R4 and R4a)

Overall Assessment = High



Key

★ Reasonable Worst Case Scenario (RWCS)

▲ Upper range ▼ Lower range

Outcome Description

A refinery refuses to load a vessel intended to deliver to Guernsey due to:

- A vessel is over an age limit within a policy set by the refinery.
- The condition of a vessel does not meet the standards within a policy set by a refinery.

Policy standards vary from refinery to refinery, for example reputable refineries would refuse to load vessels with any defects or conditions of class. Refinery policy on vessel age limits varies.

Limited availability of alternative suitable vessels significantly influences the risk and potential consequence associated with a single vessel being refused loading.

Consequences where a single vessel is refused loading are likely to be limited to temporary loss of one or more fuel types. Given the limited vessel options available commercial suppliers on island may also suffer financial loss and repeat refusals or issues may result in the commercial provision becoming untenable.

Frequent disruption to service would impact customer behaviour and buying patterns.

Confidence Levels

High confidence in the overall assessment based on a large body of knowledge of the issue and includes evidence of a high quality informed by consistent relevant expert judgments.

Linked and *Compound* Risks

B No vessel available
D2 Refineries refuse to load NAABSA vessels
F Vessel collision/damage on approach, entry/exit or during discharge

Relevant Risk Groupings

Refinery
Transportation

Impact scores (RWCS)

Financial	2
Reputation	2
Continuity of Service	3
Health & Safety	0
Regulatory	0

Specific Assumptions

For the (Reasonable Worst Case Scenario) RWCS it is assumed that vessels have not been maintained to the required standards and as other NAABSA vessels may not be immediately available, it would take 4 to 6 weeks to source a suitable vessel or to carry the appropriate repairs.

It is also assumed that no more than 2 tidal windows would be missed as 4 to 6 weeks seems a reasonable period to carry the necessary work and/or find a replacement.

Background

Refineries have strict policies and will not accept ageing vessels that are not properly maintained.

As vessels become older it becomes more onerous/ costly to maintain vessels, particularly to the high standards expected by the refineries.

The time needed to replace the vessel will vary depending on the type of fuel carried by the vessel. Whilst vessels ordinarily used to transport HFO or clean fuels could be used interchangeably (although subject to a rigorous and expensive cleaning process), LPG is transported in a more specific vessel type.

The fleet currently includes:

- 2 vessels for clean products
- 5 vessels for LPG
- 2 to 3 vessels for HFO

Clean products are currently sourced from Valero refinery in Pembroke. This has a 20 year age limit on vessels. HFO is currently loaded at Fawley Refinery in Southampton Water. This has no specific age limit but does have inspection requirements which increase with vessel age. LPG is currently sourced from a storage facility in Flushing in the Netherlands. This operated in a similar way to Fawley, with no specific age limits. It is noted that other refineries and storage facilities are available and have varying policies regarding vessel age limit.

Historic examples:

During 2007 the Sarnia Cherie (then called Vedrey Tora) was inspected and approved by Shell. It was also inspected by Total in November 2007 but not approved, primarily for operational reasons. As a result, Total was unable to use the vessel to supply fuel to Guernsey until Total did approve the vessel in autumn 2008. During this period fuel stocks on the island ran low on occasions and (as noted in Billet 2009 IV) “informal demand calming measures were introduced by the distributor companies to prevent fuel running out completely”.

Likelihood

A judgement of likelihood has been made based on the number of tides missed (2) and the current fleet available.

It is likely that the event will occur as similar events have been reported in the sector.

Likelihood Score = 3

Financial Impact

There will be a cost associated with finding an additional vessel, or repairing the existing vessel.

If one of the clean fuels vessels were refused loading by the refinery for maintenance defects, JamesCo 750 (as vessel owners) and/or the charter party (currently James Fisher Everard) would be responsible for the costs of repairs. The clean fuels importers would likely suffer no direct financial impact other than the loss of/late delivery of fuels. For the HFO and LPG vessels, the States and fuel importers would suffer no direct financial liability for effecting repairs, but would suffer from delays to fuel supplies.

Financial Impact Score = 2

Reputation Impact

The reputation impact has been estimated as being minor, causing at maximum a one off adverse local media and/or social media attention.

Reputation Impact Score = 2

Continuity of Service Impact

The continuity of service has been scored as moderate, with less than 5 days strategic volumes remaining in the tank. At this point the States would have to be ready to implement the rationing plan.

Continuity of Service Impact Score = 3

Health and Safety Impact

No injury or health effect.

Health and Safety Impact Score = 0

Regulatory Impact

No regulatory or code breach. However there could be a breach of international standards that would not result in compensation or loss for the States of Guernsey.

Regulatory Impact Score = 0

Longer Term Impacts

No longer term impact as the RWCS assumes that vessels are only temporarily unavailable pending repair.

Vulnerability Assessment

Vulnerabilities are linked to:

- the refinery changing their standards – which is beyond the control of SoG
- the standards of the ship owner/operators – ship owner/operators are responsible for the level of maintenance on their respective ships.
- The increasing maintenance requirements and costs as the vessels age

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

Vessels are not sufficiently well maintained by operators. As other NAABSA vessels may not be immediately available assume it takes < 4 weeks to source a suitable vessel, or the defect is resolved within 5 days. 1 tidal window missed.

More impactful, less likely scenario (upper range on the range diagram)

Vessels are not sufficiently well maintained by operators. As other NAABSA vessels may not be immediately available assume it takes > 6 weeks to source a suitable vessel. 3 tidal windows missed. The outcome would involve fuel rationing.

Linked and Compound Risks

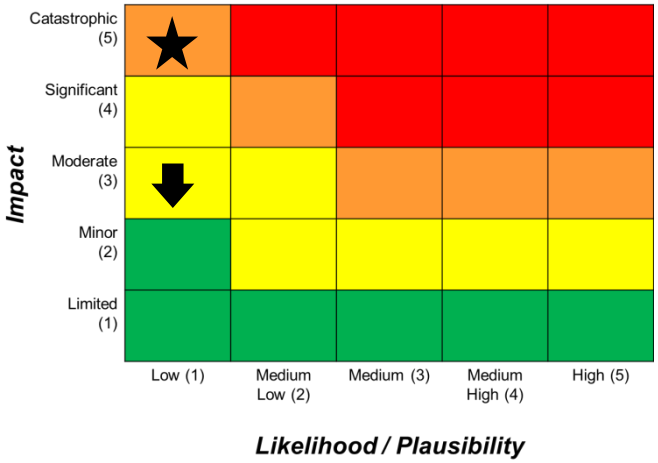
B No vessel available
D2 Refineries refuse to load NAABSA vessels
F Vessel collision/damage on approach, entry/exit or during discharge

RISK SUMMARY

Refineries refuse to load NAABSA vessels

Ref – D2 (R2, R3, R4 and R4a)

Overall Assessment = High



Key

★ Reasonable Worst Case Scenario (RWCS)

⬆ Upper range ⬇ Lower range

Outcome Description

A refinery, or in extreme all viable refineries, refuses to load Not Always Afloat But Safely Aground (NAABSA) vessels due to a NAABSA vessel elswhere being damaged whilst operating in NAABSA mode giving rise to:

- Uncontrolled discharge of cargo, pollution;
- Damage to surrounding area due to fire given the vessel cannot be put out to sea;

Policy standards vary from refinery to refinery. Refineries may suspend NAABSA loading for a temporary period pending an investigation or may determine to change policy in perpertuity. The niche/small size of the NAABSA market in Europe may contribute to a decision to suspend or change policy given the limited customer and financial impact arising for the refinery.

Consequences where a single refinery refuses to load NAABSA certified vessels are unlikely to give rise to significant impact on fuel supply as analysis has shown that there are alternative sources of supply.

Consequences of refusal by all viable refineries to load NAABSA vessels would result in the availability of all fuel types being impacted until alternative supply routes could be established and a significant financial cost to the States of Guernsey. Economic and reputational damage could be significant and long term.

Confidence Levels

High confidence in the overall assessment based on a large body of knowledge of the issue and includes evidence of a high quality informed by consistent relevant expert judgments.

Linked and *Compound* Risks

B No vessel available

D1 Refineries refuse to load due to age or condition

F Vessel collision/damage on approach, entry/exit or during discharge

Relevant Risk Groupings

Refinery
Transportation

Impact scores (RWCS)

Financial	5
Reputation	5
Continuity of Service	5
Health & Safety	0
Regulatory	0

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) assumes that a change in policy to prohibit loading of NAABSA vessels spreading across all viable refineries.

The RWCS assumes that all refineries prevent loading of NAABSA vessels due to an incident causing a wide spread change in policy.

Fuel vessels would no longer be able to discharge in St Sampson's resulting in emergency planning scenario until a permanent alternative supply chain can be established.

If an incident of this type were to happen it would be because of an issue with a NAABSA vessel operating in NAABSA mode.

It has been assumed that there would be an immediate reaction within the industry as a preventive measure until an investigation can be conducted.

It is further assumed that an accident that occurred whilst the vessel was operating in the same way that any other vessel would (ie not aground in NAABSA mode) would not illicit the same reaction from refineries.

Background

It is increasingly less common for NAABSA berths to be used to unload fuel cargos.

It does not appear that the reduced use of NAABSA vessels is due to concerns regarding them being unsafe whilst in operation. More likely, the desire in the global shipping market to achieve economies of scale by operating larger ships, capable of carrying higher amounts of cargo has driven the reduced use of NAABSA vessels.

This is because NAABSA certified vessels require extra steel to strengthen the hull, which reduces the cargo volume by around 9-10%. Although stakeholder discussions have highlighted that there is still a need for ships of a size that can access St Sampson's harbour, the extra cost and reduced carrying capacity required to achieve NAABSA certification is not appealing to operators.

It has to be noted that refineries do not currently have concerns specifically related to NAABSA-certified vessels.

Historic examples:

There is no evidence of this risk occurring previously, and research has suggested that there is no change expected on the horizon. However, it has been noted that the concern has been raised by stakeholders within the supply chain, and that if it did occur the impacts would be considerable.

There are examples in the oil and gas industry of vessel groundings/collisions and wrecking which have led in time to changes in legislation. These include, for example the grounding of the Exxon Valdez oil tanker in Alaska in 1989 which led to a major oil spill and subsequently to the introduction of new legislation in the USA, the 1990 Oil Pollution Act. In addition to preventing tankers with had suffered major oil spills from entering the area, the Act required the gradual phase of single hulled tankers and their replacement with double hulled tankers.

Likelihood

A judgement of likelihood has been made based on the fact that it is extremely unlikely that the event will occur as there is nearly no experience of it in the sector.

Likelihood Score = 1

Financial Impact

The financial impact is estimated as catastrophic i.e. greater than £5 million loss.

This includes costs incurring up to 5 years post-incident and it also includes assessment of human costs, lost working hours, lost assets, and the costs of alternative arrangements.

Financial Impact Score = 5

Reputation Impact

The reputation impact would be a sustained national adverse media attention.

Reputation Impact Score = 5

Continuity of Service Impact

It is believed that in the case of this event occurring, a fuel rationing would be implemented for more than 1 week.

Continuity of Service Impact Score = 5

Health and Safety Impact

No injury or health effect

Health and Safety Impact Score = 0

Regulatory Impact

No regulatory or code breach

Regulatory Impact Score = 0

Longer Term Impacts

An alternative supply chain would have to be defined and implemented.

Vulnerability Assessment

This event occurring is subject to an external event i.e. change of refineries policies, which is beyond the control of the States.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The risk of **some** refineries preventing NAABSA vessel calling due to safety concerns. This could have a financial impact that could flow all the way to the end consumer. It would not affect the continuity of supply. It could however affect the security of supply.

Lack of competition in the market increases cost of supply.

More impactful, less likely scenario (upper range on the range diagram)

Same as RWCS

Linked and Compound Risks

B No vessel available

D1 Refineries refuse to load due to age or condition

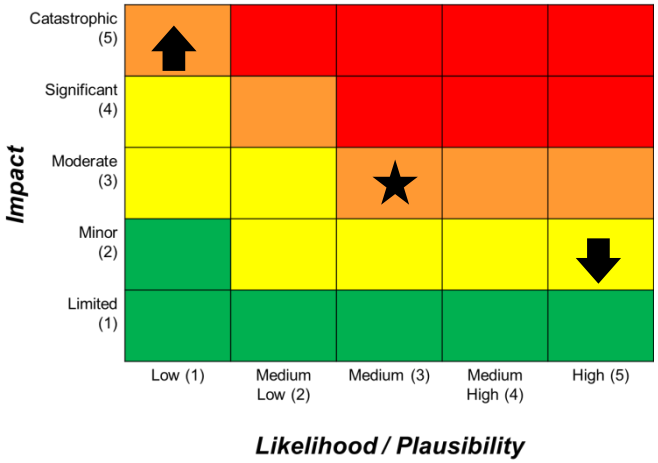
F Vessel collision/damage on approach, entry/exit or during discharge

RISK SUMMARY

Reduced availability of non-bio fuels

Ref – E (R7)

Overall Assessment = High



Key

★ Reasonable worst case scenario

▲ Upper range ▼ Lower range

Outcome Description

Bio fuels are not transportable in bulk by sea in conventional tanker ships. Government policy may in some jurisdictions be used to influence refinery production towards bio fuels and away from non bio fuels. A general shift towards bio fuels may result in further distances travelled to obtain non-bio fuels impacting cost and in the extreme no viable refineries supplying non bio fuel i.e. within a viable distance.

A general move towards bio-fuels reduces the market size and options for purchasing non bio-fuels subjecting the price to potential changes in supply and demand, costs associated with niche or small volume products.

RWCS is based on a reduced availability of non bio fuels limiting refinery options and increasing end user prices.

Confidence Levels

Low confidence in the overall assessment based on a relatively small body of knowledge of the issue and includes relevant evidence and somewhat consistent / relevant expert judgements.

Linked and *Compound* Risks

B No vessel available
P Contaminated or out of specification fuel enters on island storage and/or distribution network
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

Relevant Risk Groupings

Refinery
Transportation

Impact scores (RWCS)

Financial	3
Reputation	2
Continuity of Service	0
Health & Safety	0
Regulatory	0

Specific Assumptions

Non-bio fuels may not be available for import from a currently used refinery due to a progressing shift in UK/European government policy to favour bio fuels.

The island supply chain is not adapted to the delivery of bio-fuels.

This might lead to having to buy from a reduced number of refineries and could result increase in cost of fuels delivered to the island due to lack of competition.

There is evidence of a move towards biofuels, but the speed and impact of the change are unknown.

Background

A biofuel is a fuel that is produced through contemporary biological processes, such as agriculture and anaerobic digestion, rather than a fuel produced by geological processes such as those involved in the formation of fossil fuels, such as coal and petroleum, from prehistoric biological matter.

Hydrocarbons are increasingly blended with biofuels in European markets to meet renewable energy targets. For example, the EU has set a target for 10% of transport fuels to come from renewable sources by 2020. However, Guernsey is currently unable to import biofuels as it is difficult to transport biofuel components such as ethanol by sea.

It was noted during stakeholder interviews that bringing bio fuel products to Guernsey would require changes to the supply chain, and potentially add a greater degree of difficulty and danger to the process (related to ethanol transportation).

A report previously commissioned by the States of Guernsey considers the issues in detail. It comments that the typical composition of bio gasoline is 5%/95% (E5) mix, but notes that UK and European targets are to get this generally to 10%/90% (E10) by 2020. It also states that biodiesel (a mixture of Fatty Acid Methyl Esters (FAME]) is typically a 5%/95% (B5) mix.

The report notes that "*Transportation in sea tanker of blended E5 bioethanol is not being undertaken from any UK refineries*" and that to get biofuels to an island would require the shipping of non-bio fuel and separately bringing ethanol for blending. This might come in a chemical tanker or ISO container. There would then need to be blending facilities on Guernsey at the fuel storage sites (CIFL/Rubis).

Ethanol is also hydrophilic, so can be an issue for sea transportation but also for on island storage especially in low turnover tanks where it can cause separation, off spec fuel and increased corrosion problems. Finally there is the question of which/how many different gasoline types need to be brought to the island and the impacts on parcel sizes/storage tanks etc.

The situation for diesel is further complicated by the hydrophilic nature of FAME and the need to remove FAME from any tanks carrying Jet-A1 as it may contaminate the fuel and render it off spec. Marine gas oil (though a small market) also needs to be FAME free. A solution may be the deep cleaning of a vessel, which would add cost into the current supply chain. Pipework between vessel and storage tanks would also require cleaning.

DNV GL Statutory Update no 06, 2015/August "Carriage of Bio-fuel Blends On-Board Tankers", it notes that *"While pure bio-fuels are shipped on chemical tankers under the IBC Code Certificate of Fitness, a bio-fuel blend may be carried either as an oil subject to MARPOL ANNEX I or as a chemical subject to the IBC Code. Under which regime a biofuel blend belongs depends on the petroleum-oil/bio-fuel blending ratio. If the blend contains 75% or more of petroleum-oil, it is considered oil under MARPOL ANNEX I; and where the petroleum-oil part constitutes for less than 75% of the total blend, it is considered a chemical.*

As from 1 January 2016, to carry a bio-fuel blend under the MARPOL ANNEX I regime the (Oil Discharge Monitoring Equipment) ODME is required to be type approved for the specific blend and concentration carried. The ODME type approval standard MEPC.108(49) has been amended, and ODME manufacturers are now offering upgrade kits for existing equipment accordingly. Needless to say, if the shipping of bio-fuel blends is not intended, an upgrade will not be necessary."

Under the MARPOL ANNEX I requirements, E5, E10 and B5 could be transported to Guernsey by the existing clean fuels vessels providing they have oil discharge monitoring equipment (ODME) which is type approved for E5/B5. There may also be changes needed to the firefighting system.

The programme has not ascertained whether the Sarnia Cherie and Sarnia Liberty have the appropriate type approved ODME. They currently do not transport bio-fuels so it has been assumed unlikely as it would undoubtedly have a cost impact. Other issues further down the supply chain (as noted above) would also need consideration in terms of cost impact.

Historic examples:

Although fewer refineries were now producing biofree product, biofree products are commonly available at refineries that supply non-EU markets such as those in the ARA region. Fawley does not provide biofree product.

Likelihood

A judgement of likelihood has been made based on the fact that a shift towards bio fuels is happening now and that it is therefore extremely likely that some refineries in the supply chain will switch to bio fuels in the next 5 years. However, there is limited evidence to suggest that this will occur at the refineries currently used in the short term.

Likelihood Score = 3

Financial Impact

The financial impact has been scored as being "major" with cost ranging from £1 million to £5 million this would be the equivalent of a 5% increase to the cost of supplying fuel to the island.

Financial Impact Score = 3

Reputation Impact

The reputation impact has been estimated as being "minor", causing at its maximum a one off adverse local media and/or social media attention as it can sometimes happen when there is a rise is basic products on island (e.g. price of milk)

Reputation Impact Score = 2

Continuity of Service Impact

No impact: more than 20 days strategic volumes remaining in the tank and alternative sources can be found.

Continuity of Service Impact Score = 0

Health and Safety Impact

No injury or health effect.

Health and Safety Impact Score = 0

Regulatory Impact

No regulatory or code breach.

Regulatory Impact Score = 0

Longer Term Impacts

Financial impact as price of non-bio fuels could go up, and possibility that it becomes difficult to find sources of non-bio fuel from further afield, thus increasing transportation costs.

Vulnerability Assessment

The fluctuations of the market are beyond the States of Guernsey's control and Guernsey cannot control the shift in energy demand.

The island is totally reliant on its marine based supply chain and it is at the moment difficult, expensive and time consuming for the supply chain to adapt to the delivery of bio-fuels.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

Lower cost impact than RWCS – only some refineries convert with no impact on global prices.

More impactful, less likely scenario (upper range on the range diagram)

Due to a shift in UK/European government policy to favour bio fuels, non-bio fuels may not be available for import from all refineries.

The consequence would be that no non-bio fuels are available to Island.

This would result in additional costs incurred by fuel importers to import, store and blend bio-fuel in Guernsey.

Linked and Compound Risks

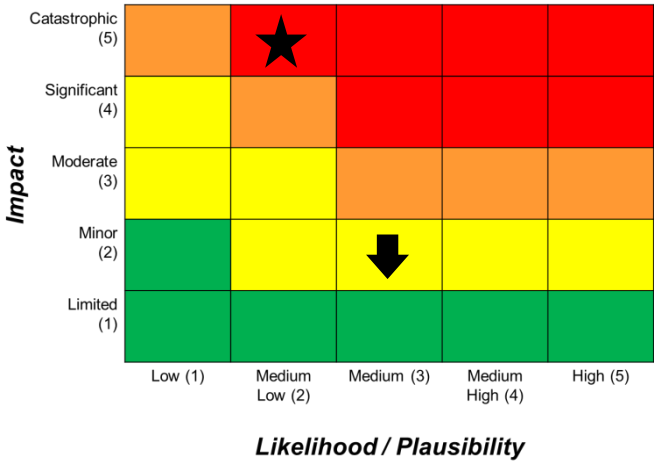
B No vessel available
P Contaminated or out of specification fuel enters on island storage and/or distribution network
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

RISK SUMMARY

Vessel collision/damage on approach, entry/exit or during discharge

Ref – F (U4, U5 and U8)

Overall Assessment = Very High



Key

★ Reasonable worst case scenario

▲ Upper range ▼ Lower range

Outcome Description

A fuel vessel is damaged on approach (pilotage zone), during entry/exit or whilst in port discharging cargo, giving rise to one or more of the following:

- Blockage of harbour;
- Loss of cargo;
- Marine pollution;
- Inability to safely discharge cargo;
- Loss of life;
- Damage to vessel, berth and/or surrounding area;
- Evacuation of immediate area;
- Blockage of fuel berth.

The consequences may vary significantly from a minor delay to loss of load, pollution, explosion, loss of life and suspension of fuel supply for a protracted period of time.

Multiple controls exist to mitigate the risk of damage to the vessel are, including trained and experienced staff, vessel maintenance programmes, experienced pilots, emergency and berth clearing procedures .

St Sampsons Harbour access is restricted with tidal and weather constraints.

Vessel collision/damage on entry has occurred previously.

The impact of the loss of a single fuel delivery is unlikely to affect fuel stock supplies to the point of disruption of island life and the economy. The impact of facilities being rendered out of use for three or more tidal windows due to damage or closure would significantly impact island life and the economy.

Impact is likely to be variable depending on the time of year and demand for fuels.

Confidence Levels

High confidence in the overall assessment based on a large body of knowledge of the issue and includes evidence of a high quality informed by consistent / relevant expert judgements.

Linked and *Compound* Risks

A Adverse Weather on route or in Guernsey
B No vessel available
C No pilot available
O Berth unavailable
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

Relevant Risk Groupings

Transportation
Upload

Impact scores (RWCS)

Financial	5
Reputation	5
Continuity of Service	3
Health & Safety	3
Regulatory	0

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) is that due to inherent risks with using St Sampson's Harbour (entry, exit and on berth) there is a shipping related incident.

The incident results in the Harbour being blocked for any other vessel and the response to that incident will take 4 to 6 weeks during which the Harbour will be closed – this causing 2 tidal windows to be missed.

It is assumed that this event would occur during the winter period when fuel demand is higher and the likelihood of adverse weather is increased.

It is likely that fuel supplies would be restricted in order to preserve stock and in recognition of the likely length of downtime. This is assumed to be distinct from emergency rationing.

Background

St Sampson's harbour is the primary entry point for hydrocarbon products onto the island. Both the North Pier and the South Commercial Quay have facilities for discharging tankers.

St Sampson's harbour was constructed in 1880 and is a drying port. The harbour entrance can be exposed during strong winds and is subject to high tidal currents across the approaches, as well as the hazard of rock outcrops limiting the amount of safely navigable waters, and poor visibility in and around the area in periods of poor weather.

St Sampson's harbour is the primary entry point for hydrocarbon products onto the island. Both the North Pier and the South Commercial Quay have facilities for discharging tankers.

The fuel vessels delivering products to the island can only enter the harbour when there is sufficient depth of water for them to enter and berth. The height of tide and therefore depth of water varies on a fortnightly basis, peaking with a spring tide when the most water is available.

As a result of the depth of water required for existing fuel vessels to deliver, the tidal window is between 8 to 10 days (four to five days either side of a spring tide) for St Sampson's Harbour. Manoeuvring inside St Sampson Harbour can prove difficult and it relies mainly on the relationship between the pilot and the ship's Master.

Manoeuvring into and inside St Sampson Harbour is difficult due to environmental factors (strong tidal currents, wind, waves and limited tidal windows in which to operate) the narrow and rocky approaches and the small physical dimensions of the harbour entrance and manouvring area inside the harbour. Navigating vessels into and within the harbour require an experienced pilot and good relationships between the pilot and the captain.

Pilotage of vessels into and out of the Port of St Sampson is compulsory and is carried out by General Pilotage.

The General Pilotage Service is currently operated by Pilots who are self-employed, but act in unison to operate the Pilotage Service as required by law. The General Pilots are based at St Peter Port and St Sampson's Harbours and operate a 24-hour service. There are Pilot boats based at both Harbours. As with other commercial ports worldwide, Guernsey's harbours are required to comply with the International Ship and Port Facility Security (ISPS) Code.

Approaches to St Sampson's harbour are difficult due to the close proximity of navigational hazards resulting in limited navigable water.

Historic examples:

Vessel collision/damage on entry has occurred previously resulting in minor damage to the vessel and port.

Examples include:
4 March 2007 – Jaynee W made contact with Longue Hougue breakwater, resulting in minor damage to the vessel.

5/12/2009 – Sigas Champion made contact with North Pier head at St Sampson's harbour on exit. Minor cosmetic damage to vessel.

4 May 2016 MV Ben Varrey bulk cargo vessel - collided with Longue Hougue reclamation on its way to berth. Vessel damaged, no pollution. Pilot suspended. This did however not result in blocking of the berth or closure of the port.

11 Jan 2017 B Gas Linda (LNG) – engine control problems on berthing. Berthed safely.

Likelihood

A judgement of likelihood has been made based on the fact that an incident of this type rarely occurs in the sector and it is also extremely rare that ports are closed for a period of time exceeding 4 weeks.

Likelihood Score = 2

Financial Impact

The financial impact is estimated as catastrophic i.e. greater than £5 million loss.

This includes costs incurring up to 5 years post-incident and it also includes assessment of human costs, lost working hours, lost assets, salvage, decontamination costs, fines or compensation and the costs of alternative arrangements.

Financial Impact Score = 5

Reputation Impact

The reputation impact would be a sustained national adverse media attention.

Reputation Impact Score = 5

Continuity of Service Impact

It is believed that in the case of this event occurring, a fuel rationing would be implemented for more than 1 week due to the length of time that the berth could be unavailable for.

Continuity of Service Impact Score = 5

Health and Safety Impact

The incident could result in a lost time injury (>3 days) or serious injury (reportable) or irreversible health effect.

Health and Safety Impact Score = 3

Regulatory Impact

No regulatory or code breach

Regulatory Impact Score = 0

Longer Term Impacts

May impact on the types of vessel permitted to berth, the range of conditions in which they are permitted to berth and the experience of the pilots permitted to bring the vessels into the port.

Vulnerability Assessment

Pilotage – human errors

Weather and tides

Physical nature of the port on approach, challenging navigation

Physical nature of the vessels entering the ports

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The more likely scenario is believed to have the same cause as the RWCS (the inherent risks linked to the use of St Sampson's Harbour (entry, exit and on berth)) that would result in one of the NAABSA vessels taken out of service while repairs are carried out resulting in 2 to 4 week delay in deliveries while alternate vessels are sourced.

More impactful, less likely scenario (upper range on the range diagram)

The less likely but more impactful scenario is believed to have the same cause as the RWCS (the inherent risks linked to the use of St Sampson's Harbour (entry, exit and on berth)) that would result in the port being closed for more than 6 weeks resulting in fuel rationing over a protracted period and emergency procedures having to be implemented. This might also result in an environmental impact from a loss of containment of the hydrocarbon product (oil spill).

Linked and Compound Risks

A Adverse Weather on route or in Guernsey
B No vessel available
C No pilot available
O Berth unavailable

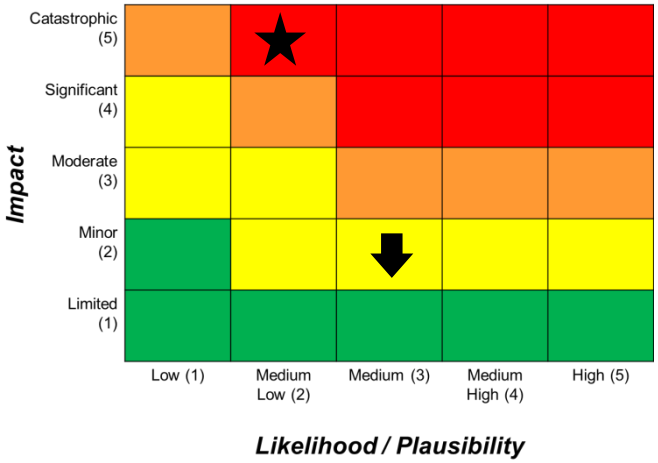
Photo: Sarnia Liberty navigating the entrance to St Sampson’s Harbour

RISK SUMMARY

Damage, fire or explosion at storage facilities

Ref – H (S2, S4 and S5)

Overall Assessment = Very High



Key

★ Reasonable worst case scenario (RWCS)

⬆ Upper range ⬇ Lower range

Outcome Description

Damage, fire or explosion at a fuel storage facility could give rise to the following impacts:

- Loss of fuel;
- Loss of life;
- Damage to surrounding premises;
- Destruction of on island storage capability depleting reserves for some fuel types or removing all reserve capability for some fuel types;
- Contamination of water supplies.

Multiple controls, both preventive measures and damage limitation measures, including operational procedures, training, regulation, equipment, inspection and testing exist to mitigate the likelihood and impact of such an event.

The underlying cause includes sabbotage, lower than best practice operating standards, failure in procedure, mechanical or electrical faults and human error.

Confidence Levels

High confidence in the overall assessment based on a large body of knowledge of the issue and includes evidence of a high quality informed by consistent / relevant expert judgements.

Linked and *Compound* Risks

I Inadequate stock/storage management
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

Relevant Risk Groupings

Storage

Impact scores (RWCS)

Financial	5
Reputation	5
Continuity of Service	4
Health & Safety	5
Regulatory	3

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) is assumed to be caused by a human error or a mechanical or electrical fault that will result in a fire or explosion at the fuel facilities.

There will be significant damage to surrounding property and loss of life. The services will be lost for up to 2 weeks while temporary measures are put in place.

This event is unlikely to occur at the HFO storage (due to its high flash point).

Background

Guernsey currently has four main storage tank locations on the island with a total storage capacity in excess of 27,000t. Guernsey Electricty stores HFO and a small quantity of diesel adjacent to its power station on the north side of St Sampson's harbour. Fuel Supplies (CI) Ltd has a storage site on the north side of St Sampson's harbour. Rubis Fuels has storage to the south of St Sampson's harbour, adjacent to Guernsey Gas's underground storage and gas bottling plant. See maps for locations of storage facilities.

Storage tanks have a typical life of 10 years before refurbishment or replacement. Rubis Fuels carried out an exteinsive refurbishment of their storage approximately 5 years ago and therefore expect the tanks to continue in full service for another 5 years. The lead time for implementing replacement storage tanks on existing sites is anticipated as approximately 6-12 months, but would vary considerably depend on the nature and scale of replacement. The lead time for establishing a new storage tank site is likely to be in excess of 2 years, given the expected planning and permitting requirements.

The Emergency Services and Fuel Supplies (CI) Ltd have tested initial emergency response arrangements to a major incident at the St Sampson Terminal, Bulwer Avenue on the evening of Wednesday 17th April 2013. The exercise has tested the arrangements set out in the States of Guernsey Emergency Plan - Off site fuel plan as well as individual services operating procedures.

Historic examples:

The Buncefield fire was a major conflagration caused by a series of explosions on 11 December 2005 at the Hertfordshire Oil Storage Terminal, an oil storage facility located near the M1 motorway by Hemel Hempstead in Hertfordshire, England. The terminal was the fifth largest oil-products storage depot in the United Kingdom, with a capacity of about 60 million imperial gallons (270 Ml) of fuel.

Pembroke refinery: At 18:20 on 2 June 2011, a 730 cubic meter storage tank exploded killing four refinery workers and seriously injuring a fifth. Ten fire and rescue appliances attended the scene, along with many other emergency services. The fire was extinguished within 90 minutes.

Grangemouth Refinery: 12.12 on 2 May 2017 Detection of a leak on a pipeline inside the KG (Kinneil Gas) manufacturing plant at Ineos, Grangemouth. Emergency services attended and refinery evacuated. No injuries were reported and the leak was contained.

Likelihood

A judgement of likelihood has been made based on the fact that the experience is very limited on the sector as events of this type do not occur frequently in the industry. It is likely that a fire can occur however in most of the cases the matter is efficiently dealt with and remains internal.

Likelihood Score = 2

Financial Impact

The financial impact is estimated as catastrophic i.e. greater than £5 million loss.

Financial Impact Score = 5

Reputation Impact

The reputation impact would be a sustained national adverse media attention.

Reputation Impact Score = 5

Continuity of Service Impact

It is believed that in the case of this event occurring, a fuel rationing would be implemented for up to 1 week.

Continuity of Service Impact Score = 4

Health and Safety Impact

The health and safety impact has been scored as "catastrophic" as this event could result in multiple fatalities from a single occurrence

Health and Safety Impact Score = 5

Regulatory Impact

Because it is assumed that the fire would be caused by human error, mechanical or electrical faults it could result in a breach of legislation or code resulting in fine or rebuke by court or regulator.

Regulatory Impact Score = 3

Longer Term Impacts

Properties around the affected area could face a drop in prices.

Site contamination – environmental issue.

Long term reduction in storage facilities.

Vulnerability Assessment

Location of storage facilities.

Extent of maintenance of the existing facilities.

Volatile substances – inherent risk.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram

The more likely scenario is believed to have the same cause as the RWCS, resulting in minor damage and/or loss of storage facilities. Temporary measures would be required while facilities are re-built.

More impactful, less likely scenario (upper range on the range diagram)

A more impactful though less likely scenario would be a complete destruction of the fuel facilities, resulting in significant damage to surrounding property and loss of life. This would cause a major disruption to Island economy and would require fuel rationing for a protracted period.

Linked and Compound Risks

I Minimum storage levels not maintained
N Insufficient resilience
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

Storage Facilities

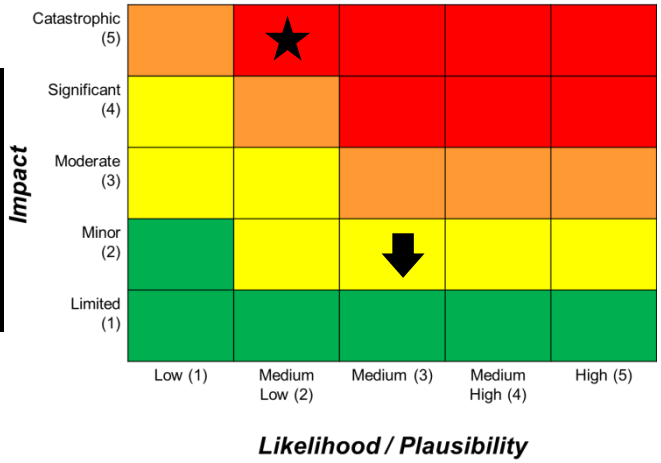
Annotated Aerial Photo of St Sampson Harbour (Image Source: DigiMap via SoG Licence: G168)

RISK SUMMARY

Inadequate fuel stocks available

Ref – I (S7)

Overall Assessment = Very High



Key

★ Reasonable worst case scenario (RWCS)

⬆ Upper range ⬇ Lower range

Outcome Description

The fuel stock levels may be inadequate because no minimum strategic level fuel storage volumes are agreed between the States and the fuel suppliers.

Insufficient fuel storage capacity may:

- Reduce the ability to maintain strategic storage levels for all fuel types,
- reduce the spectrum of fuel types supplied
- increase the frequency of fuel deliveries to the Island and reduce the package size per delivery.

Guernsey's strategic storage requirements may increase or decrease depending on internal and external influences such as:

- Lead times to invoke business continuity plans;
- Island appetite for risk;
- Geo-political stability;

Clean fuel suppliers currently agree to report when their stock levels fall below a level agreed with the States of Guernsey.

Controls include natural market forces ie on island suppliers are unlikely to risk running out of fuel and being unable to fulfil customer commitments, particularly in a competitive environment.

Confidence Levels

Low confidence in the overall assessment based on a relatively small body of knowledge of the issue and includes relevant evidence and somewhat consistent relevant expert judgments.

Linked and *Compound* Risks

P Contaminated or out of specification fuel enters on island storage and/or distribution network

T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

Relevant Risk Groupings

Storage

Impact scores (RWCS)

Financial	5
Reputation	5
Continuity of Service	5
Health & Safety	0
Regulatory	0

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) is assumed to be caused by a decision from commercial operators to run with lower minimum storage levels that would result in a failure to maintain sufficient product on island to cope with delays in the delivery schedule. This event may materialise as a consequence of falling demand or commercial pressures on fuel importers.

It is assumed that should another risk materialise, this would lead to some form of rationing as the lack of storage on island would limit the ability to absorb incidents or delays elsewhere in the supply chain.

It is assumed that the event would occur during business as usual period (normal operations and no other incident (e.g. leakage from tanks))

Background

The privately owner clean fuel suppliers to Guernsey currently operate a voluntary agreement under which they should advise the States of Guernsey if their stockholdings fall below 15 days of estimated fuel demand.

The privately owned Guernsey Gas has no such agreement regarding LPG, though its own policy is to maintain a minimum of 10 days of demand in storage.

The States owned Guernsey Electricity Limited is required to maintain a capacity for on island power generation.

Consideration should be given when setting minimum storage levels to a long term view on the following elements and reviewed periodically:

- Risk within the supply chain of missing delivery windows;
- Nature of the supply chain ie low frequency/high volume deliveries or high frequency low volume deliveries;
- Lead times to invoke business continuity plans
- Commercial viability and cost impact;
- Island appetite for risk;
- Geo political stability within supply chain and business continuity plans;
- Strategic importance of an individual fuel type to the island.

In the event minimum storage levels are set too low less time is available to make decisions and set in motion business continuity plans to avoid or minimise disruption. Potentially less resilience to natural and known supply chain delays such as adverse weather and refinery delays. Customers are likely to experience disruption to supply more frequently.

Commercial conditions could make it unattractive to meet storage levels either due to:

- an increase in the set strategic storage level;
- increase in the overall cost of storage relative to the profitability of supply of an individual fuel type.

Impact is likely to be variable depending on the time of year and the demand for fuels. In more extreme circumstances frequent disruption to one or more fuel types may be experienced. Customer buying behaviour may evolve in maintaining higher levels of storage at the customer premise.

Historic examples:

The Office of the Committee for Economic Development has provided evidence that stock levels of the clean fuels suppliers have been less than 10 days of demand on multiple occasions over the years.

Interviews with fuel importers confirmed the fact that for economic reasons companies prefer to keep stock levels as low as possible while meeting their customer demands.

Clean fuel suppliers in the past have helped each other by sharing stock and they have also managed customer demand by not always supplying the full amount of fuel requested.

In 2008 there were clean fuel delivery problems and led the States to the decision to purchase the two clean fuel tankers (Sarnia Cherie and Sarnia Liberty) to help in securing future deliveries of fuel. The stock shortages also led to the States of Guernsey drafting a Supply of Fuel emergency power regulation that would have enabled rationing of fuels.

Likelihood

The event is unlikely to occur as experience of it is very limited in the sector.

A judgement of likelihood has been made based on the fact that an event involving the activation of the rationing plan has never occurred on island and rarely occurs in the sector.

Likelihood Score = 2

Financial Impact

The financial impact is estimated as catastrophic i.e. greater than £5 million loss.

This includes costs of alternative arrangements e.g. activation and application of the rationing plan.

Financial Impact Score = 5

Reputation Impact

The reputation impact would be a sustained national adverse media attention

Reputation Impact Score = 5

Continuity of Service Impact

It is believed that in the case of this event occurring, a fuel rationing would be implemented for more than 1 week.

Continuity of Service Impact Score = 5

Health and Safety Impact

No injury or health effect

Health and Safety Impact Score = 0

Regulatory Impact

No regulatory or code breach

Regulatory Impact Score = 0

Longer Term Impacts

Vulnerability Assessment

There is no legal framework to enforce minimum levels of stock on the private fuel suppliers.

New entry to, or departure from, the market may impact on total storage capacity.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The more likely scenario is believed to have the same cause as the RWCS. In the event of shipping delays, the lack of on island storage will result in several occasions of the Civil Contingency Authority meeting. It will remain an internal matter as stock level will be under 5 days requiring consideration of rationing without activation of the rationing plan.

More impactful, less likely scenario (upper range on the range diagram)

A more impactful though less likely scenario is believed to have the same cause as the RWCS. In the event of shipping delays, the lack of on island storage will result in rationing occurring more frequently and emergency scenarios being enacted for up to 2 weeks.

Linked and Compound Risks

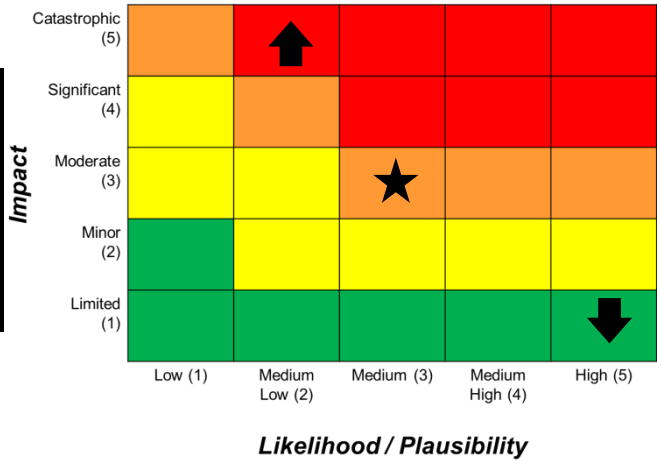
P Contaminated or out of specification fuel enters on island storage and/or distribution network
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

RISK SUMMARY

Inadequate storage capacity available

Ref – K (S1)

Overall Assessment = High



Key

★ Reasonable worst case scenario (RWCS)

⬆ Upper range ⬇ Lower range

Outcome Description

The fuel stock levels may be inadequate because of an insufficient overall storage capacity.

Insufficient fuel storage capacity may:

- Reduce the ability to maintain strategic storage levels for one or more fuel types,
- reduce the spectrum of fuel types supplied
- increase the frequency of fuel deliveries to the Island and reduce the package size per delivery.

Guernsey's strategic storage requirements may increase or decrease depending on internal and external influences such as:

- Lead times to invoke business continuity plans;
- Island appetite for risk;
- Geo-political stability
- Alternative methods of fuel delivery.

Confidence Levels

Low confidence in the overall assessment based on a relatively small body of knowledge of the issue and includes relevant evidence and somewhat consistent relevant expert judgments.

Linked and *Compound* Risks

P Contaminated or out of specification fuel enters on island storage and/or distribution network
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

Relevant Risk Groupings

Storage

Impact scores (RWCS)

Financial	3
Reputation	1
Continuity of Service	2
Health & Safety	0
Regulatory	0

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) is assumed to be caused by a lack of tankage due to planned or unplanned maintenance of storage tanks. This leading to an inability to maintain preferred minimum stock levels whilst maintaining economic parcel size deliveries.

Lack of storage on island would result in smaller packages being delivered each time, and limit the ability to absorb incidents or delays elsewhere in the supply chain.

Existing suppliers have inspection and replacement plans in place which would minimise the likelihood of the need for unplanned maintenance work.

Background

Summary of Storage Facilities

Description	**Location**	**Key Parameters**	**Operator**	**Storage Capacity**
Fuel Storage (GEL)	North of St Sampson	2 main clusters of tanks, tanks vary in size typically hold 2,000t to 3,000t each	Guernsey Electricity Limited	13,000t HFO
Fuel Storage (Clean products)*	North of St Sampson Harbour	1 main cluster of tanks	Channel Island Fuels Limited	6,135 m^3 (approx. 4,900t)
	South of St Sampson Harbour	1 main cluster of tanks	Fuel Supplies (C.I) Ltd [RUBIS Group]	8,827 m^3 (approx. 7,100t)
LPG	South of	1 main cluster (underground)	Guernsey Gas	1,600t
LPG Bottles	South of	1 bottling area	Guernsey Gas	Unknown
LPG Storage	Le Bouet	Gas “production” plant	Guernsey Gas	Unknown

* Fuel storage volumes provided for clean products provided in cubic meters with approximate tonnage, as actual tonnage varies with split of product, due to density differences

Storage tanks have a typical life of 10 years before refurbishment or replacement. Rubis Fuels carried out an extensive refurbishment of their storage approximately 5 years ago and therefore expect the tanks to continue in full service for another 5 years. The lead time for implementing replacement storage tanks on existing sites is anticipated as approximately 6-12 months, but would vary considerably depend on the nature and scale of replacement. The lead time for establishing a new storage tank site is likely to be in excess of 2 years, given the expected planning and permitting requirements.

Currently all fuel storage capacity is owned by the private sector. Decisions which may result in reduced storage capacity include:

- Some tanks life expire without replacement;
- Withdrawal of an existing supplier from the market without replacement.

Impact is likely to be variable depending on the time of year and the demand for fuels. In more extreme circumstances frequent disruption to one or more fuel types may be experienced. Customer buying behaviour may evolve in maintaining higher levels of storage at the customer premises.

Historic examples:

The Office of the Committee *for* Economic Development has provided evidence that stock levels of the clean fuels suppliers have been less than 10 days of demand on multiple occasions over the years.

Between 2009 and 2011 there were a higher number of incidences of low stock notifications made to the Committee *for* Economic Development, largely attributed to a storage tank refurbishment and replacement programme undertaken by CIFL.

Likelihood

The event is likely to occur as it has been experienced within the sector.

Likelihood Score = 3

Financial Impact

The financial impact is estimated as minor as it is assumed that some cost

Financial Impact Score = 3

Reputation Impact

The reputation impact would be a one off adverse local media and/ or social media attention. The lack of storage would likely be managed between suppliers.

Reputation Impact Score = 1

Continuity of Service Impact

It is believed that in the case of this event occurring there could be 5 to 10 days remaining in the tank

Continuity of Service Impact Score = 2

Health and Safety Impact

No injury or health effect

Health and Safety Impact Score = 0

Regulatory Impact

No regulatory or code breach

Regulatory Impact Score = 0

Longer Term Impacts

Nil. The

Vulnerability Assessment

New entry to, or departure from, the market may impact on total storage capacity.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The more likely and less impactful scenario is believed to be that storage capacity is not maintained as a consequence of a commercial decision to decommission and not replace existing storage tanks as a result of falling demand. It is expected that this is a consequence of a realisation of the predicted fall in demand for hydrocarbons, meaning that the impact will be low.

More impactful, less likely scenario (upper range on the range diagram)

A more impactful though less likely scenario is believed to be the exit of one fuel supplier from the market. This would likely mean that the storage tank would need to be purchased by another supplier or the States of Guernsey to ensure storage levels could be maintained.

Linked and Compound Risks

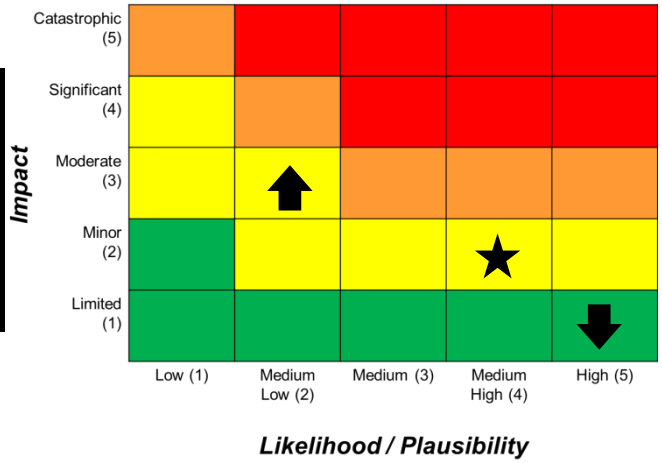
P Contaminated or out of specification fuel enters on island storage and/or distribution network
T Part of the supply chain becomes commercially unviable/no longer provided by the private sector

RISK SUMMARY - DRAFT

Berth unavailable

Ref – O (U1, U2 and U10)

Overall Assessment = Medium



Key

★ Reasonable Worst Case Scenario (RWCS)

↑ Upper range ↓ Lower range

Outcome Description

A vessel is unable to berth due to a lack of berth availability due to one of the following:

1. Inability to satifactorily prepare berth or confirm safe to use;
2. Berth occupied by another vessel including another fuel vessel, scrap and or bulk aggregate providers;
3. Berth damaged and undergoing repairs;

This may cause delay in delivery such that one or more tidal windows are missed. Delay may result in parts of the supply chain suffering increased charges. Disruption to some fuel types may be experienced if storage is low.

Flexibility in scheduling, management of strategic storage levels between suppliers and prioritisation of tankers by the Harbourmaster all mitigate the risk of vessels being held out to sea due to the berth being unavailable.

Confidence Levels

Very High confidence in the overall assessment based on a thorough knowledge of the issue and includes evidence of a very high quality informed by consistent / relevant expert judgements.

Linked and *Compound* Risks

F Vessel collision/damage on approach, entry/exit or during discharge

H Damage, fire or explosion at storage facilities

Relevant Risk Groupings

Transportation
Upload

Impact scores (RWCS)

Financial	2
Reputation	2
Continuity of Service	1
Health & Safety	0
Regulatory	0

Specific Assumptions

Reasonable Worst Case Scenario

The berth is unavailable and not repairable in time for the vessel to deliver on schedule: for example 3 days before the tidal window shuts, the berth gets damaged and it is impossible to repair it within the tidal window so the ship has to wait for the next one.

It is assumed that:

- No other berth(s) are available
- The weather is within the operating capability of the vessel
- The on-island stocks are at 10 days

It is also assumed that the berth will not become free on/during the current tidal window.

In the case that the berth does become free it is assumed that there is not sufficient time within the tidal window to allow subsequent operations.

Background

St Sampson's harbour was constructed in 1880 and is a drying port. The harbour entrance can be exposed during strong winds and is subject to high tidal currents across the approaches, as well as the hazard of rock outcrops limiting the amount of safely navigable waters, and poor visibility in and around the area in periods of poor weather.

St Sampson's harbour is the primary entry point for hydrocarbon products onto the island. Both the North Pier and the South Commercial Quay have facilities for discharging tankers.

The fuel vessels delivering products to the island can only enter the harbour when there is sufficient depth of water for them to enter and berth. The height of tide and therefore depth of water varies on a fortnightly basis, peaking with a spring tide when the most water is available.

As a result of the depth of water required for existing fuel vessels to deliver, the tidal window is between 8 to 10 days (four to five days either side of a spring tide) for St Sampson's Harbour.

The requirement to undertake inspection of the seabed after use and before arrival of the next ship has a significant impact on efficiency and berth usage.

Historic examples:

October 2016 – Berth 2S unavailable for c. two weeks following manoeuvring of "Terra Marique" to unload generator for Guernsey Electricity. The berth could not be inspected until an appropriate tide, preventing use by NAABSA cargo vessels.

January 2016 – Vessel Master protested at condition of 1N berth St Sampson. However the outcome is not known from the records.

March 2014 – Vessels delayed in berthing as bed not prepared in time. Damage caused by vessel berthing movements on previous tides.

January 2008 - Seabed of berth 2S during the berthing and unberthing of MT Vedrey Tora. Damage was subsequently repaired by JCB following examination at the expense of the vessel owner.

Likelihood

A judgement of likelihood has been made based on the recorded past events and the frequency of them happening.

Likelihood Score = 4

Financial Impact

Estimated cost: £5K to £100K

The financial impact is linked to potential demurrage costs for delays to the vessel.

It is however considered unlikely that the demurrage charges will be passed to the end users (no impact on petrol pump price) for a one off event.

Financial Impact Score = 2

Reputation Impact

Reputational impact = one off adverse local media and/or social media attention

The reputational impact of the outcome description of RWCS may attract minor media or social media attention depending of who is involved - if the fuel companies decide to write to the press for example.

There could also be a reputational impact for Guernsey Harbours if they are unable to level seabed with diggers so unable to confirm if the berth is available. However because this happens often, the matter tends to remain internal.

Reputation Impact Score = 2

Continuity of Service Impact

Insignificant because it is assumed that normal stock levels are maintained.

Continuity of Service Impact Score = 1

Health and Safety Impact

No injury or health effect.

Health and Safety Impact Score = 0

Regulatory Impact

No regulatory or breach code.

Regulatory Impact Score = 0

Longer Term Impacts

Not applicable.

Vulnerability Assessment

Different points of vulnerability:

1 - Inability to visually inspect the berth before next ship arrival and confirm it is safe to use – if the use of propellers and bow thrusters result in damage to the sea bed (due to propwash) then this can cause structural damage to the next ship (in case of two vessels arriving on the same tide). This is mitigated by strong skills/experience from both general pilots and the Harbour Authority that allows an accurate decision/assessment to be made.

2 - Vessel prioritisation – berth allocation on first come first serve basis however the Harbour Authorities consider all scheduling and the Harbour Master may prioritise vessels depending on specific circumstances.

3 - Berth damage – low vulnerability based on fact that physical constraints are imposed on vessel permitted to operate in St Sampson harbour – strong regulations. Vessels tend to be highly manoeuvrable and the manoeuvring is done by experienced general pilot.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

Berth occupied by another (fuel/scrap/bulk vessel) preventing scheduled delivery by fuel vessel or berth preparation not completed in time

Fuel vessel delayed 2 days but still makes delivery within tidal window. Impact on demurrage costs for fuel importer.

More impactful, less likely scenario (upper range on the range diagram)

Missing 3 tidal windows and/or significantly damaged berth requiring repairs and/or
vessel damaged at the berth and blocking it for a number of tides resulting in impacting stock on island.

Linked and Compound Risks

A Adverse Weather (U3 and T3)

C No pilot services (U7)

H Damage Fire or explosion at storage facilities H (S2 S4 and S5)

I Minimum Storage Levels not maintained I (S7)

J Minimum Storage Levels set too low

K Reduction in fuel storage capacity (S1)

Berth Levelling

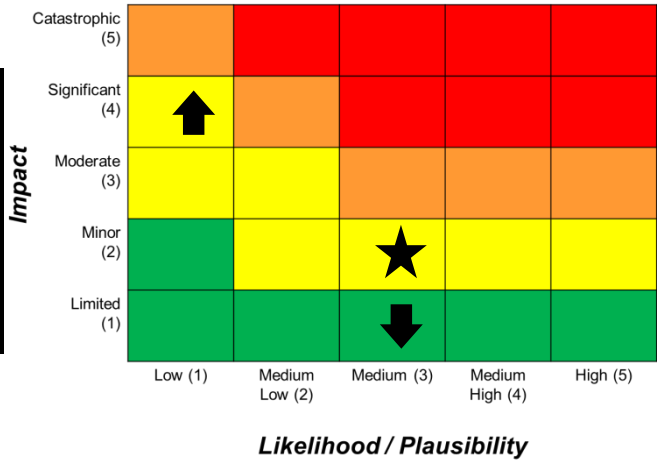
Location of Berths

RISK SUMMARY

Contaminated or out of specification fuel enters on island storage and/or distribution network

Ref – P (R5)

Overall Assessment = Medium



Key

★ Reasonable worst case scenario (RWCS)

⬆ Upper range ⬇ Lower range

Outcome Description

Contaminated or out of specification fuel may occur from:

- Refinery supply;
- Sabotage;
- Storage error.

Testing programs throughout the supply chain mitigate the probability of procuring and/or continuing to distribute contaminated or out of specification fuel. Regulation and standards for particular fuel types such as aviation fuel are more stringent to mitigate risk. The following actions may be taken upon discovery of a fuel standard issue:

- Blending fuel, co-operation between fuel supplier may be required to achieve blending;
- Removal and disposal of contaminated fuel.

Confidence Levels

Low confidence in the overall assessment based on a relatively small body of knowledge of the issue and includes relevant evidence and somewhat consistent / relevant expert judgements.

Linked and *Compound* Risks

E Reduced availability of non-bio fuels
I Inadequate on island storage
S Lack of robust disaster recovery and business continuity plans

Relevant Risk Groupings

Refinery
Storage
Distribution

Impact scores (RWCS)

Financial	2
Reputation	2
Continuity of Service	2
Health & Safety	0
Regulatory	0

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) is that the refinery provides out of specification fuel to suppliers and it is not recognized until loaded into on-island storage. It is however assumed that the contaminated fuel will not reach the consumers.

The supplier could blend fuel with other sources to meet specification. It would lead to a reduced availability of product and higher operating costs to supplier.

It is assumed that control measures are in place at the different stages in the supply chain that limit the risk of contamination.

Background

A type of fuel can become **out-of-specification** due to contamination, co-mingling, improper blending or intentional dilution.

Fuel contamination is a term used to typically sum up the water and bacterial microbes which inevitably find a home within diesel and other fuels. If left untreated the contaminants will grow and eventually render the fuel in which they reside, useless. Fuel degradation can be a costly problem. Untreated, contaminated fuel can cause early corrosion on storage tanks, as well as damage to fuel, machinery and engine.

Any fuel which can be stored in a tank is susceptible to bacterial contamination.

The importance of regular fuel testing and analysis cannot be ignored as it ensures that any fuel contamination is found early enough to treat and at a considerably reduced cost against buying a replacement batch of fuel. Testing needs to occur at different stage in the supply chain. Damage to tanks and equipment through fuel stability issues may also add to a long list of very costly clean-up jobs.

Historic examples:

Contaminated or out of specification fuel has previously been supplied by a refinery and treated on island by blending.

Likelihood

A judgement of likelihood has been made based on the fact that this event has happened previously on the island and also happens in the sector.

Likelihood Score = 3

Financial Impact

The financial impact is measured against a reasonable severity of contamination and it includes the costs linked to blending and demurrage. Costs involved are believed to be between £5,000 and £100,000.

Financial Impact Score = 2

Reputation Impact

Reputational impact = one off adverse local media and/or social media attention

The reputational impact of the outcome description of RWCS may attract minor media or social media attention based on the fact that there would be a reduced availability of fuel but it would not have more than a minor impact as the contaminated fuel would not reach the consumers.

Reputation Impact Score = 2

Continuity of Service Impact

Depending of the severity of the contamination, stock levels might be down to 5 to 10 days of strategic volumes remaining in the tank.

Continuity of Service Impact Score = 2

Health and Safety Impact

There would be no injury or health effect.

Health and Safety Impact Score = 0

Regulatory Impact

There would be no regulatory or code breach.

Regulatory Impact Score = 0

Longer Term Impacts

A storage facility could be unavailable for a protracted period of time.

Vulnerability Assessment

The main vulnerability lies in the reliance on third party to carry the testing at the different stages of the supply chain.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The more likely scenario is believed to be caused by the fuel stored on-island becoming out of specification due to contamination in transfer/storage network. This would result in importer having to blend fuels with its own sources to meet specifications and carry out repair/maintenance to affected storage/transfer facilities.

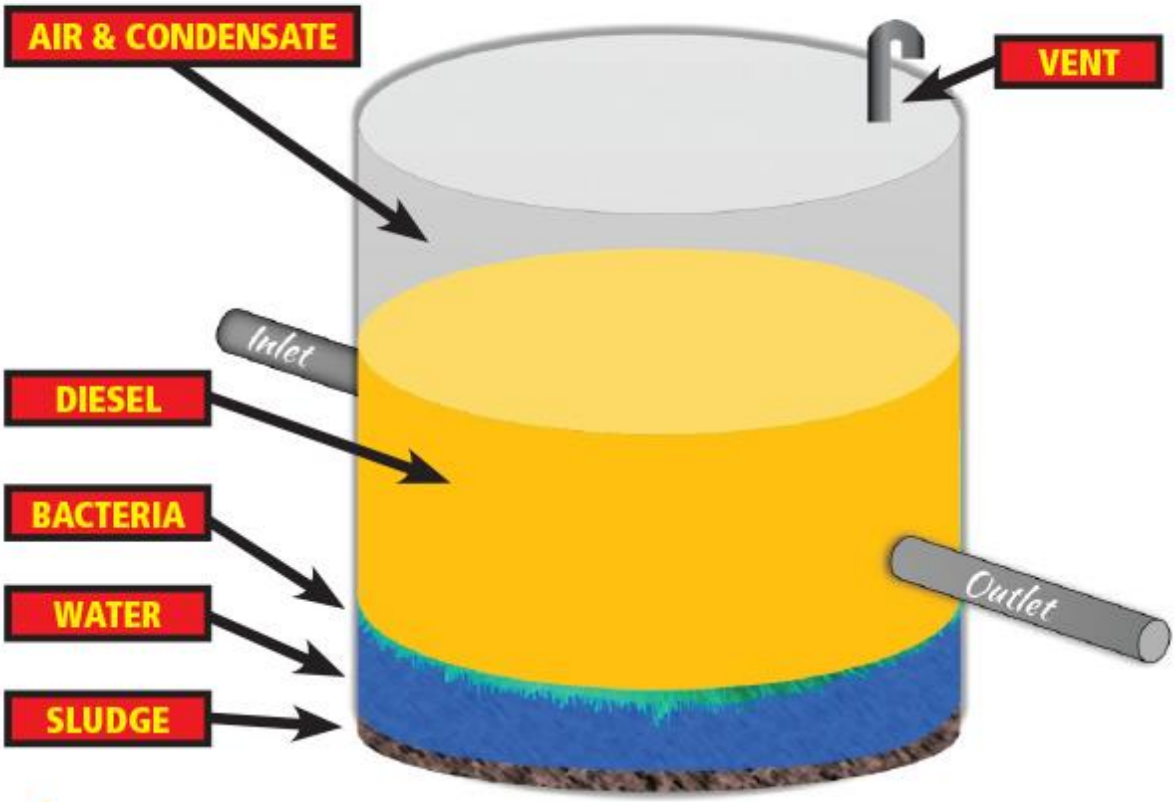
More impactful, less likely scenario (upper range on the range diagram)

The less likely scenario is believed to be caused by the fuel stored on-island becoming out of specification and not identified until delivered to customers. This would result in the fuel delivered to customers having to be collected by fuel supplier and returned to storage for treatment/blending before resale.

Linked and Compound Risks

E Reduced availability of non-bio fuels
I Inadequate on island storage
S Lack of robust disaster recovery and business continuity plans

LAYERING EFFECT IN A FUEL TANK



A typical diesel storage tank requires fuel monitoring and good maintenance practices to keep sludge, water, and bacteria from becoming a problem.

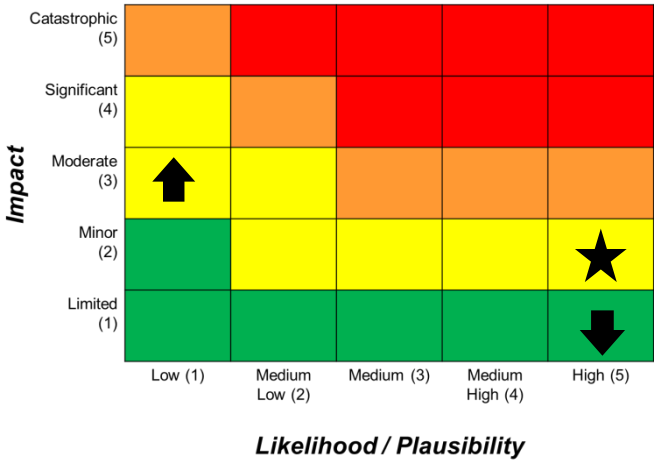
Source: Authors

RISK SUMMARY

Delay at refinery

Ref – R (R1 and R6)

Overall Assessment = Medium



Key

★ Reasonable Worst Case Scenario (RWCS)

▲ Upper range ▼ Lower range

Outcome Description

A delay loading at a refinery (or storage depot) may occur due to:

- Low prioritisation for loading due to small package sizes;
- Sabotage, malicious attack or act of terrorism;
- An incident at the refinery or technical issue prohibiting all loading for a period of time;
- Low stock levels for particular product;
- Adverse weather at the refinery;
- A number of vessels awaiting loading (serviced on a first come first served basis)
- Industrial action at refinery

The effect within supply chain may result in one or more tidal windows being missed. The number of viable refinery options available for each fuel type mitigates this risk.

Confidence Levels

High confidence in the overall assessment based on a large body of knowledge of the issue and includes evidence of a high quality informed by consistent / relevant expert judgements.

Linked and *Compound* Risks

A Adverse Weather on route or in Guernsey
I Inadequate level of storage

Relevant Risk Groupings

Refinery

Impact scores (RWCS)

Financial	2
Reputation	1
Continuity of Service	1
Health & Safety	0
Regulatory	0

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) is based on a vessel arriving at refinery on time but being delayed by 5 days due to for example small parcel size and refinery priority to load larger parcels, fog or refinery technical issues.

This will result in the vessel being delayed leaving the refinery and missing one tidal window at St Sampson's Harbour.

Background

St Sampson's harbour was constructed in 1880 and is a drying port. The harbour entrance can be exposed during strong winds and is subject to high tidal currents across the approaches, as well as the hazard of rock outcrops limiting the amount of safely navigable waters, and poor visibility in and around the area in periods of poor weather.

St Sampson's harbour is the primary entry point for hydrocarbon products onto the island. Both the North Pier and the South Commercial Quay have facilities for discharging tankers.

The fuel vessels delivering products to the island can only enter the harbour when there is sufficient depth of water for them to enter and berth. The height of tide and therefore depth of water varies on a fortnightly basis, peaking with a spring tide when the most water is available.

As a result of the depth of water required for existing fuel vessels to deliver, the tidal window is between 8 to 10 days (four to five days either side of a spring tide) for St Sampson's Harbour.

The term "demurrage" originated in vessel chartering and referred to the period when the charterer remained in possession of the vessel after the period normally allowed to load and unload cargo (lay time). By extension, demurrage refers to the charges that the charterer pays to the ship-owner for its extra use of the vessel. Officially, demurrage is a form of liquidated damages for breaching the lay time as it is stated in the governing contract (the charter party). The demurrage sometimes causes a loss to the seller as it increases cost of the total freight. Demurrage charges are applied to vessels that are unable to unload their cargo at St Sampson's due to delay.

Historic examples:

The interviews carried on with the importers revealed that delays at refineries do happen due to adverse weather. The cause can differ and delays could be attributed to the fact that refinery would prioritise bigger ships to be loaded first however this has not been verified.

In the past, some vessels had to be light loaded to allow the use of a wider tidal window at St Sampson's. This would have resulted in an increase of the cost per litre of fuel delivered to Island but no further impact (on customer fuel prices for example) have been recorded.

The fuel protests in the United Kingdom were a series of campaigns held because of the cost of rising petrol and diesel fuel prices for road vehicle use. There have been three notable campaigns amongst many other protests in the 21st century. The first major protest in 2000 was primarily led by independent truck owner-operators. Protests and blockades of oil facilities caused widespread disruption to the supply of petroleum products in the UK.

The protests spread so that on 10 September 2000 they included facilities at the Manchester Fuels Terminal, Kingsbury Oil Terminal, the largest inland oil terminal, and at Cardiff Docks. Panic buying of petrol began to close some petrol stations as motorists queued for fuel which was beginning to be rationed and reports of garages increasing their prices substantially. On 11 September 2000, the government obtained an Order in Council which was authorised by the Privy Council and the Queen to take emergency powers under the Energy Act 1976 to ensure delivery of fuel to essential services. By

then six of the nine refineries and four oil distribution depots were subject to protests. The government deployed military tankers around the country and designated 2,000 petrol stations to receive supplies for essential services.

More recently at Lindsey Refinery, England: On 28 January 2009, approximately 800 of Lindsey Oil Refinery's local contractors went on strike following the appointment by the Italian construction contractor IREM of several hundred European (mainly Italian and Portuguese) contractors on the site at a time of high unemployment in the local and global economy. Subsequently, sympathy walkouts at other UK petroleum, power and chemical sites took place.

While these protests caused problems for supply of fuels in the UK by road tanker, there was no evidence that they impacts supplies to ships carrying fuel to Guernsey or elsewhere.

In 2016, in France: strike picket blocking access to a large oil refinery near Marseille in an attempt by trade unions to paralyse the country's fuel supply network in protest at laws. Six of France's eight refineries had stopped operating or reduced output. There were long traffic jams at fuel pumps across France as regular motorists, taxi and delivery drivers fearing a fuel shortage tried to stock up on petrol. This also led to delays in exporting products by sea.

Likelihood

A judgement of likelihood has been made based on the fact that the event is believed to happen in the supply chain in the close future. More than a 50% chance for the event to happen.

Likelihood Score = 5

Financial Impact

The financial impact is measured includes the costs linked to demurrage. Costs involved are believed to be between £5,000 and £100,000.

Financial Impact Score = 2

Reputation Impact

Reputational impact = one off adverse local media and/or social media attention

The reputational impact of the outcome description of RWCS is believed to remain an internal matter and has therefore been scored as "minor".

Reputation Impact Score = 1

Continuity of Service Impact

The impact would be minor, as 10 to 20 days strategic volumes would remain in the tanks.

Continuity of Service Impact Score = 1

Health and Safety Impact

There would be no injury or health effect

Health and Safety Impact Score = 0

Regulatory Impact

There would be no regulatory or code breach.

Regulatory Impact Score = 0

Longer Term Impacts

The fuel suppliers may have to change refineries/sources of their products if the difficulties become too challenging.

Vulnerability Assessment

The vulnerability is low because the island has the ability to be supplied by many refineries located in different countries, which reduced the impact of national crises.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The more likely scenario is believed to be caused by the same cause as RWCS i.e. a vessel arriving at refinery on time but delayed 5 days due to for example small parcel size and refinery priority to load larger parcels, fog or refinery technical issues.

This would result in the vessel being light loaded to allow use of wider tidal window at St Sampson's. The cost per litre of fuel delivered to Island would increase.

More impactful, less likely scenario (upper range on the range diagram)

The less likely scenario is believed to be caused by the same cause as RWCS i.e. a vessel arriving at refinery on time but delayed 10 days due to for example small parcel size and refinery priority to load larger parcels, industrial action blockade, fog or refinery technical issues.

This would result in the vessel being delayed leaving the refinery and missing one tidal window at St Sampson's. It is assumed that this delay will happen when on Island stocks are falling below strategic storage levels leading to the implementation of Civil Contingency Plan. Demurrage costs would also be involved.

Linked and Compound Risks

A Adverse Weather on route or in Guernsey
I Inadequate level of storage

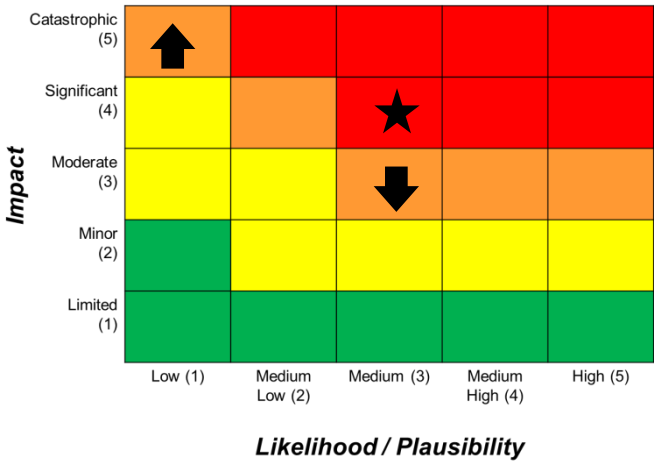
Marseille: A refinery strike impact on tankers waiting to load

RISK SUMMARY

Part of the supply chain becomes commercially unviable/no longer provided by the private sector

Ref – T

Overall Assessment = Very High



Key

★ Reasonable Worst Case Scenario (RWCS)

▲ Upper range ▼ Lower range

Outcome Description

The existing supply chain is predominantly supplied by private sector companies and no subsidies are provided within the supply chain.

Private sector supply is predicated on the ability to make a profit. A number of factors may result in a lack of interest from private sector operators to continue (or new entrants to enter the supply chain):

- costs inflating within part of the supply chain to such a level the market cannot bear the cost increase;
- unplanned costs incurred by suppliers which are difficult to pass on through the supply chain;
- insuffient profitability on capital employed to interest private sector provision for one or more parts of the supply chain;
- public sector obligations on one or more elements of the supply chain;
- risk of reputational damage to the wider group company for example from political and/or island reactions;
- market size;
- The introduction of an alternative supply route undermining the existing supply route.

This may result in turbulence within the supply chain, a reduction in the number of fuel types imported, loss of strategic fuel supplies, provision of subsidy into the supply chain or public sector purchases to secure the supply chain.

Confidence Levels

Low confidence in the overall assessment based on a relatively small body of knowledge of the issue and includes relevant evidence and somewhat consistent / relevant expert judgements.

Linked and *Compound* Risks

Relevant Risk Groupings

Refinery
Transportation
Upload
Storage
Distribution

Impact scores (RWCS)

Financial	4
Reputation	3
Continuity of Service	1
Health & Safety	0
Regulatory	0

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) is that one of the companies in supply chain cannot make commercial return resulting in the States of Guernsey having to subsidise their operations through capital investment or operational support.

Background

Historic examples:

There is evidence of changes in the market but there is no evidence that it effected the island.
In the past, one of the suppliers (Total and before them Shell) stopped supplying the island but was replaced by another company.

- Minnows in for feast if big fish leave North Sea
    - Sunday 25 May 2003 Scotsman
    - http://www.scotsman.com/news/minnows-in-for-feast-if-big-fish-leave-north-sea-1-1385841
- Oil price fall puts squeeze on North Sea energy minnows
    - Reuters Economy News | Mon Dec 22, 2014
- Shell's North Sea sale boosts optimism over smaller operators
    - 31 January 2017 Financial Times

Likelihood

A judgement of likelihood has been made based on an assumption that the States of Guernsey will have to subsidise and support one element. It has previously purchased two tankships for transporting clean fuels.

Likelihood Score = 3

Financial Impact

The financial impact has been assessed as major.

Financial Impact Score = 4

Reputation Impact

The reputational impact of the outcome description of RWCS has been scored as "moderate" as it is believed that the event would attract a sustained adverse local media and/or social media attention.

Reputation Impact Score = 3

Continuity of Service Impact

In the case of the States of Guernsey stepping in, the impact of the RWCS happening would be insignificant.

Continuity of Service Impact Score = 1

Health and Safety Impact

There would be no injury or health effect.

Health and Safety Impact Score = 0

Regulatory Impact

There would be no regulatory or code breach

Regulatory Impact Score = 0

Longer Term Impacts

There could be an impact on the island market structure, create strong monopolies or the States may have to nationalise the fuel industry.

One type of fuel may stop being supplied to the island.

Vulnerability Assessment

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The more likely scenario is believed to be caused by one of the company in the supply chain cannot make commercial return resulting in A monopoly supplier for one element of the supply chain, resulting in higher costs.

More impactful, less likely scenario (upper range on the range diagram)

The less likely scenario is believed to be caused by one of the companies in the supply chain being unable to make a commercial return resulting in one type of fuel not being available on island.

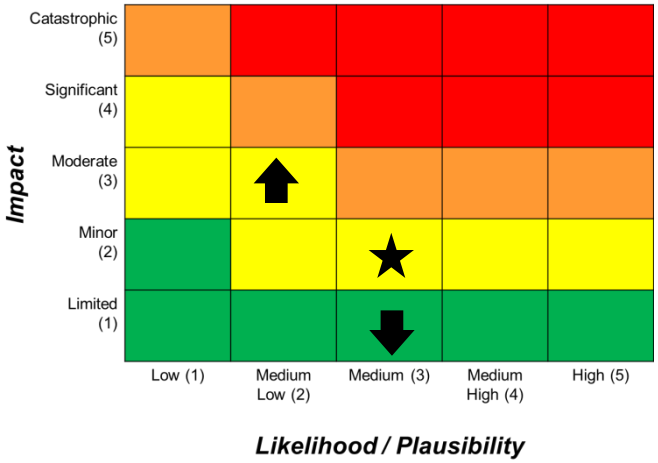
Linked and Compound Risks

RISK SUMMARY

Damage to Manifold at Upload Facilities

Ref – U (U12, U13)

Overall Assessment = Medium



Key

★ Reasonable Worst Case Scenario (RWCS)

⬆ Upper range ⬇ Lower range

Outcome Description

Damage to manifolds at upload facility can cause it to be out of service for some period of time, ranging from hours to days or even weeks. This may result in a short delay in loading or in extended delays, may prevent a vessel from discharging on one or more successive planned deliveries

Causes may include harbour or other vehicles colliding with manifolds (on South Side) or objects being dropped from cranes on North Side onto manifolds which are below the surface

Confidence Levels

Low confidence in the overall assessment based on a relatively small body of knowledge of the issue and includes relevant evidence and somewhat consistent / relevant expert judgements.

Linked and *Compound* Risks

Relevant Risk Groupings

Upload
Storage

Impact scores (RWCS)

Financial	2
Reputation	1
Continuity of Service	1
Health & Safety	0
Regulatory	0

Specific Assumptions

There is damage to manifolds at upload facilities and vessels cannot discharge fuels at facility for 24 hours while repairs to manifolds are effected and additional security measures are put in place.

For RWCS and upper range, vessel assumed to be on berth and therefore delayed. In lower range, vessel not on berth.

This risk could materialise on north or south side manifolds.

Background

The manifolds on the south side are above ground and enclosed in a metal cage which has a padlocked gate/hatch in it to allow access when the facility is in use.

The manifolds are part of a busy quay area which is used for a variety of harbour operations, including, for example general repairs and maintenance to harbour equipment and vessels.

There are few access restrictions to the south side berths.

The south side berths are used for gas and clean fuel vessel unloading but also for cement vessel unloading on an irregular basis.

The manifolds on the north side are underground, below the quay level and protected by a metal plate in the quay.

The north side berth has gated access. It is used for HFO and clean fuels offloading but also for scrap vessel loading. There are two rail mounted harbour cranes on the quay.

Historic examples:

LPG pipelines leading from the manifold to the storage were replaced to allow easier access for maintenance and inspection. Access to quay fairly unrestricted

Likelihood

A judgement of likelihood has been made based on the fact that the events have been reported in the sector.

Likelihood Score = 3

Financial Impact

The financial impact is measured includes the costs linked to demurrage. Costs involved are believed to be between £5,000 and £100,000.

Financial Impact Score = 2

Reputation Impact

Reputational impact = one off adverse local media and/or social media attention

The reputational impact of the outcome description of RWCS is believed to remain an internal matter and has therefore been scored as “minor”.

Reputation Impact Score = 1

Continuity of Service Impact

The impact would have no impact.

Continuity of Service Impact Score = 0

Health and Safety Impact

There would be no injury or health effect

Health and Safety Impact Score = 0

Regulatory Impact

There may be a regulatory or code breach.

Regulatory Impact Score = 1

Longer Term Impacts

If cause is malicious damage, it is likely that security would be increased for access to or surveillance of the area. If maintenance related, changes to maintenance regime would be expected.

Vulnerability Assessment

Currently vessel unloading operations are covered by a number of HSE specific plans for each operator/fuel type. These are reviewed by Guernsey HSE.

Operations on board the vessel prior to berthing are the responsibility of the vessel Master who has also to comply with Guernsey Harbours rules/regulations.

Guernsey Harbours operate permit to work systems for some/all operations on both quays *[Chad to confirm]*

Risk Ranges

More impactful, less likely scenario (upper range on the range diagram)

The less likely scenario is believed to be caused by malicious damage to manifolds at upload facilities. Vessels cannot discharge fuels at facility for 5 days while HSE investigation is carried out, repairs are effected, security measures put in place and site declared safe by HSE.

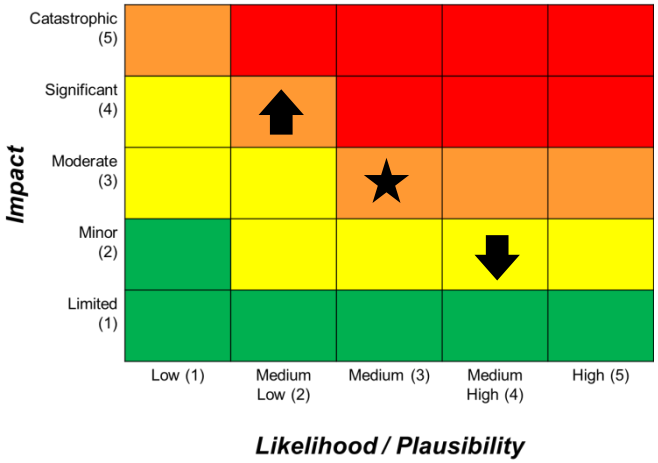
Less impactful, more likely scenario (lower range on the diagram)

The more likely scenario is believed to be caused by poor maintenance of manifolds at upload facility. Vessel discharge is delayed 6 hours while repairs to manifolds are effected.

RISK SUMMARY

V HSE Incident at upload or storage facility

Overall Assessment = High



Key

★ Reasonable Worst Case Scenario (RWCS)

⬆ Upper range ⬇ Lower range

Outcome Description

Vessel unloading may be delayed due to a variety of HSE incidents on shore.

These start with preparation of the berths prior to arrival of the vessel. This task requires accessing the berths at low tide on a large spring tide immediately before the vessel is due to berth. A mechanical digger has to be manoeuvred from the quay onto the berth using the slipway on the Northside.

Working in intertidal areas has inherent risks and there are many examples of equipment breakdown leading to loss/damage of equipment when inundated by an incoming tide.

Confidence Levels

High confidence in the overall assessment based on a large body of knowledge of the issue and includes evidence of a high quality informed by consistent / relevant expert judgements.

Linked and *Compound* Risks

F Vessel collision/damage on approach, entry/exit

H Damage, fire or explosion at storage facilities

I Minimum Storage levels not maintained

O Berth unavailable

R Delay at refinery

Relevant Risk Groupings

Upload
Storage

Impact scores (RWCS)

Financial	2
Reputation	3
Continuity of Service	0
Health & Safety	3
Regulatory	1

Specific Assumptions

The Reasonable Worst Case Scenario (RWCS) is based on an operative suffering serious injury/equipment mechanical failure during preparation of NAABSA berth. Operative hospitalised/equipment immobilised. Vessel unloading delayed by two days while equipment is recovered and site is made safe.

Background

Vessel unloading may be delayed due to a variety of HSE incidents on shore.

These start with preparation of the berths prior to arrival of the vessel. This task requires accessing the berths at low tide on a large spring tide immediately before the vessel is due to berth. A mechanical digger has to be manoeuvred from the quay onto the berth using the slipway on the Northside.

Working in intertidal areas has inherent risks and there are many examples of equipment breakdown leading to loss/damage of equipment when inundated by an incoming tide.

Loading/unloading fuel from one vessel to another (ship to storage tank to road tanker) presented risks in particular around the connections between vessels. Thus the hose and couplings connecting the ship to manifold can be weak points in the chain. They can be a source of leaks of product and if combined with an ignition source, may lead to fire or explosion.

Working in and around harbours and in particular on quays presents several slip/trip/fall hazards. These may be related to, for example, mooring lines/ropes running across quays, open quay edges (required for normal access to vessels) above water or (when the tide goes out) the sea bed.

Historic examples:

During construction of the Belgrave Bay outfall during 2015, a mechanical digger toppled into the trench it was being used to dig. It was not recovered before successive tides had inundated the vehicle rendering it inoperable. Time was lost in the construction process, there was local adverse publicity of the event and costs to replace the vehicle.

Likelihood

A judgement of likelihood has been made based on the fact that the events have been reported in the sector.

Likelihood Score = 3

Financial Impact

Costs involved have been assessed to be between £5,000 and £100,000.

Financial Impact Score = 2

Reputation Impact

The reputational impact of the outcome description of RWCS is believed to be moderate as there is likely to be sustained local media/ social media attention.

Reputation Impact Score = 3

Continuity of Service Impact

There would be no impact on strategic volumes as the delay is assumed to be a couple of days.

Continuity of Service Impact Score = 0

Health and Safety Impact

There would be a lost time injury or health effect

Health and Safety Impact Score = 3

Regulatory Impact

There would be a regulatory or code breach.

Regulatory Impact Score = 1

Longer Term Impacts

Revised HSE plans to reduce likelihood of risk or mitigate impact

Vulnerability Assessment

Currently vessel unloading operations are covered by a number of HSE specific plans for each operator/fuel type. These are reviewed by Guernsey HSE

Operations on board the vessel prior to berthing are the responsibility of the vessel Master who has also to comply with Guernsey Harbours rules/regulations.

Guernsey Harbours operate permit to work systems for some/all operations on both quays.

Risk Ranges

Less impactful, more likely scenario (lower range on the diagram)

The more likely scenario is believed to be an operative injury during vessel berthing operations such as a slip/trip/fall while working on quayside, resulting in a lost time injury for operative. Vessel unloading delayed by 4 hours.

More impactful, less likely scenario (upper range on the range diagram)

The less likely scenario is believed to be an operative fatality during cargo discharge operations due to ignition of fuel from leaking hose. Vessel discharge not completed and next planned delivery missed while HSE investigation is completed and remedial actions put in place.

Linked and Compound Risks

F Vessel collision/damage on approach, entry/exit

H Damage, fire or explosion at storage facilities

I Minimum Storage levels not maintained

O Berth unavailable

R Delay at refinery

Berth Levelling

Digger lost and subsequently recovered during Belle Greve Outfalls project