Risk Assessment for Bell Island Ferry Service

Technical Report # TR-18-34, Rev 01
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Job No.: 18.42025
24 May 2018

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EXECUTIVE SUMMARY

The Bell Island Ferry service is operated by the Marine Services Division of the Department of Transportation and Works of Newfoundland and Labrador (DTW) and provides transit between Portugal Cove and Bell Island. This crossing is mainly served by two passenger ferry vessels: the MV Legionnaire, and the MV Flanders. DTW policy requires passengers to vacate their vehicles on the vehicle deck while the ferry is in transit. The user community have recently called on DTW to allow passengers to occupy their vehicles to accommodate passengers with medical conditions or mobility challenges. This study was conducted to undertake a formal risk assessment to identify the hazards and the resulting risk associated with passengers occupying versus vacating their vehicles while the ferry is in transit. A systematic hazard identification (HAZID) exercise was used to identify hazards and associated risks by utilizing the collective knowledge and experience of LR, DTW, InclusionNL and Eastern Health. The HAZID workshop was conducted in St. John's, NL on April 24 – 25, 2018, following a visit on board the vessels, on April 23, 2018.

A review of the general arrangements, accessibility and safety features and operations of the MV Legionnaire, and the MV Flanders was carried out, along with an evaluation of the likelihood and consequences of credible hazard scenarios/incidents. Risk was assessed using a risk matrix that combines the likelihood and consequences of hazardous scenarios to rank risk on a qualitative basis as Low, Medium, High, or Extreme risk. The risk rankings were assessed with current or known safeguards. A number of additional recommendations and action items, listed in Table 4-2, were also developed to further mitigate risk. The assessment was first done for the current situation where passengers are required to vacate their vehicles when the vessel is in transit, following which a comparative assessment was done for the situation where passengers are allowed to occupy their vehicles during transit. The main observations and conclusions are provided below.

In the current situation where passengers are required to vacate their vehicles during transit, 66 hazardous scenarios that could result in personnel injuries, or asset damage were identified and assessed for the three phases of the ferry operations, namely passenger loading, transit and berthing and passenger unloading. With the multiple numbers of safeguards identified for controlling each of these hazardous scenarios, no hazardous scenario was assessed to have an Extreme risk. A majority (87%) of the hazardous scenarios were assessed to be, at most, Low or Medium risk, which is considered to be acceptable or tolerable with period review. Four distinct scenarios were assessed as High risk. These include the following hazard scenarios:

- Striking berth or other ship at berth resulting in injuries due to passengers leaving the lounge prior to arrival announcement
- Fire incidents resulting from dangerous goods (DG) operations
- Machinery room fires
- Vehicle striking other vehicle or people

Additional safeguards were developed to control these incidents and it was determined that the risks were as low as reasonably practicable (ALARP), and hence tolerable with continuous review.

In the case where passengers are allowed to occupy vehicles during transit, 66 hazardous scenarios that could result in personnel injuries, asset damage were also identified and assessed for the three phases of the ferry operations, namely passenger loading, transit and berthing and passenger unloading. As with the previous case, no hazardous scenario was assessed to have an Extreme risk. A majority (79%) of the hazardous scenarios were assessed to be Low or Medium risk, which is considered to be acceptable or tolerable with period review. However, nine distinct hazard scenarios were as assessed as High risk. These include the following:

- Fire incidents resulting from DG operations
- Machinery room fires
- Vehicle striking other vehicle or people
- Green water on vehicle deck due to extreme weather (MV Flanders)
- Collision
- Foundering due to power failure/ blackout
- Fire due to smoking
- Vehicle fire
- Sinking, capsizing or other situation requiring evacuation

ALARP justification arguments and additional safeguards were developed to control a number of these incidents. However, some of the scenarios, especially those that occur during the transit phase, would require additional considerations to make them ALARP, if the current policy of passengers vacating the vehicles is not adhered to. By following the current policy, these High risk scenarios will be eliminated.

In general, the risk profile for the passenger loading and unloading phases are lower in the case where the passengers are allowed to occupy their vehicles, whereas the risks are higher during the transit phase of the operations. On aggregate, the risk was assessed to be higher if passengers are allowed to occupy their vehicles than if they vacate their vehicles during transit.

Twenty-eight distinct recommendations and action items were generated in the HAZID workshop to further mitigate the risks. The implementation of these recommendations, as well as compliance with the stipulated safeguards and statutory rules and best practices by international organizations, will assist to ensure that the current ferry service can continue to be carried out safely.

In order to continue to improve the current Bell Island Ferry service operations it is recommended that DTW engage in concerted risk communications and awareness programs to enhance the safety culture of both the user community and the crew. Specific considerations include the following:

- **Risk Communications**: DTW should engage with the user, medical, and accessibility communities on safety aspects of the operations. It is important for the user community to understand the benefits of safety related policies. This will promote buy-in by the community and will lead to a reduction in instances of passengers not obeying rules.
- **Crew Refresher Training and Awareness of Users' Needs**: Refresher training should be provided to crew on a continuous basis so they are aware of the rules and policies, as well as being empowered with skill sets to achieve best results in enforcing rules. Crew should also be trained or sensitized on effective ways of handling persons with various kinds of medical conditions or disabilities.

- **Emergency Management Trials**: It would be helpful for crew to practice emergency procedures in real time to simulate actual situations in which the passenger populations include a mix of able bodied and mobility challenged passengers.
- **Implementation of InclusionNL Recommendations**: DTW should consider full implementation of the recommendations in the InclusionNL report to improve the accessibility facilities on the vessels.
- **Provision of Special Areas for Passengers with Medical or Mobility Concerns**: DTW should also implement recommendations on provisions of separate/ secluded areas in the passenger lounges that can be used by passengers with special medical conditions.

In terms of changing the current DTW policy to allow passengers to occupy their vehicles during transit, the results of this study cannot be used to justify an application for a MTRB exemption. As discussed above, this study has shown that the aggregate risk was higher if passengers are allowed to occupy their vehicles than if they vacate their vehicles during transit. Therefore, there is no basis from a safety point of view for such an application.

The safe and pragmatic approach is to continue with the current operations, which is in accordance with international regulations, and put measures in place to further reduce risks and improve the safety culture in the ferry service environment. If the study action items and the continuous improvement suggestions in this study are implemented, they will go a long way to the improving the safety level of the current operation as well as making the service more comfortable for users with special medical conditions or disability.

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GLOSSARY AND ACRONYMS

ABS	American Bureau of Shipping
ALARP	As Low as Reasonably Practicable
BC	British Columbia
COPD	Chronic Obstructive Pulmonary Disease
CTA	Canadian Transportation Agency
DG	Dangerous Goods
DNV	Det Norske Veritas
DTW	Department of Transportation and Works of Newfoundland and Labrador
EDG	Emergency Diesel Generator
GA	General Arrangement
HAZID	Hazard Identification
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organization
LSA	Life Saving Appliances
LR	Lloyd's Register
LRCL	Lloyd's Register Canada Limited
MTRB	Marine Technical Review Board
NL	Newfoundland
SMS	Safety Management System
SOLAS	Safety of Life at Sea
SOP	Standard Operational Procedures
TC	Transport Canada
TSB	Transportation Safety Board

1.0 INTRODUCTION

1.1 BACKGROUND

The Bell Island ferry service, operated by the Department of Transportation and Works, Marine Services Division (DTW), provides transit between Portugal Cove and Bell Island. Service is mainly served by two passenger ferry vessels: the MV Legionnaire, and the MV Flanders. Figure 1-1 shows the area of operation and pictures of the two vessels. MV Legionnaire has a capacity of 64 vehicles and 200 passengers; and MV Flanders has a capacity for 36 vehicles and 240 passengers. The voyage is typically of 20 minute duration and each of the vessels makes several trips a day. One or two voyages on Tuesdays are dangerous goods (DG) trips that also carry a maximum of 25 passengers.

Figure 1-1: Pictures of Bell Island Ferries and Area of Operation

DTW policy requires passengers to vacate their vehicles on the vehicle deck while the ferry is in transit. As the passenger population usually includes a number of people with mobility challenges, who have difficulty/ discomfort in climbing the stairs to upper decks, the user community has requested DTW to allow passengers to occupy their vehicles during the transit. However, Transport Canada (TC) regulations do not allow passengers to occupy vehicles on enclosed decks during transit. In order for TC to grant permission to allow passengers to remain in their vehicles during transit, a risk assessment is required to demonstrate that the associated risks are as low or lower than any risks present in the situation where passengers are required to vacate their vehicles during transit, and also to ensure that controls are in place to mitigate any risks. This study was undertaken to conduct a risk assessment of the Bell Island Ferry service, specifically as it relates to the requirement for passengers to vacate their vehicles on the vehicle deck while the ferry is in transit.

1.2 OBJECTIVES AND SCOPE

The main objective of this study is to undertake a formal risk assessment of hazards associated with passengers vacating or occupying their vehicles, on the vehicle deck, while travelling on the Bell Island ferry service. The scope of the study included the following:

- A review of DTW documentation related to the policies associated with activities on the vehicle deck.
- Identification and assessment of hazards/ risks associated with passengers remaining in their vehicles during transit.
- Identification and assessment of hazards/risks associated with passengers vacating their vehicles during transit.
- A review of all regulatory requirements associated with passenger safety as they may pertain to the issue of staying in a vehicle while the ferry is crossing.
- A review of emergency response protocols should evacuation of the ferry be necessary.
- An assessment of evacuation protocol including engineering controls such as deluge systems and their impact on passenger safety.
- Consultation with regulatory authorities including Transport Canada (TC) and Transportation Safety Board (TSB).

1.3 REFERENCE DOCUMENTS

The documents listed in Table 1-1 have been used as principal reference documents for the HAZID study.

Table 1-1: Reference Documents

No	Document title	Document Reference and date	Issued By
1	Fire Fighting Plan, MV Flanders	25/01/2018	Dept. of Transportation & Works, Marine Services Branch (DTW)
2	General Arrangement, MV Flanders	25/08/1995	DTW
3	Lifesaving Plan, MV Flanders	25/01/2017	DTW
4	Fire Control Plan, MV Legionnaire	DWG #1827211, 24/04/2014	DAMEN/ DTW
5	General Arrangement, MV Legionnaire	DWG #1826168, 24/04/2014	DAMEN/ DTW
6	Lifesaving Plan, MV Legionnaire	DWG #1827213, 24/04/2014	DAMEN/ DTW
7	Regulation Review	M-AA-SJF/RKEN/ 31678-J-10115, 01/12/2017	DNV GL
8	Information Bulletin #1		DTW
9	Hazard/ Incident Report #1		DTW
10	Hazard/ Incident Report #2		DTW
11	Evacuation Analysis, MV	16/07/2009	DTW

No	Document title	Document Reference and date	Issued By
	Flanders		
12	Evacuation Analysis, MV Legionnaire		DTW
13	Accessibility Review, Bell Island Ferry Service	October 2017	Inclusion NL, DTW
14	Passengers on Vehicle Deck Policy Memo	January 31, 2018	DTW
15	Incidents Database	2004 - 2017	TSB

2.0 DESCRIPTION OF BELL ISLAND FERRY SERVICE

Details of the vessel configurations and operations are provided below.

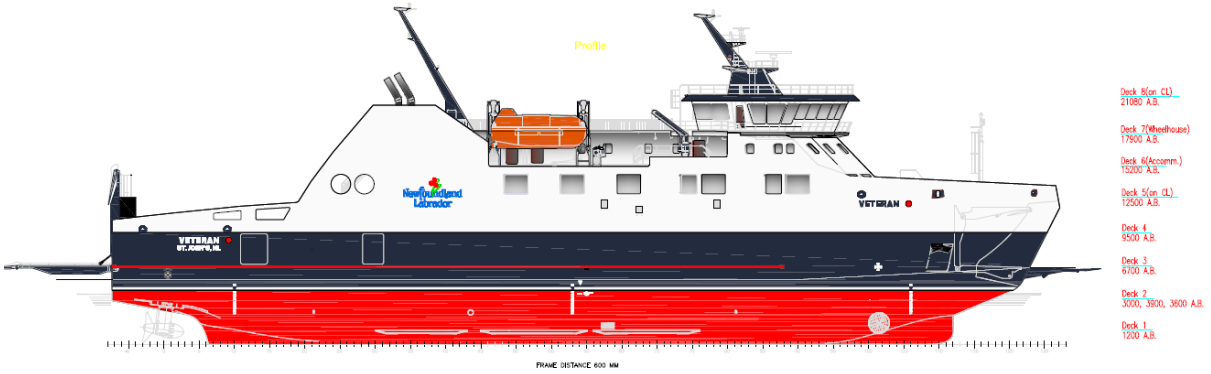
2.1 VESSEL DETAILS

2.1.1 MV Legionnaire

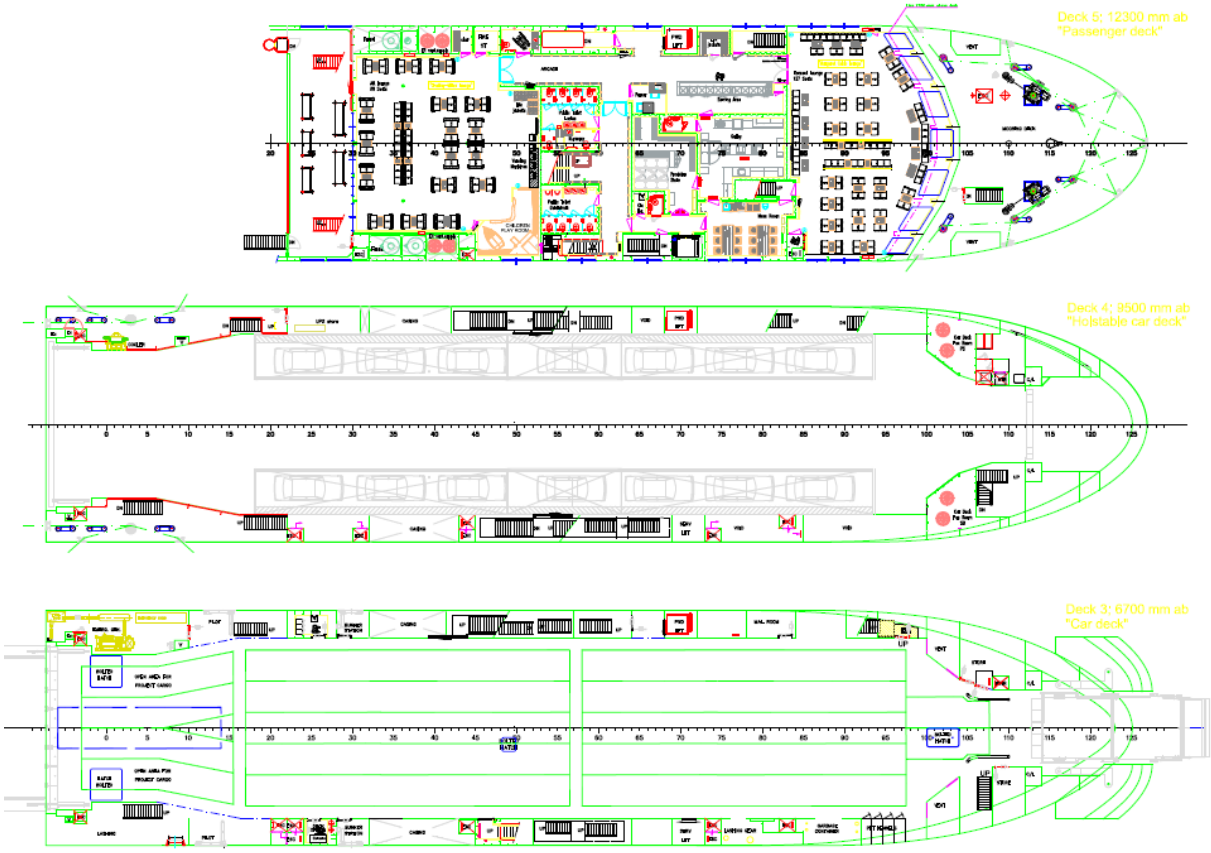
The principal particulars of the MV Legionnaire are summarized in Table 2-1. Typical views of the general arrangement of the vessel are shown in Figure 2-1.

Table 2-1: Principal Particulars of MV Legionnaire

Length overall (m)	81.05
Width (m)	17.20
Depth (m)	6.70
Draft (m)	4.30
Speed (kt)	14
Capacities	64 cars; 200 passengers
Decks	Eight: Deck 1: Machinery spaces Deck 2: Machinery spaces Deck 3: Vehicle deck Deck 4: Hoistable car deck Deck 5: Passenger lounges (contains muster stations) Deck 6: Crew Quarters (contains life boats) Deck 7: Observation deck Deck 8: Top deck



(a) Profile



(b) Passenger Deck; Hoistable Deck & Vehicle Deck

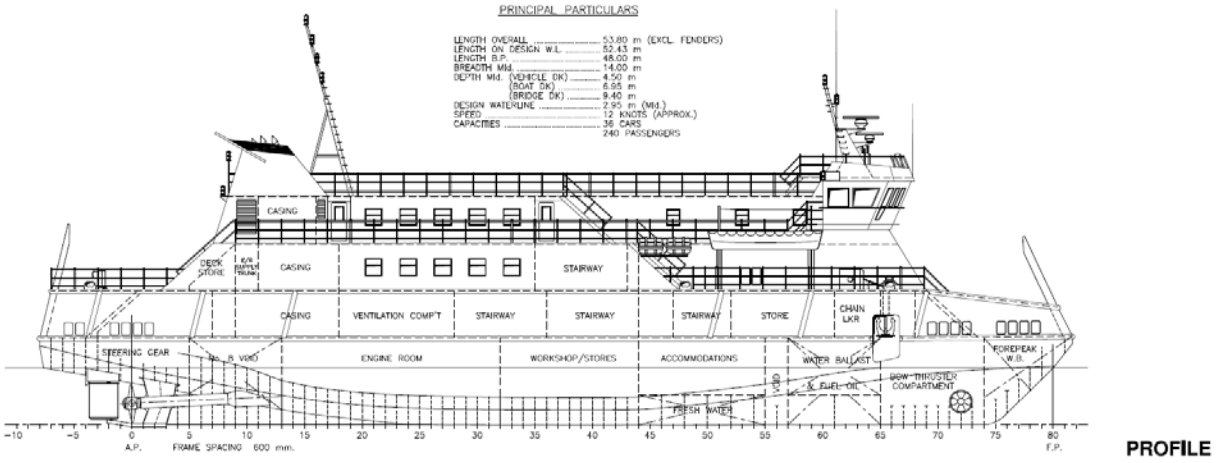
Figure 2-1: GA of MV Legionnaire

2.1.2 MV Flanders

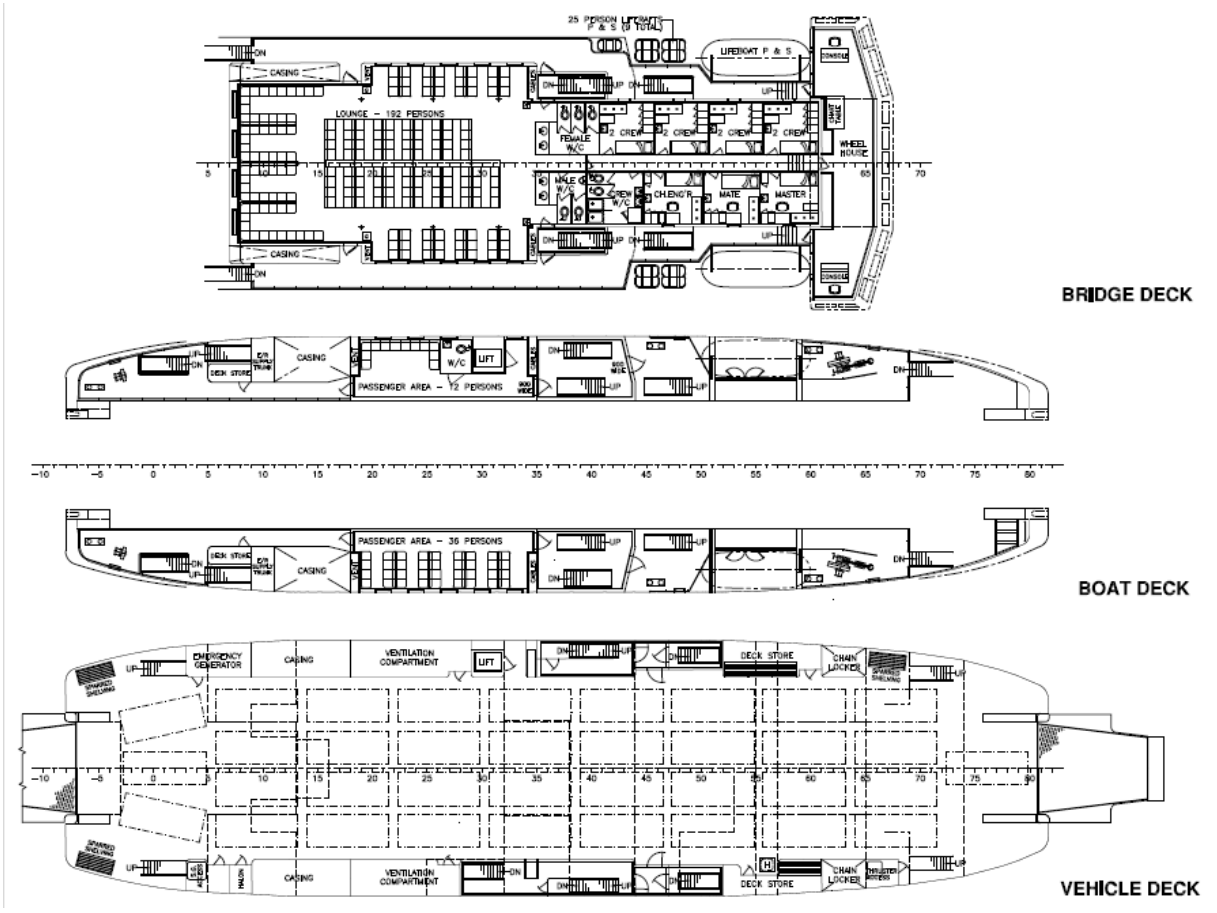
The principal particulars of the MV Flanders are summarized in Table 2-2. Typical views of the general arrangement of the vessel are shown in Figure 2-2.

Table 2-2: Principal Particulars of MV Flanders

Length overall (m)	53.80
Width (m)	14.00
Depth (m)	4.50 at Vehicle Deck; 9.40 at Bridge Deck
Draft (m)	2.95
Speed (kt)	12
Capacities	36 cars; 240 passengers
Decks	Four: Below Vehicle Deck – contains machinery Vehicle Deck Boat Deck – contains the LSA Bridge Deck – contains passenger lounges and crew quarters



(a) Profile



Bridge Deck; Boat Deck & Vehicle Deck

Figure 2-2: GA of MV Flanders

2.2 ACCESSIBILITY FEATURES ON THE VESSELS

The DTW, in collaboration with InclusionNL, recently undertook a review of accessibility features on the Bell Island ferry vessels, in order to reduce any barriers facing persons with disabilities when using the ferry service. The review was carried out in accordance with Canadian Transportation Agency (CTA) guidelines, and details of the review are provided in Ref 13 of Table 1-1.

Both vessels provide unique characteristics that are related specifically to accessibility of the vessels as passengers move from the vessel deck to the passenger lounge decks.

On the MV Legionnaire, passengers with disabilities are provided with a passenger elevator that can be accessed via a ramp on the vehicle deck, and can independently operate the elevator to the passenger deck where multiple passenger lounges are available.

On the MV Flanders, passengers with disabilities who require the use of the lift receive support from a crew member to operate the small vessel lift to a small passenger lounge designed specifically for individuals with disabilities.

In addition, the accessibility review study concludes that the two vessels meet many of the CTA requirements for reduction of barriers for travelling persons with disabilities, and also suggests additional recommendations to further improve accessibility on the vessels (see Ref #13 of Table 1-1). These accessibility features and recommendations will be considered for risk control as may be appropriate.

2.3 OPERATIONAL DETAILS AND ENVIRONMENTAL CONDITIONS

2.3.1 Operational Details

The DTW policy (Ref 14 of Table 1-1) for the Bell Island ferry stipulates no passengers are to remain in their vehicles on the vehicle deck during the transit of the ferry. The vehicle is to be clear before the voyage begins. No passengers are allowed to return to the vehicle deck until the vessel is berthed. Ambulances when carrying a patient are exempt from this policy, and the ambulance attendants are also made aware of the evacuation procedure and muster stations to allow quick evacuation of their patient.

During the boarding process, passengers without vehicles will walk on board. Passengers in vehicles will drive on board; once in position and parked they will leave their vehicles and proceed to the lounge area. The vehicle will not sail until the vehicle deck is clear.

Passengers may return to their vehicle to retrieve forgotten items but must be accompanied by a crew member.

During the unloading process, passengers will return to their vehicles only when accompanied by a crew member or when an announcement is made by the crew.

It is noted that the policy gives special attention to the needs of persons with disabilities that affect mobility. Passengers with mobility disabilities are to identify themselves during ticketing and boarding. In cases where persons with disabilities cannot get to the passenger lounge safely or with dignity, the captain may allow the passengers to stay in their vehicle

provided there are sufficient personnel available to assist if required and alternative emergency evacuation plans has been developed that recognizes the individual's unique situation. However, the DTW has noticed some abuses of this provision and intends to remove this exemption from the policy.

2.3.2 Environmental Conditions

Summaries of important environmental conditions of the operational area that were taken into account in the risk assessment are provided below [1, 2, 3]:

- The average temperature in the Portugal Cove – Bell Island area typically varies from -10 ˚C to 20˚C
- Average wind speeds in the area vary from 20 km/hr in summer months to 28 km/hr in the winter months. Wind gusts of 107 km/hr to 193 km/hr have been known to occur in the area.
- Monthly rainfall amounts range from 61 mm in February to 159 mm in October
- Monthly snowfall amounts of up to 80 cm can occur in the winter months, with significant amounts falling during the months of November to April
- Regular occurrences of sea ice can be seen in the area of operation
- The mean significant wave height for the area is in the range of 1.5 m to 2 m

2.4 APPLICABLE STANDARD AND REGULATORY REQUIREMENTS

2.4.1 Standards and Regulations

DTW in collaboration with DNV-GL undertook a review of relevant industry relations and best practices regarding the issue of passengers vacating their vehicles during ship transit (see Ref. 7 of Table 1-1). The regulations reviewed are listed in Table 2-3 along with short descriptions of the requirement or issue addressed.

Table 2-3: Summary of Applicable Standards and Regulations

Regulation/ Standard	Requirement/ Issue
SOLAS Chapter II-1, Regulation 23. Special requirements for ro-ro- passenger ships	*Every passenger ship shall have an evacuation procedure for the safe evacuation of the complement from the ship within 30 minutes after the abandon-ship signal is given*
MSC 1997 Ro-Ro Safety	*Access by passengers to the ro-ro deck when the ship is under way should be banned*
Life Saving Equipment Regulation – Part III, Reg 111 (TC Regulation)	*Every passenger ship shall have an evacuation procedure for the safe evacuation of the complement from the ship within 30 minutes after the abandon-ship signal is given.*
Fire and Boat Drill Regulation Reg 13(2)	*If passengers are scheduled to be on board a vessel for 24 hours or less and a practice muster is not held, the master of the vessel shall ensure that, immediately before or after the vessel embarks on a voyage, a safety briefing is given to the passengers informing them of the safety and emergency procedures that are relevant to the type and size of the*

	vessel.
Cargo and Fumigation Tackle Regulation 152, CSA 2001	*Every passenger shall keep off a closed vehicle deck that is underway unless the passenger* *(a) has received the express consent of the vessel's master to enter the deck, if there are no packaged goods on the deck; or* *(b) is accompanied by a crew member, if there are no goods on the deck*

I

It is noted that the vehicle deck on the MV Legionnaire is considered closed whereas the vehicle deck on MV Flanders may be considered open as it is open on both ends. It is important to consider the totality of the applicable standards to ensure their intent are fully satisfied. The proximity of muster and embarkation station with respect to the location of passengers is very important to ensure that passengers can be adequately and effectively evacuated in the case of emergency. Therefore, the policy requiring passengers to go to passenger lounges, which are close to the muster and embarkation stations appear to be in line with the regulation.

2.4.2 Worldwide Practices Regarding Passengers Occupying Vehicles During Transit

Canada

BC Ferries **(Not Allowed**) – Effective from October 2017, BC Ferries has banned access to the vehicle deck during transit.

The following excerpts from BC Ferries are worth noting and relevant to this study [4]:

> *Restricting deck access is intended to improve safety for passengers and to harmonize B.C. Ferries' policies with those of other ferry operators and Transport Canada regulations.*
>
> *The main safety concern is fire and the potential dangers it poses in an enclosed space. "Every year we have a couple of car-deck fires — lots of hot engines running, you turn off the engine, there's some leaking fluid,". "In every case in recent history, we detect it very quickly and we extinguish it very quickly, and nobody's put in harm's way."*

USA

Black Ball Ferry Line (Coho ferry) (Not allowed) - has not allowed passengers on vehicle decks for about 15 years.

UK-Scotland

Caledonian Macbrayne (**Small vessel may allow, but larger vessel does not allow**) - On smaller vessels covering shorter journeys passengers may be allowed to stay in their vehicles. On larger vessels drivers and passengers must leave their vehicles before the vessel leaves port. Passengers are not permitted to access the car deck when the vessel is at sea.

2.5 STAKEHOLDER PERSPECTIVES

It is widely known that some stakeholders, such as the ferry users themselves, have been quite critical of the requirement to vacate their vehicles during transit due to a number of users having disabilities that limit their mobility. The project team has engaged with various stakeholders in order (a) to allow the team gain an insight into their issues, for proper consideration in the risk assessment, and (b) to facilitate buy-in of the risk assessments by the stakeholders. Summaries of the issues raised by the various stakeholders are provided in the following subsections.

2.5.1 Ferry Users' Issues

The project team had consultations with representatives of the ferry users' community with the aim of gaining an understanding of the users' perspective with respect to the DTW's requirement for passengers to vacate their vehicles during transit. In essence, the ferry users feel that the requirement poses a risk to the safety and comfort of some of the users, due to a number of reasons/ issues as summarized below.

- **Medical Issues**: Some of the users have medical issues, and are usually returning from medical procedures and have difficulty to vacate their vehicles on the vehicle deck and go up to the passenger lounges on higher decks. These people are in danger of falling when going up to the lounges. In addition, some of these people are required to share the lounges with other passengers and risk exposure to communicable diseases, especially for those with lowered immune systems.
- **Accessibility Issues**: The user population includes a number of elderly people and people with mobility issues who are at risk of falling on the vehicle deck or stairs when going up to the lounges. Although the two vessels used for the Bell Island service have wheel chair access, there are times when difficulties arise when elevators are broken or other vessels that are not wheel chair accessible are used for the service.
- **Customer Service Issues**: Issues have arisen regarding how crew deal with people with medical issues or various types of disabilities, and other specific passenger encounters with crew members have been mentioned and sometimes reported to DTW management. The users will not have to deal with these issues if they are allowed to occupy their vehicles during the transit.
- **Government Policy Violation Issues**: The users' community has noticed a number of violations which the crew fail to fully address. Typical violations include issues such as smoking, use of scented cleaning products, and allowing animals in the lounges, all of which could impact passengers with medical or health conditions. The passengers will not have to encounter these issues if they are allowed to remain in their vehicles during the transit.

The above issues were discussed with DTW for addressing and also taken into consideration in the risk assessment workshop.

2.5.2 Medical Service Providers Perspectives

The medical community acknowledges that a number of patients have to use the ferry service following treatment. Typical treatments will include dialysis, surgery, chemotherapy, and opioid treatment, and patients may feel unwell for a short period of time post treatment. Patients with mobility challenges and other less serious medical conditions may also feel unwell or fatigued following treatment. Patients may feel the need to be provided medical passes on a priority bases depending on the nature of the medical condition, so as to be allowed to stay in their vehicles during the voyage. It is difficult to know where to draw the line and doctors will face pressure from patients to issue these medical passes and this can lead to doctors being conflicted, as these are their patients. The following recommendations are offered to reduce discomfort or risk of patients using the ferry services:

- Patients who have undergone serious medical treatments may be required to stay overnight in St. John's to stabilize before proceeding on the journey to Bell Island
- The medical community would prefer not to issue medical passes or boat notes, as this adds another layer of services offered by them, and has not worked out well when tried in the past.
- A proper risk communication strategy should be developed to educate the general public on risks associated with passengers occupying vehicles during transit.

2.5.3 Crew Challenges

Prior to the risk workshop, the project team went on board the two vessels to review the vessels' facilities and typical operations, and have discussions with the crew on issues and challenges they face on board the vessels. Representative crew members from each vessel also attended the workshop and provided insights that were captured in the workshop. Some of the issues raised include the following:

- Difficulties in implementing rules as some passenger refuse to obey rules, such as no smoking,
- Insufficient understanding of best practices for handling passengers with medical or mobility challenges
- Concerns on how to handle passengers with medical conditions or mobility challenges in case of emergency. Due to the presence of raised sills on doors leading to the embarkation decks, it would be required to lift passengers over the sills and onto life boats. This would require at least two people to accomplish, and the process of how to get the sick or disabled passenger onto life boats needs to be practiced.

2.5.4 Transport Canada (TC) Advice

The project team engaged TC personnel to seek advice on the issue of passengers occupying vehicles on the vehicle deck during the voyage. TC advises that the governing regulations are:

- SOLAS Chapter II-1, Regulation 23. Special requirements for ro-ro- passenger ships, which stipulates that evacuation time for the ship shall be within 30 minutes.

- Cargo and Fumigation Tackle Regulation 152, CSA 2001, which bans passengers from entering closed vehicle deck when the ship is underway, unless express consent of the vessel's master is received or if the passenger is accompanied by a crew member.

The case to allow passengers to occupy vehicles during transit will first require a risk assessment to demonstrate that intents of the regulations are satisfied if passengers are allowed in the vehicle deck. Then an application would be made to the Marine Technical Review Board (MTRB) for an exemption based on the strength of the risk assessment. TC has stated that this will have to be reviewed by all regions since this will be setting a precedent. Based on above regulations and related upcoming IMO regulations, it is very unlikely that TC will approve such exemption.

2.6 SAFETY CONSIDERATIONS

The following are some of the safety and risk control measures for the vessels:

- The vessels are operated and maintained in class, with ABS as the Class Society for MV Legionnaire, and DNV-GL as Class Society for MV Flanders.
- Safety management system (SMS) and standard operational procedures (SOP) are in place that spell out operational procedures and risk control measures.
- As per the Safety Management Code (ISM Code), DTW should ensure compliance with mandatory rules and regulations and also ensure that the applicable codes, guidelines and standards recommended by the organizations, administrations, classification societies and maritime industry organizations are taken into account.
- The vessels are provided with many accessibility features to accommodate persons with disabilities.
- DTW have internal policies and rules for various aspects of the operations. A number of the policies and guidelines are posted at various locations on the ships.

2.7 HISTORICAL INCIDENTS

2.7.1 Incidents in Canada and World-wide

A review of incidents involving passenger ships in Canada and worldwide was undertaken to provide guidance on the nature, frequency and impacts of the incidents. The incidents in Canada were based on the Transportation Safety Board's (TSB) marine incidents database from 2004 to 2017, and the worldwide incidents were derived from other studies available in the open literature.

Figure 2-3 shows the distribution of the incidents by type that have occurred during the 14 year period in the Atlantic region and in Canada as a whole. It is seen that the types of incidents in the Atlantic region follow closely the Canada-wide experience. Incidents involving total machinery failure have the most occurrences followed by striking incidents, grounding, fire and collisions.

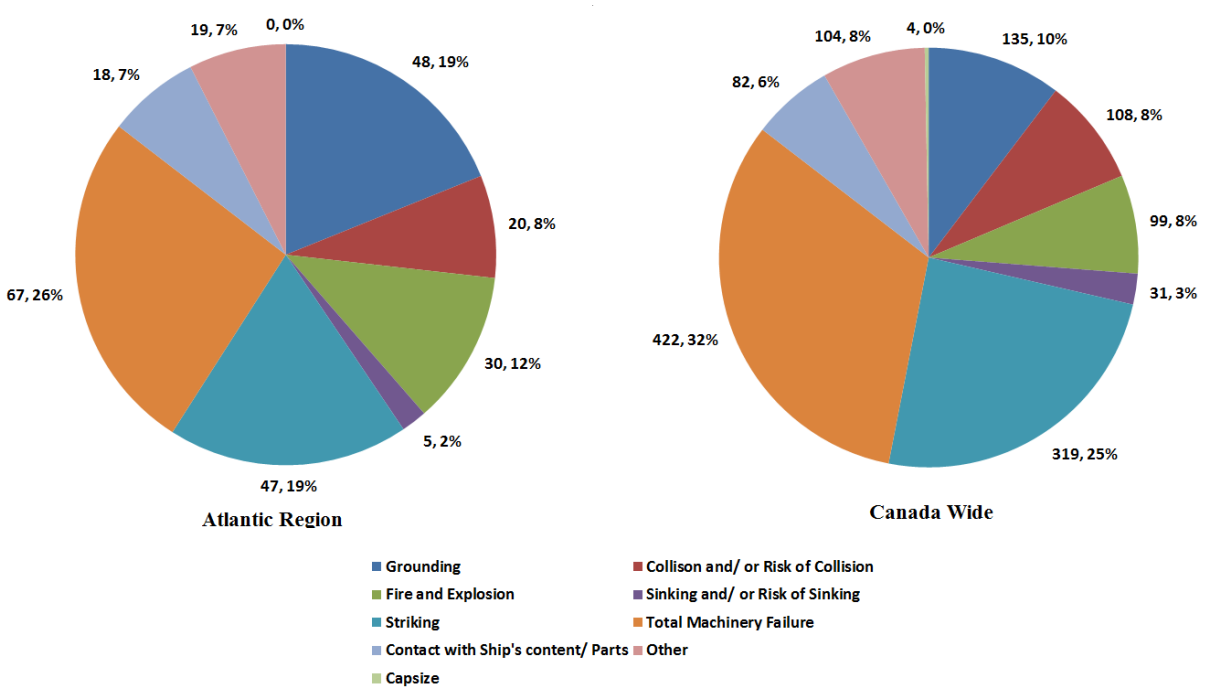


Figure 2-3: Distribution of Accident/ Incidents Types in Canada from 2004-2017

The incidents and accidents that have resulted in fatalities or serious injuries are listed below and shown in Figure 2-4.

- Passenger in contact with ship parts or its contents while boarding, on board or unloading
- Ship Collision
- Grounding
- Striking/ Allision
- Fire and Explosion
- Other reasons such as person overboard

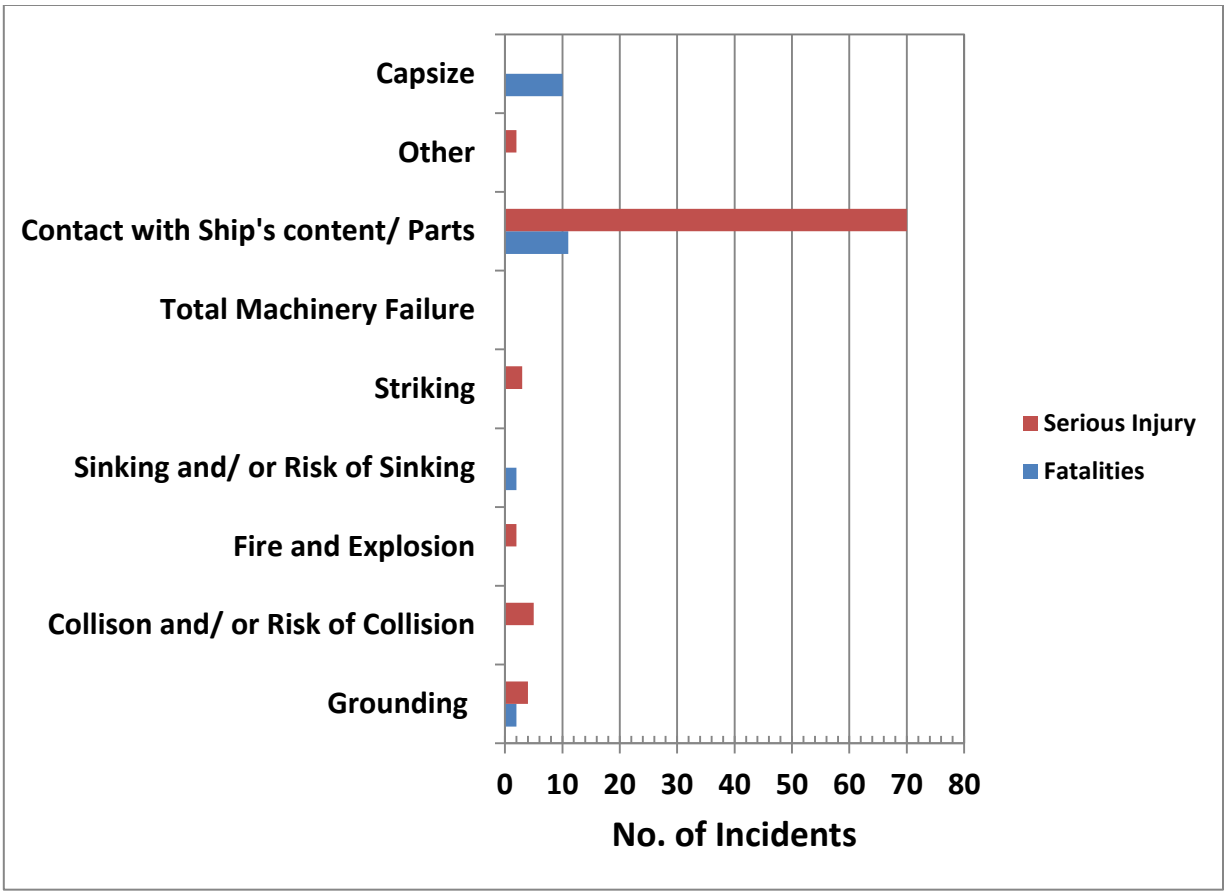


Figure 2-4: Distribution of Casualty Events in Canada from 2004-2017

Figure 2-5 shows the yearly incident occurrence from 2004 to 2017 for the Atlantic region and Canada wide. On average, 18 incidents involving passenger ships have occurred in the Atlantic region per year. Of this number, 1.4 incidents per year have resulted in serious injuries and about 0.1 incidents per year have resulted in fatalities.

Canada-wide, on average 94 incidents involving passenger ships have occurred per year. Of this number, 6.4 incidents per year have resulted in serious injuries and about 1.8 incidents per year have resulted in fatalities.

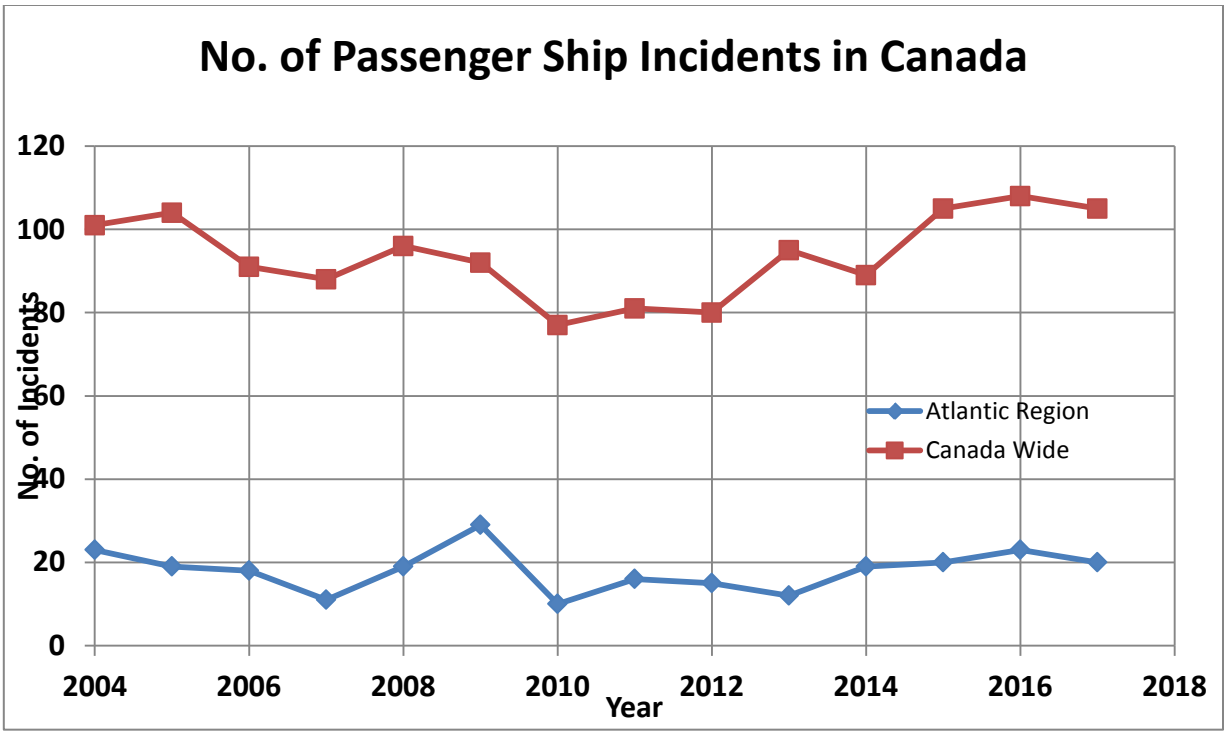


Figure 2-5: Passenger Ship Incident Occurrence by Year in Canada from 2004-2017

The worldwide incident was obtained from the study conducted by Eleftheria et al. [5]. The annual frequencies of serious incidents per ship year for passenger vessels are shown in Table 2-4.

Table 2-4: Annual Frequency (per ship year) of Serious Accidents [5]

Year	Passenger Ro-Ro Vessels	Passenger Vessels	Cruise Vessels
2000	1.84E-02	3.63E-03	3.15E-02
2001	1.59E-02	6.37E-03	4.96E-02
2002	1.51E-02	5.02E-03	4.56E-02
2003	2.95E-02	8.58E-03	3.18E-02
2004	3.98E-02	9.85E-03	3.33E-02
2005	2.91E-02	9.52E-03	5.11E-02
2006	2.30E-02	6.38E-03	5.25E-02
2007	5.78E-02	1.01E-02	7.10E-02
2008	6.53E-02	1.56E-02	8.17E-02
2009	7.23E-02	3.00E-02	7.05E-02
2010	7.71E-02	2.57E-02	9.47E-02
2011	4.80E-02	1.90E-02	2.02E-02
2012	5.03E-02	1.92E-02	2.70E-02

The frequencies by incident type are shown in Figure 2-6. Again, it is seen that similar to the Canada-wide trend, incidents involving hull and machinery damage have occurred the most followed by striking (contact) incidents, grounding, fire and collisions. Therefore, in the

absence of specific data for the ferry transit area, world-wide and Canada-wide trends can be used.

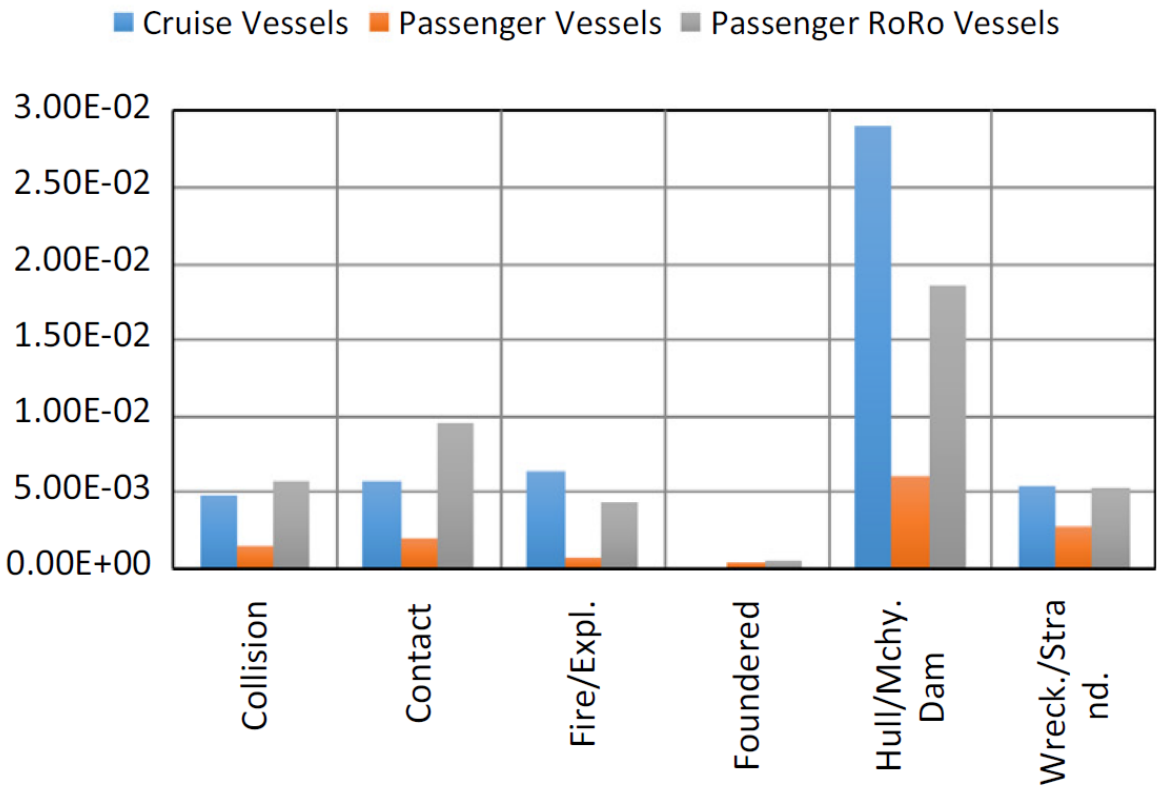


Figure 2-6: World-wide Incident Frequencies by Incident Type [5]

2.7.2 Incidents in Portugal Cove

There are 12 incidents recorded in TSB accident database in the Portugal Cove area during the period from 2004 to 2017. A breakdown of the incidents by type is provided in Table 2-5.

Table 2-5: Accident Reported in TSB in the Area of Portugal Cove from 2014 to 2017

Incident Type	No of Incidents
Allision with a fixed object (Striking includes berthed/ docked vessels)	7
Grounding due to power loss	1
Total machinery failure or Technical system failure	2
Unfit for purpose due to sustained damage	2

The above mentioned incidents involve Bell Island ferries. In addition to the incidents in the TSB database, two trip and fall incidents on Bell Island ferries have been reported to DTW, both of which occurred in 2017.

3.0 HAZID METHODOLOGY

3.1 STUDY TEAM

The HAZID team members are listed in Table 3-1.

Table 3-1: HAZID Team Members

Name Organization	Position/Title	Role	E-mail Address	Attendance		
				Site Visit	Day 1	Day 2
Lloyd's Register Canada Limited (LRCL)						
Tamunoiyala Koko	Team Leader, Reliability & Risk	Facilitator	Tamunoiyala.koko@lr.org	Yes	Yes	Yes
Sirinath Herat	Senior Surveyor	SME, Ship Safety Advisor	sirinath.herat@lr.org,	Yes	Yes	Yes
Brent Martin	Senior Surveyor	SME, Regulatory Aspects	Brent.martin@lr.org	Yes	Yes	Yes
Samith Rathnayaka	Risk & Reliability Consultant	Technical Scribe	Samith.rathnayaka@lr.org	Yes	Yes	Yes
GNL						
Glenn Tremblett	Marine Services Manager	SME, Marine Operations	GlennTremblett@gov.nl.ca	Yes	Yes	Yes
Jennifer Temple	Safety & Compliance Officer	SME, Safety & Compliance	JenniferTemple@gov.nl.ca	No	Yes	Yes
Barry Fitzgerald	Senior HSE Manager	SME, Safety & Compliance	BarryFitzgerald@gov.nl.ca	No	Yes	Yes (Partially)
Morgan Pilgrim	Captain, MV Legionnaire	SME, Vessel Operations	spilgrim@nl.rogers.com	No	Yes	Yes (Partially)
Carol Ann Mason	Site Manager, Dr. Walter Templeman Health Center	SME, Passenger Health & Comfort	carolann.mason@easternhealth.ca	No	Yes	Yes
Jamie Coles	Chief Mate, MV Flanders	SME, Vessel Operations	jgcoles@hotmail.com	No	Yes	Yes
Jody Fancey	Manager, Stakeholder Relation and Contract Services	SME, Communication	jodyfancey@ gov.nl.ca	No	Yes	Yes
Inclusion NL						
Kathy Hawkins	Inclusion NL	SME, Accessibility Features/ Passenger Comfort	kathy@inclusionnl.ca	No	Yes	Yes
SME = Subject Matter Expert						

The workshop was held on April 24-25, 2018 at the Petten Building, Department of Fisheries & Land Resources, 30 Strawberry Marsh Road; St. John's, NL, A1B 4J6.

The workshop was preceded by a visit on board the vessels, on April 23, 2018, to familiarize the Project Team with the vessels' facilities and operational procedures. A summary of the observations is provided in Appendix B.

3.2 HAZID TECHNIQUE

HAZID is a checklist-based approach for the identification of hazards during operation and construction activities. The aim of the HAZID approach is to consider the effects of a range of possible initiating events that may lead to an incident; producing a comprehensive list of possible accidents detailing the worst credible outcomes; and the equipment or procedures that play a part in preventing the accident.

The main elements of the HAZID review are shown in Figure 3-1 and outlined below.

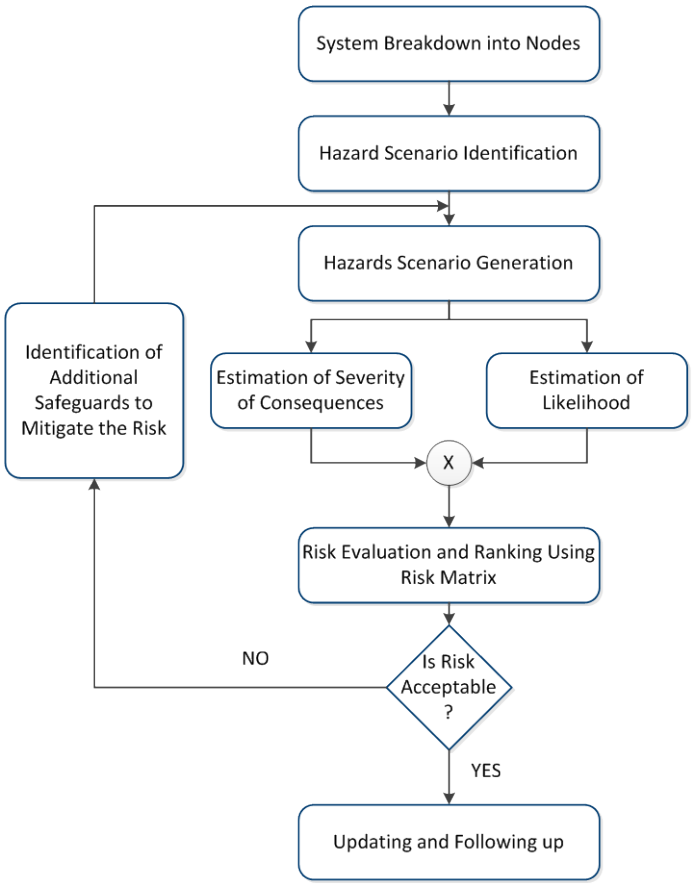


Figure 3-1: HAZID Process

3.3 SELECTION OF NODES

A node is the sub system that is subjected to HAZID study. For each node considered a definition is required. This is based on the operation and the node extent. Having a clear definition helps the team concentrate on the node being considered. Table 3-2 shows the nodes considered in this study.

Table 3-2: HAZID Nodes

Node No.	Node
1	Passenger Loading Phase – Passengers Vacate Vehicles
2	Transit and Berthing Phase – Passengers Vacate Vehicles
3	Passenger Unloading Phase – Passengers Vacate Vehicles
4	Passenger Loading Phase – Passengers Occupy Vehicles
5	Transit and Berthing Phase – Passengers Occupy Vehicles
6	Passenger Unloading Phase – Passengers Occupy Vehicles

3.4 POTENTIAL HAZARDS

For each node, a check list of possible hazards was used to identify the hazardous scenarios. The list of hazards used for this study is presented in Table 3-3. The applicable hazards for each operational phase are indicated by an "x" in the table. Using these hazard prompts, a number of incident scenarios were identified, based on a number of potential causes and consequences. Details are presented in Chapter 4.

Table 3-3: List of Potential Hazards

No.	Hazard	Passengers Vacate Vehicles			Passengers Occupy Vehicles		
		Node 1 Loading Passengers	Node 2 Transit & Berthing	Node 3 Unloading Passengers	Node 4 Loading Passengers	Node 5 Transit & Berthing	Node 6 Unloading Passengers
1	Slip, Trip and Falls	x	x	x	x	x	x
2	Fire	x	x	x	x	x	x
3	Vehicle striking other vehicles, or people (crew or passengers)	x		x	x		x
4	Structural/ equipment failure	x	x	x	x	x	x
5	Striking berth/ other ship at berth		x			x	
6	Grounding		x			x	
7	Foundering		x			x	
8	Sinking/ capsizing and/or other situation requiring evacuation		x			x	
9	Collision		x			x	
10	Green water		x			x	

3.5 RISK MATRIX

A risk matrix was used to assess the risk of hazards associated with the Bell Island ferry operations. Table 3-4 to Table 3-6 show the definitions of likelihood, consequence and the risk matrix that was used for the HAZID. Using HAZID worksheets, causes and consequences were assessed for each hazard prompt and subsequently the hazards were scored in terms of

their likelihood and their severity of the consequence. Due to the nature of this risk study, the focus was mainly on personnel and asset (damage or fitness-for-purpose) consequences.

Table 3-4: Likelihood Definitions

Rank	Likelihood	Definition
1	Improbable	Unlikely to occur during the life of the vessel
2	Remote	Unlikely but possible to occur during life of vessel or within similar operations
3	Possible	Unlikely, but can be reasonably expected to occur at some time during life of vessel or within the similar operations
4	Probable	Known to occur several times within life of the vessel or similar operation
5	Frequent	Likely to occur regularly within life of the vessel or similar operation. (several times per year)

Table 3-5: Consequence Definitions

Consequence Definitions		
Level	**People**	**Assets**
1. Negligible	Minimal effect and not requiring First Aid (i.e. a slight bruising of affected area)	Minimal effect (i.e. a slight marring of paint surface / asset still completely usable)
2. Minor	Minor injury requiring first aid treatment and no time loss	Minor loss with minor interruption to regular operation (i.e. a small crack, a slight bend, flange repair)
3. Moderate	Injury that requires medical treatment other than First Aid (i.e. hospitalization) and is eligible for compensation	Moderate loss requires some level of repair before return to normal use (i.e. critical equipment failure)
4. Major	Fatality and/or a permanent partial disability.	Major loss (i.e. the loss a terminal building, office building or equipment which requires substantial repairs and/or partial replacement to make usable)
5. Catastrophic	Multiple fatalities (more than 1) and/or multiple cases of permanent total disability	Massive loss (i.e. the total loss of a vessel, major terminal or several large buildings)

Table 3-6: Risk Matrix

Likelihood	Consequences				
	Negligible (1)	**Minor (2)**	**Moderate (3)**	**Major (4)**	**Catastrophic (5)**
5- Frequent	Medium	High	Extreme	Extreme	Extreme
4– Probable	Low	Medium	High	Extreme	Extreme
3– Possible	Low	Medium	Medium	High	Extreme
2– Remote	Low	Low	Medium	Medium	High
1– Improbable	Low	Low	Low	Low	Medium

The risk acceptance/ tolerance table is provided in Table 3-7.

Table 3-7: Risk Tolerance Table

RISK Level	Risk Control Measure
Extreme	**Intolerable**: Operation/ activity must be NOT preceded. Find an alternative method and re-assess.
High	**Tolerable with continuous review**. A full safety justification and ALARP argument must be provided, including safety assessment, to justify the risk. Should only proceed if permitted by authority of a Senior personnel
Medium	**Tolerable with periodic review:** Can proceed if all control measures are in place before start of the activity and risk has been reduced to ALARP
Low	**Acceptable with periodic review:** Simple control measures are in place; The record of ALARP status is to be provided in the Hazard Log.

4.0 RESULTS AND DISCUSSIONS

The HAZID worksheets are shown in Appendix C. Risk ranking was undertaken for those hazards exhibiting significant consequences, as judged by the team. In the HAZID worksheets, the hazardous scenarios or mishaps are identified by unique numbers that identify the Node, Hazard Prompt and unique combination of hazard cause and consequence, as follows:

Hazardous Scenario (or Mishap) No.: XX.YY.ZZ, where

- XX – Refers to the node
- YY – Refers to the hazard prompt; and
- ZZ – Refers to the cause

For each cause, the impact on personnel and asset, as well as the effective safeguards for controlling the causes are identified. The unique combination of hazard prompt, cause, consequence and effective safeguards is considered as a hazardous scenario or mishap that is evaluated in terms of consequence severity and likelihood to arrive at a risk score. As can be seen in the worksheets in Appendix C, there are in total 66 potential mishaps that were identified and assessed for the case in which passengers are required to vacate their vehicles during transit. The same number (66) of mishaps were also identified and assessed for the case in which passengers are allowed to occupy their vehicles during transit. Summaries of the risk profile for the different phases of the ferry service are provided in the following sections.

Note that the study is limited to issues that arise due to passengers vacating or occupying vehicles during transit, and should not be considered as a comprehensive risk assessment that covers all aspects of the ferry service.

4.1 PASSENGERS REQUIRED TO VACATE VEHICLES DURING VOYAGE

4.1.1 Passenger Loading

Consider the current scenario in which passengers are required to vacate their vehicles during transit. As shown in Table 3-3, four main hazards associated with the passenger loading phase were identified and assessed. Details of the assessments of these hazards are discussed below.

Slips, trips, and falls

Slips, trips and falls hazards were considered to be the main hazards during passenger loading, for the current scenario in which passengers are required to vacate their vehicles and climb up the stairs or elevators to the passenger lounges before the ship embarks on the voyage. The hazard could result from a number of causes:

- Rolling motion and/or waves
- Inadequate lighting during night operations
- Inadequate clearance in walkways on vehicle deck, corridors, passage ways or elevators
- Unsafe walking surfaces (e.g.: barriers such as ramps, bumps)
- Snow, ice, rain, wet surfaces
- Physical limitations of passengers (medical)

- Physical limitations of passengers (under influence of drugs and alcohol)
- Passenger behaviour (e.g. inappropriate footwear, carrying luggage while climbing stairs, lack of mobility)

This hazard could lead to personnel injuries or vehicle damage. For incidents leading to personnel injuries, the likelihood was assessed to be Remote or Possible, and the severity of the consequence to be at most Moderate, as such injuries may require medical treatment or hospitalization. This gives a risk score of at most Moderate for the personnel consequence category. As per the risk tolerance criteria, this risk is considered tolerable with periodic review.

The damage consequences were considered to result from passengers damaging vehicles while falling, as have happened in the ferry service history. However, the likelihood of such incidents was considered to be Improbable and the consequences Negligible. Hence the risk for the damage category was assessed to be Low.

Fire

During regular trips (other than DG trips) fire could result from any of the following causes:

- Smoking
- Fire from EDG Room or Bunker Station that are close to the vehicle deck
- Vehicle fire
- Faulty electrical equipment in lounges/ crew accommodations
- Sabotage
- Fire from machinery spaces

Consequences of the fire hazard could include personnel injury due to fire and smoke; damage to vessel and vehicles, and operations delay.

Fire from machinery space (e.g.: main engine room) was considered to be the most onerous fire incident. The likelihood was assessed to be Possible and consequences Major, giving a risk score of High. According to the risk acceptance criteria, this risk level is tolerable with continuous review, and can be justified by an ALARP statement. It is noted that the fire safety arrangements for the main engine rooms on the two vessels are in accordance with SOLAS Chapter II-2 and DTW has in place the required fire detection, fire suppression and firefighting systems, some of which are listed in worksheets. In light of these measures being in place, the risk is considered to be ALARP.

For the other fire incidents during regular trips the likelihood of the incidents was considered to be Remote or Possible, and the consequences at most Moderate. The risk was assessed to be at most Medium, and considered to be tolerable with periodic review.

During dedicated DG trips, fire incidents could also occur due to the presence of DG on the vehicle deck. The likelihood was assessed to be Possible and consequences Catastrophic, giving a risk score of High.

According to the risk acceptance criteria, this risk level is tolerable with continuous review, and can be justified by an ALARP statement. It is noted that only two DG trips are undertaken on Tuesdays and Thursdays every week, and following international regulations, only a maximum of 25 passengers are carried during these trips. So the exposure to the hazard is

reduced. In addition, DTW follows DG segregation and other IMDG rules for the carriage of DG. It was also recommended that DTW continue to review and refresh training to crew in the transportation of DG. With these measures, the risk was considered to be ALARP.

Vehicle striking other vehicles or people (crew and passengers)
Incidents of vehicles striking other vehicles or personnel (crew or passengers) could occur as a result of distracted drivers or passengers not following rules. This could cause injuries to passengers and crew, damage to vehicles or potential fire if the vehicles' fuel tanks were damaged in the presence of heat sources. Based on DTW experience, the likelihood of this incident scenario was assessed to be Probable. The consequence severities were assessed to be Moderate for personnel category, and Minor for damage category. This results in a risk score of at most High risk for this incident, being governed by the personnel consequence category. They following recommendations were made to demonstrate ALARP:

- DTW should undertake a communication campaign with the ferry user community to highlight benefits of safety measures on the ferry service
- DTW should sensitize the crew on ways to promote better enforcement of the appropriate on-board safety measures such as not allowing passengers who appear to be under the influence of drugs and/or alcohol.

Structural failure
Structural failure of the upper vehicle deck could occur as a result of inadequate strength or maintenance, leading to a number of consequences, such as personnel injuries, vessel and vehicle damage, and potential fire if vehicles' fuel tanks are damaged. The likelihood of this incident was considered to be Improbable, and the risk was assessed to be Low, which is acceptable.

4.1.2 Transit and Berthing

As shown in Table 3-3, nine main hazards associated with the vessel transit phase were identified and assessed. Details of the assessments of these hazards are discussed below:

Slips, trips, and falls
Slips, trips and falls hazards could also occur during the transit as passengers move around in the lounges and catering, washroom and sun deck facilities. The hazard could result from similar causes as in the loading phase, and include:

- Rolling motion and/or waves
- Inadequate lighting, obsolete lighting fixtures
- Passengers not following rules (e.g.: moving down to vehicle deck before vessel comes to a stop)
- Unsafe walking surfaces (e.g. door sills)
- Snow, ice, rain, wet surfaces
- Physical limitations of passengers (medical)
- Physical limitations of passengers (under influence of drugs and alcohol)
- Passenger behaviour (e.g. inappropriate footwear, carrying luggage while climbing stairs, lack of mobility)

This hazard could lead to personnel injuries, the likelihood of which was assessed to be Remote. The severity of the consequence was considered to be at most Moderate, as such injuries may require medical treatment or hospitalization. This gives a risk score of at most Moderate for this scenario. As per the risk tolerance criteria, this risk is considered tolerable with periodic review. It should be noted that in general, the risk of slips, trips and falls during the transit phase is generally lower than the passenger loading phase.

Fire

The fire incidents discussed for the passenger loading phase are also applicable for the transit phase. In addition to the causes identified in the loading phase, galley fire was also identified during the transit phase. For most of the fire scenarios during regular trips the risk was assessed to be at most Medium, and considered to be tolerable with periodic review. The risks for machinery room fire and DG related fire were also assessed to be High risk for the transit phase and are no different than during the loading phase.

Structural failure

This situation is the same as for the loading phase. The risk is considered to be Low.

Striking berth or other ship at berth

Incidents of the vessel striking the berth or the other ship at berth could occur due to number of causes including the following:

- Human error
- Passenger behaviour (leaving lounge prior to arrival announcement)
- Mechanical failure/ blackout
- Extreme weather (e.g. fog, wind, snow storm, high seas, etc.)
- Limited berthing space

The consequences could include damage to either or both vessels, damage to the berth, injuries and fatality, delay or loss of service and damage to vehicles. A number of safeguards have been identified for controlling these causes (see worksheets). Even with these safeguards, the likelihood of the scenarios was determined to be either Possible or Probable based on historical experience of the DTW fleet. The risk for most of the scenarios was assessed as Medium, which is considered acceptable.

The risk of one scenario was assessed to be High. This involves the risk arising due to passengers leaving the lounge prior to the arrival announcement, which occurs frequently, and was observed by the project team on all the trips undertaken during the ship visits. In order to reduce or eliminate this incident scenario it was recommended that DTW consider the following additional safeguards:

- Providing crew monitoring during the disembarkation.
- Provide announcements for passengers to remain seated until vessel comes to a stop.
- Provision of barriers (ropes) at the exits, after considering any potential impacts.
- DTW should undertake a communication campaign with the ferry user community to highlight benefits of safety measures on the ferry service.

Grounding

The possibility of grounding incidents was discussed and the likelihood of such incidents was considered to be Improbable given the water depths in the operating area (water depths of 6m at berth to over 150m at mid-channel, compared to vessel draft of 4.3m or less) and the multiple safeguards in place. Consequently, the risk of grounding was considered to be Low.

Foundering

Foundering of the vessel could occur if a power failure or blackout occurs. This could cause excessive vessel motion leading to vessel and vehicle damage, injury to personnel or delay of service. The likelihood of such an incident was considered to be Remote and the severity of the consequences moderate. Hence the risk was scored as Medium, which is tolerable with periodic review.

Sinking, capsizing and/or other situation requiring evacuation

The scenario of sinking/ capsizing and/ or situations requiring evacuation of the vessel was considered. This could be due to flooding, loss of stability, loss of propulsion, extreme weather, fire or explosion. Although the likelihood of such incidents was considered to be Improbable, the consequences were determined to be catastrophic. Furthermore, this was a situation in which the location of the passengers during the voyage impacts the ability of the crew to perform effective evacuation of the passengers. In this case where passengers are required to vacate their vehicles and stay in the lounges during the voyage they would be close to the muster stations and the embarkation deck which is beneficial for the evacuation process. Based on this and all of the safeguards listed in the worksheets, the risk for this scenario was assessed as Medium risk, and considered acceptable with periodic review.

Collision

Collision incidents could occur during the transit phase of the ferry service as a result of a number of potential causes including:

- Human error
- Mechanical or power failure/ blackout
- Presence of iceberg

This could lead to minor or major personnel of damage consequences. A number of safeguards were identified to mitigate or reduce the risk of collision incidents, as highlighted in the worksheets. With these safeguards the risk was assessed to be at most Medium, which is considered tolerable with periodic review.

Green water

Green water is described as large amounts of water splashing on the ship's deck as a result of large waves. Due to the open ended design of the MV Flanders, the scenario of green water on the vehicle deck was considered possible in extreme weather conditions. This could result in vehicle movement, vessel damage, or injuries to persons (if passengers or crew present on the vehicle deck). Based on historical precedents, the likelihood of this scenario was considered to be Possible and the consequence severities were assessed to be Minor for personnel category (as no personnel are expected to be on the vehicle deck during transit) and Moderate for damage category. Therefore the risk was considered be at most Medium, which is considered

tolerable with the safeguards in place, such as weather forecasts, passengers vacating the vehicle deck during transit, discretions of trained and experienced Masters who make appropriate go or no-go decisions in bad weather.

4.1.3 Passenger Unloading

The hazards during the passenger unloading phase are very similar to those discussed for the passenger loading phase in Section 4.1.1, and are not repeated here in detail. Only the main highlights are summarized below (refer to the worksheets for detailed risk scores):

- The risks for slips, trips and falls hazards are the same as in the loading phase, except that some of the likelihoods have been assessed to be higher, as the hazards are considered more likely to occur during the descent from the stairs to the vehicle deck.
- The risks for fire incidents are the same except the risks of fire due to smoking, fire from lounges or sabotage were assessed to be lower.
- The risk of vehicle striking other vehicles or people is the same as for the passenger loading phase.
- The risk of structural failure is the same as for the passenger loading phase.

4.2 PASSENGERS ALLOWED TO OCCUPY VEHICLES DURING VOYAGE

This section provides details of the risk assessment for the scenario in which passengers are allowed to occupy their vehicles during the voyage. It is noted that as discussed in Section 2.5.4, passengers occupying vehicle during transit is not allowed by TC, so an exemption will have to be sought from TC before this scenario will be allowed to proceed. DTW will have to apply to the MTRB for an exemption based on the strength of the risk assessment, which has to demonstrate that the intents of the regulations are satisfied and that the risks under this scenario are the same or lower than the risks under the current scenario of requiring passengers to vacate vehicles during transit.

Detailed assessments of the hazards and risks associated with the three operational phases – passenger loading, transit and berthing, and passenger unloading have been carried out and presented in the worksheets. In the following sections, highlights of the assessments for each operational phase are provided and compared with the appropriate assessments for the scenario in which passengers are required to vacate their vehicles during the transit.

4.2.1 Passenger Loading

The main consideration during the passenger loading phase is that most of the passengers will not have to move from the vehicle deck to the passenger lounges. Only those passengers coming on board by foot would be required to move from the vehicle deck, climb the stairs and go to the passenger lounges. Therefore the exposure to hazards such as slips, trips and falls is greatly reduced, and the risks for a number of the incidents have been assessed to be lower than the corresponding incidents under the scenario of passengers being required to vacate their vehicles.

The risk profiles for the two scenarios are summarized in the risk map shown in Figure 4-1. In the figure, the incident scenarios have been placed in the appropriate cells of the risk matrix that indicate the assigned likelihood and consequence for the incident. As described in Section 4.0, the incident scenarios are identified by unique numbers that identify the Node, Hazard Prompt and unique combination of hazard, cause and consequence. In this figure the following notations apply:

- The first number denotes the HAZID node – 1 for passengers loading with passengers required to vacate their vehicles, and 4 for passengers loading with passengers allowed to occupy their vehicles
- The second number denotes the hazard number as presented in Table 3-3.
- The third number identifies a cause, with the associated consequences and safeguards.

It is seen that most of the incidents under the scenario of passengers occupying their vehicles are in the Low risk cells of the risk matrix, whereas most of the incidents for the scenario of passengers vacating their vehicles are in the Medium risk cells of the risk matrix.

Each of the two scenarios has three High risk incidents. These include:

- Fire incidents resulting from DG operations
- Machinery room fires
- Vehicle striking other vehicle or people

ALARP justification arguments and additional safeguards were recommended in Section 4.1.1 to control these incidents and the risks were considered tolerable with continuous review. The situation is exactly the same for the scenario of passengers being allowed to occupy vehicles during transit.

In view of all of the above discussions, it can be stated that the risk profile for the passenger loading phase is lower in the case where passengers are allowed to occupy their vehicles.

Likelihood	Consequences				
	Negligible (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Frequent (5)					
Probable (4)			1.3.1 4.3.1		
Possible (3)		1.1.1; 1.1.3; 1.1.4; 1.1.5; 1.1.7; 1.1.8; 1.1.9	1.2.1; 1.2.3 4.2.1	1.2.7 4.2.7	
Remote (2)		1.1.2 4.1.1; 4.1.2; 4.1.3; 4.1.4; 4.1.5; 4.1.8; 4.1.9; 4.2.2; 4.2.4	1.1.6; 1.2.2; 1.2.4 4.1.6; 4.2.3	1.2.6 4.2.6	1.2.5 4.2.5
Improbable (1)		4.1.7	1.4.1	4.4.1	

Figure 4-1: Risk Map for Loading Phase

4.2.2 Transit and Berthing

During the transit and berthing phase, most of the passengers will be in their vehicles on the vehicle deck, and only a few passengers who board by foot will be in the passenger lounges. Therefore, most of the passengers will be exposed to hazards on the vehicle deck, such as rolling motion/ vehicle movements, vehicle fires, or green water (for MV Flanders). Furthermore, most of the passengers will be farther away from muster stations and the embarkation deck. This will have significant impact on emergency operations in a number ways:

- Reduced ability of the crew to perform effective evacuation in emergency situations requiring evacuation of the vessel.
- Exposure of crew to additional harm as they would be required to go down to the vehicle deck to assist passengers to move from the vehicle deck to muster station and embarkation deck.
- Presence of the vehicles will impede movement on the deck, especially as passengers open vehicle doors to try to escape from vehicles thereby blocking the walkways.
- Increased evacuation time, possibly exceeding the 30 minute evacuation time requirement of SOLAS Chapter II-1, Regulation 23.

Therefore the risks for a number of the incidents have been assessed to be higher than the corresponding incidents under the scenario of passengers being required to vacate their vehicles.

The risk profiles for the two scenarios are summarized in the risk map shown in Figure 4-2. In the figure, the incident scenarios have been placed in the appropriate cells of the risk matrix that indicate the assigned likelihood and consequence for the incident. The following notations apply for the incident identification numbers:

- The first number denotes the HAZID node – 2 for passengers unloading with passengers required to vacate their vehicles, and 5 for passengers unloading with passengers allowed to occupy their vehicles.
- The second number denotes the hazard number as presented in Table 3-3.
- The third number identifies a cause, with the associated consequences and safeguards.

Likelihood	**Consequences**

	Negligible (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Frequent (5)					
Probable (4)		2.5.4			
Possible (3)		2.1.3; 2.5.1; 2.5.3; 2.5.5 5.1.3; 5.5.1; 5.5.2; 5.5.3	2.2.5; 2.10.1 5.2.5	2.2.8; 2.5.2 5.2.1; 5.2.8; 5.7.1; 5.10.1	
Remote (2)		2.1.1; 2.1.2; 2.1.4; 2.2.1 5.1.1; 5.1.2; 5.1.4; 5.1.7; 5.5.4	2.1.5; 2.1.6; 2.1.7; 2.1.8; 2.2.3; 2.2.4; 2.7.1 5.1.5; 5.2.4	2.2.7 5.2.7; 5.6.1; 5.6.2	2.2.6 5.2.3; 5.2.6; 5.8.1; 5.9.1
Improbable (1)		2.2.2 5.1.6; 5.1.8	2.4.1	2.6.1; 2.6.2; 2.9.3 5.2.2; 5.4.1; 5.9.3	2.8.1; 2.9.1; 2.9.2; 5.9.2

Figure 4-2: Risk Map for Transit and Berthing Phase

As shown in the figure most of the incidents under the scenario of passengers occupying their vehicles are in the higher risk cells of the risk matrix, whereas most of the incidents for the scenario of passengers vacating their vehicles are in lower risk cells of the risk matrix than in the former scenario.

Table 4-1 shows the list of hazards that were assessed as High risk in either scenario. As seen from the table, there are three High risk hazards/ incidents under the scenario of passengers being required to vacate their vehicles, compared to eight High risk hazards/ incidents under the scenario of passengers being allowed to occupy their vehicles.

Based on the above discussions, it can be stated that the risk profile for the transit and berthing phase is higher in the case where passengers are allowed to occupy their vehicles.

Table 4-1: Hazards/ Incidents with High Risk Scores

Hazards/ Incidents	Maximum Risk Score	
	Passengers Vacate Vehicles	Passengers Occupy Vehicles
Striking berth/ other ship at berth resulting in injury due to passengers leaving the lounge prior to arrival announcement	High	Medium
Fire due to presence of DG	High	High
Fire from machinery spaces	High	High
Green water on vehicle deck due to extreme weather	Medium	High
Collision	Medium	High
Foundering due to power failure/ blackout	Medium	High
Fire due to smoking	Low	High
Vehicle fire	Medium	High
Sinking/ capsize and/or situations requiring evacuation	Medium	High

4.2.3 Passenger Unloading

This situation is very similar to the situation described for the passenger loading case in Section 4.2.1. During passenger unloading, most of the passengers are already on the vehicle and can begin to disembark from the vessel once the announcement is made to do so. Only those passengers that came on board by foot would be required to move from the passenger lounges climb down stairs and go to the vehicle deck to disembark. Therefore the exposure to hazards such as slips, trips and falls is greatly reduced, and the risks for a number of the incidents have been assessed to be lower than the corresponding incidents under the scenario of passengers being required to vacate their vehicles.

The risk profiles for the two scenarios are summarized in the risk map shown in Figure 4-3. In the figure, the incident scenarios have been placed in the appropriate cells of the risk matrix that indicate the assigned likelihood and consequence for the incident. The following notations apply for the incident identification numbers:

- The first number denotes the HAZID node – 3 for passengers unloading with passengers required to vacate their vehicles, and 6 for passengers unloading with passengers allowed to occupy their vehicles
- The second number denotes the hazard number as presented in Table 3-3.
- The third number identifies a cause, with the associated consequences and safeguards.

Most of the incidents under the scenario of passengers occupying their vehicles are in the Low risk cells of the risk matrix, whereas most of the incidents for the scenario of passengers vacating their vehicles are in the Medium risk cells of the risk matrix. The same three High risk incidents discussed in Section 4.2.1 (i.e. fire incidents resulting from DG operations; machinery room fires; and vehicle striking other vehicle or people) are present for the two scenarios, and were considered tolerable with continuous review in this case as well.

Therefore, again, it can be stated that the risk profile for the passenger unloading phase is lower in the case where passengers are allowed to occupy their vehicles.

Likelihood	Consequences				
	Negligible (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Frequent (5)					
Probable (4)		3.1.1; 3.1.4; 3.1.9	3.3.1 6.3.1		
Possible (3)		3.1.3; 3.1.5; 3.1.7; 3.1.8	3.1.6; 3.2.3 6.2.1	3.2.7 6.2.7	
Remote (2)		3.1.2; 3.2.4 6.1.1, 6.1.2, 6.1.3; 6.1.4; 6.1.5; 6.1.8; 6.1.9; 6.2.2; 6.2.4	6.1.6; 6.2.3	6.2.6	3.2.5 6.2.5
Improbable (1)	3.2.1; 3.2.2	6.1.7	3.4.1	3.2.6 6.4.1	

Figure 4-3: Risk Map for Passenger Unloading Phase

4.3 ACTION ITEMS

The list of recommendations and action items developed at the workshop is provided in Table 4-2

Table 4-2: Recommendations and Action Items

Recommendations	Hazard Scenario	Responsibility
1. Provide handrails on three walls of elevators on all ships	1.1.3, 3.1.3, 4.1.3, 6.1.3	DTW
2. Provide a means of communicating GNL Marine Service safety practices to the Public/ Passengers	1.1.4, 1.1.7, 1.1.9, 1.3.1, 2.1.3, 2.1.6, 2.1.8, 2.5.2, 3.1.7, 3.1.9, 3.3.1, 4.1.7, 4.1.9, 4.3.1, 5.1.6, 5.1.8, 6.1.7, 6.1.9, 6.3.1	DTW
3. Confirm the limits of operation for rolling motion	1.1.1, 2.1.1, 3.1.1, 4.1.1, 5.1.1, 6.1.1	DTW
4. Provide non-skid surfaces, and high contrast tapes on all stairs for all ships	1.1.5, 3.1.5, 4.1.5, 6.1.5	DTW
5. Provide one handrail on each side of the stairwells (on MV Flanders)	1.1.1, 2.1.1, 3.1.1, 4.1.1, 5.1.1, 6.1.1	DTW
6. Ensure availability of spares for light fixtures	1.1.2, 2.1.2, 3.1.2, 4.1.2, 5.1.2, 6.1.2	DTW
7. Provide procedures to ensure that walkways are clear of vehicles on the MV Legionnaire	1.1.3, 3.1.3, 4.1.3, 6.1.3	DTW
8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	1.1.3, 1.1.9, 2.1.8, 3.1.3, 3.1.9, 4.1.3, 4.1.9, 5.1.8, 6.1.3, 6.1.9	DTW
9. Review the number of lanes on the vehicle decks of all vessels, in order to provide adequate width for walkways	1.1.3, 3.1.3, 4.1.3, 5.6.1, 6.1.3	DTW
10. Review loading procedures for persons requiring Blue Zone parking	1.1.3, 3.1.3, 4.1.3, 6.1.3	DTW
11. Provide high contrast edge for mat in the vehicle deck near the passenger elevator on the MV Legionnaire	1.1.5, 3.1.5, 4.1.5, 6.1.5	DTW
12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	1.1.3, 1.1.5, 2.1.4, 3.1.3, 3.1.5, 4.1.3, 4.1.5, 5.1.4, 6.1.3, 6.1.5	DTW
13. Review bumps and tripping hazards for rectifications	1.1.5, 3.1.5, 4.1.5, 6.1.5	DTW
14. Provide awareness training to crew on dealing with passengers with disabilities and/ or medical conditions	1.1.7, 2.1.6, 3.1.7, 4.1.7, 5.1.6, 6.1.7	DTW

Recommendations	Hazard Scenario	Responsibility
15. Comply with TC and international regulations	5.11.1	DTW
16. Review emergency procedures for vessel operations (vessel specific) so that steps are made clearer	1.2.1, 2.2.1, 3.2.1, 4.2.1, 5.2.1, 6.2.1	DTW
17. Review and refresh TDG training	1.2.5, 2.2.6, 3.2.5, 4.2.5, 5.2.6, 6.2.6	DTW
18. Review frequency of crew rounds, sensors and door code	1.2.6, 2.2.7, 3.2.6, 4.2.6, 5.2.7, 6.2.5	DTW
19. Review smoking policy and implementation	1.2.1, 2.2.1, 3.2.1, 4.2.1, 5.2.1, 6.2.1	DTW
20. Review and formalize procedures for incoming vessels when other vessel is at dock	2.5.1, 5.5.1	DTW
21. Review and formalize alternative berthing location in extreme weather	2.5.4, 5.5.3	DTW
22. Consider possibility of providing crew monitoring during passenger unloading	2.5.2	DTW
23. Consider provision of barriers (ropes) at the exits during transit	2.5.2	DTW
24. Formalize procedures for captain to go to closest point of landing in case of emergency	2.2.2, 5.2.2	DTW
25. Provide latching for vehicles	5.7.1	DTW
26. Communication with ferry user community on safety practices using different of media.	1.3.1, 3.3.1, 4.3.1, 6.3.1	DTW
27. Enforce DTW rules regarding requiring passengers to vacate the vehicle during transit	2.10.1, 5.8.1, 5.10.1	DTW
28. Consider securing the cars during the extreme weather	2.10.1, 5.10.1	DTW

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY AND CONCLUSIONS

The Bell Island ferry service, operated by the DTW, provides transit between Portugal Cove and Bell Island, and is mainly served by two passenger ferry vessels: the MV Legionnaire, and the MV Flanders. DTW policy requires passengers to vacate their vehicles on the vehicle deck while the ferry is in transit. As the passenger population usually includes a number of people with medical or mobility challenges, there have been recent calls by the user community to allow passengers to occupy their vehicles during the transit in order to reduce health and safety risks to these passengers. The study was conducted to undertake a formal risk assessment to identify the hazards and the resulting risk associated with passengers remaining in their vehicles versus vacating their vehicles while the ferry is in transit.

Consider the case of passengers being required to vacate their vehicles during transit. Sixty-six hazardous scenarios that could result in personnel injuries, asset damage were identified and assessed for the three phases of the ferry operations. These phases are: passenger loading, transit and berthing and passenger unloading. Multiple numbers of safeguards were identified for controlling each of these hazardous scenarios. No hazardous scenario was assessed to have an Extreme risk. A majority (87%) of the scenarios were assessed to be at most Low or Medium risk, which is considered to be acceptable or tolerable with period review. Four of the scenarios were assessed as High risk. ALARP justification arguments and additional safeguards were developed to control these incidents and the risks were considered tolerable with continuous review.

Consider the case of passengers being allowed to occupy their vehicles during transit. Sixty-six hazardous scenarios that could result in personnel injuries or asset damage were identified and assessed for the three phases of the ferry operations. These phases are: passenger loading, transit and berthing and passenger unloading. Multiple numbers of safeguards were also identified for controlling each of these hazardous scenarios. No scenario was assessed to have an Extreme risk. As with the previous case, a majority (79%) of the incident scenarios were assessed to be Low or Medium risk, which is considered to be acceptable or tolerable with periodic review. Nine distinct hazard scenarios were assessed as High risk. ALARP justification arguments and additional safeguards were developed to control a number of these incidents. However, some of the scenarios, especially those that occur during the transit phase, would require additional considerations to make them ALARP, if the current policy of passengers vacating the vehicles is not adhered to. By following the current policy, these High risk scenarios will be eliminated.

In general, the risk profile for the passenger loading and unloading phases are lower in the case where the passengers are allowed to occupy their vehicles, whereas the risks are higher during the transit phase of the operations. Overall, the risk was assessed to be higher if passengers are allowed to occupy their vehicles than if they vacate their vehicles during transit.

5.2 RECOMMENDATIONS

Twenty-eight distinct recommendations and action items were generated in the HAZID workshop to further mitigate risks. The implementation of these recommendations, as well as compliance with the stipulated safeguards and statutory rules and best practices by international organizations, will assist to ensure that the current ferry service can continue to be carried out safely.

In order to continue to improve the current Bell Island Ferry service operations it is recommended that DTW engage in concerted risk communications and awareness programs to enhance the safety culture of both the user community and the crew. Specific considerations are presented in the Executive Summary.

In terms of changing the current DTW policy to allow passengers to occupy their vehicles during transit, the results of this study cannot be used to justify an application for a MTRB exemption. As discussed above, this study has shown that the aggregate risk was higher if passengers are allowed to occupy their vehicles than if they vacate their vehicles during transit. Therefore, there is no basis from a safety point of view for such an application.

If the study action items and the continuous improvement suggestions in this study are implemented, they will go a long way to the improving the safety level of the current operations as well as making the service more comfortable for users with special medical conditions or disability.

6.0 REFERENCES

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[4] Jeff Bell, Times Colonist (2017), B.C. Ferries: On enclosed decks, you won't be able to stay in your car (New Paper Article)
[5] E. Eliopoulou, A. Papanikolaou and V. Markos, "Statistical analysis of ship accidents and review of safety level," Safety Science, vol. 85, pp. 282-292, 2016

APPENDIX A: BRIEF BIOS OF WORKSHOP TEAM MEMBERS

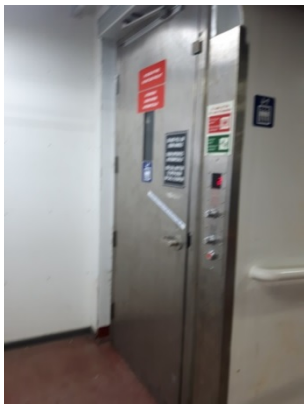
Name Organization	Position/ Company	HAZID Role	Qualifications and Experience	E-mail Address
Tamunoiyala Koko	Team Leader, Reliability & Risk, LR	Facilitator	PhD, structures and applied mechanics. Over 25 years' experience in in marine industry. Facilitated numerous risk assessment workshops for marine passenger ferries and other marine operations	Tamunoiyala.koko@lr.org
Sirinath Herat	Senior Surveyor, LR	SME, Ship Safety Advisor	Chartered Marine Engineer, Certificate of Competency Class 1 from DOT, UK Over 30 years' experience in marine, 18 year with LR. Experienced in undertaking periodical surveys of existing ships at port and at sea, and serving as lead auditor for ISM/ISPS/MLC audits.	sirinath.herat@lr.org,
Brent Martin	Senior Surveyor, LR	SME, Regulatory Aspects	B.Eng. Naval Architecture. Over 16 years 'experience in marine industry. Current duties include hull, machinery and statutory surveys of LR classed vessels.	Brent.martin@lr.org
Samith Rathnayaka	Risk & Reliability Consultant, LR	Technical Scribe	MEng in oil and gas engineering with specialization in process safety and risk assessment. Over 5 years' engineering experience. Participated in a number of risk assessment workshops, serving as scribe and performing results and data analysis.	Samith.rathnayaka@lr.org
Glenn Tremblett	Marine Services Manager, DTW	SME, Marine Operations	Over 30 years' experience marine technical expertise, marine operations and in leading and participating in Hazard Identification and Risk Assessments	GlennTremblett@gov.nl.ca
Jennifer Temple	Safety & Compliance Officer, DTW	SME, Safety & Compliance	Over 10 years' experience in the safety field. Experienced Advisor and facilitator with a demonstrated history of working in the management consulting industry. Skilled in Petroleum, Oilfield, Risk Assessment, Occupational Health, and Safety Management Systems. Strong professional with a Post Diploma (CO-OP) focused in Safety Engineering Technology and B.A. Participated, developed and implemented risk assessments for various organizations.	JenniferTemple@gov.nl.ca
Barry Fitzgerald	Senior HSE Manager, DTW	SME, Safety & Compliance	B.Tech, Over 25 years' experience in high risk environments, currently Senior Manager, Occupational Health and Safety for the DTW. Volunteer in the safety field as a member of the Canadian Society of Safety Engineering (CSSE) for many years. Past chair of the NL Chapter of the CSSE and currently sits on the CSSE national board of directors as the regional vice-president representing Atlantic Canada.	BarryFitzgerald@gov.nl.ca
Morgan Pilgrim	Captain, MV Legionnaire, DTW	SME, Vessel Operations	Master Near Coastal. Starting working on various Provincial Government ferries on July 1993. 19 years' experience as Master. Currently Captain onboard the M/V Legionnaire operating on the Bell Island service.	spilgrim@nl.rogers.com
Jamie Coles	Chief Mate, MV Flanders	SME, Vessel Operations	Ten years' experience in the fishing industry, 2 years working on survey ships, 12 years with DTW, currently working as Chief Mate on MV Flanders	jgcoles@hotmail.com
Jody Fancey	Manager, Stakeholder Relation & Contract Service	SME, Stakeholder Relations	BBA - 20 years' experience providing fiscal, strategic and organizational leadership through my involvement in the fields of municipal/ provincial government, community, economic and business development with a focus on innovation and continuous improvement in the context of building and sustaining effective partnerships within diverse multi-stakeholder environments.	jodyfancey@gov.nl.ca

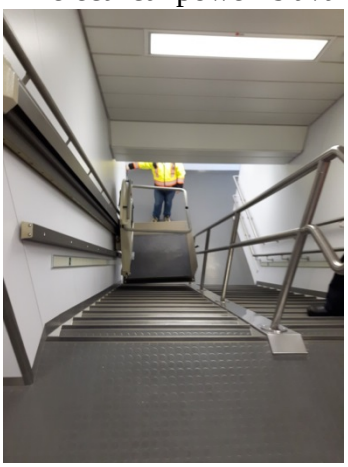
Name Organization	Position/ Company	HAZID Role	Qualifications and Experience	E-mail Address
Carol Ann Mason	Site Manager, Dr. Walter Templeman Health Centre, Bell Island	SME, Passenger Health & Comfort	35+ years in the health care industry; registered nurse by profession with 25 years management experience involving risk assessment and management, patient safety and quality initiatives. 2 years' as the site manager for the Dr. Walter Templeman Health Center on Bell Island and a ferry user during that time.	carolann.mason@easternhealth.ca
Kathy Hawkins	Inclusion NL	SME, Accessibility Features/ Passenger Comfort	30+ years' experience working in the cross disability community, 12 years at Empower, The Disability Resource Centre. 6+ years supporting businesses/employers to build accessibility in workplace environments. Currently active Member of International Association of Accessibility Professionals (IAAP); Vice President and formerly National Coordinator of the DisAbled Women's Network (DAWN) of Canada; Board Director of NL Association of the Deaf, and previously Board Director on Council of Canadians with Disabilities (CCD).	kathy@inclusionnl.ca

APPENDIX B: OBSERVATIONS ON BOARD SHIPS

OBSERVATIONS ON MV LEGIONNAIRE

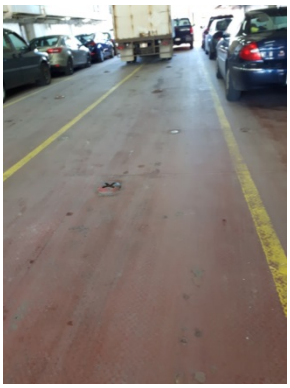
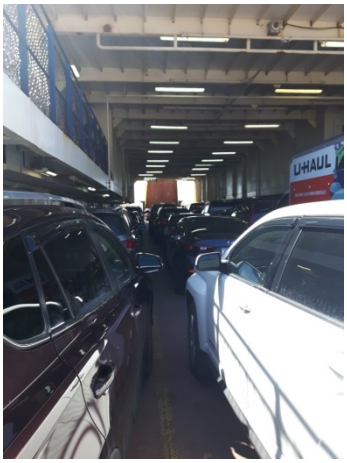
General	
Vessel Name	MV Legionnaire
Date and Time of Visit	23/04/2018 (9:00am – 11:30am)
Location/ Voyage	Round Trips to Bell Island
Observer	Project Team
Vessel Details, Facilities and Conditions	
Vehicle Decks	1. Improper parking of vehicles on vehicle deck. Vehicles can be seen parked on the designated walkways.  2. Cigarette butts can be seen on the vehicle deck, close to flammable material. 3. There are no signs close to stored flammable material to warn about fire hazard 4. "No Smoking" and "No Entry" signs provided on door to EDG room   5. Safety announcement barely audible/ clear in vehicle deck. 6. Deck clean, enclosed
Access to Lounges	7. Wheel chair available in the vehicle deck 8. Ramps to elevator are provided

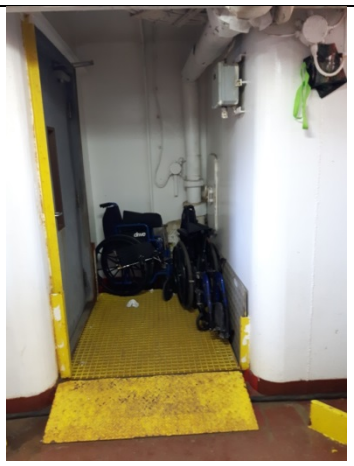
	 9. Elevator access from vehicle deck and to Lounge clear and no barriers   10. Clean stairways with hand rails
Lounges	11. Clean, comfortable 12. No pets allowed 13. No special space for passengers with special health concerns. A location was identified that could be potentially used as a separate spaces for passengers with special health concerns   14. Passengers have no access to crew lounges
Muster Stations	15. Aft and Fwd lounges are the main passengers muster stations 16. Embarkation is at Deck 6 where Lift chair is provided for disability passengers

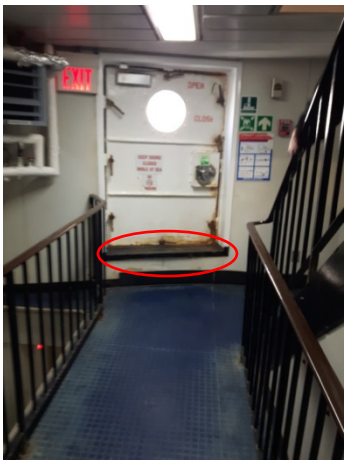
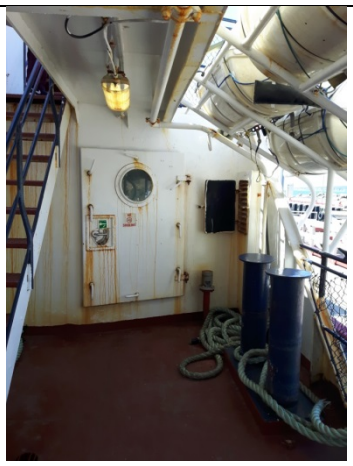
	17. Muster station looks small for the population 18. Crew muster by the embarkation deck, top of stairs 19. Passengers muster in lounge and are directed to embarkation deck
Life Saving Appliances	20. Class approved and Adequate 21. 2 @ 120 capacity
Accessibility Features	22. Lift chair is provided for use during EER activities. Need to confirm if electrical power is available for chair lift in emergency.  23. Lift chair (stair lift) took approximately 75 sec for one run with no passenger. Only crew have the keys to operate. Two crew are needed (Chief and 2nd mate). 24. Crew training may be required for effective and efficient evacuation. 18Minimum 4 crew members needed for evacuation process
Operations	
Crew: No, disposition	25. DTW policies and crew responsibilities are displayed in the bridge 26. 14 crew members on ship
Passengers: No, composition	27. Max 240, may contain up to 10 people with mobility challenges 28. Crew mentioned that in some cases, passengers may resist going lounges. In that case vessel won't go. Instances of these have reduced, since the new policy came into effect 29. Crew interviewed have not noticed harassment alleged by user community. It was later confirmed during the workshop that allegations of harassments have been brought to DTW attention.
Boarding Process	30. No formalized/ written procedure was found for boarding passengers with disability or medical issues. However, crew give priority boarding based on the communications between deck hand and crew handling the traffic. Disability passengers will be located as close to the elevator as possible.
Accessing the Lounges	31. Elevator and stairs are provided 32. Wheel chairs are available 33. Passengers not allowed in crew lounge
Voyage	34. Rolling motion was experienced on vehicle deck and in lounges

Disembarkation	35. Door sills in embarkation door  36. No priority given to passenger with medical conditions during disembarkation 37. Passengers leave the lounge area start heading to vehicle deck before vessel comes to a stop on all trips
Other Safety Observations	
	38. Most of the door sills may need portable ramps for accessibility purposes. 39. In emergency, crew enter LB on Deck 7 and lower it to Dec 6. There is a disability chair, Second Mate and Coxman have the key. Have to lift wheel chair from Muster Station through the door to the LB. Need at least 6 crew at Muster Station and 4 crew at LB. 40. Wheel chair accessibility to LB considered challenging (appears to have not been practiced). Need ramp at Muster Station to go through door to embarkation deck 41. Reviewed possible areas for providing special spaces for passengers with medical conditions.

OBSERVATIONS ON MV FLANDERS

General	
Vessel Name	MV Flanders
Date and Time of Visit	23/04/2018, 11.50am
Location/ Voyage	Round Trip to Bell Island
Observer	Project Team
Vessel Details, Facilities and Conditions	
Vehicle Decks	1. Open on both ends, sides not open. Looks old. 2. No designated walkways 3. Bumps and barriers in vehicle deck   4. Low clearance between vehicles  5. Safety announcement is barely audible in the vehicle deck.
Access to Lounges	6. Wheel chair available in the vehicle deck and ramp to lift 7. Elevator access from vehicle deck to Lounge allocated for passengers with disabilities, size of elevator is adequate but small

	  8. Good steps with railings
Lounges	9. Clean, straight from vehicle deck. 3 lounges in total 10. “No Pets Allowed” (signage needs to improve)  11. Special space for passengers with disability, but no space for passengers with special medical conditions such as chemo and dialysis.  12. No access for passengers to crew lounges

Muster Stations	13. Passengers with disability lift rafts at the Embarkation # 1. certainly needed for the door to embarkation station.   embark to Ramp is
Life Saving Appliances	14. Class approved and Adequate. Eight rafts, four on each side (37 capacity each)
Accessibility Features	15. Very difficult to access the life rafts from the muster station because of 17in high door sill 16. Small lift provided 17. Handicapped bathroom provided 18. Need privacy area. Even with disability lounge, it does not provide privacy.
Operations	
Crew: No, disposition	19. DTW policies and crew responsibilities are displayed in the bridge 20. Professional, courteous 21. Noticed crew member talking with passengers on stairwell platform leading to vehicle deck (not allowed)
Passengers: No, composition	22. Noticed a number of elderly people needing disability facilities
Boarding Process	23. No formalized/ written procedure was found for boarding passengers with disability or medical issues. However, crew give priority boarding based on the communications between deck hand and crew handling the traffic. Disability passengers will be located as close to the elevator as possible.
Accessing the Lounges	24. Elevator and stairs are provided 25. Wheel chairs are available
Voyage	26. Rolling motion was experienced
Disembarkation	27. Door sills in embarkation door 28. Slide is provided to load passengers to Life rafts at Embarkation Station # 1. Consideration should be given to assess the time taken by crew for

	the embarkation process. 
Other Safety Observations	
	29. Most of the door sills may need portable ramps

APPENDIX C: HAZID WORKSHEETS

Node: 1. Passenger Loading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
1.1. Slip, trip and falls	1.1.1. Rolling motion and/or high waves	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Provision of wheel chairs for passengers with disabilities		2	3	Medium	1	1	Low	3. Confirm the limits for operation under rolling	DTW
			Crew patrol								5. Provide one handrail on each side of the stairwells (on MV Flanders)	DTW
			Hand rails for all stairs									
			Elevators for disabled and medical personnel									
			Operational Limits for weather (at discretion of the captain)									
	1.1.2. Inadequate lighting, obsolete parts	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Regular Inspection to ensure lights are working properly		2	2	Low	1	1	Low	6. Ensure availability of spares for light fixtures	DTW
			Emergency lighting provided									
	1.1.3. Inadequate clearance in walkways in vehicle deck, corridors and passageways, elevators	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Corridor are designed as per CTA requirements	Hazard mostly on the MV Flanders	2	3	Medium	1	1	Low	1. Provide handrails three walls of elevator (All ships)	DTW
			Signage								7. Procedures to ensure that walkways are clear of vehicles on the MV Legionnaire	DTW
											8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	DTW
											9. Review the number of lanes on the vehicle decks of all vessels, in order to provide adequate width for walkways	DTW
											10. Review loading procedures for person requiring Blue Zone parking	DTW
											12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	DTW
	1.1.4. Passengers not following rules	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Crew patrol		2	3	Medium	1	1	Low	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			Signage									
	1.1.5. Unsafe walking surfaces (barriers such as ramps,	Injuries to passengers, vehicle damage (passenger damaging	Non-skid surfaces (stairs)		2	3	Medium	1	1	Low	4. Provide non-skid surfaces on all stairs for all ships and provide high contrast tapes on all ship stairs	DTW

Node: 1. Passenger Loading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	bumps)	the vehicle while falling)	Signage								11. Provide high contrast edge for mat in the vehicle deck near the passenger elevator on the MV Legionnaire	DTW
											12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	DTW
											13. Review bumps and tripping hazards for rectifications	DTW
	1.1.6. Snow, ice, rain, wet surfaces	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Proper house keeping		3	2	Medium	1	1	Low		
			Ice control procedure (salting)									
			Exterior stairs closed down during the extreme weather conditions									
			Non slip surfaces									
			Crew patrol									
			Crew inspection and tool box talks									
			Communication between vessels and public									
	1.1.7. Physical limitations of passengers (medical)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Provide wheel chair services to passengers as required		2	3	Medium	1	1	Low	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			Elevator services								14. Crew awareness for dealing with passengers with disabilities and/ or medical conditions	DTW
			Priority boarding for passengers with medical passes									
			Crew patrol									
	1.1.8. Physical limitations of passengers (under the influence of drugs and alcohol)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Crew patrol		2	3	Medium	1	1	Low		
			No alcohol and drugs policy for crew and passengers									
			Crew training to not accept/ allow intoxicated passengers onboard. Crew notifies the captain for decisions									
			Crew assistance for									

Node: 1. Passenger Loading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			walking passengers									
			Follow DTW procedures for passengers who appear to be under the influence of drugs and/or alcohol									
	1.1.9. Passenger behaviour (Inappropriate footwear, carrying luggage while climbing stairs, lack of mobility support)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Signage to hold handrail provided in stairs of MV Legionnaire		2	3	Medium	1	1	Low	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			PA to hold handrail provided in stairs of MV Flanders								8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	DTW
1.2. Fire	1.2.1. Smoking	Injuries to passengers and crew, damage to vehicles, vessel damage, escalation due to presence of fuel in vehicles, smoke inhalation	Smoking in prohibited		3	3	Medium	3	3	Medium	16. Review emergency procedures during vessel operation (vessel specific) so that steps are clearer	DTW
			Signage								19. Review smoking policy and implementation	DTW
			Crew patrol									
			Sprinklers on activated manually									
			Heat detectors on vehicle deck									
			Smoke detectors in stairwells									
			Local fire department available for support									
			Fire alarms (visual and audio)									
			Emergency procedures									
			Stop loading									
			PA									
	1.2.2. Fire from Emergency Diesel Generator Room (EDG), Bunker Station, etc	Injuries to passengers and crew, damage to vehicles, vessels damage, escalation due to presence of fuel in vehicles, smoke inhalation	PA		3	2	Medium	2	2	Low		
			Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									

Node: 1. Passenger Loading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			Smoke detectors in EDG									
			Heat detectors on vehicle deck									
			Heat detectors in bunker station									
			Sprinklers on activated manually									
			Crew patrol									
			Heat detectors on vehicle deck									
			Regular Maintenance of the EDG									
			Restricted access to machinery rooms/technical spaces									
			Structural fire protection (A-60)									
	1.2.3. Vehicle fire	Injuries to passengers and crew, damage to vehicles, escalation due to presence of fuel in vehicles	PA		3	3	Medium	3	3	Medium		
			Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Heat detectors on vehicle deck									
			Sprinklers on activated manually									
			Crew patrol									
			Vehicles with leaky/ oil spills not allowed									
			Turn off engine when on deck									
	1.2.4. Fire in Lounges/ crew accommodation (electrical appliances, heaters, washer and dryer/ electrical fires)	Injuries to passengers and crew, vessel damage, delaying operation	PA		3	2	Medium	3	2	Medium		
			Stop loading									
			Emergency procedures									
			Fire alarms (visual and									

Node: 1. Passenger Loading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			audio)									
			Local fire department available for support									
			Heat detectors in galley, laundry									
			Smoke detectors in lounges, crew accommodations									
			Sprinklers on activated manually									
			Portable fire extinguishers as per TC/ Approved fire plan									
			Ventilation shut down									
			Fire dampers									
			Structural fire protection									
			Crew patrol									
	1.2.5. Dangerous goods (Gasoline, Propane, Acetylene, Oxygen, potentially Dynamite)	Damage to vessels and vehicles, injuries to passengers and crew, explosion	Dedicated DG trips		5	2	High	5	2	High	17. Review and refresh TDG training	DTW
			Segregation as per DG rules									
			TDG training									
			Specific PA for TDG									
			Communication to public regarding carriage of DG									
			All other fire control and detection systems as per TC/ Approved fire plan									
	1.2.6. Sabotage	Damage to vessels and vehicles, injuries to passengers and crew	Crew patrol		4	2	Medium	4	2	Medium	18. Review frequency of crew rounds, sensors and door code	DTW
			Signage									
			CCTVs									
			All other fire control and detection systems as per TC/ Approved fire plan									
	1.2.7. Fire from Machinery space	Injuries to crew, vessels damage, smoke	PA		3	3	Medium	4	3	High		
			Stop loading									

Node: 1. Passenger Loading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
		inhalation, escalation to vehicle deck	Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Smoke detectors									
			Heat detectors									
			Multiple Fixed FF systems									
			Crew patrol									
			Regular Maintenance and inspection									
			Restricted access to machinery rooms/technical spaces									
			Structural fire protection (A-60)									
			Spray shields (LOC controls									
			Permanently manned									
1.3. Vehicle striking other vehicles or people (passengers or crew)	1.3.1. Mechanical faults and/ or human error (distracted driver/passengers' behaviour-not following directions)	Injuries to passengers and crew; damage to vehicles; potential fire if fuel tank is damaged	Crew control the traffic	Incidents of passengers ignoring direction have been recorded on several vessels	3	4	High	2	4	Medium	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
		Injuries to passengers who in the vehicle, damage to vehicles	Low speeds		1	2	Low	2	2	Low	26. Communication with ferry user community on safety practices	DTW
			Crew training to not accept/ allow distracted drivers onboard									
			Follow DTW procedures for passengers who appear to be under the influence of drugs and/or alcohol									
1.4. Structural/ Equipment Failure	1.4.1. Structural failure (failure of upper deck) due to inadequate strength	Injuries to passengers, damage to vessel and vehicles, potential fire if vehicles fuel tanks are damaged	Maintenance of deck structure, designed to Class rules		1	1	Low	3	1	Low		

Node: 2. Transit and Berthing Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
2.1. Slip, trip and falls	2.1.1. Rolling motion and/or high waves	Injuries to passengers	Provision of wheel chairs for passengers with disabilities		2	2	Low				3. Confirm the limits for operation under rolling	DTW
			Crew patrol								5. Provide one handrail on each side of the stairwells (on MV Flanders)	DTW
			Hand rails for all stairs									
			Operational Limits for weather (at discretion of the captain)									
	2.1.2. Inadequate lighting, obsolete parts	Injuries to passengers	Regular Inspection to ensure lights are working properly		2	2	Low				6. Ensure availability of spares for light fixtures	DTW
			Emergency lighting provided									
	2.1.3. Passengers not following rules	Injuries to passengers	Crew patrol		2	3	Medium				2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			Signage									
	2.1.4. Unsafe walking surfaces (door sills)	Injuries to passengers	Non skid surfaces (stairs)		2	2	Low				12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	DTW
			Signage									
			Some portable ramps are provided									
	2.1.5. Snow, ice, rain, wet surfaces	Injuries to passengers	Proper house keeping		3	2	Medium					
			Ice control procedure (salting)									
			Exterior stairs closed down during the extreme weather conditions									
			Non-slippery surfaces									
			Crew patrol									
			Crew inspection and tool box talks									
			Communication between vessels and public									
	2.1.6. Physical limitations of passengers (medical)	Injuries to passengers	Provide wheel chair services to passengers as required		3	2	Medium				2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			Crew patrol								14. Crew awareness for dealing with passengers with disabilities and/ or	DTW

Node: 2. Transit and Berthing Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
											medical conditions	
	2.1.7. Physical limitations of passengers (under the influence of drugs and alcohol)	Injuries to passengers	Crew patrol		3	2	Medium					
			No alcohol and drugs policy for crew and passengers									
			Crew assistance for walking passengers									
			Follow DTW procedures for passengers who appear to be under the influence of drugs and/or alcohol									
	2.1.8. Passenger behaviour (Inappropriate footwear, carrying luggage while climbing stairs, lack of mobility support	Injuries to passengers	Signage to hold handrail provided in stairs of MV Legionnaire		3	2	Medium				2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			PA to hold handrail provided in stairs of MV Flanders								8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	DTW
2.2. Fire	2.2.1. Smoking	Injuries to passengers and crew, vessel damage, smoke inhalation	Smoking in prohibited	Depend on the size, location and type of the fire	2	2	Low	2	2	Low	16. Review emergency procedures during vessel operation (vessel specific) so that steps are clearer	DTW
			Signage								19. Review smoking policy and implementation	DTW
			Crew patrol									
			Sprinklers on activated manually									
			Smoke detectors in stairwells									
			Local fire department available for support									
			Fire alarms (visual and audio)									
			Emergency procedures									
			PA									
	2.2.2. Fire from Emergency Diesel Generator Room (EDG), Bunker	Injuries to passengers and crew, vessel damage, smoke inhalation	PA		2	1	Low	2	1	Low	24. Formalize procedures for captain to go to closest point of landing	DTW
			Emergency procedures									
			Fire alarms (visual and audio)									

Node: 2. Transit and Berthing Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	Station, etc		Local fire department available for support									
			Injuries to passengers and crew, vessel damage, Smoke inhalation									
			Smoke detectors in EDG									
			Heat detectors on vehicle deck									
			Heat Detectors in bunker station									
			Sprinklers on activated manually and automatically									
			Crew patrol									
			Heat detectors on vehicle deck									
			Regular Maintenance of the EDG									
			Restricted access to machinery rooms/technical spaces									
			Structural fire protection									
	2.2.3. Vehicle fire	Injuries to passengers and crew, damage to vehicles, escalation due to presence of fuel in vehicles	PA		1	2	Low	3	2	Medium		
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Heat detectors on vehicle deck									
			Sprinklers on activated manually									
			Crew patrol									
			Heat detectors on vehicle deck									
	2.2.4. Fire in Lounges/ crew accommodation,	Injuries to passengers and crew, vessel	PA		3	2	Medium	3	2	Medium		
			Emergency procedures									

Node: 2. Transit and Berthing Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	public spaces (electrical appliances, heaters, washer and dryer/ electrical fires)	damage, delaying operation	Fire alarms (visual and audio)									
			Local fire department available for support									
			Heat detectors in laundry									
			Smoke detectors in lounges, crew accommodations									
			Sprinklers on activated manually									
			Portable fire extinguishers as per TC/ Approved fire plan									
			Ventilation shut down									
			Fire dampers									
			Structural fire protection									
			Crew patrol									
	2.2.5. Galley fire	Injuries to passengers and crew, vessel damage, delaying operation	PA		3	3	Medium	3	3	Medium		
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Heat detectors in galley									
			Sprinklers on activated manually									
			Portable fire extinguishers as per TC/ Approved fire plan									
			Ventilation shut down									
			Fire dampers									
			Structural fire protection									
			Crew patrol									
	2.2.6. Dangerous goods (Gasoline, Propane, Acetylene,	Damage to vessels and vehicles, injuries to passengers and crew,	Dedicated DG trips		3	2	Medium	5	2	High	17. Review and refresh TDG training	DTW
			Segregation as per DG rules									

Node: 2. Transit and Berthing Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	Oxygen, potentially Dynamite)	explosion	TDG training Specific PA for TDG Communication to public regarding carriage of DG All other fire control and detection systems as per TC/ Approved fire plan									
	2.2.7. Sabotage	Damage to vessels and vehicles, injuries to passengers and crew,	Crew patrol Signage CCTVs All other fire control and detection systems as per TC/ Approved fire plan		4	2	Medium	4	2	Medium	18. Review frequency of crew rounds, sensors and door code	DTW
	2.2.8. Fire from Machinery space	Injuries to crew, vessels damage, Smoke inhalation, escalation to vehicle deck	PA Emergency procedures Fire alarms (visual and audio) Local fire department available for support Smoke detectors Heat detectors Multiple Fixed FF systems Crew patrol Regular Maintenance and inspection Restricted access to machinery rooms/technical spaces Structural fire protection Spray shields (LOC controls Permanently Manned		3	3	Medium	4	3	High		
2.3. Vehicle striking other vehicles or people	2.3.1.			Not applicable for this Node								

Node: 2. Transit and Berthing Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
(passengers or crew)												
2.4. Structural/ Equipment Failure	2.4.1. Structural failure (failure of upper deck) due to inadequate strength	Injuries to passengers, damage to vessel and vehicles, potential fire if vehicles fuel tanks are damaged	Maintenance of deck structure, designed to Class rules		1	1	Low	3	1	Low		
2.5. Striking berth/ other ships at berth	2.5.1. Human error	Damage to either or both vessels, damage to berth, injuries and fatalities for crew and passengers; loss or long delay of services, damage to vehicles	Communication protocol for ship and shore crew		2	3	Medium	2	3	Medium	20. Review and formalize the procedures for incoming vessels if other vessels are at dock	DTW
			Best practice for incoming vessels to wait									
			Training and competency/ proficiency									
	2.5.2. Passenger behaviour (Leaving the lounge prior to the arrival announcement)	Injury or fatality of passengers	Rules in place (PA)	This can happen at any time of ship operation. However, this scenario considered as worst case scenario.	4	3	High				2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			Signage and passenger announcement to remind the passenger to remain seated								22. Consider possibility of providing crew monitoring during passenger unloading	DTW
											23. Consider provision of barriers (ropes) at the exits during transit	DTW
	2.5.3. Mechanical failure, power failure/ blackout	Damage to either or both vessels, damage to berth, injuries and fatalities for crew and passengers; loss or long delay of services, damage to vehicles	Regular Maintenance and inspection		2	3	Medium	2	3	Medium		
			Redundancies (Multiple engines, thrusters, EDG on board)									
			Emergency procedures									
			Fendering on dock									
			Maintenance of the berth infrastructure									
	2.5.4. Extreme weather/ environmental conditions (fog, visibility, wind, snow storm, sea state)	Damage to either or both vessels, damage to berth, injuries and fatalities for crew and passengers; loss or long delay of services, damage to vehicles	Best practice for alternative berthing location in extreme weather		2	4	Medium	2	4	Medium	21. Review and formalize alternative berthing location in extreme weather	DTW
			Maintenance of the berth infrastructure									
			Fendering on Dock									

Node: 2. Transit and Berthing Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			Weather forecasts									
			Training, proficiency and discretion of master									
	2.5.5. Limited berthing space	Damage to either or both vessels, damage to berth, injuries and fatalities for crew and passengers; loss or long delay of services, damage to vehicles	Best practice for alternative berthing location in extreme weather		2	3	Medium	2	3	Medium		
			Communication protocol for ship and shore crew									
			Best practice for incoming vessels to wait									
			Training and competency/ proficiency									
2.6. Grounding	2.6.1. Human error	Injuries, vessel damage (bottom hull), flooding; delay of service	Vessel navigation system		3	1	Low	4	1	Low		
			EER Procedure									
			Bridge watch									
			Navigational aids (lights)									
			Fog signals									
			Crew training and certification (familiarization with vessel)									
	2.6.2. Mechanical or power failure/ blackout	Injuries, vessel damage (bottom hull), flooding; delay of service	Vessel navigation system		3	1	Low	4	1	Low		
			EER Procedure									
			Bridge watch									
			Navigational aids (lights)									
			Fog signals									
			Crew training and certification (familiarization with vessel)									
			Regular maintenance									

Node: 2. Transit and Berthing Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			and inspection									
2.7. Foundering	2.7.1. Power failure/ black outs	Excessive vessel motion leading to vessel and vehicle damage, injuries, delay of service	EER Procedure		3	2	Medium	3	2	Medium		
			Bridge watch									
			Crew training and certification (familiarization with vessel)									
			Regular maintenance and inspection									
			Mast lights NUC									
2.8. Sinking/ Capsize and/or other situation requiring Evacuation	2.8.1. Flooding, loss of stability, loss of propulsion, extreme weather, fire and explosion	Loss of vessel, potential injuries and fatalities	EER Procedure	Location of passengers impacts crews ability perform effective evacuation	5	1	Medium	5	1	Medium		
			DTW rules regarding requiring passengers to vacate the vehicle during transit									
			Location of passengers close to embarkation decks									
			Drills									
			Maintenance, testing and inspection of LSA									
			Provision of chair lifts									
			Damage control procedures									
			All other controls associated with list of causes									
2.9. Collision	2.9.1. Human error	Minor damage; minor injuries	Vessel navigation system	Impact to third party vessel is excluded in this study because passengers staying vehicles or not has no impact on this scenario	2	2	Low	2	2	Low		
		Major injuries, casualty, major damage	EER Procedure		5	1	Medium	5	1	Medium		
			Bridge watch									
			Navigational aids (lights)									
			Fog signals									
			Follow COLREG									
			Crew training and certification (familiarization with vessel)									

Node: 2. Transit and Berthing Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			Communication with nearby vessels as much as possible (Blow the horn)									
	2.9.2. Mechanical or power failure/ blackout	Minor damage; minor injuries	Vessel navigation system	Impact to third party vessel is excluded in this study because passengers staying vehicles or not has no impact on this scenario	2	2	Low	2	2	Low		
		Major injuries, casualty, major damage	EER Procedure		5	1	Medium	4	1	Low		
			Bridge watch									
			Navigational aids (lights)									
			Fog signals									
			Follow COLREG									
			Crew training and certification (Familiarization with Vessel)									
			Communication with nearby vessels as much as possible (Blow the horn)									
			Regular Maintenance and inspection									
			Redundancies (Multiple engines, thrusters, EDG on board)									
			Life cycle management (Obsolete parts)									
	2.9.3. Ice berg	Major injuries, fatalities, major damage, flooding	Weather forecasts/ iceberg monitoring		4	1	Low	4	1	Low		
			Bridge watch									
			Navigational aids (radar)									
2.10. Green water	2.10.1. Extreme weather	Vehicle movement, injuries to crew, vessel damage	Weather forecasts	Primarily in MV Flanders	2	3	Medium	3	3	Medium	27. DTW rules regarding requiring passengers to vacate the vehicle during transit	DTW
			Training, proficiency and discretion of master								28. Consider securing the cars during the extreme weather	DTW

Node: 3. Passenger Unloading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
3.1. Slip, trip and falls	3.1.1. Rolling motion and/or high waves	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Provision of wheel chairs for passengers with disabilities	More likely to fall when coming down stairs	2	4	Medium	1	1	Low	3. Confirm the limits for operation under rolling	DTW
			Crew patrol								5. Provide one handrail on each side of the stairwells (on MV Flanders)	DTW
			Hand rails for all stairs									
			Elevators for disabled and medical personnel									
			Operational Limits for weather (at discretion of the captain)									
	3.1.2. Inadequate lighting, obsolete parts	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Regular Inspection to ensure lights are working properly		2	2	Low	1	1	Low	6. Ensure availability of spares for light fixtures	DTW
			Emergency lighting provided									
	3.1.3. Inadequate clearance in walkways in vehicle deck, corridors and passageways, elevators	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Corridor are designed as per CTA requirements	Hazard mostly on the MV Flanders	2	3	Medium	1	1	Low	1. Provide handrails three walls of elevator (All ships)	DTW
			Signage								7. Procedures to ensure that walkways are clear of vehicles on the MV Legionnaire	DTW
											8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	DTW
											9. Review the number of lanes on the vehicle decks of all vessels, in order to provide adequate width for walkways	DTW
											10. Review loading procedures for person requiring Blue Zone parking	DTW
											12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	DTW
	3.1.4. Passengers not following rules	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Crew patrol		2	4	Medium	1	1	Low		
			Signage									
	3.1.5. Unsafe walking surfaces (barriers such as ramps/ bumps)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Non-skid surfaces (stairs)		2	3	Medium	1	1	Low	4. Provide non-skid surfaces on all stairs for all ships and provide high contrast tapes on all ship stairs	DTW
			Signage								11. Provide high contrast edge for mat in the vehicle deck near the passenger	DTW

Node: 3. Passenger Unloading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
											elevator on the MV Legionnaire	
											12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	DTW
											13. Review bumps and tripping hazards for rectifications	DTW
	3.1.6. Snow, ice, rain, wet surfaces	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Proper house keeping Ice control procedure (salting) Exterior stairs closed down during the extreme weather conditions Non slip surfaces Crew patrol Crew inspection and tool box talks Communication between vessels and public	Passenger rushing to vehicle deck in the stairwells	3	3	Medium	1	1	Low		
	3.1.7. Physical limitations of passengers (medical)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Provide wheel chair services to passengers as required Elevator services Priority boarding for passengers with medical passes Crew patrol		2	3	Medium	1	1	Low	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
											14. Crew awareness for dealing with passengers with disabilities and/ or medical conditions	DTW
	3.1.8. Physical limitations of passengers (under the influence of drugs and alcohol)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Crew patrol No alcohol and drugs policy for crew and passengers Crew training to not accept/ allow intoxicated passengers onboard. Crew notifies the captain for decisions Crew assistance for walking passengers		2	3	Medium	1	1	Low		

Node: 3. Passenger Unloading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			Follow DTW procedures for passengers who appear to be under the influence of drugs and/or alcohol									
	3.1.9. Passenger behaviour (Inappropriate footwear, carrying luggage while climbing stairs, lack of mobility support)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Signage to hold handrail provided in stairs of MV Legionnaire	Passenger rushing to vehicle deck in the stairwells	2	4	Medium	1	1	Low	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			PA to hold handrail provided in stairs of MV Flanders								8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	DTW
3.2. Fire	3.2.1. Smoking	Injuries to passengers and crew, damage to vehicles, vessel damage, escalation due to presence of fuel in vehicles, Smoke inhalation	Smoking in prohibited		1	1	Low	1	1	Low	16. Review emergency procedures during vessel operation (vessel specific) so that steps are clearer	DTW
			Signage								19. Review smoking policy and implementation	DTW
			Crew patrol									
			Sprinklers on activated manually									
			Heat detectors on vehicle deck									
			Smoke detectors in stairwells									
			Local fire department available for support									
			Fire alarms (visual and audio)									
			Emergency procedures									
			Stop loading									
			PA									
	3.2.2. Fire from Emergency Diesel Generator Room (EDG), Bunker Station, etc	Injuries to passengers and crew, damage to vehicles, vessels damage, escalation due to presence of fuel in vehicles, smoke inhalation	PA		1	1	Low	1	1	Low		
			Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Smoke detectors in									

Node: 3. Passenger Unloading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			EDG									
			Heat detectors on vehicle deck									
			Heat detectors in bunker station									
			Sprinklers on activated manually and automatically									
			Crew patrol									
			Heat detectors on vehicle deck									
			Regular maintenance of the EDG									
			Restricted access to machinery rooms/technical spaces									
			Structural fire protection									
	3.2.3. Vehicle fire	Injuries to passengers and crew, damage to vehicles, escalation due to presence of fuel in vehicles	PA		3	3	Medium	3	3	Medium		
			Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Heat detectors on vehicle deck									
			Sprinklers on activated manually									
			Crew patrol									
			Heat detectors on vehicle deck									
			Vehicles with leaky/ oil spills not allowed									
			Turn off engine when on deck									
	3.2.4. Fire in Lounges/ crew accommodation (electrical appliances, heaters, washer and	Injuries to passengers and crew, vessel damage, delaying	PA		2	2	Low	2	2	Low		
			Stop loading									
			Emergency procedures									

Node: 3. Passenger Unloading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	dryer/ electrical fires)	operation	Fire alarms (visual and audio)									
			Local fire department available for support									
			Heat detectors in galley, laundry									
			Smoke detectors in lounges, crew accommodations									
			Sprinklers on activated manually									
			Portable fire extinguishers as per TC/ Approved fire plan									
			Ventilation shut down									
			Fire dampers									
			Structural fire protection									
			Crew patrol									
	3.2.5. Dangerous goods (Gasoline, propane, acetylene, oxygen, potentially Dynamite)	Damage to vessels and vehicles, injuries to passengers and crew, explosion	Dedicated DG trips		5	2	High	5	2	High	17. Review and refresh TDG training	DTW
			Segregation as per DG rules									
			TDG training									
			Specific PA for TDG									
			Communication to public regarding carriage of DG									
			All other fire control and detection systems as per TC/ Approved fire plan									
	3.2.6. Sabotage	Damage to vessels and vehicles, injuries to passengers and crew,	Crew patrol		4	1	Low	4	1	Low	18. Review frequency of crew rounds, sensors and door code	DTW
			Signage									
			CCTVs									
			All other fire control and detection systems as per TC/ Approved fire plan									
	3.2.7. Fire from	Injuries to crew or	PA		3	3	Medium	4	3	High		

Node: 3. Passenger Unloading Phase-Passengers Vacate Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	Machinery space	passengers, vessels damage, Smoke inhalation, escalation to vehicle deck	Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Smoke detectors									
			Heat detectors									
			Multiple Fixed FF systems									
			Crew patrol									
			Regular maintenance and inspection									
			Restricted access to machinery rooms/technical spaces									
			Structural fire protection									
			Spray shields (LOC controls									
			Permanently manned									
3.3. Vehicle striking other vehicles or people (passengers or crew)	3.3.1. Mechanical faults and/ or human error (distracted driver/passengers' behaviour-not following directions)	Injuries to passengers and crew, damage to vehicles, potential fire if fuel tank is damaged	Crew control the traffic	Incidents of passengers ignoring direction have been recorded on several vessels	3	4	High	2	4	Medium	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
		Injuries to passengers who in the car, damage to vehicles	Low speeds		1	2	Low	2	2	Low	26. Communication with ferry user community on safety practices	DTW
			Crew training to not accept/ allow distracted drivers onboard									
			Follow DTW procedures for passengers who appear to be under the influence of drugs and/or alcohol									
3.4. Structural/ Equipment Failure	3.4.1. Structural failure (failure of upper deck) due to inadequate strength	Injuries to passengers, damage to vessel and vehicles, potential fire if vehicles fuel tanks are damaged	Maintenance of deck structure, designed to Class rules		1	1	Low	3	1	Low		

Node: 4. Passenger Loading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
4.1. Slip, trip and falls	4.1.1. Rolling motion and/or high waves	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Provision of wheel chairs for passengers with disabilities		2	2	Low	1	1	Low	3. Confirm the limits for operation under rolling	DTW
			Crew patrol								5. Provide one handrail on each side of the stairwells (on MV Flanders)	DTW
			Hand rails for all stairs									
			Elevators for disabled and medical personnel									
			Operational Limits for weather (at discretion of the captain)									
	4.1.2. Inadequate lighting, obsolete parts	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Regular Inspection to ensure lights are working properly		2	2	Low	1	1	Low	6. Ensure availability of spares for light fixtures	DTW
			Emergency lighting provided									
	4.1.3. Inadequate clearance in walkways in vehicle deck, corridors and passageways, elevators	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Corridor are designed as per CTA requirements	Hazard mostly on the MV Flanders	2	2	Low	1	1	Low	1. Provide handrails three walls of elevator (All ships)	DTW
			Signage								7. Procedures to ensure that walkways are clear of vehicles on the MV Legionnaire	DTW
											8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	DTW
											9. Review the number of lanes on the vehicle decks of all vessels, in order to provide adequate width for walkways	DTW
											10. Review loading procedures for person requiring Blue Zone parking	DTW
											12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	DTW
	4.1.4. Passengers not following rules	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Crew patrol		2	2	Low	1	1	Low		
			Signage									
	4.1.5. Unsafe walking surfaces (barriers such as ramps, bumps)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Non-skid surfaces (stairs)		2	2	Low	1	1	Low	4. Provide non-skid surfaces on all stairs for all ships and provide high contrast tapes on all ship stairs	DTW
			Signage								11. Provide high contrast edge for mat in the vehicle deck near the passenger	DTW

Node: 4. Passenger Loading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
											elevator on the MV Legionnaire	
											12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	DTW
											13. Review bumps and tripping hazards for rectifications	DTW
	4.1.6. Snow, ice, rain, wet surfaces	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Proper house keeping Ice control procedure (salting) Exterior stairs closed down during the extreme weather conditions Non slip surfaces Crew patrol Crew inspection and tool box talks Communication between vessels and public		3	2	Medium	1	1	Low		
	4.1.7. Physical limitations of passengers (medical)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Provide wheel chair services to passengers as required Elevator services Priority boarding for passengers with medical passes Crew patrol		2	1	Low	1	1	Low	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
											14. Crew awareness for dealing with passengers with disabilities and/ or medical conditions	DTW
	4.1.8. Physical limitations of passengers (under the influence of drugs and alcohol)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Crew patrol No alcohol and drugs policy for crew and passengers Crew training to not accept/ allow intoxicated passengers onboard. Crew notifies the captain for decisions Crew assistance for walking passengers		2	2	Low	1	1	Low		

Node: 4. Passenger Loading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			Follow DTW procedures for passengers who appear to be under the influence of drugs and/or alcohol									
	4.1.9. Passenger behaviour (Inappropriate footwear, carrying luggage while climbing stairs, lack of mobility support)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Signage to hold handrail provided in stairs of MV Legionnaire		2	2	Low	1	1	Low	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			PA to hold handrail provided in stairs of MV Flanders								8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	DTW
4.2. Fire	4.2.1. Smoking	Injuries to passengers and crew, damage to vehicles, vessel damage, escalation due to presence of fuel in vehicles, Smoke inhalation	Smoking in prohibited		3	3	Medium	2	2	Low	16. Review emergency procedures during vessel operation (vessel specific) so that steps are clearer	DTW
			Signage								19. Review smoking policy and implementation	DTW
			Crew patrol									
			Sprinklers on activated manually									
			Heat detectors on vehicle deck									
			Smoke detectors in stairwells									
			Local fire department available for support									
			Fire alarms (visual and audio)									
			Emergency procedures									
			Stop loading									
			PA									
	4.2.2. Fire from Emergency Diesel Generator Room (EDG), Bunker Station, etc	Injuries to passengers and crew, damage to vehicles, vessels damage, escalation due to presence of fuel in vehicles, Smoke inhalation	PA		2	2	Low	2	2	Low		
			Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Smoke detectors in									

Node: 4. Passenger Loading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			EDG									
			Heat detectors on vehicle deck									
			Heat detectors in bunker station									
			Sprinklers on activated manually and automatically									
			Crew patrol									
			Heat detectors on vehicle deck									
			Regular Maintenance of the EDG									
			Restricted access to machinery rooms/technical spaces									
			Structural fire protection									
	4.2.3. Vehicle fire	Injuries to passengers and crew, damage to vehicles, escalation due to presence of fuel in vehicles	PA		3	2	Medium	2	2	Low		
			Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Heat detectors on vehicle deck									
			Sprinklers on activated manually									
			Crew patrol									
			Heat detectors on vehicle deck									
			Vehicles with leaky/ oil spills not allowed									
			Turn off engine when on deck									
	4.2.4. Fire in Lounges/ crew accommodation (electrical appliances, heaters, washer and	Injuries to passengers and crew, vessel damage, delaying	PA		2	2	Low					
			Stop loading									
			Emergency procedures									

Node: 4. Passenger Loading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	dryer/ electrical fires)	operation	Fire alarms (visual and audio) Local fire department available for support Heat detectors in galley, laundry Smoke detectors in lounges, crew accommodations Sprinklers on activated manually Portable fire extinguishers as per TC/ Approved fire plan Ventilation shut down Fire dampers Structural fire protection Crew patrol									
	4.2.5. Dangerous goods (Gasoline, Propane, Acetylene, Oxygen, potentially Dynamite)	Damage to vessels and vehicles, injuries to passengers and crew, explosion	Dedicated DG trips Segregation as per DG rules TDG training Specific PA for TDG Communication to public regarding carriage of DG All other fire control and detection systems as per TC/ Approved fire plan	Passengers are not permitted to stay in the Vehicle deck during DG trip	5	2	High	5	2	High	17. Review and refresh TDG training	DTW
	4.2.6. Sabotage	Damage to vessels and vehicles, injuries to passengers and crew	Crew patrol Signage CCTVs All other fire control and detection systems as per TC/ Approved fire plan		4	2	Medium	4	2	Medium	18. Review frequency of crew rounds, sensors and door code	DTW
	4.2.7. Fire from	Injuries to crew, vessels	PA		3	3	Medium	4	3	High		

Node: 4. Passenger Loading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	Machinery space	damage, Smoke inhalation, escalation to vehicle deck	Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Smoke detectors									
			Heat detectors									
			Multiple Fixed FF systems									
			Crew patrol									
			Regular maintenance and inspection									
			Restricted access to machinery rooms/technical spaces									
			Structural fire protection									
			Spray shields (LOC controls									
			Permanently manned									
4.3. Vehicle striking other vehicles or people (passengers or crew)	4.3.1. Human error (mechanical faults/ distracted driver/passengers' behaviour-not following directions)	Injuries to passengers and crew, damage to vehicles, potential fire if fuel tank is damaged	Crew control the traffic	Incidents of passengers ignoring direction have been recorded on several vessels	3	4	High	2	4	Medium	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
		Injuries to passengers who in the car, damage to vehicles	Low speeds		3	2	Medium	2	2	Low	26. Communication with ferry user community on safety practices	DTW
			Crew training to not accept/ allow distracted drivers onboard									
			Follow DTW procedures for passengers who appear to be under the influence of drugs and/or alcohol									
4.4. Structural/ Equipment Failure	4.4.1. Structural failure (failure of upper deck) due to inadequate strength	Injuries to passengers, damage to vessel and vehicles, potential fire if vehicles fuel tanks are damaged	Maintenance of deck structure, designed to Class rules		4	1	Low	3	1	Low		

Node: 5. Transit and Berthing Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
5.1. Slip, trip and falls	5.1.1. Rolling motion and/or high waves	Injuries to passengers	Provision of wheel chairs for passengers with disabilities		2	2	Low				3. Confirm the limits for operation under rolling	DTW
			Crew patrol								5. Provide one handrail on each side of the stairwells (on MV Flanders)	DTW
			Hand rails for all stairs									
			Operational Limits for weather (at discretion of the captain)									
	5.1.2. Inadequate lighting, obsolete parts	Injuries to passengers	Regular Inspection to ensure lights are working properly		2	2	Low				6. Ensure availability of spares for light fixtures	DTW
			Emergency lighting provided									
	5.1.3. Passengers not following rules	Injuries to passengers	Crew patrol		2	3	Medium					
			Signage									
	5.1.4. Unsafe walking surfaces (door sills)	Injuries to passengers	Non-skid surfaces (stairs)		2	2	Low				12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	DTW
			Signage									
			Some portable ramps are provided									
	5.1.5. Snow, ice, rain, wet surfaces	Injuries to passengers	Proper house keeping		3	2	Medium					
			Ice control procedure (salting)									
			Exterior stairs closed down during the extreme weather conditions									
			Non-slippery surfaces									
			Crew patrol									
			Crew inspection and tool box talks									
			Communication between vessels and public									
	5.1.6. Physical limitations of passengers (medical)	Injuries to passengers	Provide wheel chair services to passengers as required		2	1	Low				2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			Crew patrol								14. Crew awareness for dealing with passengers with disabilities and/ or	DTW

Node: 5. Transit and Berthing Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
											medical conditions	
	5.1.7. Physical limitations of passengers (under the influence of drugs and alcohol)	Injuries to passengers	Crew patrol		2	2	Low					
			No alcohol and drugs policy for crew and passengers									
			Crew assistance for walking passengers									
			Follow DTW procedures for passengers who appear to be under the influence of drugs and/or alcohol									
	5.1.8. Passenger behaviour (Inappropriate footwear, carrying luggage while climbing stairs, lack of mobility support	Injuries to passengers	Signage to hold handrail provided in stairs of MV Legionnaire		2	1	Low				2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			PA to hold handrail provided in stairs of MV Flanders								8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	DTW
5.2. Fire	5.2.1. Smoking	Injuries to passengers and crew, vessel damage, smoke inhalation	Smoking in prohibited	Depend on the size, location and type of the fire; passengers could be stuck in the vehicles	4	3	High	2	3	Medium	16. Review emergency procedures during vessel operation (vessel specific) so that steps are clearer	DTW
			Signage								19. Review smoking policy and implementation	DTW
			Crew patrol									
			Sprinklers on activated manually									
			Smoke detectors in stairwells									
			Local fire department available for support									
			Fire alarms (visual and audio)									
			Emergency procedures									
			PA									
	5.2.2. Fire from Emergency Diesel Generator Room (EDG), Bunker	Injuries to passengers and crew, vessel damage, smoke inhalation	PA		4	1	Low	4	1	Low	24. Formalize procedures for captain to go to closest point of landing	DTW
			Emergency procedures									
			Fire alarms (visual and audio)									

Node: 5. Transit and Berthing Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	Station, etc.		Local fire department available for support Smoke detectors in EDG Heat detectors on vehicle deck Heat detectors in bunker station Sprinklers on activated manually and automatically Crew patrol Heat detectors on vehicle deck Regular Maintenance of the EDG Restricted access to machinery rooms/technical spaces Fire wall insulation (Passive)									
	5.2.3. Vehicle fire	Injuries to passengers and crew, damage to vehicles, escalation due to presence of fuel in vehicles	PA Emergency procedures Fire alarms (visual and audio) Local fire department available for support Heat detectors on vehicle deck Sprinklers on activated manually Crew patrol Heat detectors on vehicle deck		5	2	High	3	2	Medium		
	5.2.4. Fire in Lounges/ crew accommodation, public spaces (electrical appliances, heaters, washer and dryer/ electrical fires)	Injuries to passengers and crew, vessel damage, delaying operation	PA Emergency procedures Fire alarms (visual and audio) Local fire department		3	2	Medium	3	2	Medium		

Node: 5. Transit and Berthing Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			available for support									
			Heat detectors in laundry									
			Smoke detectors in lounges, crew accommodations									
			Sprinklers on activated manually									
			Portable fire extinguishers as per TC/ Approved fire plan									
			Ventilation shut down									
			Fire dampers									
			Structural fire protection									
			Crew patrol									
	5.2.5. Galley fire	Injuries to passengers and crew, vessel damage, delaying operation	PA		3	3	Medium	3	3	Medium		
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Heat detectors in galley									
			Sprinklers on activated manually									
			Portable fire extinguishers as per TC/ Approved fire plan									
			Ventilation shut down									
			Fire dampers									
			Structural fire protection									
			Crew patrol									
	5.2.6. Dangerous goods (Gasoline, Propane, Acetylene, Oxygen, potentially Dynamite)	Damage to vessels and vehicles, injuries to passengers and crew, explosion	Dedicated DG trips		3	2	Medium	5	2	High	17. Review and refresh TDG training	DTW
			Segregation as per DG rules									
			TDG training									
			Specific PA for TDG									
			Communication to									

Node: 5. Transit and Berthing Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			public regarding carriage of DG									
			All other fire control and detection systems as per TC/ Approved fire plan									
	5.2.7. Sabotage	Damage to vessels and vehicles, injuries to passengers and crew,	Crew patrol		4	2	Medium	4	2	Medium	18. Review frequency of crew rounds, sensors and door code	DTW
			Signage									
			CCTVs									
			All other fire control and detection systems as per TC/ Approved fire plan									
	5.2.8. Fire from Machinery space	Injuries to crew, vessels damage, smoke inhalation, escalation to vehicle deck	PA		4	3	High	4	3	High		
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Smoke detectors									
			Heat detectors									
			Multiple Fixed FF systems									
			Crew patrol									
			Regular maintenance and inspection									
			Restricted access to machinery rooms/technical spaces									
			Structural fire protection									
			Spray shields (LOC controls									
			Permanently manned									
5.3. Vehicle striking other vehicles or people (passengers or crew)	5.3.1.			Not applicable for this Node								
5.4. Structural/	5.4.1. Structural	Injuries to passengers,	Maintenance of deck		4	1	Low	3	1	Low		

Node: 5. Transit and Berthing Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
Equipment Failure	failure (failure of upper deck) due to inadequate strength	damage to vessel and vehicles, potential fire if vehicles fuel tanks are damaged	structure, designed to Class rules									
5.5. Striking berth/ other ships at berth	5.5.1. Human error	Damage to either or both vessels, damage to berth, injuries and fatalities for crew and passengers, loss or long delay of services, damage to vehicles	Communication protocol for ship and shore crew Best practice for incoming vessels to wait Training and competency/ proficiency		2	2	Low	2	3	Medium	20. Review and formalize the procedures for incoming vessels if other vessels are at dock	DTW
	5.5.2. Mechanical failure, power failure/ blackout	Damage to either or both vessels, damage to berth, injuries and fatalities for crew and passengers, loss or long delay of services, damage to vehicles	Regular maintenance and inspection Redundancies (multiple engines, thrusters, EDG on board) Emergency procedures Fendering on Dock Maintenance of the berth infrastructure		2	2	Low	2	3	Medium		
	5.5.3. Extreme weather/ environmental conditions (fog, visibility, wind, snow storm, sea state,)	Damage to either or both vessels, damage to berth, injuries and fatalities for crew and passengers, loss or long delay of services, damage to vehicles	Best practice for alternative berthing location in extreme weather Maintenance of the berth infrastructure Fendering on Dock Weather forecasts Training, proficiency and discretion of master		2	3	Medium	2	3	Medium	21. Review and formalize alternative berthing location in extreme weather	DTW
	5.5.4. Limited berthing space	Damage to either or both vessels, damage to berth, injuries and fatalities for crew and passengers, loss or long delay of services, damage to vehicles	Best practice for alternative berthing location in extreme weather Communication protocol for ship and shore crew		2	2	Low	2	2	Low		

Node: 5. Transit and Berthing Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			Best practice for incoming vessels to wait									
			Training and competency/ proficiency									
5.6. Grounding	5.6.1. Human error	Injuries, vessel damage (bottom hull), flooding, delay of service	Vessel navigation system	Reduced the EER effectiveness	4	2	Medium	4	2	Medium	9. Review the number of lanes on the vehicle decks of all vessels, in order to provide adequate width for walkways	DTW
			EER Procedure									
			Bridge watch									
			Navigational aids (lights)									
			Fog signals									
			Crew training and certification (familiarization with vessel)									
	5.6.2. Mechanical or power failure/ blackout	Injuries, vessel and vehicle damage (bottom hull), Flooding; delay of service	Vessel navigation system	Reduced the EER effectiveness	4	2	Medium	4	2	Medium		
			EER Procedure									
			Bridge watch									
			Navigational aids (lights									
			Fog signals									
			Crew training and certification (familiarization with vessel)									
			Regular maintenance and inspection									
5.7. Foundering	5.7.1. Power failure/ black outs	Excessive vessel motion leading to vessel and vehicle damage, injuries; delay of service	EER Procedure		4	3	High	3	2	Medium	25. Provide latching for vehicles	DTW
			Bridge watch									
			Crew training and certification (Familiarization with Vessel)									
			Regular maintenance and inspection									
			Mast lights NUC									
5.8. Sinking/	5.8.1. Flooding, Loss	Loss of vessel, Potential	EER Procedure	Location of	5	2	High	5	2	High	27. DTW rules regarding requiring	DTW

Node: 5. Transit and Berthing Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
Capsize and/or situation requiring Evacuation	of stability, Loss of propulsion, Extreme Weather, Fire and explosion	injuries and fatalities	Location of passengers close to embarkation decks	passengers impacts crews ability perform effective evacuation							passengers to vacate the vehicle during transit	
			Drills									
			Maintenance, testing and inspection of LSA									
			Provision of chair lifts									
			Damage control procedures									
			All other controls associated with list of causes									
5.9. Collision	5.9.1. Human error	Minor damage, minor injuries	Vessel navigation system	Impact to third party vessel is excluded in this study because passengers staying vehicles or not has no impact on this scenario	2	2	Low	2	2	Low		
		Major injuries, casualty, major damage	EER Procedure		5	2	High	5	2	High		
			Bridge watch									
			Navigational aids (lights)									
			Fog signals									
			Follow COLREG									
			Crew training and certification (Familiarization with Vessel)									
			Communication with nearby vessels as much as possible (Blow the horn)									
	5.9.2. Mechanical or power failure/ blackout	Minor damage, minor injuries	Vessel navigation system	Impact to third party vessel is excluded in this study because passengers staying vehicles or not has no impact on this scenario	2	2	Low	2	2	Low		
		Major injuries, casualty, major damage	EER Procedure		5	1	Medium	4	1	Low		
			Bridge watch									
			Navigational aids (lights)									
			Fog signals									
			Follow COLREG									
			Crew training and certification (familiarization with									

Node: 5. Transit and Berthing Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			vessel)									
			Communication with nearby vessels as much as possible (Blow the horn)									
			Regular maintenance and inspection									
			Redundancies (multiple engines, thrusters, EDG on board)									
			Life cycle management (Obsolete parts)									
	5.9.3. Ice berg	Major injuries, fatalities, major damage, flooding	Weather forecasts/ iceberg monitoring		4	1	Low	4	1	Low		
			Bridge watch									
			Navigational aids (radar)									
5.10. Green water	5.10.1. Extreme weather	Vehicle movement, injuries to persons in vehicles, vessel damage	Weather forecasts	Primarily in MV Flanders	4	3	High	3	3	Medium	27. DTW rules regarding requiring passengers to vacate the vehicle during transit	DTW
			Training, proficiency and discretion of master								28. Consider securing the cars during the extreme weather	DTW
5.11. Non Compliance with TC and International Regulation	5.11.1. Passengers remains in the vehicle on the Vehicle Deck	Not allowed to operate by TC, vessel not fit for service, non-conformance notes									15. Comply with regulations	DTW

Node: 6. Passenger Unloading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
6.1. Slip, trip and falls	6.1.1. Rolling motion and/or high waves	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Provision of wheel chairs for passengers with disabilities		2	2	Low	1	1	Low	5. Provide one handrail on each side of the stairwells (on MV Flanders)	DTW
			Crew patrol								3. Confirm the limits for operation under rolling	DTW
			Hand rails for all stairs									
			Elevators for disabled and medical personnel									
			Operational Limits for weather (at discretion of the captain)									
	6.1.2. Inadequate lighting, obsolete parts	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Regular Inspection to ensure lights are working properly		2	2	Low	1	1	Low	6. Ensure availability of spares for light fixtures	DTW
			Emergency lighting provided									
	6.1.3. Inadequate clearance in walkways in vehicle deck, corridors and passageways, elevators	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Corridor are designed as per CTA requirements	Hazard mostly on the MV Flanders	2	2	Low	1	1	Low	1. Provide handrails three walls of elevator (All ships)	DTW
			Signage								7. Procedures to ensure that walkways are clear of vehicles on the MV Legionnaire	DTW
											8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	DTW
											9. Review the number of lanes on the vehicle decks of all vessels, in order to provide adequate width for walkways	DTW
											10. Review loading procedures for person requiring Blue Zone parking	DTW
											12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	DTW
	6.1.4. Passengers not following rules	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Crew patrol		2	2	Low	1	1	Low		
			Signage									
	6.1.5. Unsafe walking surfaces (barriers such as ramps/ bumps)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Non-skid surfaces (stairs)		2	2	Low	1	1	Low	4. Provide non-skid surfaces on all stairs for all ships and provide high contrast tapes on all ship stairs	DTW
			Signage								11. Provide high contrast edge for mat in the vehicle deck near the passenger	DTW

Node: 6. Passenger Unloading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
											elevator on the MV Legionnaire	
											12. Provide portable ramps as per InclusionNL report including storage and handling procedures of ramps	DTW
											13. Review bumps and tripping hazards for rectifications	DTW
	6.1.6. Snow, ice, rain, wet surfaces	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Proper house keeping Ice control procedure (salting) Exterior stairs closed down during the extreme weather conditions Non slip surfaces Crew patrol Crew inspection and tool box talks Communication between vessels and public		3	2	Medium	1	1	Low		
	6.1.7. Physical limitations of passengers (medical)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Provide wheel chair services to passengers as required Elevator services Priority boarding for passengers with medical passes Crew patrol		2	1	Low	1	1	Low	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
											14. Crew awareness for dealing with passengers with disabilities and/ or medical conditions	DTW
	6.1.8. Physical limitations of passengers (under the influence of drugs and alcohol)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Crew patrol No alcohol and drugs policy for crew and passengers Crew training to not accept/ allow intoxicated passengers onboard. Crew notifies the captain for decisions Crew assistance for walking passengers		2	2	Low	1	1	Low		

Node: 6. Passenger Unloading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			Follow DTW procedures for passengers who appear to be under the influence of drugs and/or alcohol									
	6.1.9. Passenger behaviour (Inappropriate footwear, carrying luggage while climbing stairs, lack of mobility support)	Injuries to passengers, vehicle damage (passenger damaging the vehicle while falling)	Signage to hold handrail provided in stairs of MV Legionnaire		2	2	Low	1	1	Low	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
			PA to hold handrail provided in stairs of MV Flanders								8. Confirm adequate signage on board as per InclusionNL recommendations (i.e.: provide signage on MV Flanders to hold handrail provided in stairs)	DTW
6.2. Fire	6.2.1. Smoking	Injuries to passengers and crew, damage to vehicles, vessel damage, escalation due to presence of fuel in vehicles, Smoke inhalation	Smoking in prohibited		3	3	Medium	2	2	Low	16. Review emergency procedures during vessel operation (vessel specific) so that steps are clearer	DTW
			Signage								19. Review smoking policy and implementation	DTW
			Crew patrol									
			Sprinklers on activated manually									
			Heat detectors on vehicle deck									
			Smoke detectors in stairwells									
			Local fire department available for support									
			Fire alarms (visual and audio)									
			Emergency procedures									
			Stop loading									
			PA									
	6.2.2. Fire from Emergency Diesel Generator Room (EDG), Bunker Station, etc.	Injuries to passengers and crew, damage to vehicles, vessels damage, escalation due to presence of fuel in vehicles, Smoke inhalation	PA		2	2	Low	2	2	Low		
			Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Smoke detectors in									

Node: 6. Passenger Unloading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
			EDG									
			Heat detectors on vehicle deck									
			Heat detectors in bunker station									
			Sprinklers on activated manually and automatically									
			Crew patrol									
			Heat detectors on vehicle deck									
			Regular maintenance of the EDG									
			Restricted access to machinery rooms/technical spaces									
			Structural fire protection									
	6.2.3. Vehicle fire	Injuries to passengers and crew, damage to vehicles, escalation due to presence of fuel in vehicles	PA		3	2	Medium	2	2	Low		
			Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Heat detectors on vehicle deck									
			Sprinklers on activated manually									
			Crew patrol									
			Heat detectors on vehicle deck									
			Vehicles with leaky/ oil spills not allowed									
			Turn off engine when on deck									
	6.2.4. Fire in Lounges/ crew accommodation (electrical appliances, heaters, washer and	Injuries to passengers and crew, vessel damage, delaying	PA		2	2	Low					
			Stop loading									
			Emergency procedures									

Node: 6. Passenger Unloading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	dryer/ electrical fires)	operation	Fire alarms (visual and audio)									
			Local fire department available for support									
			Heat detectors in galley, laundry									
			Smoke detectors in lounges, crew accommodations									
			Sprinklers on activated manually									
			Portable fire extinguishers as per TC/ Approved fire plan									
			Ventilation shut down									
			Fire dampers									
			Structural fire protection									
			Crew patrol									
	6.2.5. Sabotage	Damage to vessels and vehicles, injuries to passengers and crew,	Crew patrol		4	2	Medium	4	2	Medium	18. Review frequency of crew rounds, sensors and door code	DTW
			Signage									
			CCTVs									
			All other fire control and detection systems as per TC/ Approved fire plan									
	6.2.6. Dangerous goods (Gasoline, propane, acetylene, oxygen, potentially Dynamite)	Damage to vessels and vehicles, injuries to passengers and crew, explosion	Dedicated DG trips		5	2	High	5	2	High	17. Review and refresh TDG training	DTW
			Segregation as per DG rules									
			TDG training									
			Specific PA for TDG									
			Communication to public regarding carriage of DG									
			All other fire control and detection systems as per TC/ Approved fire plan									
	6.2.7. Fire from	Injuries to crew, vessels	PA		3	3	Medium	4	3	High		

Node: 6. Passenger Unloading Phase-Passengers Occupy Vehicles

Hazard	Cause	Consequence	Effective Safeguards	Comment	Safety			Damage			Recommendations	Responsibility
					S	L	RR	S	L	RR		
	Machinery space	damage, Smoke inhalation, escalation to vehicle deck	Stop loading									
			Emergency procedures									
			Fire alarms (visual and audio)									
			Local fire department available for support									
			Smoke detectors									
			Heat detectors									
			Multiple Fixed FF systems									
			Crew patrol									
			Regular maintenance and inspection									
			Restricted access to machinery rooms/technical spaces									
			Structural fire protection									
			Spray shields (LOC controls									
			Permanently Manned									
6.3. Vehicle striking other vehicles or people (passengers or crew)	6.3.1. Human error (mechanical faults/ distracted driver/passengers' behaviour-not following directions)	Injuries to passengers and crew, damage to vehicles, potential fire if fuel tank is damaged	Crew control the traffic	Incidents of passengers ignoring direction have been recorded on several vessels	3	4	High	2	4	Medium	2. Provide a means of communicating GNL Marine Service Safety practices to the Public/ Passengers	DTW
		Injuries to passengers who in the car, damage to vehicles	Low speeds		3	2	Medium	2	2	Low	26. Communication with ferry user community on safety practices	DTW
			Crew training to not accept/ allow distracted drivers onboard									
			Follow DTW procedures for passengers who appear to be under the influence of drugs and/or alcohol									
6.4. Structural/ Equipment Failure	6.4.1. Structural failure (Failure of upper deck) due to inadequate strength	Injuries to passengers; damage to vessel and vehicles; potential fire if vehicles fuel tanks are damaged	Maintenance of deck structure		4	1	Low	3	1	Low		