ITEM	5
MANAGER'S REPORT NO.	58
COUNCIL MEETING	91/10/15

TO: MUNICIPAL MANAGER 1991 October 09

FROM: DIRECTOR PLANNING AND BUILDING Our File: 01.301

SUBJECT: RISK ANALYSIS OF TANKER TRAFFIC MOVEMENTS WITHIN THE PORT OF VANCOUVER

PURPOSE: To provide Council with information on the risk analysis study completed for the Port of Vancouver.

RECOMMENDATIONS:

1. THAT the Federal Minister of Environment be requested to initiate a co-ordinated Port, Federal, Provincial, Regional, Municipal and industry approach to the planning, development and operation of Burrard Inlet in the context of the growth of the region and a sustainable level of hazardous goods movement.

2. THAT Chevron, PetroCanada, Shellburn and Trans Mountain Pipe Line be requested to respond to the risks at their facilities as identified in the Sandwell risk analysis report and indicate what remedial actions are planned to address these risks.

3. THAT the Federal and Provincial Ministers of Environment, the GVRD, the Vancouver Port Corporation and all Municipalities that abut Burrard Inlet be forwarded a copy of this report.

R E P O R T

1.0 BACKGROUND

Risks associated with tanker traffic, the handling of dangerous goods, and the possibility of increased levels of tanker traffic in the Port of Vancouver are ongoing concerns and have been the subject of considerable discussion by Council and citizen delegations. On 1989 November 28 Council wrote to Mr. David Brander-Smith Chairman of the Federal Government's Public Review Panel on Tanker Safety regarding the need to establish a sustainable iimit for the movement of crude oil and petroleum products within Burrard Inlet. Because of concerns about potential increases in Burrard Inlet tanker traffic that might occur as a consequence of PetroCanada's now inactive proposal to ship MTBE, a gasoline additive, out of the Port by tanker, Council also requested that the MTBE project be subjected to a comprehensive environmental review through the Federal Environmental Review Assessment Office (FEARO).

In 1990 January, Council received a letter from the Burnaby Citizens for Environmental Protection concerning hazardous industries and their future growth in Burrard Inlet. In response to this letter Council wrote to the Minister of the Environment on 1990 March 01 requesting "..that an independent, comprehensive environmental and risk assessment of hazardous goods movement and storage in the Burrard Inlet basin be undertaken through EARP or a similar process.". On 1990 October 09, the Minister of the Environment responded to Council's letter and informed Council that the Vancouver Port Corporation had hired a consultant to conduct a risk analysis of tanker traffic in the Port. The Municipal Manager recently received copies of the risk analysis report for Council's information and review.

The Vancouver Port Corporation commissioned Sandwell Inc. (with subconsultants Bennett Environmental Consultants Ltd. and Seaconsult Marine Research Ltd.) to conduct a risk analysis of tanker traffic movements within the Port of Vancouver. The purpose of the study was to assess environmental, safety and operational risks related to the movement of crude oil, petroleum products and chemicals by tanker and tanker barge within the Port. The study also addressed methods of handling cargo, vessel traffic control, contingency planning and spill response capability within the Port of Vancouver.

The purpose of this report is to outline the contents and highlights of the risk analysis report for Council and to describe the public review process for the risk analysis. Implications of the report findings for Burnaby are also discussed.

2.0 RISK ANALYSIS REPORT

Risk analysis is a mathematical modeling technique used to quantify the likelihood of events such as tanker accidents and spills and estimate the nature and extent of associated environmental, economic, property and community damages. This technique is commonly used as a tool for identifying specific aspects of operations and facilities that may increase the risk of accidents. Results of a risk analysis also provide useful information for preparing emergency response plans for spills and accidents.

The comprehensive report, "A Risk Analysis of Tanker Traffic Movements within the Port of Vancouver", consists of an executive summary and four volumes. Copies of these documents are available for review in the Manager's office. The following paragraphs outline the contents and highlights of each volume.

2.1 Recommendations

The risk analysis study makes 46 recommendations (Attachment #1) that pertain to terminal facilities, Port operations, and environmental protection and contingency measures. The Port of Vancouver intends to implement all of these recommendations. As of early August, 1991, approximately one-third of these recommendations had been implemented.

2.2 Volume 1 - Tanker Operations in the Port

Volume 1 presents data on the volumes of bulk liquids handled (see Attachment #2), vessels calling (see Attachment #3), terminals and terminal facilities (see Attachment #4), tanker and tanker barge operations, legislative framework, and risk of accidents in the Port of Vancouver.

2.2.1 Risks at Terminal Facilities in Burnaby

The 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.

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On the Burnaby waterfront, opportunities for improvements that would reduce risk were identified for facilities at 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 barge that spread to the wharf would result in a very difficult firefighting situation. These risks could be reduced by installation of sprinkler systems or replacement of the timber structures with concrete when facilities are rebuilt.

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 would reduce risks associated with tanker mooring.

At Trans Mountain Pipe Line's Westridge terminal, some tankers are loaded to a draft that exceeds the available water depth at low tide. On the rising tide, "tidally assisted" loading is used to load additional cargo. To reduce risk, the loaded draft of tankers should be restricted to available water depth (less under keel clearance) at low tide on the day of loading.

2.2.2 Risk of Accidents in the Port of Vancouver

The risk of tanker and tanker barge accidents in the Port of Vancouver is estimated using data from the Port and several data bases on tanker casualties worldwide. Fire or explosion on a tanker or tanker barge, possibly resulting in a spill, is the most likely accident in the Port of Vancouver. On average, fire or explosion on a tanker or tank barge would be expected once every 12 or 16 years for tankers or tanker barges, respectively. The average time between fires/explosions resulting in spills is estimated to be 62 and 24 years for tankers and tanker barges, respectively.

Other types of accidents are predicted to have lower likelihoods. For example, a 1,000 barrel spill of crude or bunker oil would be expected once every 120 years while a 10,000 barrel spill would be expected once every 5,700 years. Similarly, a 1,000 barrel spill of gasoline would be expected every 180 years and a 10,000 barrel spill every 1,475 years. This raises the question of what constitutes acceptable risk?

2.3 Volume 2 - Characterization of the Port and its Environs

Volume 2 presents information on the biology, physical oceanography, shoreline geology, land use, property values and population of the waterfront of the Port. Summaries of this information are presented as text, maps and tables of data. The potential effects of spills of various bulk liquids handled in the Port on people, the ecosystem and port facilities are outlined. This information is used to predict impacts and estimate costs of cleaning up a major spill in the Port of Vancouver (see Section 2.4).

2.4 Volume 3 - Spill Risks, Fates and Damages

Volume 3 explains the risk modeling approach used in the study and presents the spill model scenarios that were developed to identify potential impacts of spills of various materials under differing conditions of weather and season. Risks related to increased tanker traffic are estimated. Operational improvements that could reduce spill risk in the Port and the state of preparedness for responding to spills are outlined.

2.4.1 Spill Scenarios

Six "critical" spill scenarios, low probability accidents with potentially onerous consequences, were modeled and described in terms of spill behaviour, appropriate spill response procedures, environmental impacts, and public health consequences. Estimated damages for the various spill scenarios and conditions are expressed in terms of probabilities and range from $100,000s to $100,000,000 or more depending upon the material spilled and conditions at the time of a spill.

Damage estimates include financial losses to affected facilities and the cost of emergency response, clean-up operations, and remediation. The report presents consider- able detail on how damage estimates were calculated. However, estimates are cumulative totals for the entire Port, and based on the information presented, it is not possible to determine what portion of the estimated damages would be related to resources, property or shoreline facilities on the Burnaby waterfront.

Of all the accident scenarios considered in the Port of Vancouver, a collision resulting in the puncture of a chlorine tank on one of Canadian Oxy's tank barges could have the most severe consequences and result in several thousand deaths through exposure to chlorine gas. The area of impact and number of people affected would depend on weather conditions and wind direction at the time of an accident; any area of the Port could potentially be affected. The likelihood of an accident resulting in the release of chlorine is considered to be "very remote". To ensure maximum safety for the transport of chlorine, the establishment of a moving marine exclusion zone around chlorine tank barges is strongly recommended.

2.4.2 Spill Risks with Increased Tanker Traffic

The change in risk of oil spills in the Port of Vancouver was calculated assuming an additional movement of 1,000,000 tonnes of crude oil exports from Westridge Terminals. This is equivalent to approximately double 1988 crude oil exports. Increasing exports of crude oil would result in increased tanker traffic. The risk analysis shows that the likelihood of spills increases from 3 percent to 92 percent depending on the size of spill predicted, but spill probability does not double as might be expected. For instance, with a doubling of crude oil exports, the likelihood of a 10,000 barrel spill which is once in every 5,727 years under present levels of vessel traffic would increase by 92 percent to one in every 2,989 years.

2.4.3 Operational Improvements

The report makes a series of recommendations for operational improvements that the Harbour Master can implement directly. These recommendations include tug escorts for tankers over 10,000 dead weight tonnes, limits on maximum tanker size, piloting and training standards, minimum standards for vessels chartered, moving exclusion zones for chlorine tank barges, ship safety, spill response capability and spill contingency plans.

2.5 Volume 4 - Appendices

Volume 4 contains five appendices of detailed technical information on the flora and fauna of the Port, an analysis of tanker casualties and spill risk, a catalogue of intertidal and backshore characteristics, equations used in risk modeling, and a technical description of the oil spill model used in this study.

3.0 IMPLICATIONS FOR BURNABY

The recommendations (Attachment #1) focus on specific measures for reducing risk and improving port safety at terminals (5 recommendations), in port operations (24 recommendations), and through protective and contingency measures (17 recommendations).

Burnaby and other municipalities on Burrard Inlet will benefit from improved safety procedures and stricter operating standards which reduce the risk of spills and other accidents in the Port. At the terminal facilities located in Burnaby, risks of fire, tankers that exceed the design size of terminal facilities, and "tidally assisted" loading of tankers are specific concerns. One recommendation specifically addresses "tidally assisted" loading and recommends that the practice be abandoned. The other concerns are not specifically addressed by recommendations, but appropriate improvements for responding to these concerns are outlined in the report.

Council will recall that in 1989, Mr. David Anderson, Special Advisor to the Premier and the Environment Minister on marine oil transportation and oil spill response, identified crude oil shipments from Burrard Inlet as an area of concern. Specifically, Mr. Anderson's recommendations included the following:

- there should be no further development of export trade of crude oil from the Port of Vancouver.

- existing exports of crude oil from the Port of Vancouver should be phased out as a matter of environmental policy.

In addition, Mr. David Brander-Smith, Chairman, Public Review Panel on Tanker Safety and Marine Spills Response Capability, in response to submissions from Municipalities on Burrard Inlet wrote to the Federal Environment Minister stating that an assessment should be made of the "..effects of increased movements of crude oil and petroleum products through Burrard Inlet, and establish a sustainable limit for such activity.".

The recommendations to reduce risk and improve safety in the Port are commendable. However, none of the recommendations address the issue of defining a sustainable level of tanker traffic in Burrard Inlet or address the future role of the Port in the context of hazardous goods movement and the growth and development framework of the region.

With population growth, the interface between Port activities and adjacent areas has become more critical. Refineries, storage tanks and terminals for shipment of crude oil, gasoline, fuel oil, and liquid chemical products, are located on Burnaby's Burrard Inlet foreshore. The refining, storage and transportation of hazardous materials by rail, road, tanker and barge adjacent to heavily populated areas could have potentially adverse affects on the adjacent community. The development goals for the region encourage the continued population growth of our inner metropolitan areas to ensure a more efficient use of available infrastructure. As such, the community surrounding Burrard Inlet can be expected to experience additional population growth and a corresponding increase in the level and frequency of potential conflict with adjacent port/industrial uses. It has therefore been previously suggested by the Municipality that the locational relationship between terminals handling hazardous goods and the movement of these goods within metropolitan areas should be reviewed to determine whether or not in the long term they would be more appropriately situated outside metropolitan areas. This major issue has not been addressed in the Port's study. It is therefore our view that a co-ordinated Port, Federal, Provincial, Regional, Municipal and industry approach to the planning, development and operation of Burrard Inlet in the context of the growth of the region and a level of sustainable hazardous goods movement is necessary to complement the recommendations of the Port's study. This co-ordinated approach should be initiated by the Federal Minister of the Environment.

It is recognized that the Vancouver Port Corporation is presently undertaking a review of their planning and development process affecting lands within their jurisdiction. This program is called 'Port 2010'. It appears however that this study does not embody the necessary context as outlined in this report. Therefore, notwithstanding the Port 2010 review, staff are of the view that the additional though related initiative dealing with a sustainable level of hazardous goods movement is necessary.

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4.0 PUBLIC REVIEW PROCESS

The Vancouver Port Corporation is holding a series of public meetings in Burrard Inlet Municipalities during October to discuss the risk analysis and to answer questions. The consultants who conducted the risk analysis will make a presentation on the report and the Port will report on progress on implementing the recommendations. Comments on the risk analysis are being sought from all interested parties.

The Burnaby meeting is scheduled for 1991 October 24 from 7 to 9 p.m. at the Engineers' Hall, 4333 Ledger Avenue.

A.L. Parr, Director
PLANNING AND BUILDING

SG/mm
Attachs: (4)

cc: Acting Chief Public Health Inspector
Fire Chief

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

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

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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 2.1

Port of Vancouver
Bulk Liquids Throughput
(Tonnes per year)

Commodity	1985	1986	1987	1988	1989
Crude Oil	195,921	439,922	646,051	1,024,692	804,817
Gasoline	1,353,084	1,424,247	1,466,294	1,207,048	1,062,910
Fuel Oil	1,723,634	1,642,659	2,041,998	1,910,633	1,862,819
Misc. Petroleum Products	311	32,295	1,012	589	491
Liquid Chemical Products	1,450,805	1,435,588	1,750,763	2,121,666	2,231,597
Oils, Fats and Waxes	225,934	171,680	266,975	151,165	63,764
Tallow	62,358	76,819	76,907	110,400	101,234
Total	5,012,047	5,223,210	6,250,000	6,526,193	6,127,632
Import Cargoes	77,285	79,211	99,766	163,825	447,655
Export Cargoes	2,751,872	2,736,300	3,646,241	4,097,507	3,492,743
Coastal Cargoes	2,182,890	2,407,699	2,503,993	2,264,861	2,187,234

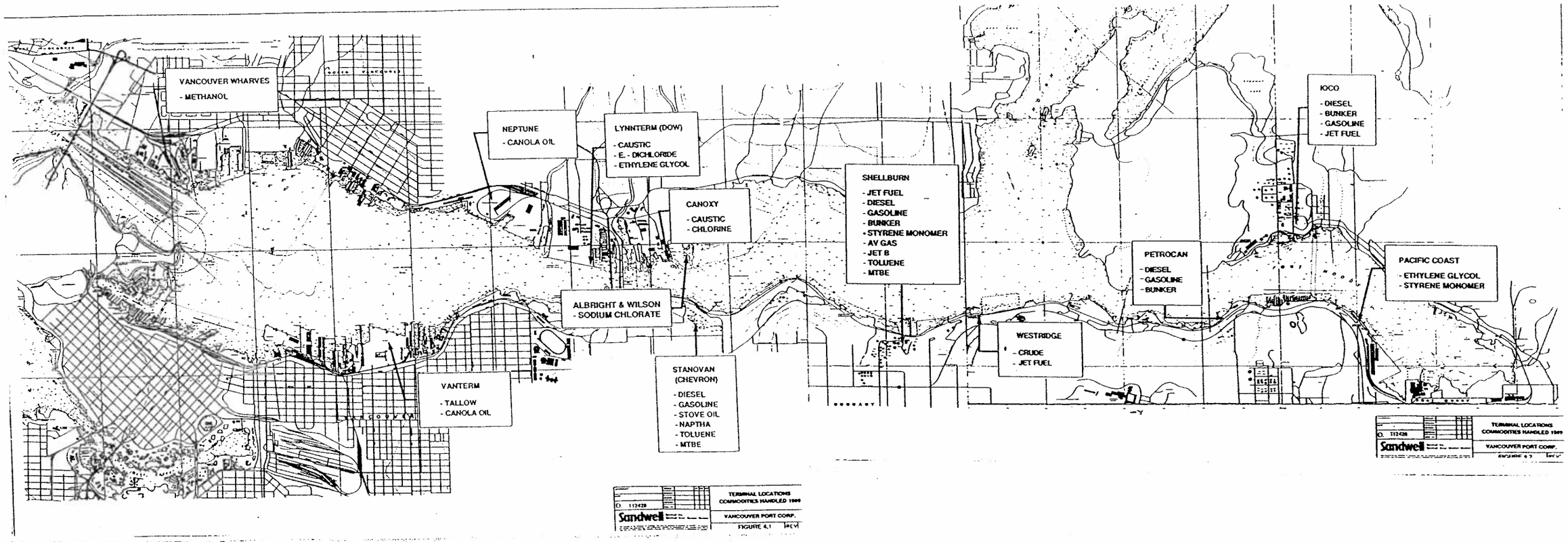
Source: Port of Vancouver

4. BULK LIQUID TERMINALS

Table 4.1 presents a list of the terminals handling bulk liquids, their throughputs in 1988, and the number of tankers, coastal tankers and barges calling at each facility during that year. 1988 is used as the base year for this study as it was the year with the maximum volumes handled to date. Figures 4.1 and 4.2 locate the terminals and identify the commodities handled at each terminal. There is a 3% discrepancy between the tonnages presented below (derived from the individual terminal operators) and those presented in Table 2.1 which were extracted from Port statistics. No effort was made in this study to resolve this small difference.

Table 4.1 - Bulk Liquid Terminals in the Port of Vancouver
1988 Traffic

Terminal	Throughput (tonnes)	No. of Vessel Calling		
		Tankers	Coastal Tankers	Barge
Albright & Wilson	55,933	-	-	47
Canadian Oxy Industrial Chemicals	277,261	2	-	112
Chevron - Stanovan	679,323	1	26	247
Dow Chemicals	825,000	73	-	87
Esso Petroleum - Ioco	1,210,827	13	204	232
Neptune Terminals	43,693	7	-	-
Pacific Coast Terminals	281,931	64	-	-
Petro-Canada	656,350	8	21	376
Shell Canada - Shellburn	823,400	24	24	366
Trans Mountain Pipe Line Westridge Terminal	1,152,979	14	-	30
Vancouver Wharves	590,500	74	-	-
West Coast Reduction	147,323	64	-	-
TOTALS	6,744,520	344	275	1,497



ATTACHMENT 4

Terminal locations and bulk commodities handled, Port of Vancouver.

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