Section 3.9: Ship Specifications

TERMPOL Surveys and Studies

ENBRIDGE NORTHERN GATEWAY PROJECT

FINAL - REV. 0

Prepared for:
Northern Gateway Pipelines Inc.

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1 Objective

In accordance with the TERMPOL Review Process (TRP) Guidelines, TP743E 2001, the objective of this study is “to determine the suitability of the design ship, or when applicable, design ships, selected by the proponent.”

1.1 Context

The design vessels for this project range from Aframax class (approximately 80,000 to 120,000 Deadweight Tons [DWT]), through Suezmax (120,000 to 200,000 DWT) to up to Very Large Crude Carrier (VLCC) class, which range up to 320,000 DWT. Some photographs of typical vessels within these ranges are shown in Figure 1-1, Figure 1-2 and Figure 1-3. As terminal operator, Enbridge will not directly own or charter the vessels and does not have a role in the selection of particular vessel(s) that will call at the terminal. Nonetheless, Enbridge will establish Tanker Acceptance (Vetting) Criteria that will be used review and approve each vessel prior to it being granted permission to call at the terminal. This vetting process is carried out for each vessel and is conducted every time that vessel calls at the terminal, and is described in detail in Sections 3 and 4 below.

Figure 1-1 Typical Aframax-Class Tanker 117,100 DWT M.V. Stena Arctica

(Source: www.Stenabulk.com)

Figure 1-2 Typical Suezmax-Class Tanker 160,000 DWT M.V. SCF Khibiny

(Source: www.Unicom-cy.com)

Figure 1-3 Typical VLCC-Class Tanker 303,000 DWT Olympic Loyalty

(Source: www.aukevisser.nl - Photo collection by Jack Steeghs)

1.2 Vessel Ownership and Liability

The transportation of hydrocarbon products by sea typically involves one of two business models:

- Oil owners or producers ship their product on proprietary tankers; or,
- Oil owners or producers ship their product in chartered tankers, owned by independent tanker owners.

It is expected that vessels calling at Kitimat Terminal will be chartered and, hence, shippers on the Northern Gateway pipeline system will not be operating proprietary tankers.

When using the charter method of marine transportation, there are two basic charter arrangements:

- The voyage (spot) charter, in which the oil owner or producer (charterer) leases the tanker for a specific voyage from a load port to a discharge port. The tanker owner is paid according to the amount of cargo in tonnes and is responsible for all the operating costs of the voyage (e.g., crew wages, food, fuel, insurance, port fees and vessel maintenance).
- The time charter, in which the oil owner or producer (charterer) lease the tanker for a specific period of time. A time charter may be for 3 months or up to 10 years or more, depending on the needs of the charterer. During the charter period, the charterer directs the tanker to port destinations and pays for fuel and port fees. The tanker owner is paid according to the carrying capacity of the tanker and pays for all remaining operating costs.

Under either arrangement, the tanker owner has the sole responsibility for safety of the tankers and the oil owner or producer maintains title to the cargo. Each party will provide their own insurance for loss of cargo (oil spill). The vessel insurance is provided by the tanker owner.

2 Ship Particulars and Characteristics

While tankers are built in different sizes depending on the commodity they are destined to transport, they all share some common characteristics. Because of the proposed business model for the Project, specific plans or technical documents of the design ships cannot be provided because the vessel trade is open to the world fleet, as discussed in Section 1.2 above. In the discussion that follows, the description of vessels is intended to be somewhat general in nature. Nonetheless, the descriptions are considered reasonably representative of the types of vessels expected to call at the Enbridge Northern Gateway terminal.

2.1 General Tanker Description

A typical tanker is shown in Figure 2-1 below. The navigation bridge, crew accommodations, engine room, auxiliary generators, propulsion, steering, and cargo pumps are all located aft. The center portion of the ship is occupied by the cargo and ballast tanks, while the forward part of the ship contains additional storage spaces. On the top deck are located the cargo manifolds (pipe connections and control valves), mooring winches, lights, and the like.

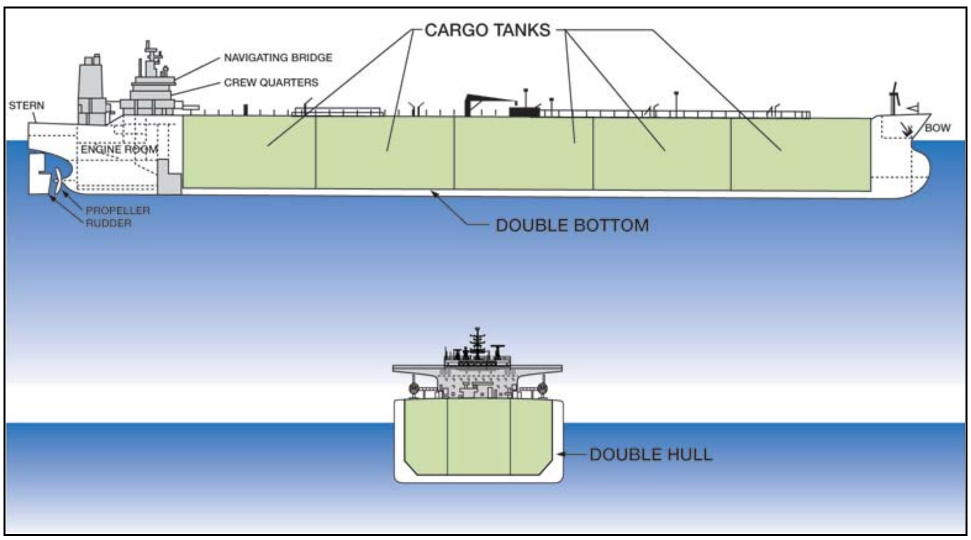

Figure 2-1 Typical Crude Oil Tanker

(Source: Moffatt and Nichol)

2.2 Double Hulls

By law, all tankers in international trade will have double hulls by 2010, with certain non-double-hull tankers being able to trade to the USA up to 2015. A double hull is essentially a hull within a hull. The cargo is carried inside the inner hull with a space dividing it from the outer hull. The cargo space is protected from the environment by the double hull, which consists of a double-side and double-bottom space dedicated to the carriage of ballast. The ballast space extends for the full length of the cargo carrying area. An unloaded tanker requires some of the ballast space between the hulls to be filled with seawater for stability and propeller immersion. A double-hull design contributes to the prevention of oil pollution in three ways:

- A hydrocarbon spill may be prevented in the event of a low-energy grounding or collision with another ship or object where only the outer hull is breached.
- Steel hulls may develop small cracks from thermal and mechanical stresses. In a double-hulled vessel, the outer hull will prevent hydrocarbon pollution in the event of a minor inner hull leak due to these small cracks.
- Ballast seawater is typically segregated from the cargo and, as a result discharged ballast does not, in most cases, contain hydrocarbon residue. In accordance with the Canada Shipping Act, Ballast Water Control and Management Regulations (BWCMR), if heavy-weather ballast water (dirty ballast) has been taken onboard in cargo holding tanks or if there has been a minor inner hull leak into the segregated ballast hold space, the following Ballast Water Management Options will apply.

Heavy-weather ballast water loaded during transit in locations where water depths are not less than 2,000 metres may be decanted in accordance with the requirements of the Canada Shipping Act. The decanted water must be monitored to ensure compliance with oil concentration limits and operations must be completed at established distances from landfall. The remaining dirty ballast must be retained on board. If space in the hold is available, the “load on top” system may be used, whereby cargo is loaded on top of the remaining oil in the tank.

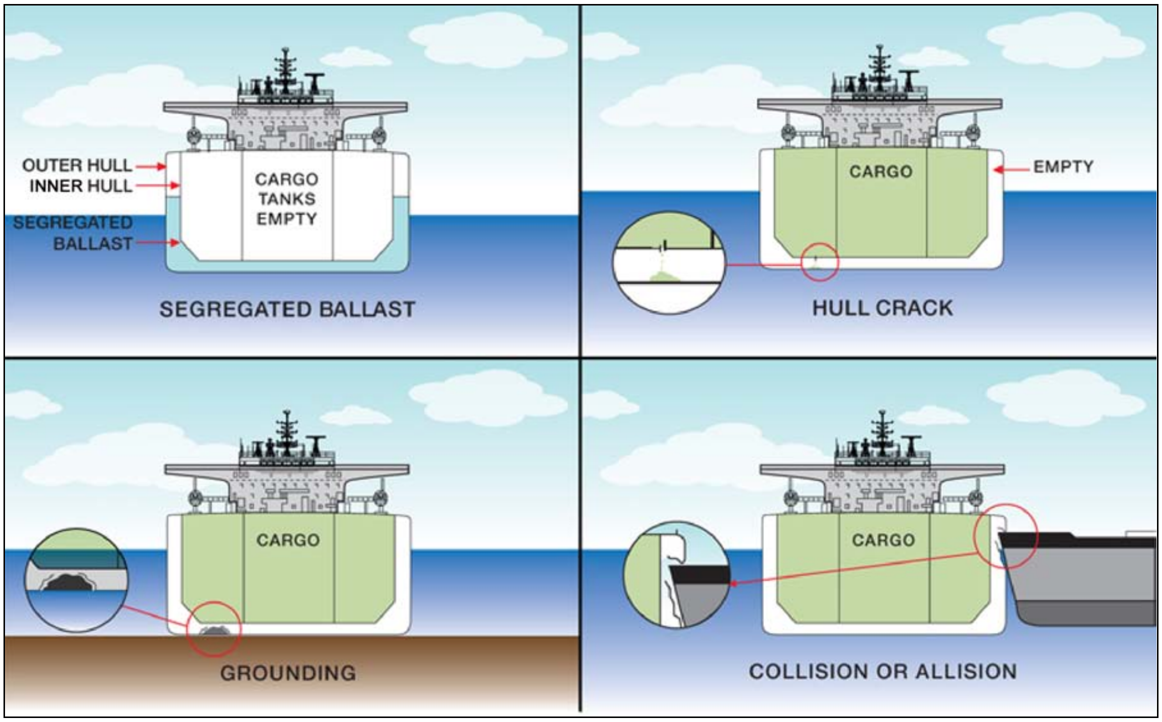

Figure 2-2 Functions of Double-Hulls for Tankers

2.3 Machinery

Most tankers are powered with large industrial diesel engines. Some may have two diesel engines, but most only have one. The engine is coupled to a single propeller by a large shaft. The engines, propeller and shafting are very reliable. Tankers will have a boiler to manufacture steam for the turbines which provide power to the cargo pumps. There will be three service generators. All electrical power for all tanker operations is provided by these generators. All generators do not operate at the same time so that in the event one breaks down there are sufficient redundant service generators.

Most engine rooms are controlled automatically. There are sensors and alarms throughout the engine room to notify engine personnel of malfunctions. There is an engine control room from which the engine personnel observe all the automation and operation of the machinery.

There are many redundant systems. Steering controls, pumps and control systems are among the redundant systems. The tankers have their own water making, sewage treatment and trash compacting systems on board.

2.4 Inert Gas System

All tankers are required to possess inert gas systems. These systems protect cargo tanks from explosion by creating an inert atmosphere in the tanks. This is done by reducing the oxygen content to within ranges that do not allow combustion, typically below 4 percent, but in all cases below 8 percent. During cargo discharge operations, inert gas is fed into the cargo tanks to prevent ingress of oxygen bearing air that is required to support combustion. Inert gas is either provided by an independent inert gas generator or can be provided as cleaned flue gas from the tanker boiler.

Both The International Convention for the Safety of Life at Sea (SOLAS 1974) as referenced by ISGOTT [Ref. 1] and Transport Canada's Transport Publication TP 4295 E – "Standard of Inert Gas Systems" require that a vessel's inert gas system be capable of delivering inert gas with an oxygen content of not more than 5 percent by volume at any required flow rate; and of maintaining a positive pressure within the cargo tanks at all times with an atmosphere having an oxygen content of not more than 8 percent, except when a tank is required to be gas free. These values represent maximum limits which, for safety reasons, cannot be exceeded. If the oxygen content levels exceed these values, cargo operations cannot be conducted.

Although it may not be required by law, in certain ports the maximum allowed oxygen content of inert gas in the cargo tanks may be set at 5 percent by volume to meet particular safety requirements, such as the operation of a vapour emission control system. Since most modern tankers are capable of delivering inert gas with an oxygen content of 2 to 4 percent, it has, for the most part, become standard industry practice to maintain the oxygen content in the cargo tanks below 5 percent. This provides an additional margin of safety compared to the 8 percent limit. To confirm oxygen levels, the tankers are required to have a method of measuring the oxygen content in each cargo tank.

2.5 Segregated Ballast

Unloaded tankers transiting between destinations require ballast water for additional weight to improve stability while at sea. Double hulled tankers use the space between the outer and inner hulls as a holding tank for the ballast water. The common name for this ballast is "segregated ballast" because it is isolated from the cargo system and the cargo tanks. Although segregated ballast is typically oil free and can be discharged directly into the water, it is known to potentially carry evasive species that may not be indigenous to Canadian waters. Therefore, when the tankers are in the open ocean, they must conduct ballast exchange operations, where the ballast that was taken-on from the previous port-of-call is exchanged with water from the open ocean. This procedure reduces the possibility of evasive species entering local Canadian waters through a vessel's segregated ballast discharge.

During cargo transfer operations, tankers will be allowed to pump out (discharge) clean segregated ballast into Canadian waters assuming that proper ballast exchange was conducted in the open ocean as per International and Canadian law. The management of ballast water discharge in Canadian waters falls under the federal regulations outlined in the Canada Shipping Act, Ballast Water Control and Management Regulations (BWCMR). Under the current regulations, a vessel bound for a port on the north coast of British Columbia is required to carry onboard a Ballast Water Management Plan and submit a complete ballast water report to a Marine Communications and Traffic Service (MCTS) centre prior to entry into Canadian waters.

In accordance with the BWCMR vessels should generally conduct ballast exchange in locations no less than 200 nautical miles from shore where water depths are not less than 2,000 metres. In exceptional circumstances, where it may not be possible to exchange ballast water due to inclement weather, sea conditions or any other conditions that may endanger human life or the safety of the vessel, alternative exchange zones may be utilized on notification of the appropriate MCTS officer. The use of alternative exchange zones may also be appropriate for vessels that are not able to comply with the general ballast exchange protocol because they do not voyage into mid-ocean where water depths are greater than 2,000 metres.

Ballast exchange is typically conducted by one of following methods:

1. Dilution or Flow-through Exchange Method: This process involves first lowering the content of the ballast tank(s) by gravity to static sea level, to reduce the volume to be diluted. Using ballast pumps, clean ocean water is then pumped into the ballast tank(s), which are allowed to overflow continuously until the calculated volume of new ballast pumped in, is at least three times the volume required to be exchanged. Since the segregated ballast tanks are normally wing tanks, they are usually treated in pairs. The process is repeated until all the ballast tanks' contents have been exchanged. For reasons of better mixing and dilution with a slower pumping rate, less possible stress on ballast tank construction and conservation of bunkers, it is preferable to employ only one ballast pump for this operation. Calculations indicating the amount of water to be utilized and pumping rates required to achieve this shall be recorded.
2. Sequential Exchange Method: This process involves completely emptying the ballast tanks and refilling them with new clean ocean water. The process is carried out in a controlled sequence designed to minimize stresses upon the ship's hull. Generally one ballast pump is used to pumping ballast out and a second is used to pump ballast in, but it may be necessary, to only do one operation at a time within the sequence. Different builds and tank configurations for tankers within the same class will have different requirements in this respect which are detailed within the specific ship's operation manual. To maintain ship safety, this operation is limited to fair weather conditions only. Operations will be logged.
3. Other Methods: Although the previous two methods are predominantly used, other methods have been developed including one patented by Teekay Shipping that uses a special system of pipelines and valves, to allow for the automatic exchange of ballast by utilizing the tanker's forward momentum to force new water in and suck old water out simultaneously. No ballast pumps are required.

2.6 Electronics

Shipboard navigational equipment includes electronic technology such as Radio Detection and Ranging (RADAR), Global Positioning Systems (GPS) and other navigation systems, to ensure safe passage across the ocean and into ports worldwide. Electronic Chart Information Display Systems (ECDIS) allow navigational overview and Automatic Identification Systems (AIS) and Computerised Collision Avoidance Systems, such as Automatic Radar Plotting Aids (ARPA), allow navigation officers to identify proximate vessels accurately and to determine quickly the heading and speed necessary for collision avoidance.

Automatic Identification System (AIS) electronically identifies the ship by the use of VHF radio. As of year 2003, AIS capability has been required by the IMO (Regulation 19 (Emergency Training and Drills) of the International Convention for the Safety of Life at Sea (SOLAS) for all ships of greater than 300 gross tons. AIS is required to provide, receive and exchange information, including the ship's identity, type, position, course, speed, navigational status and other safety-related information, automatically to shore stations, other ships and aircraft.

Radio and internal communications equipment will include dedicated satellite communication systems that allow ships anywhere in the world to communicate with home offices, authorities, charters, port authorities, coast guard, and Vessel Traffic Management (VTM) agencies. Vessels can communicate with other vessels and appropriate authorities during any shipboard emergency using the Global Maritime Distress and Safety System (GMDSS). Intership communications also make it possible for ships to communicate in close proximity of each other, preventing any misunderstanding as to each ship's intentions.

2.7 Fire Fighting Systems and Emergency Equipment

All tankers have firefighting systems which are approved by the classification societies. These systems consist of water, foam and other chemical systems. Each system is located in the area where a fire would most likely begin. There are water monitors on the deck area. The tanker must have a fire plan and all personnel are trained for firefighting.

All ships are equipped with life saving equipment primarily for the crew. Life boats, life rafts and personal life saving equipment are among the lifesaving equipment on board.

Every tanker is required to have an emergency towage system on board which would be deployed in the event the tanker had to be towed. Tankers of 50,000 DWT or larger are recommended by the OCIMF's "Recommendations for Ships' Fittings for use with Tugs" [Ref. 2] to provide the following:

- A chock (fairlead) arrangement, with suitable reinforcement, having a minimum Safe Working Load (SWL) of 200 metric tonnes; and,
- A strong point arrangement, with suitable reinforcement, having a minimum Safe Working Load (SWL) of 200 metric tonnes when used with a single eye towing line or grommet.

2.8 Operational Characteristics

The modern tanker fleet that is expected to call at Kitimat Terminal will be operated in accordance with international standards such as Standards of Training, Certification and Watchkeeping (STCW 1995). The STCW 1995 requires worldwide sea-going personnel to meet standardized regulations. Specifically, STCW 1995 sets forth standard competencies for each position aboard a ship. It stipulates that an individual seeking employment aboard a vessel must possess and demonstrate the appropriate skills for the specific position. STCW 1995 requiring periodical updating of knowledge and re-validation, is a major departure from the former certification schemes that required only sea experience and a one-time-only written and oral test.

2.9 Geometrical Characteristics

The particulars and geometrical characteristics of the design vessels are widely variable. However, appropriate values can be defined for the "design ships" based on a review of the current fleet of tankers worldwide. Statistical characteristics are presented in Table 2-1 and are given for the largest available VLCC, the smallest available Aframax and an average Suezmax tanker (Refer also to Appendix A – Vessel Specification Database). The relative hull sizes for an 80,000 DWT Aframax, 160,000 DWT Suezmax, and 320,000 DWT VLCC are shown in Figure 2-3.

Table 2-1 General Ship Characteristics

Vessel Particular	Oil	Oil and Condensate	
Vessel Class	VLCC (Design Max.)	Suezmax (Average)	Aframax (Design Min.)
Length Overall (metres)	343.7	274.0	220.8
Length Between Perpendiculars (metres)	328.0	265.0	210.0
Beam (metres)	70.0	48.0	32.2
Depth (metres)	30.5	23.1	18.6
Hull Type	Double	Double	Double
Cargo Capacity (bbls)	2.2 million	1.0 million	0.5 million
Gross Tonnage	160,000	80,000	45,000
Net Tonnage	105,000	50,000	29,000
Air Draft (metres)	67.8	50.0	47.5
Summer Load Condition - Even Keel			
Loaded Draft (metres)	23.1	17.0	11.6
Freeboard (metres)	7.4	6.1	7.0
Deadweight (tonnes)	320,472	160,000	81,408
Displacement (tonnes)	365,472	185,000	96,408
Winter Load Condition - Even Keel			
Loaded Draft (metres)	22.5	16.6	11.3
Freeboard (metres)	8.0	6.5	7.3
Deadweight (tonnes)	312,500	155,000	79,000
Displacement (tonnes)	357,500	180,000	94,100
Ballast Load Condition			
Mean Draft (metres)	10.0	8.0	6.9
Mean Freeboard (metres)	20.5	15.1	12.1
Trim By Stern (metres)	6.0	4.0	3.0
Maximum Draft (metres)	13.0	10.0	8.4
Deadweight (tonnes)	100,000	50,000	33,000
Displacement (tonnes)	145,000	75,000	48,000

Vessel Particular	Oil	Oil and Condensate	
Lightship Load Condition			
Mean Draft (metres)	3.2	2.5	2.3
Mean Freeboard (metres)	27.3	20.6	16.7
Trim By Stern (metres)	8.0	6.0	5.0
Maximum Draft (metres)	7.2	5.5	4.8
Deadweight (tonnes)	0	0	0
Displacement (tonnes)	45,000	25,000	15,000

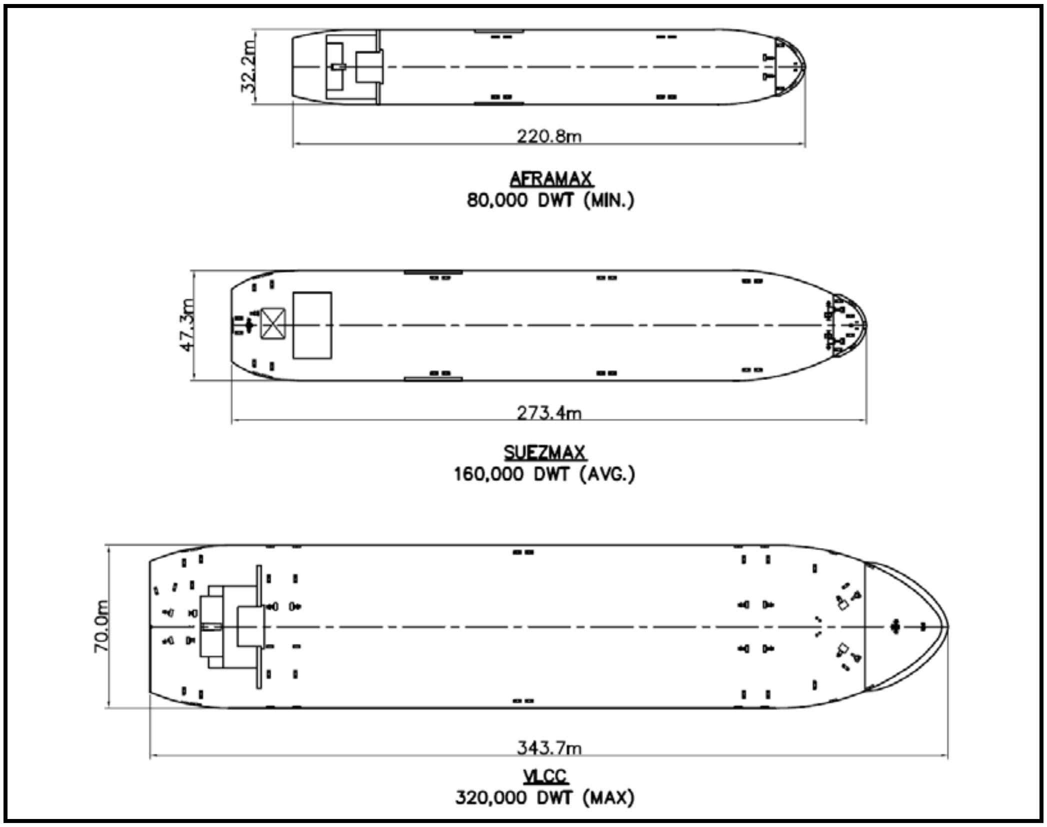

Figure 2-3 Design Vessel Classes

2.10 Cargo System and Operations

Cargo transfer systems include in-tank cargo measurement abilities, such that loading and discharging operations are conducted in a totally closed system. The closed system prevents air ingress to cargo containment tanks and cargo vapours from accumulating on the deck area thus helping to prevent a dangerous explosive situation.

The cargo system consists of tanks, piping and pumps. The tanks are a series of divided compartments in the inner hull. They may be as few as 10 tanks and as many as 18. The number is dependent on the design. Each tank is connected by a series of pipe lines located in the bottom of each tank. These pipelines alternate between loading and discharging the tank. At the end of the tank section is a pump room in which the cargo pumps are located When the cargo is being discharged ashore these pumps are used. There are normally 3 or 4 large pumps. The pumps move the cargo from the tankers cargo tanks to on deck manifold and on to the shore side distribution system. When the cargo is loaded it bi-passes the cargo pumps and goes directly into the cargo tanks. The load and discharge process is controlled by a tanker officer usually located in the cargo control room. The system used to control cargo operations is electronic and can provide cargo personnel with adequate warning when tanks are full or pumps are not operating correctly.

Tankers are equipped with vapour control systems. These systems collect the vapours from the cargo tanks when loading and send them ashore to be treated. This prevents the vapours in the tanks from being vented into the atmosphere.

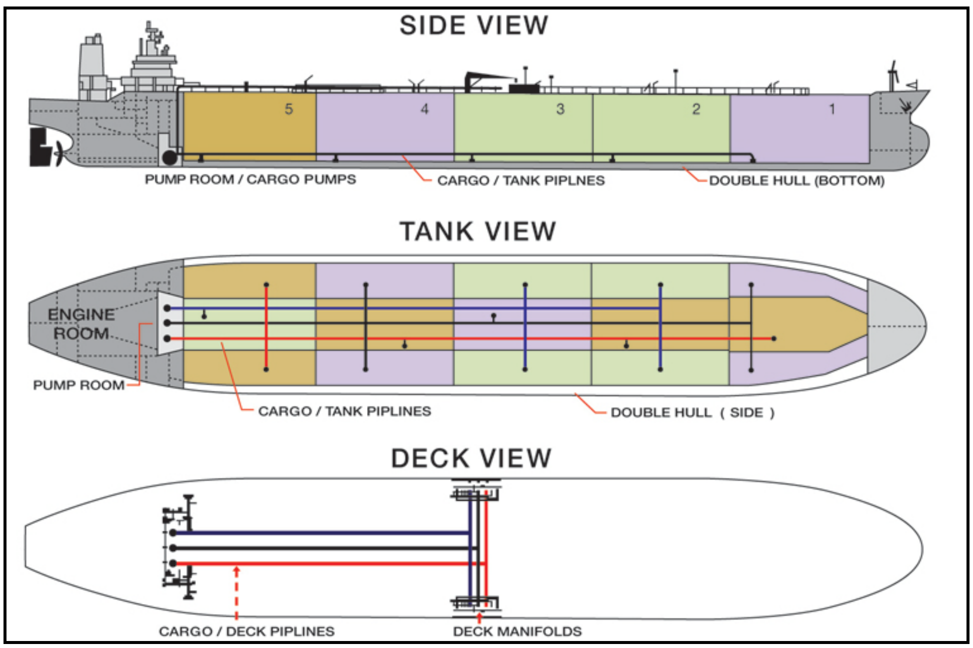

Figure 2-4 General Configuration of Tanks, Pumps, and Manifolds

2.11 Cargo Tank Configurations

The Cargo Oil Tank (COT) configurations for double hulled tankers vary in design and concept. Earlier builds featured large open cargo tanks along the centre line of the ship with the double bottom and sides being dedicated for ballast. For reasons of stability, hull stress management and cargo operations flexibility, later designs included:

- Centre-line longitudinal swash bulkheads that reduced sloshing of the cargo;

- Centreline longitudinal oil-tight bulkheads that reduced tank size and increased cargo options flexibility; and,
- Double longitudinal oil-tight bulkheads within the inner hull, creating port, centre and starboard cargo oil tanks, giving improved stability, increased cargo option flexibility and better hull stress management. In some versions the amidships wing ballast tanks are increased in capacity to reduce hull stresses in the ballasted condition.

All configurations generally have two or three small slop tanks aft, adjacent to the cargo pump room specifically for the collection and separation of oil / water mixtures (Slop Tanks).

Some typical cargo tank arrangements in Aframax, Suezmax and VLCC Double Hulled Tankers are shown in Figure 2-5, Figure 2-6, Figure 2-7 and Figure 2-8.

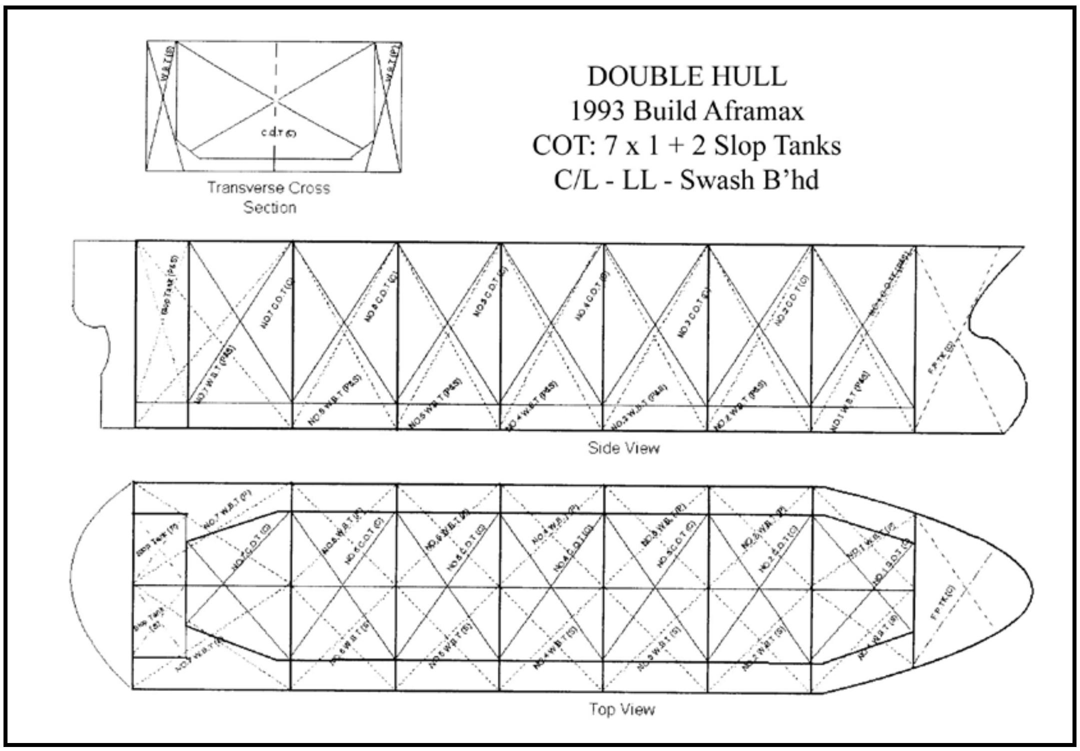

Figure 2-5 Configuration A – Centreline COT with Longitudinal Swash Bulkhead

(Source: www.teekay.com)

The arrangement of the cargo tanks in the configuration as shown in Figure 2-5 is basically seven large tanks centrally situated longitudinally. A longitudinal 'Swash Bulkhead' with lightening and limber holes divides each cargo tank into two conjoined compartments but allows cargo oil to free-flow. The swash bulkheads purpose is to prevent cargo sloshing and provide additional longitudinal strengthening. Much of the vessels scantlings are within the ballast tanks.

This results in:

- Large uniform tanks that give better results with Crude Oil Washing.
- Being less subject to the damaging effects of cargo sloshing.
- Less flexibility with cargo loading options.
- A single tank breached offers large loss of cargo.

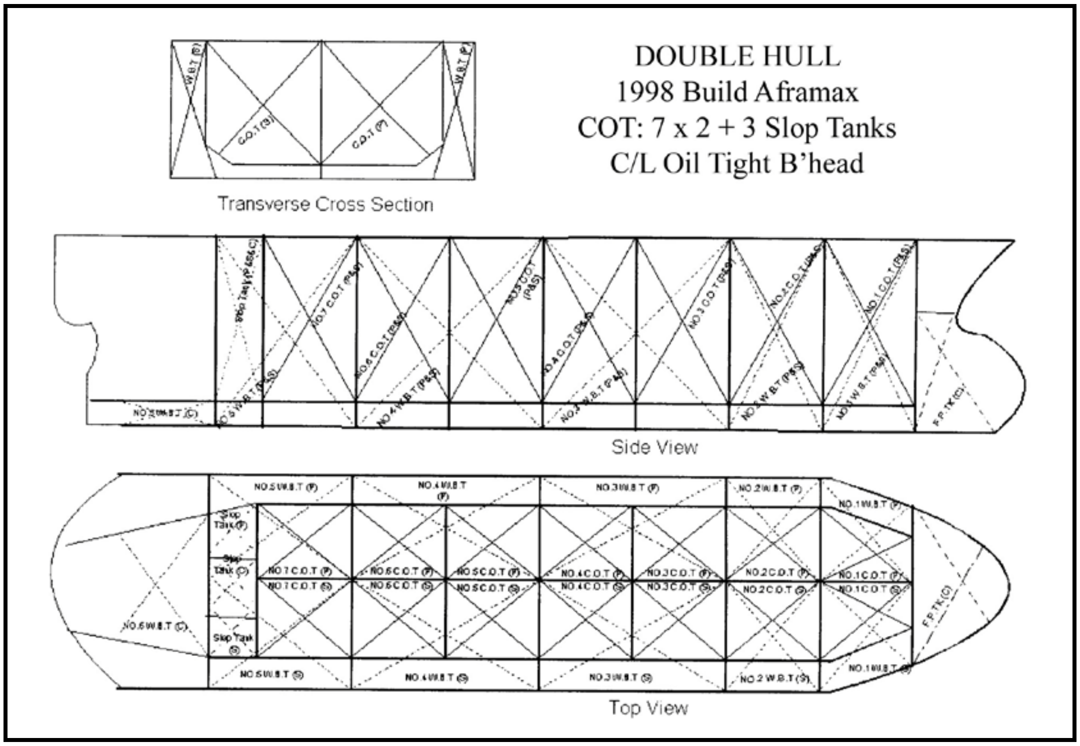

Figure 2-6 Configuration B – Centreline Oil-Tight Bulkhead with Port and Stbd COT

(Source: www.teekay.com)

The arrangement of the cargo tanks in the configuration as shown in Figure 2-6 is fourteen tanks situated in pairs, either side of a centreline longitudinal oil-tight bulkhead. The longitudinal oil-tight bulkhead adds longitudinal strength and with much of the vessels scantlings being within the ballast tanks, offers better tank cleaning results.

This results in:

- Smaller uniform tanks that give good results with Crude Oil Washing.
- Being less subject to the damaging effects of cargo sloshing.
- More flexibility with cargo loading options.
- A single tank breached offers less cargo loss than earlier builds with fewer cargo tanks.

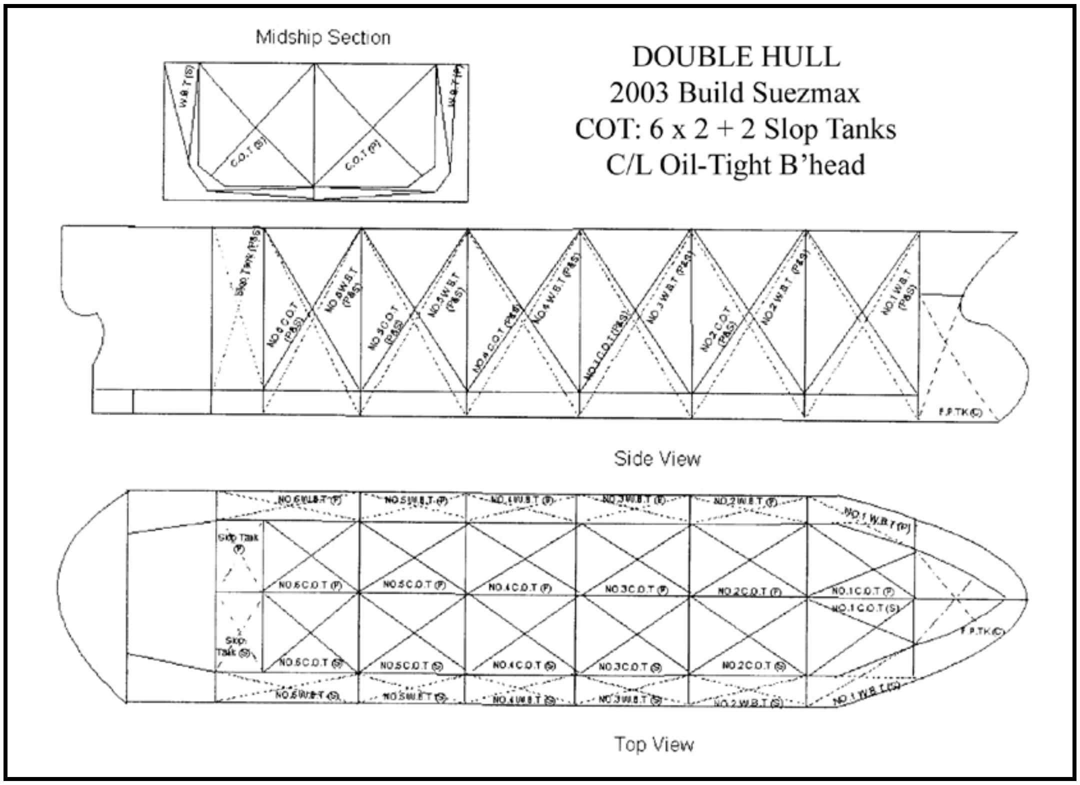

Figure 2-7 Configuration C – Centreline Oil-Tight Bulkhead with Port and Stbd COT

(Source: www.teekay.com)

The arrangement of the cargo tanks in the configuration as shown in Figure 2-7 is twelve tanks situated in pairs, on either side of a centreline longitudinal oil-tight bulkhead. The longitudinal oil-tight bulkhead adds longitudinal strength and with much of the vessels scantlings being within the ballast tanks, offers better tank cleaning results.

This results in:

- Uniform tanks that give good results with Crude Oil Washing.
- Being less subject to the damaging effects of cargo sloshing.
- Flexibility with cargo loading options.
- A single tank breached offers less cargo loss than earlier builds with fewer cargo tanks.

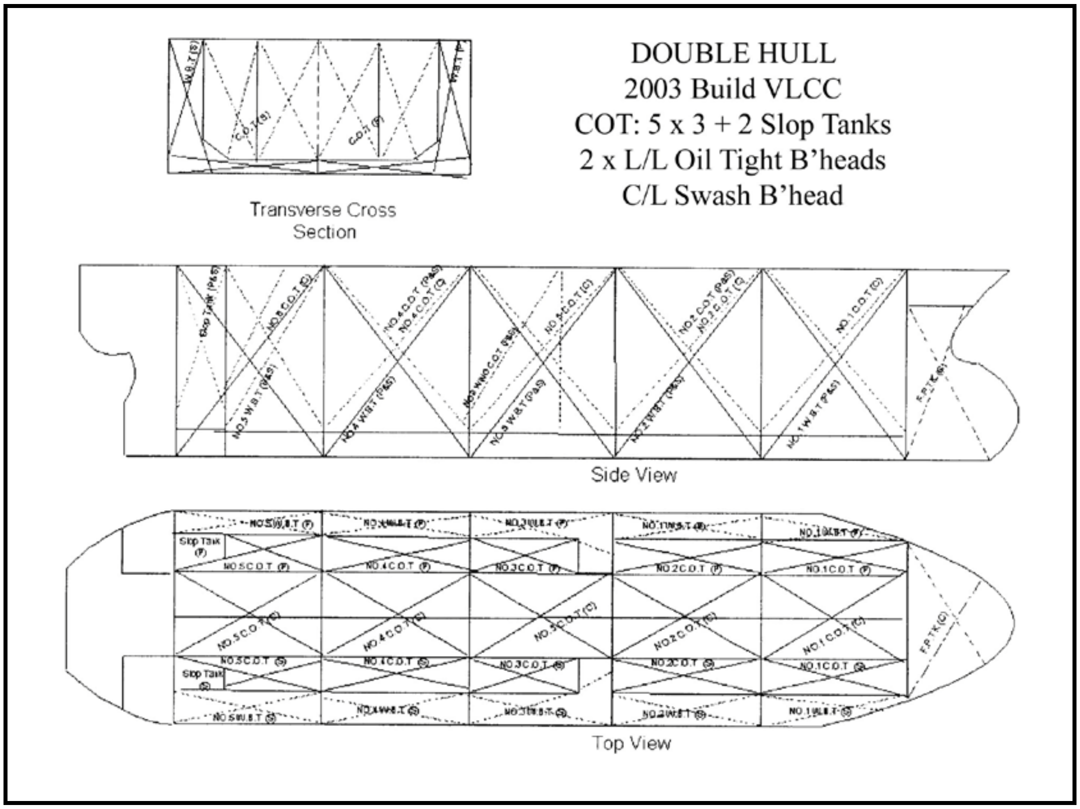

Figure 2-8 Configuration D – Centreline Swash Bulkhead with Double Longitudinal Oil-Tight Bulkheads

(Source: www.teekay.com)

The arrangement of the cargo tanks in the configuration as shown in Figure 2-8 is 15 tanks situated in groups of three tanks across and five tanks longitudinally. The two longitudinal oil-tight bulkheads and one longitudinal swash bulkhead add longitudinal strength and with much of the vessel's scantlings being within the ballast tanks, the arrangement offers good tank cleaning results.

This results in:

- Uniform tanks that give good results with Crude Oil Washing.
- Larger Centre Tanks with dividing swash bulkhead, being less subject to the damaging effects of cargo sloshing.
- Greater flexibility with cargo loading options.
- No. 3 Wing Ballast Tank (WBT) increases ballast amidships to counter bending stresses.
- A single wing cargo tank breached offers less cargo loss than a larger centre cargo tank.

Alternatives to this configuration include omitting the centreline bulkhead completely while constructing smaller center tanks and larger wing tanks to minimize lateral sloshing and free surface effects. Longitudinal strength can be maintained by increasing the number and size of scantlings.

Another alternative includes constructing the centerline bulkhead as an oil-tight bulkhead essentially creating rows of 4 tanks each. This configuration is less common.

2.12 Additional Particulars and Characteristics

Additional particulars and characteristics of the actual ships that will call at Kitimat Terminal will be specified in the Oil Companies International Marine Forum (OCIMF) Ship Inspection Report Programme (SIRE), allowing Enbridge or its agent to determine the suitability of the vessel prior to its arrival at the berth. These particulars include:

- General information on the vessel, its owners and operators, the builders, dimensions, load-line information, recent history, the assigned ships classification details and class; and, the identification of the appointed Classification Society, see Table 2-2 for a sample listing of Classification Societies.

Table 2-2 Classification Societies

Name	Abbreviation	Date	Head office	IACS[a]	EMSA[b]
Lloyd's Register of Shipping	LR	1760	London	X	X
Bureau Veritas	BV	1828	Paris	X	X
Registro Italiano Navale	RINA	1861	Geneva	X	X
American Bureau of Shipping	ABS	1862	Houston	X	X
Det Norske Veritas	DNV	1864	Oslo	X	X
Germanischer Lloyd	GL	1867	Hamburg	X	X
Nippon Kaiji Kyokai	NKK	1899	Tokyo	X	X

Notes:

[a] IACS – International Association of Classification Societies;

[b] EMSA – European Maritime Safety Agency

The oldest recognized Classification Societies, established prior to the year 1900 are all members of IACS and EMSA. Classification Societies are Non-Governmental Organizations that are responsible for establishing and maintaining Standards for Construction of, Classification of and Operational Maintenance of Ships and Offshore Structures. There are upwards of 50 such societies globally, not all are IACS or EMSA approved.

- Vessels Certification and Documentation – All necessary certificates, required publications and documents listed with issue and expiry dates.
- Crew Management – Details of Vessel Operator, Manning Agency, Officers and Crew, including training.
- Navigation Equipment – Full details of all navigational equipment and instruments carried.
- Safety Management – Details of the Safety Management System (SMS), of firefighting and life saving appliances and of arrangements for helicopter operations.
- Pollution and Prevention – Details of pollution prevention equipment and supplies, of policies and plans in place and of OPA'90 compliance.

- Structural Condition – Details of cargo tank protection, coatings, anodes, of planned maintenance system in place; and of cargo tank, ballast tank and void space inspection program.
- Cargo and Ballast Systems – Full details of the vessels cargo arrangements including tank capacities, cargo and ballast handling capabilities, cargo and ballast pumping systems, gauging and sampling capabilities, vapour emission control and venting, manifold arrangements, gas monitoring and cargo heating.
- Inert Gas Systems (IGS) and Crude Oil Washing (COW) Systems – Details of installed equipment, IGS and COW safety systems and operational procedure manuals carried.
- Mooring Systems – Details with SWL and test dates, expiry dates and location on board of all mooring equipment including mooring wires and ropes, winches, bitts, chocks, anchors and windlass, emergency towing arrangements and lifting equipment.
- Communications and Electronics – Details of vessels external and internal radio communication systems, Global Maritime Distress Safety System (GMDSS) capability, Search and Rescue (SAR) capabilities and survival craft radios.
- Engine Room and Steering Gear Systems – Details of vessels main propulsion, thrusters, generators, compressors, bunker types and capacities, steering gear and engine room located anti-pollution measures.
- Ship-to-Ship Transfer Capabilities – Details of vessels compliance with OCIMF – STS Guidelines.
- Supplements for other vessels, OBO's, Chemical, Gas Carriers – There are some additional questions relating to specialized carriers.
- General Vessels Appearance – The latest version includes a section on the appearance and housekeeping of the vessel, externally and internally.

Other particulars that may be required by Flag State, Port State and/or Coastguard inspections will include items that mirror the above, but, in addition, will include Ship Stability Data and Manoeuvring Data in accordance with IMO Standards. (See Section 4.3).

3 Tanker Vetting

It is Enbridge's view that the social and ecological values of the surrounding waterways dictate that terminals receive tankers that are properly operated and maintained. Historically, the risk and liability inherent to the shipment of oil via tankers have required oil exporters to establish extensive inspection programs, referred to as "vetting," to prevent unsafe tankers from entering into service.

In addition to vetting, Canadian maritime regulations are stipulated in the Canada Shipping Act and are developed and administered jointly by Transport Canada and Fisheries and Oceans Canada. Canadian maritime regulations are largely based on conventions adopted by the IMO, which is an international authority of maritime safety established by the United Nations to improve safety and prevent pollution in the shipping industry.

3.1 Tanker Acceptance Program (TAP)

The Enbridge Northern Gateway Kitimat Terminal will use a Tanker Acceptance Program to assure that the tankers scheduled to berth at the terminal will meet the highest industry standards.

Upon the nomination of a tanker to berth at Kitimat Terminal, Enbridge will submit the tanker to, the Tanker Acceptance Program (TAP). All tankers, regardless of clearances received during previous calls at the terminal, will be subject to TAP each and every time they are nominated to berth at the Kitimat Terminal.

Enbridge will either clear or reject any nominated tanker within three days of receipt of nomination and at least four days prior to berthing at the terminal. This amount of time should be sufficient for Enbridge to review and interpret the inspection report received from the SIRE program, which is the key component for TAP clearance as described below. Acceptance or rejection of the tanker will be based on Enbridge's review of the SIRE report and any subsequent requests for additional information or clarifications. Any tanker nominated to berth within four days of its expected arrival may be subject to delay for TAP clearance. Enbridge will not accept the tanker's notice of readiness to berth or request to lay-by at the berth without TAP clearance.

Enbridge will subscribe to the most current Ship Inspection Report (SIRE) Program. SIRE was established by the OCIMF in 1993 to address concerns of sub-standard vessels in the oil tanker industry. SIRE includes a standardized inspection protocol for the tankers, as well as a database for ship operators, terminal operators and government agencies. The document is some 40 pages long and contains extensive information needed to assess the condition of a tanker. The document may be downloaded from the following website: www.ocimf.com.

A typical TAP Clearance procedure will follow the following steps, as shown in the flowchart presented in Figure 3-1:

- Customer nominates a tanker for docking by providing name and IMO number.
- Enbridge or its agent submits the tanker to the SIRE system.

- Enbridge or its agent reviews the SIRE report for outstanding inspection reports. The interpretation of the SIRE reports is the key determinant of the tanker's suitability. An experienced or fully trained individual must interpret the reports because there are key points of information which may cause Enbridge to question the suitability of the tanker for the terminal. An inexperienced person may not understand the nuances of the information. The following are some of the report indicators which may cause Enbridge to question the suitability of the tanker or to seek additional information.

On review of the SIRE, Enbridge or its agent may identify additional information that must be addressed by the customer prior to receiving clearance from Kitimat Terminal. For example, some questions may be as follows:

- How old is the information in the report? Out-of-date information may indicate that the tanker owner does not have a reliable inspection program or that the vessel had a previous outstanding inspection item that had not been resolved. Tankers without a SIRE filed within the previous two years will not be allowed to use the Kitimat Terminal under any circumstances.
- Are there any outstanding inspection items identified in previous SIRE? Open regulatory requirements indicate either the tanker needs to proceed to the shipyard to correct the situation or there are other outstanding items which the owner is waiting to correct.
- Has the vessel changed flags, classification societies, ownership, or operating agent in the last two years? If so, it may be an indication that the vessel may not be in good operating condition and requires costly repairs, or requires regulatory changes that the owner may be hesitant to complete.

At the discretion of Enbridge and depending on the responses, the vessel may be cleared for arrival. Otherwise, Enbridge may require the customer to contact the tanker owner or operator for clarification, or the vessel may be refused clearance altogether. Enbridge will review the nominated tanker and decide if it should be allowed to berth. If the tanker is not cleared, it is the responsibility of the customer to require the tanker to comply for clearance.

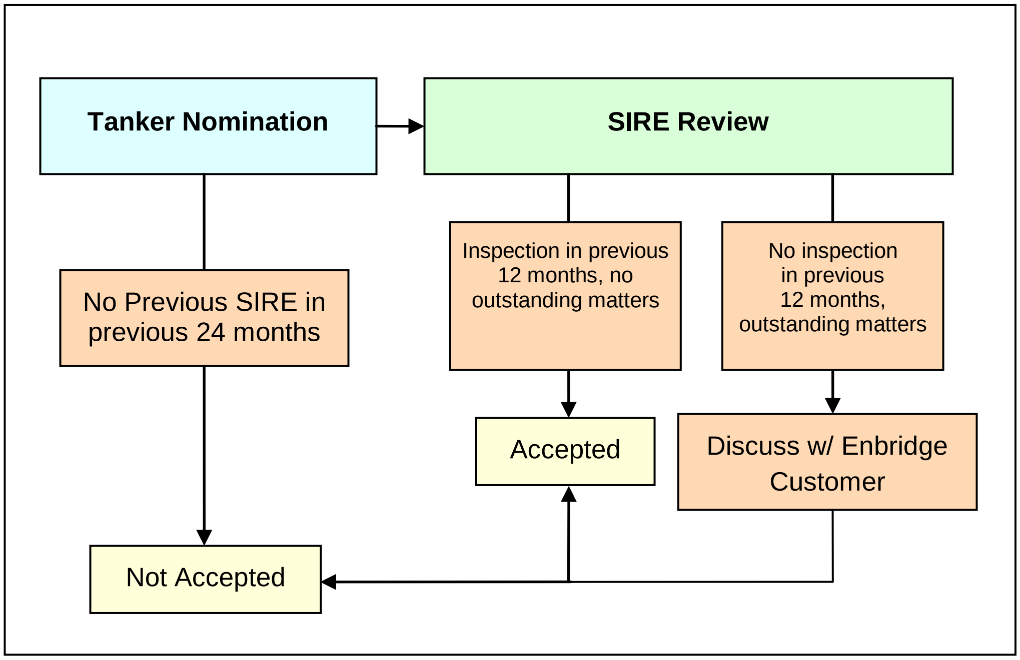

Figure 3-1 Typical TAP Clearance Procedure

3.2 International Safety Management Code (ISM Code)

The ISM Code was developed by the IMO. A key element of the ISM Code provides that companies must have a verifiable safety management system. It requires a commitment from shipping company executives and an assignment of responsibility to remedy deficiencies.

An ISM Certificate will be issued only after extensive audit requirements have been satisfied. A ship will not be allowed to leave port if it is not in compliance with its ISM certificate.

3.3 Additional Vessel Vetting

Other bodies that periodically vet or monitor the condition of Ocean Tankers are:

- Flag State; The Authority of each Flag State has a process by which vessels are inspected periodically / annually. These inspections are focussed towards vessel and personnel safety.
- Port State and/or Coast Guard; Governments may appoint specialist inspectors or appoint the nation’s Coast Guard as in the case of the USA to make periodic inspections, without which, a vessel does not receive the necessary documentation or permission to operate. These inspections are focussed on safety and operational condition. They also ensure that vessels comply with Class and IMO conventions in regards to ship stability and manoeuvring.
- Class: The Classification Society appointed by the vessels owners will make regular and periodic inspections focused on, regulations including, navigational safety, safety equipment and life-saving appliances, pollution equipment, machinery, structural requirements and vessel’s condition. The Classification Society issues certificates of compliance and monitors vessels documentation, inspection and testing schedule and fitness to operate.

- Owners; The vessel's owners appoint staff including Vessel Managers, Marine and Technical Superintendents and Ships Officers to ensure that vessels are maintained in the required condition.
- Third Party Vetting Agencies.

The industry is well regulated and it is apparent that the OCIMF – SIRE is a "catch-all" for the industry in that any part of the above vetting process that is not carried out or is lacking in any way, will be highlighted by SIRE.

4 Terminal Regulations for Vessel Acceptance

To further ensure the highest standards for tankers calling at Kitimat Terminal, minimum Standards of Acceptance will be developed by Enbridge that will include additional ship vetting items to complement their TAP.

As part of TERMPOL Survey Nos. 3.17, 3.18 and 3.19, the Kitimat Terminal operational parameters and criteria will be investigated and documented in a Terminal Operations Manual. The manual will delineate the complete terminal operation cycle from tanker vetting, arrival and berthing, to loading and unloading operations, and vessel departure. This document is planned for completion six months prior to the start of terminal operations.

The following requirements are to be included in the terminal regulations and may also be attached to chartering agreements between Enbridge and its customers. In the case of the latter, the customer would then communicate the requirements to the tanker owner. The tanker owner must agree to meet all of the terminal regulations.

4.1 Vessel Requirements

Among other things, Enbridge will require that all vessels calling at the terminal be equipped with double hulls, inert gas systems, and all safety, navigation and communication equipment required by international and Canadian regulations. (Double hull construction and inert gas systems are discussed in Section 2.1 above.)

4.2 Age of Vessel

The ship acceptance criteria will include a maximum vessel age of 20 years. Based on a review of current vessel fleet age statistics and considering the significant number of new-build vessels that are currently on order with deliveries expected by 2010, the vast majority of tankers will meet the stated age criteria when Kitimat Terminal is eventually commissioned. Table 4-1, below, presents a summary of the vessel age statistics.

Table 4-1 Current Vessel Fleet Age Statistics

Description	VLCC	Suezmax	Aframax
Current fleet.	518	363	783
Current fleet less than 20 years old, all hull types.	96%	94%	91%
Current double hull fleet less than 20 years old.	100%	97%	97%
Current double hull fleet projection to 2015, less than 20 years old.	93%	97%	91%
New-build deliveries by 2015.	217	176	244
Future fleet projection to 2015, less than 20 years old.	~ 97%	>90%	>90%

4.3 Additional Terminal Regulations

The terminal regulations will also include the following terms:

- Tanker classification society must be a member of the International Association Classification Societies (IACS).
- If requested, the tanker owner must agree to allow Enbridge or its agent access to the tanker for inspection independent of the SIRE Program.
- Tanker must have English-speaking officers.
- Tanker shall not have any expired or temporary certificates on board.
- Tankers must certify it meets all Flag and Port State requirements.
- Tanker must agree to allow Enbridge to place a representative on-board the tanker for the duration of the discharge operation to observe for safety and pollution prevention.

In accordance with Clause 3.9.2 of the TERMPOL Code, Enbridge's TAP and Terminal Regulations will ensure that vessels calling at Kitimat Terminal will comply with all applicable IMO conventions and initiatives, directed at marine safety, marine pollution prevention and atmospheric protection; and furthermore, that vessels will be certificated to comply with the Canada Shipping Act and other relevant Canadian statutes and all applicable marine and regulatory requirements.

5 References

1. International Chamber of Shipping, Oil Companies International Marine Forum (OCIMF), International Association of Ports and Harbors. 2006. Fifth Edition, *International Safety Guide for Oil Tankers and Terminals (ISGOTT)*.

1. Oil Companies International Marine Forum (OCIMF), 2002. First Edition. *Recommendations for Ships' Fittings for Use with Tugs (With Particular Reference to Escorting and Other High Load Operations)*.

2. *Clarkson Register*. July 1, 2008. CD Version 2.560, Standard Edition.

3. *Enbridge Marine Transportation Management Plan*, January 2006. (Internal documentation not published).

Appendix A Vessel Specification Database

A.1 Aframax - Double Hulls Only

Table A-1 Aframax Fleet Size by Vessel Capacity

Vessel Size – Capacity (bbls)	Number of Ships
500,000 – 550,000	17
550,000 – 600,000	13
600,000 – 650,000	24
650,000 – 700,000	79
700,000 – 750,000	331
750,000 – 800,000	173
800,000 – 850,000	11
Grand Total	**648**

Table A-2 Aframax Measurements

Measurement	Minimum	Maximum	Average
LOA (m)	220.8	256.2	243.9
LBP (m)	210.0	245.0	233.5
Beam (m)	32.2	48.0	41.9
Draught (m)	11.6	16.1	14.6
Deadweight Tonnage (t)	81,408	117,099	104,374
Capacity by barrels (bbls)	534,376	848,848	720,609
Capacity by volume (m^3)	84,959	134,956	114,568

Notes:

The above data shows that AFRAMAX vessels are more commonly of the 100,000 to 110,000 DWT size with a loaded draught of about 14 m to 15 m.

Source:

Clarkson Register CD Standard Edition, Version 2.560, July 1, 2008 – 50,000 bbls sub-groups. A review of the Clarkson Tanker Register, 2009 indicated that vessel dimensions may vary by approximately ±2 percent from those stated here.

A.2 Suezmax - Double Hulls Only

Table A-3 Suexmax Fleet Size by Vessel Capacity

Vessel Size – Capacity (bbls)	Number of Ships
800,000 – 850,000	13
850,000 – 900,000	17
900,000 – 950,000	7
950,000 – 1,000,000	3
1,000,000 – 1,050,000	121
1,050,000 – 1,100,000	134
1,100,000 – 1,150,000	14
1,150,000 – 1,200,000	0
1,200,000 – 1,250,000	0
1,250,000 – 1,300,000	5
Grand Total	**314**

Table A-4 Suezmax Measurements

Measurement	Minimum	Maximum	Average
LOA (m)	249.1	290.4	273.4
LBP (m)	239.0	278.9	262.7
Beam (m)	41.5	53.7	47.3
Draught (m)	14.6	18.8	16.7
Deadweight Tonnage (t)	120,499	193,050	152,667
Capacity by barrels (bbls)	802,617	1,269,114	1,033,336
Capacity by volume (m^3)	127,606	201,773	164,287

Notes:

The above data shows that SUEZMAX vessels are more commonly of the 150,000 to 160,000 DWT size with a loaded draught of about 16 to 17 metres. A popular size is just below 160,000 DWT.

Source:

Clarkson Register CD Standard Edition, Version 2.560, July 1, 2008 – 50,000 bbls sub-groups. A review of the Clarkson Tanker Register, 2009 indicated that vessel dimensions may vary by approximately ±2 percent from those stated here.

A.3 VLCC – Double Hull Only

Table A-5 Double Hull Fleet Size by Vessel Capacity

Vessel Size – Capacity (bbls)	Number of Ships
1,500,000 – 1,550,000	1
1,550,000 – 1,900,000	0
1,900,000 – 1,950,000	6
1,950,000 – 2,000,000	20
2,000,000 – 2,050,000	77
2,050,000 – 2,100,000	126
2,100,000 – 2,150,000	109
2,150,000 – 2,200,000	14
2,200,000 – 2,250,000	2
Grand Total	**355**

Table A-6 Double Hull Measurements

Measurements	Minimum	Maximum	Average
LOA (m)	324.0	343.7	332.6
LBP (m)	310.9	328.0	319.6
Beam (m)	56.0	70.0	59.0
Draught (m)	18.7	23.1	21.7
Deadweight Tonnage (t)	258,076	320,472	302,255
Capacity by barrels (bbls)	1,537,651	2,205,207	2,078,908
Capacity by volume (m^3)	244,467	350,600	330,520

Notes:

The above data shows that VLCC vessels are more commonly of the 300,000 to 310,000 DWT size with a loaded draught of about 21 to 23 metres. Significantly there are no VLCC tankers in the 1,550,000 to 1,900,000 barrels capacity range, or approximately 260,000 to 280,000 DWT.

Source:

Clarkson Register CD Standard Edition, Version 2.560, July 1, 2008 – 50,000 bbls sub-groups. A review of the Clarkson Tanker Register, 2009 indicated that vessel dimensions may vary by approximately ±2 percent from those stated here.