ITEM	10
MANAGER'S REPORT NO.	76
COUNCIL MEETING	92/12/14

TO: **CITY MANAGER** 1992 DECEMBER 07
FROM: **ACTING DIRECTOR**
PLANNING AND BUILDING

SUBJECT: SHELLBURN REFINERY DOCK UPGRADE

PURPOSE: To provide Council with information on the proposed existing dock upgrade at the Shellburn Refinery site.

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RECOMMENDATION:

1. **THAT** a copy of this report be sent to: Dave Peters, Environmental Control Coordinator, Shell Canada Products Limited, Shellburn Refinery, 201 Kensington Avenue, Burnaby, B. C., V5B 1B2.

R E P O R T

1.0 BACKGROUND:

On November 02, 1992, staff presented an information report to Council that summarized proposed changes and provided comment on possible land use, environmental and other ramifications of the Shellburn conversion program. Arising from consideration of this report a motion was put forward requesting information as to Shellburn's intent with respect to upgrading the existing wooden dock to bring the structure into compliance with full current standards.

2.0 THE SANDWELL REPORT:

In June 1991 the Sandwell report was released after the Vancouver Port Corporation commissioned Sandwell Inc. to assess the risk of tanker traffic movements within the Port of Vancouver. The intent of the study was to determine the environmental, human safety and operational risks of the movement of crude oil, petroleum and chemical products by tanker and tanker barge within the Port of Vancouver. The report made 46 recommendations that pertain to terminal facilities, port operations and environmental protection and contingency measures (see Attachment #1).

Subsequent to the release of this report staff, on 1991 October 09, provided Council with information on the risk analysis study. This report reviewed the five volume Sandwell study with an overview to those facilities on the Burnaby waterfront. The Sandwell Study team visited each terminal in the Port and evaluated it using standard criteria including terminal description, wharf facilities, bulk liquids handled, vessel characteristics, loading procedures and spill containment measures, controls and electrical systems, accident and spill history, training standards, fire and spill response equipment available. Wherever appropriate, the study team identified opportunities for improvements and estimated the level of risk reduction that might be achieved with specific improvements.

On the Burnaby waterfront, opportunities for improvements that would reduce risk were identified for facilities such as Chevron, PetroCanada, Shellburn and Trans Mountain Pipe Line. Chevron and Shellburn both have wharves constructed of timber piles and timber decking. A wharf fire or a fire on a tanker or barge that spread to the wharf would result in a very difficult firefighting situation. These risks were identified as being greatly reduced by installation of sprinkler systems or replacement of the timber structures with concrete when facilities are rebuilt.

ITEM	10
MANAGER'S REPORT NO.	76
COUNCIL MEETING	92/12/14

At Shellburn and PetroCanada, the largest tankers utilizing the terminal facilities exceed the tanker size for which the facilities were designed. Additional berthing dolphins, additional mooring lines or reduction in the maximum size of tanker calling were recommendations in reducing risks associated with tanker mooring. 127

Table 3.15 of the Sandwell report is a summary of Terminal Profiles, (see Attachment #2). Three levels of potential improvement were noted as:

". Marginal benefit - no strong rationale for make the improvement
. Tangible benefit - the suggested improvement would make a considerable reduction in risk
. Significant benefit - the suggested improvement substantially reduces risk and the improvement should be made as soon as possible.

In the table, the facilities at which tangible possibilities for improvements have been identified are shaded."

3.0 SHELLBURN DOCK UPGRADE:

On 1992 November 09, staff met with Mr. D. Peters, Environmental Coordinator of Shellburn Refinery to discuss concerns with the existing wood dock. It was confirmed that there are plans to upgrade the present dock which would not involve a replacement of the wood facility but would enable it to meet safety and fire guidelines already laid out. The proposed dock upgrade is anticipated to be completed mid-January with a cost of approximately one million dollars. While incorporating many of the berthing and fire safety concerns of the Sandwell report in this dock upgrade, it was noted that these were recommendations only and not mandatory regulations. A report was prepared by Westmar Consultants Inc. for Shell which was a review based on the Sandwell study. It identified deficiencies with respect to the long-term use of existing docks.

3.1 Deficiencies

Two safety concerns were identified, and proposals to deal with the deficiencies were advanced.

A) Berthing Strength

There is a code of practice that is observed in berth design, called the "termpol code", as it relates to the ability of a dock to absorb the shock of a ship against it when docking or conversely, restaint strengths due to wind and tide pulls. The Westmar Consultants' recommendations identified the requirements for the tanker traffic projected over the next 10 - 20 years, to bring the existing dock into compliance with the above "code". In order to accommodate berthing of the projected 40,000 DWT tankers at this port, the following steps will be undertaken:

- rebuilding the face of the dock, installing "bumpers" for shock absorption.
- increasing the waterlot lease in order to provide better angled mooring buoys and anchors.
- reinforcing existing dolphins.
- dredging to a deeper berthing depth.

ITEM	10
MANAGER'S REPORT NO.	76
COUNCIL MEETING	92/12/14

B) Fire Safety

The Sandwell report identified concerns with wooden structures used for docks at refineries, specifically in the difficulty of extinguishing fires at docks handling petroleum products. The risk of fires was identified as being reduced by either the addition of sprinkler systems or replacement of timber docks with concrete structures. Shell determined that the wooden dock would not be replaced at this time nor would any encapsulation take place but instead, additional fire safety features would be incorporated according to the recommendations laid out.

- A review was undertaken as to the installation of an under dock sprinkler system. It was felt that the water was not adequate but a foam dispensing system could aid in fire suppression.
- There is a dedicated water line along the trestle to the dock at present.
- A standpipe connection to the water line, at a fire fighting "shed" on dry land will be fitted with a concentrate foam supply.
- The existing monitors on the dock will be retrofitted with foam nozzles.
- 45 gal. drums of foam concentrate will be placed beside the 3 fire monitors which can aid in a short duration fire fighting situation.
- Most tankers using the dock have their own foam or inert gas fire protection systems to control on board fires.
- Putting new dock procedures, training and certification programs into effect.
- Requiring a constant review of safety features.

4.0 DISCUSSION:

The Fire Prevention Office has indicated that the chief concern would be fires originating aboard a ship or barge. In addition to the fact that most tankers have their own foam and an inert gas fire suppression system on board, the Fire Prevention Office also pointed out that within the next year five new Pumper Fire Boats are to be in operation within the harbour. One will be located at the Petro Can dock near Port Moody at the beginning of 1993. This boat will be manned by trained Marine Firefighters both from Burnaby and Port Moody. It is the feeling of the Fire Department that these combined new features are adequate in ensuring fire safety.

The dock upgrade proposed addresses a number of the recommendations laid out by the Sandwell report in respect to berthing and fire safety and will result in a substantial improvement to existing conditions.

This is for the information of Council.

D. G. Stenson,
Acting Director
Planning and Building

PJA/ds

Attachments

cc: Assistant Chief Fire Prevention Officer

ATTACHMENT 1

Sandwell

9. STUDY RECOMMENDATIONS

9.1 Terminals

1. The practice of finishing loading on a rising tide to take advantage of tidal assistance should be abandoned. A tanker should never have a loaded draft greater than the depth of water at the dock at the following low tide.

2. An information package should be developed for each terminal outlining the terminal dimensions, design ship dimensions, water depths, mooring point capacities, recommended mooring arrangements, loading procedures, fire protection measures in place and other terminal regulations. The Oil Company's International Marine Forum (OCIMF) has developed a draft format which could be adopted.

3. The use of Vanterm 4 as a berth for chemical tankers should be discontinued until such time as proper fenders are installed.

4. Loading of barges should be suspended while tugs are working in the area or large vessels depart or arrive.

5. Refineries should provide a training program in line handling to their personnel to outline to them mooring procedures, provision of assistance to tug crews in connecting lines to buoys, etc. They should also ensure that a sufficient number of linesmen is available to handle the ship's lines in a timely fashion.

In addition to the above specific recommendations, a number of opportunities for improvement was noted during the inspections of the individual bulk liquids terminals.

9.2 Operations

1. All loaded tankers in excess of 10,000 DWT moving in the port should have a tug escort through the port to the west of First Narrows. In specifying the size and number of tugs required as a function of ship size, the following issues need to be examined:

   - Design, power and bollard pull requirements for the tugs.
   - Overall speed capability of the tugs.
   - Requirement for twin screw twin engine tugs.
   - Escort tugs to act as a watch and intervention vessel.
   - The safest and most efficient towing configuration should be established, i.e. on the hip, pushing or on a line.

2. The Manoeuvring Simulation Model study being conducted at Ship Manoeuvring Facility on Rhode Island should be used to provide realistic size limitations for tankers transitting Second Narrows.

3. Two pilots are not required on all tankers. The ship's master is fully qualified to handle the ship in an emergency situation. Recommendation 8 incorporates the

ITEM	10
MANAGER'S REPORT NO.	76
COUNCIL MEETING	92/12/14

addition of a Marine Technical Supervisor who is a fully qualified tanker master on board at all times and can provide the necessary bridge supervision previously provided by the second pilot.

4. The Port, industry, Pacific Pilotage Authority and B.C. Coast Pilots should agree on minimum standards and training for pilots handling tankers and large vessels. Pilots would not be allowed to handle these vessels until they had completed a requisite level of training and/or refresher courses. The concept is not to create an elite class of pilots but to ensure that the pilots on the tankers have completed courses (and periodic refresher courses) in amongst others, radar systems and full bridge simulators in response to emergency situations. This system is already in place in an informal basis in the selection system that BC Coast Pilots uses in allocating pilots to tankers.

5. The Vancouver Port Corporation should promote the use of the existing model at CAORF by pilots and others in training for emergency situations.

6. The Harbour Master should institute a policy whereby a foreign tug towing a barge through Vancouver Harbour must have an adequate escort from a Vancouver harbour tug on both inbound and outbound transits. This escort should incorporate the First Narrows and the whole Inner Harbour and not just Second Narrows as currently required in the MRA for barges over 6,500 tonnes displacement.

7 The Harbour Master should work with the shippers of liquids through the Port of Vancouver to establish minimum standards that should be adopted prior to the chartering of any tanker to load or discharge liquids in the Port of Vancouver. He also should work with the shippers of liquids sold FOB Vancouver (i.e. purchaser charters the tanker) to ensure that the seller retain the right to approve the nominated tanker prior to its selection by the purchaser and that the seller retain the right to reject the tanker on arrival if it is found not to meet the agreed standards and/or enforce the rectification of any deficiencies at no cost to the seller.

8. An independent Marine Technical Supervisor should be engaged to audit the operations of all crude oil and petroleum product tankers in the Port of Vancouver. The Marine Technical Supervisor's vessel loading report should be circulated to the Harbour Master and appropriate records kept.

9. The Harbour Master's launch should join the tug escort to clear all interacting vessel traffic from the path of the tankers. A Moving Exclusion Zone is not necessary.

10. A Moving Exclusion Zone, possibly 1 nautical mile ahead and .5 nautical miles astern and abeam, should be instituted for chlorine tank barges.

11. While the provision of the Emergency Response Vessel (ERV) may be reasonable for the escort of tankers through the Straight of Georgia and Strait of Juan de Fuca, given the significant response capability in Vancouver Harbour, the deployment of the ERV vessel within the bounds of the Port of Vancouver only does not appear warranted. If the policy of instituting an ERV escort for crude oil tankers through

the Straits of Georgia and Juan de Fuca is implemented, then the ERV should accompany the tankers through the Port of Vancouver.

12. The practice of leaving petroleum barges at anchor at buoys should be eliminated or reduced. Where possible the barges should remain anchored inside booms at the refinery docks until the coastwise tug is available to take possession of the barge. Loaded and/or unloaded petroleum/product barges moored at buoys in the Port of Vancouver should be provided with an attendant tug and a full watch maintained.

    The mooring buoys should be clearly lit.

    Petroleum/product barges should be thoroughly inspected for damage by the skipper of the mother tug prior to hook up.

    Note: In conjunction with the petroleum industry, Seaspan is currently reviewing present buoy mooring practices.

13. All crude and petroleum tankers in the Port of Vancouver should be required to have operating inerting systems and have a non-explosive atmosphere in the vessel cargo tanks. The Marine Technical Supervisor (see Recommendation 8) can inform the Harbour Master of the status of the system.

    The inerting requirements for chemical carriers should be assessed on a chemical by chemical basis and appropriate recommendations developed.

14. Topping off / lightering operations should be conducted only with the prior authorization of the Harbour Master. Both the ship and barge should be boomed when diesel and heavier products are being transferred. These operations should only be allowed in sheltered locations where tidal currents are less than 1.5 knots (.7 m/sec), the limit for effective containment of liquids by booms.

15. Bunker barges should be equipped with boom and adsorbents to provide immediate response to spills. Refineries should be encouraged to allow tankers to bunker from barges.

16. Tugs used in the movement of petroleum barges, empty or loaded, through the port, should be restricted to twin screw twin engine tugs. Empty barges would only be excluded if they were gas free.

17. The Port should work with the Council of Maritime Carriers to establish guidelines for minimum standards for towlines (sizes as a function of tug and barge size). Guidelines should also be established for the maintenance, inspection and replacement of the towlines. These guidelines could then be used by the insurance and petroleum industry to police tug operators.

18. The Port Corporation should support the Coast Guard in pursuing the improvement to V.T.S. Service and equipment.

19. The Port, the Pilots and the towing companies should invest as soon as possible in upgrading their radio systems to the requisite standards to filter out pager interference on the Marine VHF Channels.

20. The Port should work with the Canada West Petroleum Association and the Council of Marine Carriers to establish requisite minimum training for bargemen. Courses could be developed through the auspices of the Pacific Marine Training Institute.

21. The tug and barge industry, with the assistance of the Canadian West Petroleum Association, Coast Guard and the Pacific Marine Training Institute, should establish mandatory training in spill response programs, similar to that in place in the larger companies on the Coast, for all crews of tugs and tank barges.

22. The Vancouver Port Corporation should support Transport Canada initiatives to institute drug and alcohol testing.

23. The Port Corporation should work with the Council of Marine Carriers and the Canada West Petroleum Association to see that spill response gear is deployed on all oil barges operating in the Port of Vancouver.

24. The Port Corporation should demand oil spill contingency plans for all tankers operating in the port. In the case of foreign flag tankers, this contingency plan would be as simple as a demonstrated understanding of Port of Vancouver spill call-out procedures. More formal documentation should be demanded of all carriers trading frequently in the Port.

9.3 Protective and Contingency Measures

1. The Vancouver Port Corporation should urge the federal government to make a formal response to the Brander-Smith Report. Specifically, lead agency jurisdiction for marine spills should be confirmed by the federal government in consultation with the provinces.

2. The Vancouver Port Corporation should recommend that lead agency jurisdiction for marine spills be confirmed by the government in consultation with the Government of B.C.

3. The Vancouver Port Corporation should retain lead role in all spills within the Port of Vancouver and should in its proposed Memorandum of Agreement with the Canadian Coast Guard confirm: what their respective jurisdictions and roles for spills in the Port would be; how this might be affected by spill size or other factors; what resources and commitment the respective jurisdictions bring to this responsibility; and what management structure would be set up to implement effectively this Agreement.

4. The Vancouver Port Corporation should ensure that industries operating in the Port, particularly terminals and vessels, have the necessary equipment, personnel, and planning apparatus to deal effectively with spills in the Port.

5. The Vancouver Port Corporation should require that all vessels and tank barges transporting dangerous goods in the Port have spill contingency plans and that these should be individually reviewed and approved by the Canadian Coast Guard as a condition of operating in the Port. This would reduce some of the current variability in the scope, content and presentation of plans.

6. The Vancouver Port Corporation should require that all shoreline industries handling dangerous goods in the Port have spill contingency plans and that these should be individually reviewed and approved by the provincial Ministry of Environment as a condition of operating in the Port.

7. The Vancouver Port Corporation should recommend to the Canadian Coast Guard and B.C. Ministry of Environment that contingency plans (Recommendations #5 and 6) be accompanied by planning targets which identify the type and volume of spill for which to plan.

8. The Vancouver Port Corporation should take the lead in creating an integrated joint industry-government response capability to deal with large spills in Port waters. The planning target is 10,000 barrels (1,200 m^3 or 1,100 tonnes).

9. In creating such a response capability, the Vancouver Port Corporation should take the lead and delegate important planning and response functions to appropriate units under its authority. These would include the petroleum and chemical industries, vessel operators, Coast Guard, B.C. Ministry of Environment, Environment Canada, municipalities and other industries and agencies as appropriate.

10. The Vancouver Port Corporation should set the mobilization target for such an integrated response unit at two hours. Within two hours, a core response team of response commanders, managers, and supervisors should be at their appropriate stations, and the response equipment should have been dispatched to the site.

11. The Vancouver Port Corporation should complete its communications plan as part of the integrated spill response plan proposed for the Port of Vancouver.

12. The Vancouver Port Corporation as lead agency of the integrated spill response plan should set training standards which encourage the continuation of the current programs while stimulating some specific improvements. These might include greater participation by industries and government agencies to increase the number of trained local personnel and to provide as many opportunities as possible within these training sessions to simulate spill incidents.

13. In support of a 10,000 barrel (1,200 m^3) barrel spill planning target, the Vancouver Port Corporation, in collaboration with industry, the Canadian Coast Guard and other agencies, should conduct a detailed analysis of the equipment requirements and the management structure necessary to coordinate such an arsenal in the field.

14. As part of this analysis, procedures to bring in equipment from Central and Eastern Canada, and parts of the U.S. should be drawn up so that a 48 hr planning target for

local deployment can be met. These procedures should include loan agreements and in the case of U.S. equipment, prior customs clearance.

15. In planning for the target spill, the planned open water recovery should be 50%, with the daily recovery of 1470 barrels (200 tonnes, 175 m^3) on the peak day.

16. The Vancouver Port Corporation should lobby for the petroleum industry, the marine transport industry and appropriate government agencies to conduct regular realistic oil spill simulation exercises along the Coast of B.C., starting with the Port of Vancouver. The exercise format of the U.S. Coast Guard or a variant of it would be appropriate.

17. The Vancouver Port Corporation should require the petroleum industry to create a roster of trained personnel at the manager and operator levels, with qualification criteria for each level. The industry should target 60 managers which could be mobilized to fill pre-designated functions within a large response force. A further 200 workers and operators should be similarly available for specific tasks.

10. REFERENCES

EPS, 1984. Manual for Spills of Hazardous Materials. Environmental Protection Service, Technical Services Branch, Ottawa, Ontario.

McKelvey, R.W, I. Robertson and P.E. Whitehead, 1980. Effect of Non-Petroleum Oil Spills on Wintering Birds Near Vancouver. Mar. Poll. Bull 11(6):169-171.

Sax, I.J. and R.J. Lewis, 1987. Hazardous Chemicals Deck Reference. Van Nostrand Reinhold, New York.

Smith, D.W. and S.M. Herunter, 1989. Birds affected by a Canola Oil Spill in Vancouver Harbour, February, 1989. Spill Technology News Letter. October - December (4):3-5.

Sandwell

ATTACHMENT 2

Table 3.15
Summary of Terminal Profiles

FACTOR	Albright & Wilson	Canadian Occidental	Chevron	Dow	ESSO	Neptune
Commodities	Sodium Chlorate	Chlorine, Caustic Soda	Petroleum Products	Caustic Soda, Ethylene Glycol, Ethylene Dichloride	Petroleum Products	Canola Oil
Terminal Procedures Handbook	No	No	No	No	No	No
Ship/Shore Checklist	Yes	Yes	Yes	Yes	Yes	No Tangible
Tanker Selection Audit	N/A	No	Yes	For some vessels	Yes	No
Pollution Contol Officer On Board	No	No	No	No	Under Consideration	No
Maximum Tanker Using Dock	3500 t barge	40,000 dwt	39,000 dwt	50,000 dwt	48,000 dwt partly laden	30,000 dwt
Terminal Design Ship	3500 t barge	60,000 dwt	40,000 dwt	58,500 dwt	35,000 dwt	60,000 dwt
TERMPOL						
Turning Circle with No Tide Assist Benefit of Improvement	No Marginal	Yes	Yes	Yes	No Marginal	Yes
Current Alignment Benefit of Improvement	Yes	No data	Marginal	No data	No data	No data
Depth for Design Ship Benefit of Improvement	OK	No - 10.7 m Ship - 11.4 m Marginal	No - 9 m Ship - 11.4 m Infrequent Tidal Assist	Yes	No - 10.3 m Ship - 11 m Draft Limits In Place	Yes
Design Depth Each Side of Centreline Benefit of Improvement	No Marginal	No Marginal	No Marginal	No Marginal	No Marginal	No Marginal
5° Structures Clearance Benefit of Improvement	No Marginal	No Marginal	Yes	No None	No Marginal	Yes
Outside Berthing Dolphins Benefit of Improvement	Yes	Yes	Yes	Yes	Yes	Yes
Inside Berthing Dolphins Benefit of Improvement	Yes	Yes	Yes	Yes	Yes	Yes
Head/Stern Lines @ 45° Benefit of Improvement	Yes	Yes	No Tugs Utilized	Yes	Yes	Yes
Breast Lines Benefit of Improvement	Yes	Yes	Yes	Yes	No Marginal	Yes
Spring Lines Benefit of Improvement	Yes	Yes	Yes	Yes	Yes	Yes
Fender System Benefit of Improvement	Yes	Yes	Yes	Yes	Minimal Marginal	Yes
Ship Size Constrained by	Draft Length	Draft	Moorings, Draft	Moorings	Fenders, Depth	N/A

FACTOR	Albright & Wilson	Canadian Occidental	Chevron	Dow	ESSO	Neptune
OPERATIONS						
Loading Arm	Yes	Yes, on barge for chlorine	No	Yes	Yes	No
Flexible Hose	No	Yes, for caustic	Yes	Yes, at barge station	Yes	Yes
Hose Pressure Tested	N/A	Yes External	Yes Internal	Yes External	Yes Internal	Yes External
Dock Pipelines Full When not in use	No	No	Yes	No	Yes	No
Automated Emergency Shutdown	Yes	Yes	No	Yes	Yes	No
Drip Trays and Tanks on Dock	Yes	Yes	Yes	Yes	Yes	No
Spill Containment on Dock	Yes	No Timber Dock	No Timber Dock	No	Yes	No Timber Dock
Vessels Boomed	No, Not Useful	No, Not Useful	Yes, for Heavy Products	No, Not Useful	Yes, for Heavy Products	No
Spill Response Ability	None Possible	Excellent for Chlorine, None for Caustic	Considerable	None Possible	Considerable	None
Electrical Equipment Intrinsically Safe	Yes	Yes	Yes	Yes	Yes	No
Fire Fighting Equipment	None	Sprinklers on Dock	Fire Water Monitors, Foam Truck	Fire Water Monitors, Foam Trailer	Fire Water Monitors Foam Truck	Chemical Fire Extinguisher
Trained Fire Fighting Capability	None	None	Yes	Yes	Yes	None
Wharf Construction Benefit of Improvement	Steel Pile, Concrete	Timber	Timber Tangible	Concrete	Concrete	Timber
Emergency Procedures Posted	No	Yes	Yes	Yes	Yes	No
Contingency Plan Prepared	Yes	Yes	Yes	Yes	Yes	No

Table 3.15
Summary of Terminal Profiles

FACTOR	Pacific Coast Terminals	Petro-Canada	Shellburn	TMPL	Vancouver Wharves	West Coast Reduction
Commodities	Styrene monomer, Ethylene glycol	Petroleum Products	Petroleum Products, Styrene monomer	Crude oil, Jet Fuel B	Methanol	Canola oil, Tallow
Terminal Procedures Handbook	No	No	No	Yes	No	No
Ship/Shore Checklist	Yes	Yes	Yes	Yes	Yes	No Tangible
Tanker Selection Audit	No	No	Yes	Yes	No	No
Pollution Officer On Board	No	No	In Process of Implementing	Yes	No	No
Maximum Tanker Using Dock	38,000 dwt	50,000 dwt	40,000 dwt	90,000 dwt	39,000 dwt	46,000 dwt part laden
Terminal Design Ship	60,000 dwt	48,000 dwt	30,000 dwt	90,000 dwt	60,000 dwt	50,000 dwt
TERMPOL						
Turning Circle with No Tide Assist Benefit of Improvement	No Marginal	Yes	Yes	Yes	Yes	Yes
Current Alignment Benefit of Improvement	No data	No data	No data	No data	No data	No data
Depth for Design Ship Benefit of Improvement	Yes for tanker	No - 10.3 m Ship - 12.5 m Draft Limits in Place	No - 8.8 m Ship - 11.6 m Draft Limits in Place	No - 10.1 m Ship 13.4 m Significant	No - 10.3 m Ship - 10.8 m Marginal	Yes at Vanterm 5
Design Depth Each Side of Centreline Benefit of Improvement	No Marginal	No	No Marginal	No Marginal	Berth 1 no Berth 2 yes Marginal	No
5° Structures Clearance Benefit of Improvement	Yes	Yes	Yes	Yes	Yes	No
Outside Berthing Dolphins Benefit of Improvement	Yes	72m required 42m provided Significant	Yes	87m required 83m provided Marginal	Yes	No
Inside Berthing Dolphins Benefit of Improvement	Yes	Yes	Yes	Yes	Yes	Yes
Head/Stern Lines @ 45° Benefit of Improvement	Yes	Not Suitable Tangible	Not Provided Tangible	Marginal Marginal	Yes	Yes
Breast Lines Benefit of Improvement	Yes	Not Suitable Tangible	Yes	Yes	Yes	Yes
Spring Lines Benefit of Improvement	Yes	Yes	Not Suitable Tangible	Yes	Yes	Yes

FACTOR	Pacific Coast Terminals	Petro-Canada	Shellburn	TMPL	Vancouver Wharves	West Coast Reduction
Fender System Benefit of Improvement	Yes	Yes	Marginal Tangible	Yes	Yes	Vanterm 4 Significant
Ship Size Constrained by	N/A	Berthing dolphins, mooring dolphins, water depth	Fender energy, mooring dolphin spacing	draft	Water Depth	Fenders
OPERATIONS						
Loading Arm	No	Yes	Yes (Propane)	Yes (Crude)	No	No
Flexible Hose	Yes	Yes	Yes	Yes (Jet Fuel)	Yes	Yes
Hose Pressure Tested	Yes External	Yes	Yes Internal	Yes	Every 2 Years External	Yes External
Dock Lines Full When not in use	Yes	Yes	Yes	Yes	No	No
Automated Emergency Shutdown	Yes	Yes	No	Yes	Remote Switch on ship, pumphouse and tank farm	Manual, by Radio
Drip Trays and Tanks on Dock	Yes	Yes	Yes	Yes	Sump at pipe manifold. No trays on dock	Hose Shore Manifold in Sump
Spill Containment on Dock	No Timber Dock	Yes	No Timber Dock	Yes	No Timber Dock	No
Vessels Boomed	Yes	Yes, for heavy products	Yes, for heavy products	Yes	No (No Point, Methanol is miscible)	No
Spill Response Ability	Limited	Considerable	Considerable	Considerable	None on water	None. 200 ft boom in storage
Electrical Equipment Intrinsically Safe	Yes	Yes	Yes	Yes	Yes	Not on dock
Fire Fighting Equipment	Fire Water Monitors, Sprinklers	Fire Water Monitors, Foam truck		Fire Water Monitors, Foam Truck	Water on Dock, Chemical Fire Extinguisher	Water on Dock
Trained Fire Fighting Capability	Some	Yes	Yes	Yes	None - Rely on N. Van. Fire Dept	None (None required)
Wharf Construction Benefit of Improvement	Timber Marginal	East Dock Timber Pile Marginal	Timber Dock Tangible	Concrete	Timber Marginal	Concrete
Emergency Procedures Posted	Yes	Yes	Yes	Yes	Yes	No Tangible
Contingency Plan Prepared	Yes	Yes	Yes	Yes	Yes	No Tangible