Resilient Coast: Liquid Fuel Delivery to British Columbia Coastal Communities

Fall 2017

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Executive Summary

Coastal and island communities in British Columbia (BC) are highly dependent on maritime transportation to support their basic needs, such as fuel deliveries. Historically, coastal communities maintained substantial local caches of supplies; however, with the advance of integrated supply chains and more frequent scheduled maritime service, just-in-time delivery has become the norm for providers such as supermarket chains, acute healthcare facilities, and fuel suppliers. Thus, coastal communities will experience shortages of critical supplies any time regular maritime service is disrupted beyond the level that can be met using local caches. In a disruption, fuel is a critical commodity that is required not only by the public in general, but also for emergency response vehicles and facilities. Emergency management and planning for community resilience to disruptions therefore requires an understanding of how fuel is supplied and flows in the region. The region has had comparatively little direct experience with fuel supply chain disruptions and shortages. Publicly available information on the fuel system in BC is highly fragmented, inconsistent, and incomplete, thus posing a critical information gap for emergency planning.

This report provides a characterization of the fuel supply chain in the south coastal region of BC. It addresses questions such as how much fuel is consumed in the region, where it originates from, how it is conveyed to this region, and how it is transported to coastal communities. It further characterizes how different communities may be vulnerable to supply disruptions, and how organizational considerations related to governments and the private sector influence the vulnerability of the fuel supply chain. This report draws on multiple sources of information: publicly available reports and statistics, expert interviews, stakeholder surveys and workshops, and satellite data on ship tracks. While numerous data gaps, inconsistencies, and questions remain, the report offers a system-wide overview of the fuel supply chain in coastal BC and identifies issues important for emergency planning.

The Lower Mainland serves as BC's main multi-modal hub for liquid fuel transportation. Currently, most of the fuel arriving in the Lower Mainland is consumed in the south coastal region of BC after arriving as refined products imported from Alberta and Saskatchewan by pipeline and rail. Secondary sources of imported products include crude oil from Alberta and Saskatchewan that is refined at the Chevron Stanovan facility in Burnaby, BC, and refined products transported from the Puget Sound region of Washington State by marine barges and, at peak demand periods, supplemented by tanker trucks. Five facilities receive petroleum products that are destined for local consumption: the Chevron refinery, and four marine fuel terminals on Burrard Inlet.

From the fuel terminals, the petroleum products are distributed throughout the BC south coastal region via a multi-modal supply chain. Except for aviation fuel, delivered directly to the Vancouver International Airport (YVR) via a dedicated pipeline, the refined products are
distributed throughout the Lower Mainland via tanker trucks. The majority of fuel destined for Vancouver Island is barged directly from the marine fuel terminals at Burrard Inlet. Fuel destined for coastal BC communities, and to a lesser extent to Vancouver Island, is trucked to docks on the Fraser River, transported by barge to coastal communities, sometimes stored at distribution stations, and finally brought to gas stations and end users by truck. A handful of companies provide the maritime transport service, using different docking locations, routes, vessel types, and equipment. For the most part, the marine transportation network for fuel is separate from the passenger ferry network and involves different companies, routes, vessels, and service frequency.

BC coastal and island communities are vulnerable to disruptions in differing ways. Operational decisions to use just-in-time delivery in BC and the size of local demand in comparison to the delivery vessel’s capacity are two key factors leading to differences in fuel disruption vulnerability. In addition, the location where the community is situated within the supply chain is critical; a community that receives direct deliveries from Burrard Inlet may be less vulnerable than those communities that are situated at the end of the supply chain. As well, communities that receive infrequent deliveries are highly dependent on when in the supply cycle the disruption occurs and the resupply protocol of the local community. Finally, smaller communities may have less purchasing power and priority for delivery than larger communities in the event of an imminent regional fuel shortage.

Planning for fuel disruptions should engage organizations involved in the fuel chain on a regular basis, as well as those that would become involved in the event of a disruption. During day-to-day operations, the supply chain is run by the private sector with essentially no direct government involvement. In response to an event, meeting the energy needs of emergency services is critical. While, the Provincial government has authority to take over the fuel supply management during these events, there has been no pre-planning or engagement with suppliers, emergency response or municipal government stakeholders for such an action.

Administratively, response to disruption will require all levels of government to work in concert and rely heavily on the private sector for recovery. However, institutional barriers have hindered pre-planning and there are currently no contracts in place for private sector services essential to rapid response and early recovery. Different segments of the fuel supply chain are not in regular contact with one another and the private sector has been largely absent from emergency planning. The complex decision-making process and lack of pre-planning will exacerbate losses and delay recovery in the event of a disruption.
There is a critical need in BC for informed, concerted, and coordinated planning for potential fuel disruptions. The following recommendations are drawn directly from the findings in this report:

1. The provincial government should lead detailed pre-planning efforts for potential fuel disruptions that enable rapid and coordinated emergency response across local, provincial, and federal governments. In particular a detailed fuel prioritization plan is needed.

2. Planning efforts should directly engage all stakeholders -- especially private sector organizations involved in day-to-day fuel delivery -- to ensure greater preparedness and fuel allocation priorities for emergency services and to meet expectations of the general public in the event of a disruption.

3. Planning efforts should include all BC coastal communities, particularly those that rely on maritime transportation to deliver fuel from the Lower Mainland hub.

4. Formal agreements should be put in place with conveyers of critical information identified and alternative suppliers outlined, prior to an emergency situation occurring.

5. Planning efforts should be based on robust information about the fuel supply chain in normal and emergency situations. Key information gaps such as fuel reserve volumes, storage facility vulnerabilities, and fuel-pumping capacities during power outages require additional investigation.

6. Assessments should be made on the different types of potential disruptions and the effects these disruptions would have on the supply chain.

7. A better understanding is needed of how the demand for fuel may change during both an emergency event and a supply chain disruption.

8. Planning for fuel supply disruptions must take a system-wide perspective on vulnerability and resilience-building opportunities, considering not only physical networks and their functional operations but also the organizations, rules, and relationships involved in how the system would respond to a disruption.
1. Introduction

Fuel is necessary for a broad spectrum of societal functions, from the movement of people and goods to heating, industry, commerce, and allowing for social services such as emergency response and health care to be provided. Coastal and island communities in British Columbia (BC) are highly dependent on maritime transportation to support their basic needs, such as the transportation of fuel. Without a well functioning supply chain these communities are highly vulnerable to supply shortages and associated disruptions in societal functions.

In day-to-day operations, the fuel supply chain is run by the private sector using an integrated supply chain. Just-in-time delivery is used in large communities to meet fuel needs without the need for substantial local caches. Smaller communities, such as Hartley Bay, rely on deliveries to be made on an as-need basis, typically once per month with quantities determined based on anticipated demand. Thus, coastal communities will experience shortages of fuel any time regular maritime services is disrupted beyond the level that can be met using local caches and anticipated demands. While the fuel supply chain is typically run by the private sector, in a disruption government involvement greatly increases, and the provincial government can claim eminent domain over fuel supplies in order to meet emergency response needs.

Previous disruptions in Canada and around the world have demonstrated how fuel transportation systems can be disrupted in extreme events, the consequences of the ensuing fuel shortages, and the importance of planning for such fuel emergencies. Natural disasters, such as hurricanes, can damage pipelines and refineries, and shut down ports and fuel terminals. They may also obstruct shipping channels from above (e.g., collapsing bridges) and below (e.g., slumping mud banks). In the emergency response to Hurricane Sandy, fuel shortages became both a logistical and a public relations concern (Smythe, 2013). In Japan's 2011 earthquake, tsunami, and nuclear disaster, fuel shortages compounded emergency response difficulties (Holguín-Veras et al., 2014). In summer 2015, Nova Scotia experienced a temporary fuel shortage when the main marine fuel terminal shut down unexpectedly for three days; an investigation found that public health could have been affected had the outage lasted a day longer (MacNeil & Keefe, 2015).

While the BC region faces many hazards that could disrupt fuel supply and distribution, it has had comparatively little direct experience with fuel shortages. Indeed, the only experience that participants in this study could recall was a 2007 flood in northern BC, in which a highway closure halted fuel deliveries by truck and threatened a fuel shortage in Prince Rupert. In this event, the Province arranged an emergency diesel fuel delivery by a Canadian Coast Guard vessel, and the city arranged for a barge delivery from a major fuel company. However, it is noted that the region is not adequately prepared for a fuel disruption that is of any greater scale (Auditor General of British Columbia, 2014; AIR Worldwide, 2013).
Recognizing the importance of fuel system vulnerabilities, numerous states and local governments in the United States have been planning for fuel disruptions through energy assurance and emergency planning. Particularly relevant for BC are the efforts in Washington State, specifically the State's Energy Assurance and Emergency Preparedness Plan (Energy Policy Office, 2013) and the Puget Sound Regional Supply Chain Resilience Project's workshop on regional fuel distribution (RCPGP, 2014). In BC, there is a critical need to plan for potential fuel disruptions. However, to date, planning for fuel emergencies has been limited and ad hoc.

The government has many roles in the fuel transportation system. In the event of a disruption involving multiple stakeholders, it is expected that government agencies will lead the response. In a large-scale event, governments also have the power to make resource arrangement and allocation decisions. In general, while the government is expected to step in during an emergency, it plays a limited role in normal supply chain operations.

No government entity has engaged with the entire fuel supply chain, particularly the private sector that is ultimately responsible for restoring integrity to fuel supply after a disruption. Recent efforts that addressed maritime commerce resilience (Maritime Commerce Resumption Committee (MCRC), 2010; Transport Canada, US Coast Guard, Pacific Northwest Economic Region, 2012) did not focus on fuel supply and distribution. There have been four key impediments to systematic pre-planning:

- Absence of a basic description of the fuel transportation system;
- Absence of an understanding of BC’s coastal fuel network and its vulnerabilities;
- Characterization of the needs for effective emergency response (in fuels, materials and personnel);
- Institutional barriers to contracting with the private sector, defining their roles in response to emergencies.

In this report we make initial steps to characterize the fuel supply chain in the south coastal region of BC. This includes how much fuel is transported and consumed in the region and who the critical service providers are. Community vulnerability is assessed through the potential for supply disruptions and how the governance structure influences the vulnerabilities within the fuel supply chain.

The report will directly benefit emergency planning in the local, provincial, and federal governments as well as the private sector involved with the fuel supply chain. Resilience of the fuel supply network is vital to minimizing the impact of disruptions and ensuring rapid resumption of normal social and economic activities. Without this forethought, coastal communities will find themselves under substantial and protracted stress in the wake of a supply chain disruption.

This report is organized as follows. Section 2 summarizes the data sources. Section 3 describes the
fuel imports received in the Lower Mainland. Section 4 examines the distribution of fuel from the local fuel refinery and mainland terminals to smaller terminals on Vancouver Island and distribution centers. Section 5 depicts the coastal community dependence on marine transportation for fuel supply. Section 6 provides a description of the stakeholders and their perception of the transportation network. Finally, Section 7 outlines the report's recommendations and conclusions. As a whole, the focus of the report is on the role of maritime transportation of fuel to coastal communities.
2. Data Sources

To gain a broad understanding of the fuel network, a University of British Columbia research team gathered data from 2015-2017 through expert interviews, stakeholder workshops, a stakeholder survey, and satellite tracking of ship movement. Publicly available reports, websites, and media accounts were also gathered.

Nineteen interviews with twenty-eight key stakeholders were completed to achieve a representative sample of the fuel supply system. The interviewees included representatives from municipalities in the Georgia Straight region, emergency response organizations, shipping and transportation companies, and port authorities. Interviews focused on understanding fuel distribution throughout the region, operations management, emergency response planning, and foreseen weaknesses in the maritime fuel transportation system. These interviews were conducted between February 2015 and March 2016. A full list of interviewees can be found in Appendix II.

Taking key themes that were raised during the interviews, two stakeholder workshops were held in conjunction with the Annual MEOPAR Strait of Georgia Marine Hazards workshop; one in May 2015 and the other in December 2016. These workshops were designed to report our initial findings to stakeholders and to elicit responses to survey-based questions. To allow those unable to attend the workshop to participate in the survey, a link to the survey was also emailed to stakeholders.

Publicly available data and reports were utilized to understand fuel facility locations, capacities, fuel transportation operations, and to estimate the quantity of fuel flowing within the province. Automatic Identification System (AIS) satellite data was also used to track commercial shipping vessel movement; specifically, for vessels transporting fuel. This data was provided through the MEOPAR – ExactEarth partnership agreement. Combined, these data sources allowed for estimates to be made regarding fuel distribution throughout the region.

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1 Initial data analysis was conducted by C. Hilliard at MEOPAR.
2 Parkland announced in April 2017 their intent to purchase the Chevron refinery and associated assets for $1.5B. (http://globalnews.ca/news/3387420/parkland-to-buy-chevron-fuel-assets-for-1-5b/)
3. Fuel supply to the region

The quantity of oil production within British Columbia is insufficient to supply the local demand, making the Province dependent on imported fuel. The fuel distribution chain typically starts in distant sites and reaches BC by pipeline, rail, road, and maritime transportation. This is depicted in Figure 1, below.

Figure 1. Fuel distribution on the Southern Coast of BC

Unlike most other advanced economies, Canada does not publish detailed data on energy production or consumption on an annual basis. Therefore, there are no complete and coherent energy balance tables at the federal, provincial or regional levels. Data available from various private sources in Canada and the US and the US Energy Information Administration have been stitched together here to arrive at a quasi-coherent (yet still incomplete) picture.

Accurate and up-to-date estimates of the supply and demand of fuel are crucial in the development of regional emergency plans. While the goal of this report is not to offer exact estimates of fuel flows in the Province, this section summarizes efforts to catalogue the main suppliers, distributors, and consumers of fuel in the region. The information presented in this section is based on publicly available data, indirect information, and reasonable assumptions. The gaps present in this data emphasize the challenges of this task.
3.1 Fuel consumption

An indirect estimate of fuel consumption per capita in Canada can be obtained from the 2016 population data collected by Statistics Canada (Statistics Canada, 2016a) and the 2016 Canadian Association of Petroleum Users report on refined fuel consumptions (Canadian Association of Petroleum Products, 2016). Combined, these reports show the average Canadian consumes 18 barrels (bbl) of liquid fossil fuel per year.

In BC, the most recent appraisal of liquid fuel consumption was found to be 181,000 bbl/day in 2009. With the average per capita consumption being recorded as 15 bbl/year (Minister of Industry, 2013). Concurrently, StatsCan data for 2015 reported gasoline sales at 80,200 bbl/d and diesel sales at 31,900 bbl/d (Statistics Canada, 2016b). Though these are approximations, per capita consumption data can be used in inferring fuel flows in the absence of direct data. A summary of the fuel demand for key coastal regions in British Columbia can be found in Table 1, below.

The overall consumption pattern has been categorized into three leading sectors by StatsCanada - Industrial, Transportation, and Other. "Other" includes, but is not limited to, pump sales, agricultural, residential, public administration, and other institutional means. Across Canada, approximately 85% of the fuel consumed is used for transportation, while industrial activities accounts for 10%, and other sectors account for 5% of total consumption (Statistics Canada, 2016b).

<table>
<thead>
<tr>
<th>BC Coastal Region</th>
<th>Demand (bbl/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Mainland</td>
<td>139,660⁹</td>
</tr>
<tr>
<td>YVR Airport</td>
<td>45,000⁰</td>
</tr>
<tr>
<td>Vancouver Island</td>
<td>40,537⁶</td>
</tr>
<tr>
<td>Powell River</td>
<td>902⁶</td>
</tr>
<tr>
<td>Mid Coast</td>
<td>336⁶</td>
</tr>
<tr>
<td>North Coast</td>
<td>361⁶</td>
</tr>
</tbody>
</table>

Notes:
- ⁹ - based on average per capita demands
- ⁶ - Brown (2016)
3.2 Sources and conveyance of fuel

The approximate quantities of crude and refined oil movement within the Lower Mainland are depicted in Figure 2. This fuel flow diagram represents annually averaged flows. There are significant seasonal variations in volume and type of fuel demanded. In winter, demand is for heating and power generation is highest, particularly in remote regions where diesel is predominantly used for generating electricity. In other seasons, forestry and mining operations are more active and travel demand (tourism) is at a peak, while warmer temperatures reduce heating demand and longer daylight hours lead to lower electricity demand, fuel requirements remain high throughout the summer.

The bulk of liquid fuels used in the province is imported from Alberta and Saskatchewan via pipeline and railcars. In addition, BC imports refined products from Washington State via marine barges and, at peak demand, tanker trucks. A small amount of conventional crude oil, approximately 11,000 bbl/d, is produced in BC and refined at the Husky Energy, Prince George Refinery. BC also exports crude oil to Washington State, USA via pipeline and marine transportation.

Figure 2. Sources and conveyances of fuel in the South Coast BC
The Kinder Morgan Trans-Mountain Pipeline (TMPL) is the only pipeline crossing the Rocky Mountains. The pipeline begins near Edmonton, Alberta and stretches 1150 km to its end points on the Burrard Inlet and Puget Sound, Washington State, USA. TMPL is capable of carrying crude and refined fuel in batches with the reported capacity of 300,000 bbl/d.

Once in BC, fuel products from the Kinder Morgan pipeline are delivered to the Kinder Morgan Burnaby Terminal for temporary storage and distribution (capacity 1,680,000 bbl or roughly 9 days of the supply to the lower mainland via the TMPL). Local pipelines are used to transport the fuel to local fuel terminals or to the Chevron refinery. Fuel destined for export is transported to the Westridge Marine Terminal (capacity 395,000 bbl). In addition, significant quantities of crude oil and semi-refined products are exported to refineries in Puget Sound, Washington State (Kinder Morgan, 2015a). The locations of these terminals are shown in Figure 3.

![Figure 3. Main fuel terminals in the south coast BC](image)

The increasing demand for oil products and the closure of smaller, local, refineries has led the demand of fuel in BC to vastly exceed the local production capacity. This puts dependence on TMPL and external forms of fuel transportation to meet local demand. For example, in 2009, 52,000 bbl/d of oil products were transported to BC by rail. By 2013, this volume increased to 80,000 bbl/d (Pynn, 2015). Today, rail transports approximately 35% of all BC’s petroleum products coming from Alberta, Saskatchewan, and Washington State. Rail transportation of fuel is
expected to continue to grow in relation to demand in the coming years (Canadian Association of Petroleum Producers, n.d.)

While pipeline and rail supplies the majority of fuel imported to the Lower Mainland, some of the refined products - notably Jet A - are exported from Puget Sound via tanker or barge and arrive in BC at the Westridge Marine Terminal in the Burrard Inlet. Truck transportation from Puget Sound is also used to deliver fuel to the Lower Mainland, particularly to the YVR airport.

Once the petroleum products arrive in BC, the fuel is destined for either the local refinery, one of three fuel terminals, or the YVR airport for local consumption. Semi-refined and crude products arriving in the province via TMPL are delivered to the only local refinery still in operation, Chevron Stanovan, in Burnaby. Chevron Stanovan has a refining capacity of 57,000 bbl/d, is responsible for nearly 30% of the province’s gasoline (Moreau, 2012), and supplies about 40% of the fuel consumed by YVR airport using the Trans-Mountain Jet Fuel pipeline (Vancouver Airport Fuel Facilities Corporation, n.d.). The Chevron Stanovan terminal is also directly connected to the CN railway (Pynn, 2015) and receives approximately 8,000 bbl/d by rail (Pynn, 2013).

The three fuel terminals in the Lower Mainland are owned and operated by independent providers. Refined products delivered via TMPL are destined to Suncor Oil, on the Burnaby-Port Coquitlam border, and for domestic fuel needs (Moreau, 2012). Imperial Oil (IOCO) Esso, in Port Moody, is supplied mostly by rail from Edmonton with a focus on Marine Gas Oil (used by tugs and ferries), diesel flux, intermediate, and bunker fuel (City of Port Moody, n.d.). Finally, Shell owns and operates the Shellburn Terminal located in Burnaby and focuses on meeting local demand. The Shellburn Terminal receives fuel from barges or ships coming from the USA and rail from Alberta and does not use the TMPL (Moreau, 2012).

The YVR Airport receives fuel from trucks and barges coming from the USA. An average of 25 truck deliveries are received at YVR daily, with up to 35 deliveries being made during peak periods, such as summer and holiday periods (Vancouver Airport Fuel Facilities Corporation, n.d.). In addition, barges deliver fuel to the Westridge Marine Terminal where it is combined with fuel from the Chevron Stanovan fuel terminal and sent via the Trans-Mountain Jet Fuel pipeline to YVR.

Figure 2, above, provides an overview of BC’s dependence on refined product deliveries from refineries in Alberta and Puget Sound, with the width of each connecting line displaying the level of dependency by product type. Table A.1 in Appendix I, which is calculated from Statistics Canada data for 2016, provides an overview of major products used in BC and the ratio of domestic sales to local production and imports from Alberta and Puget Sound. The imbalances in the data and the disparities between figure 2 and the table in Appendix I indicate that a significant part of regional fuel flow remains unknown. This is labeled as ‘unknown’ and shaded in black in Figure 2. There is no complete and coherent available data about volumes, origins, destinations, and transportation modes, indicating a critical gap in knowledge.
4. Fuel distribution within the region

Once the fuel is delivered to BC, it is distributed across the Southern Coast using both land and marine transportation (see Figure 1, above). Fuel destined for the Lower Mainland is transported directly from the distribution centers by land delivery. Fuel for coastal communities is first transported from distribution centers to nearby marine docks by pipe or truck, and then shipped to the destined ports for local distribution.

4.1 Land

A handful of companies truck fuel from storage facilities to the docks for marine transport to coastal distribution points and ultimately, end-users. Parkland Industries Ltd. manages a large proportion of fuel distribution originating at BC’s storage and refining facilities. The contract for fuel is between Parkland and the refinery. Parkland draws fuel from their multiple suppliers as available and needed.\(^2\) Independent distributors of commercial fuels hold contracts with Parkland, who allocates the fuel resources between their customers. At any time, Parkland can hold fuel contracts with multiple distribution terminals, allowing flexibility in supply in the event of a minor fuel disruption or delay at one of these centers.

Parkland has used this flexibility in fuel sourcing in the past to ensure uninterrupted supply of fuel. For example, when Imperial Oil Terminal had a failure at its racks, Parkland redirected some of its clients to the Shell Terminal to obtain their fuel requirements. Due to the contractual relationships of Parkland, switching from one supplier to the other had no effect on overall relationships and the end user benefits from a more reliable supply of fuel.

Pipelines are also prevalent in the transfer of oil from storage facilities to barges and marine tankers, and from dockside ships to nearby tank farms. For example, the Vancouver International Airport is served via Kinder Morgan Trans-Mountain Jet Fuel (TMJ), a dedicated 41 km pipeline between Chevron Burnaby, Westridge Marine Terminal, and Vancouver International Airport (Kinder Morgan, 2015b). Chevron provides close to 50% of the aviation fuel transported via TMJ to the airport. A similar volume is delivered by tanker or barge to Westridge Marine Terminal. However, during peak times, additional supply is provided to the airport by up to 35 tanker trucks per day (over 8000 bbl/d) from Cherry Point refinery in Washington State.\(^3\) Aside from these services, there are additional trucking services between Cherry Point, Washington State, and prominent locations in BC.

\(^2\) Parkland announced in April 2017 their intent to purchase the Chevron refinery and associated assets for $1.5B. (http://globalnews.ca/news/3387420/parkland-to-buy-chevron-fuel-assets-for-1-5b/)

\(^3\) A new, higher capacity fuel delivery system is under development on the South Arm of the Fraser. The new facility would receive fuel by barge from Puget Sound and deliver fuel via a dedicated (larger) pipeline to the airport. This new route changes the nature of events that could disrupt fuel supply to the airport, but increases resilience if the pipeline from Burrard Inlet remains operational in a disruption.
Once the fuel arrives to coastal communities by marine transportation, trucks are the last link in fuel delivery. In the case of tanker vessels, trucks deliver fuel from local storage tanks to fuel retailers and end-users. Moreover, in the case of roll-on roll-off ships, tanker trucks are key at both ends of the supply chain; trailers can also be used directly from barges. Trucks transport fuel to gas stations and local businesses, dispensing fuels to the capacity of the recipient’s onsite tanks. In the Lower Mainland, twelve registered companies advertise transportation of fuel. Of these, several distribute fuel exclusively from refineries and storage facilities to the Lower Mainland. Some, however, service both the mainland and island or coastal communities. The majority of these are independently owned, although some companies are a subsidiary of a larger fuel company and exclusively transport their products.

4.2 Marine transportation

Fuel barges and marine tankers are both utilized to serve BC coastal communities. The larger corporations use marine tankers which are loaded and unloaded at a dock by pipeline. Service to medium and smaller communities use roll-on-roll-off inventory, and barges carry fuel in trailers. This portfolio of marine vessels provides flexible transportation options to meet the needs of end-users. They require far less fixed infrastructure but need cleared shipping lanes, safe harbours, docks and mechanisms to deliver cargo to shore.

Automatic Identification System (AIS) satellite data can permit the most accurate micro-data collection on each fuel delivery. Ships above 300 tons are obligated to have an operating AIS transponder on board, allowing real-time tracking. Most fuel deliveries in BC use tugboats pulling fuel barges. Figure 4 displays a map of movements for 81 vessels along 381 routes during 2015. While tugs may be tracked by AIS, since a tug may be pulling any of a fleet of fuel barges with different capacities, and fuel barges do not carry individual AIS transponders, it is not possible to use the AIS data to make an accurate estimate of total fuel flows.
Figure 4 highlights the major distribution centers on Vancouver Island, namely, ESSO Nanaimo, Suncor Nanaimo, Shell Chemainus and Chevron Cobble Hill. Various marine vessels frequently visit the distribution centers to support the nearby communities, while rural communities receive fewer fuel deliveries to meet supply needs.

Based on the AIS tracking data, the number of distinct vessels and the number of visits each vessel makes can be estimated for each distribution center (Table 2, below). By gathering the vessel characteristics, the volume of fuel being transported during a delivery can also be estimated. This information is then combined to calculate the amount of fuel destined for each distribution center. However, as mentioned above, the AIS data does not identify which barge was used and we have used average capacities of fleets of barges owned by different tug-boat owners / operators. Instead, we present estimated shares of fuel deliveries to each distribution center, as shown in Table 2.
Table 2. Frequency of deliveries to Fuel Distribution Centers on Vancouver Island*

<table>
<thead>
<tr>
<th>Island distribution center</th>
<th>Number of distinct vessels</th>
<th>Deliveries per year</th>
<th>Percentage of Fuel Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESSO Nanaimo</td>
<td>7</td>
<td>121</td>
<td>36.0%</td>
</tr>
<tr>
<td>Suncor Nanaimo</td>
<td>7</td>
<td>82</td>
<td>40.1%</td>
</tr>
<tr>
<td>Shell Chemainus</td>
<td>8</td>
<td>23</td>
<td>5.5%</td>
</tr>
<tr>
<td>Chevron Cobble Hill</td>
<td>10</td>
<td>95</td>
<td>18.5%</td>
</tr>
</tbody>
</table>

*Courtesy of C. Hilliard, MEOPAR. Estimates are for fuel delivery, inferred from AIS vessel tracking data for one year.

Several shipping companies transport fuel within the Southern Coast of BC, each with its own routes and service areas. It is critical to note that the marine network of fuel transportation is separate from passenger services and the general freight network. Each company involved in the fuel transportation system uses different routes, ships, and frequencies. This is summarized below and depicted in Figure 5.

- Island Tug and Barge (ITB) is the largest bulk transporter of refined fuel in the West Coast. Deliveries are made from Burrard Inlet terminals to Vancouver Island, Kitimat, Prince Rupert and other coastal communities.

- City Transfer offers truck and barge shipping services. Their ships depart from Richmond, where products destined to Powell River, including fuel and other goods, are collected and dispatched.

- North Arm Transportation ships fuel from barge loading facilities on Mitchell Island, Metro Vancouver to small communities along the Mid and North Coast of BC. Their operations cover coastal BC, from Vancouver to north of Prince Rupert, but they do not operate on Vancouver Island. North Arm Transportation supplies two scheduled barges a month, one to the Mid-Coast in a 10 to 12-day trip and one to the North Coast, including the Haida Gwaii archipelago, in an 18-day trip. Deliveries are also made to a range of small coastal communities and two BC Hydro generating stations on an as needed basis.

- Seaspan dominates bulk and hazardous cargo shipments with Seaspan Marine (tug boats and barges) and Seaspan Ferries (drop trailer ferries). Operations occur between mainland terminals, located at Tilbury (in Delta) and Surrey, and Vancouver Island terminals, located at Duke Point and Swartz Bay. Seaspan Ferries uses roll-on-roll-off drop trailers for a small share of fuel delivery.

- BC Ferries’ ships can move fuel, but only on separate sailings from passenger runs. These additional regulations are cost-prohibitive, and trucking companies prefer to use other marine transportation options.
Figure 5. Selected routes of maritime fuel transportation for prominent companies
5. Communities dependent upon marine transportation

Coastal and island communities in southern BC rely heavily on the maritime transportation system to support their basic needs. These communities vary in size, connectivity, and frequency of delivery (from daily to monthly), as shown in Table 3. On-site storage facilities provide fuel supply security and are managed in accordance with the local delivery frequency. Each tank owner-operator has its own fuel inventory management strategy – some keep their tanks as close to full as the supply-demand permits, while others keep a smaller inventory to minimize costs. Improved fuel inventory strategies and post-disruption supply management can lead to significant enhancement in community resilience.

Table 3. Fuel demand and supply frequency of refined products, by BC Coastal region*

<table>
<thead>
<tr>
<th>BC Coastal Region</th>
<th>Demand (b/d)</th>
<th>Frequency of Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancouver Island</td>
<td>40,537</td>
<td>Daily</td>
</tr>
<tr>
<td>Powell River</td>
<td>902</td>
<td>Two or three times per week</td>
</tr>
<tr>
<td>Mid Coast</td>
<td>336</td>
<td>Monthly</td>
</tr>
<tr>
<td>North Coast</td>
<td>361</td>
<td>Monthly</td>
</tr>
</tbody>
</table>

For communities dependent on maritime fuel deliveries, vulnerability of fuel shortages is dependent upon the local storage capacity, the inventory management strategy used in the local community, and the speed with which emergency response can resume fuel delivery. This can be assessed in terms of the number of days' supply of fuel that is in storage. Note that the daily demand for fuel may differ between the emergency response period and business-as-usual days. The implications for vulnerability and resilience to disruption are depicted in three representative community types:

1) Large population centers on Vancouver Island rely on just-in-time delivery, with tank farms being replenished on a daily basis. The limited storage of fuel means that only a minimal number of days' worth of fuel are stored in the local communities. However, these communities have a high fuel demand, allowing them to independently negotiate fuel deliveries from alternative suppliers (IBI Group 2010).

2) Medium-sized, semi-remote communities typically place orders as needed (twice to three times per week) and are delivered via a supply chain, so that individual communities further down the fuel supply chain are subject to more points of potential disruption.

3) Remote communities on the Mid and North Coast use diesel power generation which is supported by monthly fuel shipments. For this reason, these communities tend to keep large fuel reserves on site that are consumed as the month progresses. This is then re-supplied in large quantities, allowing for direct deliveries to be made from the
distributors located in the Lower Mainland. Smaller communities' capacity to handle fuel disruptions is greatly dependent on when in the fuel delivery cycle a disruption occurs. Interruptions in supply that happen right after a delivery will be less severe than a disruption in the fuel supply chain that happens near the end of the cycle (i.e., right before a new delivery, when reserves are low).

Communities with multiple days of supply in reserve can adopt strategies within their authorities to respond to fuel shortages. In an emergency context, the community can restrain the fuel consumption to the volume that is sufficient to satisfy only emergency and essential services. Organizations and facilities that provide emergency services, such as medical, fire and police, can be given priority to use the existing fuel reserves. The strategy could significantly reduce the local fuel consumption while ensuring the essential operations and order of the community.
6. Organizations involved in the fuel transportation system

Fuel transportation within BC is a shared responsibility involving many organizations. During day-to-day operations, the supply chain is run by the private sector with oversight from provincial and federal regulators. As described in detail above, five major oil and gas corporations (Imperial Esso, Suncor Energy, Shell Canada, Chevron Canada, and Kinder Morgan) supply the fuel that enters BC, using pipeline, rail, truck, and marine tankers. Within the Province, a multitude of local distributors delivers refined fuel to local communities; this is done by the shipping and trucking industry. When marine transportation is involved, local ports become key hubs in the supply chain as all fuel destined to maritime communities must flow through a small number of ports. This is particularly the case for shipping fuel to Vancouver Island and semi-remote and remote communities in northern British Columbia that are dependent on sea transportation for all liquid fuel deliveries. An initial list of key stakeholders in the fuel supply chain is provided in Appendix III.

During normal operations, the government has no direct involvement with the fuel supply chain. However, oversight is provided by key government agencies to ensure the safe transportation of fuel. These include Transport Canada, Public Safety Canada, the Canadian Coast Guard, and the BC Ministry of Transportation and Infrastructure.

In the event of an emergency, the level of government involvement increases with a range of government departments and organizations potentially playing a role in response and recovery efforts. These include: Transport Canada, the Canadian Coast Guard, the Department of Fisheries and Oceans, Environment and Climate Change Canada, the Department of National Defense, Public Safety Canada, Emergency Management British Columbia, BC Ministry of Transportation and Infrastructure, local emergency management offices, local port authorities, and marine emergency response organizations. The private sector, including the shipping and trucking industries, also plays a role in protecting proprietary assets, serving customers, and maintaining business function; see Appendix III. Within Canada, it has been the norm to have many organizations come together during a disruption to make decisions regarding emergency response. This has proven to hinder response efforts due to the ad hoc nature of planning and the sheer number of stakeholders involved.

If a State of Emergency is declared in the Province, the provincial government has rights under the Emergency Program Act to procure assets in the Province needed for emergency response, including fuel. For this shift of power to be successful, extensive pre-planning is required, including negotiations, signed contracts, and general engagement with all stakeholders. At this point, this pre-planning does not appear to have been completed, nor does it appear to be a priority for immediate action. For instance, there are no contracts in place for the use of private sector services and assets by government agencies or pre-established negotiations between fuel suppliers, local delivery companies, and emergency management agencies. This includes limited forethought into and communication about how fuel will be prioritized and rationed to ensure that emergency
response activities and priority organizations receive the fuel supply they require to operate.

Of additional concern, different segments of the fuel supply chain do not appear to be in regular contact with one another. The land and marine systems are operated independently, and both are removed from emergency response planning. As summarized by two stakeholders interviewed in this study, current plans are “very fragmented and siloed in terms of coordinated awareness and performance sharing” and “they don’t know our plans and we don’t know their plans.” Some interviewees recalled that in the lead-up to the 2010 Olympics, emergency response was a priority for government agencies; however, this attention has not continued.

These findings are supported by survey responses, most of which were from government employees. Responses indicate stakeholders are aware of, and much of the time have worked with, the key players in responding to emergencies within the maritime fuel system, with the exception of shipping and trucking companies and associations (see Figure 6). This indicates that knowledge of, and interconnections between, the key organizations within the government sector is high, but less is known about shipping and trucking companies where the private sector plays a critical role. This limited integration is made more difficult as staff turnover is high within government agencies and limited institutional memory exists.

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4 Twenty-participants completed our survey on perceptions of the fuel system’s vulnerability and resilience. Respondents were predominantly employed in government agencies within emergency management, with limited participation from those working in the private sector despite concerted efforts to encourage participation from this group.
Efforts have been made by government agencies and our research team to engage the private sector in emergency response planning, both in the research reported here and in government emergency planning, though this has been largely unsuccessful. Most companies have their own emergency response and business continuity plans, but there is a clear need for public-private partnerships. This is critical to establish as the public sector will be relying on private services (such as transportation equipment and expertise) for emergency response, particularly as it is the private sector that has the expertise in the day-to-day operations of the fuel supply system. While the provincial government has the right to take over assets if a State of Emergency is declared, having pre-established partnerships and signed contracts is critical, as emergency managers will not have the requisite capacity or expertise in fuel distribution.

Unconventional emergency response actions should also be considered in the process of negotiating contracts and establishing relationships. For instance, what sort of assets do local businesses own, and are they willing to provide them for emergency response? In the event of an employee shortage,
can critical services be run with fewer people than normally allowed by regulation? Can retired employees be certified to provide critical services in an emergency? Can recently decommissioned vessels be quickly re-commissioned? These are just a few examples of how leniency in regulatory requirements may allow for an improved emergency response. Government officials have had limited interest in discussing leniency of regulations despite past examples of this being done. Having these discussions and setting guidelines prior to an event would allow for forethought and application of an analytic process rather than reacting in an emergency situation.

Overwhelmingly, stakeholders feel that the provincial government is responsible for taking action to reduce the risk of a disruption in the fuel supply chain and to plan for emergency response actions. Stakeholders are looking to the provincial government for leadership and are relying on provincially created emergency response plans. This was particularly the case for the process of prioritizing fuel allocation in BC (89% of survey respondents) and fuel availability among users (62% of respondents). However, the provincial government currently has no plans for allocating fuel resources or continuity plans for the fuel system. At the most basic level, there is little understanding of who the key players are, what resources are available, and which communities and sectors may be in the greatest need of emergency fuel support. This should be a critical concern and focus area for the Province as 63% of respondents indicated that the provincial government is ultimately responsible for managing fuel distribution in an emergency.

One reason provided for the lack of planning for the provision of fuel is the limited resources dedicated to emergency management. Minor events, such as single dwelling landslides, take up a considerable amount of time, resources, and focus of provincial emergency managers, limiting the opportunity for large-scale and long-term emergency planning.

In terms of how potential disruptions are currently being prepared for, 29% of survey respondents indicated that they were doing nothing to reduce the likelihood of disruption to the fuel supply chain while 33% of respondents indicated that they were undertaking some action. Results for building capacity to respond to a disruption were more neutral, with 67% of respondents indicating that a little or some action was being done with only 17% indicating that a lot of action was being done. This indicates that there is substantial room to reduce the likelihood of a disruption and to build capacity within the system.

Interviewees raised further concerns. First, federal government requirements for sole source providers have proven to delay emergency response, particularly for oil spill protocols. The process requires the spiller pays, leading to prolonged periods of determining who is legally responsible, and sourcing appropriate contracts. Second, there is significant dependency on refined fuel being brought into the province and limited redundancy to deliver this fuel to marine dependent communities. This lack of redundancy and interoperability has also been raised in regards to the number of qualified employees, equipment, and service providers available. Rural and semi-rural locations have also raised concerns over the emphasis placed on central locations and a dependency
on these locations to supply the needs of downstream communities. These issues and associated risks are furthered compounded by the shift towards just-in-time delivery, lowering the resilience of the system as a whole. These oversights, in part, could be addressed if a system-wide perspective were taken in emergency preparedness planning.

The significance of these results can be summarized by one interviewee's perception of the fuel system: “without fuel, everything stops.”. Nevertheless, findings from this study indicate that most stakeholders in the system have limited awareness of the system as a whole, yet a system-wide perspective is paramount for enhancing community resilience to fuel disruption.
7. Recommendations and Conclusion

This report has made initial efforts to characterize the fuel supply system, identify who the critical stakeholders are, and address organizational opportunities to strengthen the system's resilience. Results indicate the critical need for coordinated action to be taken in coastal BC to prevent disruptive fuel shortages and the need for improved information to overcome gaps in the data. Without these efforts being taken, the fuel supply chain remains a critical vulnerability for coastal BC communities’ ability to function in the event of a disruption, and ultimately puts BC at a greater risk for devastating impacts from a hazardous event such as a catastrophic earthquake.

Based on the findings in this report, the following recommendations are made:

1. Improved emergency plans:
   a. The provincial government should lead detailed pre-planning efforts for potential fuel disruptions that enable rapid and coordinated emergency response across local, provincial, and federal governments. In particular, a fuel prioritization plan should be created and formal agreements be put in place. Unconventional emergency response actions should be discussed and a common understanding held on acceptable actions. These results should be communicated to all stakeholders.
   
b. Accordingly, planning efforts need to directly engage all stakeholders -- especially private sector organizations involved in day-to-day fuel delivery -- to ensure greater preparedness and fuel allocation priorities for emergency services and to meet expectations of the general public in the event of a fuel disruption. Due to the demands placed on emergency managers in an emergency situation and the specialized knowledge held by the private sector, it is unlikely that emergency responders will take full control over the fuel supply. As such, clarity is needed on realistic actions and clear responsibilities of the public and private sector.
   
c. Planning efforts should include all BC coastal communities, particularly those located far from the Lower Mainland fuel hub. Due to differing needs in coastal and rural communities compared to urban centers, a wide scope of communities should be included in planning efforts. Particularly fuel supply reserves, differences in perceptions of risk, and connectivity of communities should be addressed.
   
d. Formal agreements should be put in place with conveyors of critical information identified and alternative suppliers outlined. Appendix III contains an initial list of stakeholders within the fuel supply chain. Relationships between these stakeholders should be strengthened throughout the planning process.
   
e. All planning efforts ought to be discussed and implemented with urgency so an analytic process can be undertaken. Pre-planning would allow for improved
emergency response and decreased vulnerability in the event of an emergency. Planning efforts should be reviewed regularly to allow for adaptive actions to be taken.

f. Planning efforts should include both short- and long-term risks and resilience actions. This may require that certain groups focus only on planning for rare but catastrophic events, while others focus on the smaller hazards that occur more frequently.

g. Clear communication between stakeholders and local communities should occur at all stages of planning.

h. Planning efforts should be based on robust information about the fuel supply chain in normal and emergency situations.

2. Overcoming information gaps

a. Numerous information gaps exist in the fuel supply system that should be examined further to understand the full nature of fuel disruption risks. Inconsistencies and incomplete data should be addressed and studied directly. Particular areas where gaps in data exist include:

i. Information about the fuel reserve volume in local communities

ii. Storage facility vulnerabilities

iii. Fuel-pumping capacities during power outages

b. Further information is needed on anticipated fuel demand changes during an emergency event and supply chain disruption. This includes calculating fuel needs of emergency responders, having a better understanding of how the general public is anticipated to respond to a fuel shortage, and planning emergency communications to modulate potential hoarding behaviours.

c. Assessments should be made on the different types of potential disruptions, and the effects these disruptions would have, on the supply chain. The fuel supply system faces a myriad of risks; these should be identified explicitly and examined in relation to anticipated effects on the fuel supply chain for each community.

3. System-wide perspective

a. Planning for fuel supply disruptions must take a system-wide perspective on vulnerability and resilience-building opportunities, considering not only physical networks and their functional operations but also the organizations, rules, and relationships involved in how the system would respond to a disruption.
8. Acknowledgements

The authors would like to thank all those who participated in the various stages of data collection required to complete this report. Particular acknowledgement goes to the City of Powell River, Powell River Regional District, Dr. Terje Haukaas, Casey Hilliard and Bethany Dobson. Satellite AIS data used were provided by exactEarth (www.exactearth.com), as part of the exactEarth – MEOPAR – Dalhousie University academic agreement. This research was funded by the Marine Environmental Observation, Prediction, and Response (MEOPAR) Network of Centres of Excellence.
9. References


Maritime Commerce Resumption Committee (MCRC), Pacific Region (Vancouver, 2010). Regional Maritime Commerce Resumption Plan. 31pp.


Appendix I. Fuel production, imports and exports in BC

Table A.1. Known and unknown sources of BC production, imports and exports as % of domestic demand (2015)

<table>
<thead>
<tr>
<th>Products</th>
<th>All refined Products</th>
<th>Motor Gasoline</th>
<th>Diesel Fuel Oil</th>
<th>Aviation Jet A</th>
<th>Other products (n=13)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Barrels/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refinery production</td>
<td>7,832</td>
<td>4,113</td>
<td>2,135</td>
<td>708</td>
<td>876</td>
</tr>
<tr>
<td>Inter-provincial transfers in</td>
<td>10,677</td>
<td>3,373</td>
<td>4,863</td>
<td>46</td>
<td>2,395</td>
</tr>
<tr>
<td>Inter-provincial transfers out</td>
<td>(3,377)</td>
<td>(868)</td>
<td>(1,521)</td>
<td>(23)</td>
<td>(965)</td>
</tr>
<tr>
<td>Imports</td>
<td>2,877</td>
<td>208</td>
<td>325</td>
<td>1,286</td>
<td>1,058</td>
</tr>
<tr>
<td>Exports</td>
<td>(1,548)</td>
<td>-</td>
<td>(452)</td>
<td>-</td>
<td>(1,096)</td>
</tr>
<tr>
<td>Losses and adjustments</td>
<td>(146)</td>
<td>246</td>
<td>(50)</td>
<td>(9)</td>
<td>(334)</td>
</tr>
<tr>
<td>Own consumption</td>
<td>56</td>
<td>-</td>
<td>(50)</td>
<td>0</td>
<td>56</td>
</tr>
<tr>
<td>Domestic sales</td>
<td>31,423</td>
<td>14,961</td>
<td>4,387</td>
<td>2,990</td>
<td>9,085</td>
</tr>
<tr>
<td>Imbalance in flows</td>
<td>(15,052)</td>
<td>(7,889)</td>
<td>914</td>
<td>(981)</td>
<td>(7,096)</td>
</tr>
<tr>
<td>Imbalance as % of Domestic Sales</td>
<td>-48%</td>
<td>-53%</td>
<td>21%</td>
<td>-33%</td>
<td>-78%</td>
</tr>
</tbody>
</table>

Source: Calculated from data retrieved from Statistics Canada CANSIM table 134-0004.

As displayed in Table A.1, official data on petroleum product flows in BC is woefully incomplete. Reported sources of motor gasoline are only 49% of reported domestic sales. In contrast, there is 21% more diesel fuel that reported sales. Aviation fuel production or imports is underreported by 33% and volume of 13 other petroleum products sold in BC (in volumes below 1 million barrel per year in 2015) shows a deficit of 78%.

From the perspective of resilience to fuel supply disruptions, a more telling picture can be gleaned from the balance of flows in specific refined products. Small fixed wing aircraft are key to swift delivery of personnel and medical supplies to remote communities. Flows of aviation gasoline used by these aircraft is not reflected in Table A.1, however, as all such fuel used in BC is imported via the TMPL, there is a need for careful cache management for its cache management to ensure availability during an emergency.
Appendix II. Study Participants

Note: some participants are not named, according to their request.

Federal Government

Captain Bernie Dumas, Nanaimo Port Authority
Edward Dahlgren, Nanaimo Port Authority
Rodney Grounds, Nanaimo Port Authority

Provincial Government

Anonymous Contributor 7, Emergency Management
Heather Lyle, Emergency Management British Columbia (EMBC)
Maurie Hurst, Emergency Management British Columbia
Steve Newton, Emergency Management British Columbia
Patricia Wong, Ministry of Transportation and Infrastructure

Local and Regional Government

Shawn Cator, City of Powell River
Tor Birtig, City of Powell River
Edward Robinson, Hartley Bay Council
Chad Pacholik, Integrated Partnership for Regional Emergency Management (IPREM)
Mike Andrews, North Shore Emergency Management
Al Radke, Powell River Regional District
Laura Roddan, Powell River Regional District
Mike Wall, Powell River Regional District
Ryan Thomas, Powell River Regional District

Private Sector

Alan Galambos, Binnie Engineering Consultants
Louise Yako, British Columbia Trucking Association
Captain Stephen Brown, Chamber of Shipping, British Columbia
Thomas Gregoire, Chamber of Shipping, British Columbia
Ferdi Van De Kuijlen, Island Tug & Barge Marine Group
Gino Stradiotti, North Arm Transportation
Matt Stradiotti, North Arm Transportation
Pat Docking, PDocking Consulting Ltd.
Anonymous Contributor 11, Transportation
Anonymous Contributor 15, Transportation
Kevin Gardner, West Coast Marine Response Corporation
Lee Hammond, West Coast Marine Response Corporation
Appendix III. Stakeholder List

The following is a list of key stakeholders in the fuel supply system that have been identified as critical by our research participants. This list is not indicative of all players associated with the fuel supply system but represents some key organizations. An asterisk indicates those who are not directly involved with the fuel supply system in normal operations but play a critical role when an event occurs.

Federal Government

Canadian Coast Guard
Department of Fisheries and Oceans *
Environment and Climate Change Canada*
Local port authorities
  Port Metro Vancouver
  Nanaimo Port Authority
Public Safety Canada*
The Department of National Defense*
Transport Canada

Provincial Government

BC Ministry of Transportation and Infrastructure
Emergency Management British Columbia*
Local emergency management offices*
  City of Burnaby, Emergency Planning
  Integrated Partnership for Regional Emergency Management
  North Shore Emergency Management Office
  Powell River Regional District

Private Sector

Marine emergency response organizations*
  Marine Emergency Response Coordination Committee
  Western Canada Marine Response Corporation
Oil and gas companies
  Chevron Canada
  Imperial Esso
  Kinder Morgan
  Oil & Gas Commission
  Shell Canada
  Suncor Energy
Shipping industry
  BC Chamber of Shipping
  BC Council of Marine Carriers
  BC Marine Terminals Association
  BC Ferry Services Inc.
  City Transfer
  Cormorant Marine Tug and Barge
  Crosby Marine Services
  Dolphin Marine
  Island Tug and Barge
  Marine PetroBulk
  North Arm Transportation
  Seaspan

Trucking industry
  British Columbia Trucking Association
  Parkland Industries Ltd.