

Review of the Oil
Pollution Levy
Industry consultation document

December 2010



Contents

- Glossary of terms v
- Foreword..... vii
- Section 1 – Executive summary 1
- Section 2 – What is the Oil Pollution Levy?.....2
 - Introduction2
 - Framework for New Zealand’s oil pollution preparedness and response.....2
 - About Maritime New Zealand2
 - Preparedness and response services in New Zealand3
 - Funding of preparedness and response services.....4
 - Oil Pollution Fund financial performance to date4
 - Required level of funding for the OPF5
 - Operating and capital expenditure.....5
 - Contingency and reserves6
- Section 3 – Current gross tonnage method of collection8
 - Current levy charging regime.....8
- Section 4 – A new approach to the Oil Pollution Levy9
 - Introduction9
 - Threat units9
 - Determining the Oil Pollution Levy rate9
 - Aggregate threat units.....10
 - Required funding.....12
 - Conclusion13
- Section 5 – Criteria for the review of the Oil Pollution Levy14
 - Introduction14
 - Effectiveness.....14
 - Efficiency.....14
 - Equity15
 - Special points for submission15
- Section 6 – Assessing the options16
 - Introduction16
 - Assessment of options against the criteria16
 - Summary and preferred option17
 - Special points for submission18
- Section 7 – Implementation19
 - Exceptions to the model19
 - Fishing industry19
 - Domestic coastal traffic.....19
 - Specified time period19
 - Implications for levy payers20
 - Conclusion21
 - Special points for submission21
 - Making a submission21

Appendices

1. Methodology 23
2. Worked examples 28
3. Levy tables 32
4. Empirical equations for residual units..... 38

Tables

1. OPF financial information5
2. OPL cash flow statement.....6
3. Estimated threat units for calculating the levy rate..... 10
4. OPL revenue and expenditure forecasts..... 12
5. Comparison of existing GT method levy and the preferred option.....20
6. Dissipation of Fuel Type 124
7. Dissipation of Fuel Type 224
8. Assumptions used in the calculation of threat units26
9. Example of how threat units are derived for cell 127
10. Example of how threat units are derived for cell 227
11. Levy calculation, Auckland to Bluff.....28
12. Levy calculation, Northwest to Whangarei29
13. Levy calculation, Leg 1, Whangarei to Wellington29
14. Levy calculation, Leg 2, Wellington to Lyttelton30
15. Voyage totals.....31
16. Bunker units.....32
17. Residual oil factors for contributing and non-contributing cargo oil factor by oil volume33
18. Track units 336

Figures

1. Human sensitivity and environmental sensitivity factors around New Zealand coastline25
2. Existing Levies Order, Leg 130
3. Existing Levies Order, Leg 231
4. Dissipation curve for HFO 18038

Glossary of terms

| | |
|--------------------|---|
| AGO diesel | fuel |
| Authority | governing body of the Crown entity of Maritime New Zealand, as defined by Section 429 of the Maritime Transport Act 1994 |
| Cargo oil | any type of petroleum-based oil carried by vessels as cargo |
| CLC | Civil Liability Convention and Protocols Fund 1992 |
| Director | Director of Maritime New Zealand, as defined by Section 439 of the Maritime Transport Act 1994 |
| FPSO unit | floating production, storage and offloading unit |
| GT gross tonnage | gross tonnage |
| HFO | heavy fuel oil |
| IOPCF | International Oil Pollution Compensation Fund |
| LOA length | overall |
| MARPOL | International Convention for the Prevention of Pollution from Ships |
| MOSRA | Marine Oil Spill Risk Assessment |
| MPRS | Marine Pollution Response Service |
| MTA | Maritime Transport Act 1994 |
| Non-persistent oil | oil that dissipates relatively quickly from the environment when spilled |
| OPAC | Oil Pollution Advisory Committee |
| OPF | Oil Pollution Fund |
| OPL | Oil Pollution Levy |
| OPRC | International Convention on Oil Pollution Preparedness, Response and Coordination |
| Persistent oil | oil that, when spilled, remains in the environment for an appreciable period of time |
| SOLAS | Safety of Life at Sea |
| Threat generator | any vessel or non-vessel activity (such as oil production or storage) that poses a threat to the environment and human well-being through a potential oil spillage in New Zealand's marine waters |

Foreword

The purpose of this discussion document is to obtain views from the maritime sector and other interested stakeholders on proposed changes to the Oil Pollution Levy (the levy), which is recovered from the maritime, offshore oil production and oil exploration industries to maintain the Oil Pollution Fund (OPF).

This document discusses the first phase of a three-phase approach, namely the method by which the levy is calculated. The second and third phases are the completion of a capability review of New Zealand's preparedness and response regime, followed by the setting of the levy amount.

The objective of the OPF is to provide sufficient funding to maintain New Zealand's marine oil spill preparedness and response capabilities, and to pay the costs of responding to spills where the source is unidentified, or where the full costs are not recovered from the polluter.

There are two principal reasons for reviewing how the levy is calculated now. The first is that the current method for calculating the levy has been in place for more than a decade, and so it is appropriate to look at whether it is the 'best' methodology. The second reason is because OPF reserves were previously substantial and a decision was made to reduce the reserves by under-recovering the costs of the OPF. That approach will cease to be sustainable if an adequate level of reserves is to be maintained.

In undertaking this review of the levy, the Maritime New Zealand (MNZ) Authority has been influenced by four important factors:

1. An appropriate level of reserves must be maintained to fund emergency oil response expenditure.
2. Relevant levels of national oil preparedness and response capabilities must be provided.
3. New Zealand's oil spill preparedness and response regime is being reviewed.
4. Industry has called for the review to be progressed as a matter of priority.

This document proposes a new threat-based model as the preferred option for calculating the levy. It is considered that this approach is more equitable and effective than the current gross tonnage method.

A capability review of New Zealand's oil spill preparedness and response is currently being undertaken. This review will help identify the type, location and amount of oil spill services provided across New Zealand. It is proposed that, in the final phase after the results of the review are known, the levy is set so that sufficient funds are available to meet both the operating costs and capital expenditure required to provide a marine oil spill preparedness and response capability for New Zealand.

The Oil Pollution Advisory Committee (OPAC) has been consulted about the proposed changes to the levy methodology. It will also be consulted on completion of this review.

We invite you to comment on this discussion document and look forward to your feedback on the suitability of MNZ's preferred option, including the decision-making criteria used to inform the decision. You may also wish to provide comment on other matters you consider important.

Feedback on the preferred approach will be taken into account in advice to Ministers about any proposed changes.

David Ledson
Chairman

Cathe

rine Taylor
Director of Maritime New Zealand

Section 1 – Executive summary

The purpose of the Oil Pollution Levy is to collect monies for the OPF. This fund is used to support oil pollution preparedness and response functions, as set out in the Maritime Transport Act 1994 (MTA). The current method of determining the levy payable is related to a vessel's gross tonnage (GT). This approach is neither equitable nor very effective.

Furthermore, for the past 12 years the levy has been set at a level below what was needed to recover the costs of the OPF, in order to reduce the level of reserves held. It is timely to review the levy to ensure it represents an efficient, effective and equitable way of collecting revenue for the OPF, and to consider the future ramifications of under-recovery on the OPF.

Two levy options have been considered:

Option 1 – Existing model based on gross tonnage

This option sees the current GT model (as set out in the existing Oil Pollution Levies Order 1998) used for allocating the costs between relevant 'users'.

Option 2 – New threat-based model

This option uses a threat-based model to determine the cost allocation between relevant maritime and offshore oil production and exploration operators. The approach for this method is outlined in Section 4 and the calculations are explained in detail, with examples, in Appendix 1.

As noted above, a review of the levy has found that the current under-recovery is no longer sustainable and there are more equitable and effective ways of determining the levy payable. The preferred option is Option 2, which is based on using a threat assessment to apportion the levy payable and maintain appropriate reserves. The assessment involves the level of threat posed to the environment, human well-being and economic activity from the transport of different classes of oil around New Zealand's coast. The higher the level of threat, the higher the number of calculated threat units and the higher the amount of levy payable. For the new method to be efficient, a range of assumptions have been made and industry averages used.

There are a relatively small number of parties for whom the proposed approach is not the most practical solution. These parties include the fishing industry and domestic coastal traffic (except coastal trades). It is proposed that the basis for charging these parties would not change from the current Levies Order, but that the amount levied is increased.

Finally, it is proposed that a three-yearly review be undertaken of both the levy and the OPF. This review will allow for changes in shipping activity and associated threats so they can be better reflected in the levy.

OPAC has been involved in developing the preferred approach and has endorsed the methodology for changing how the levy is calculated, as well as the level of funding the OPF is forecast to need.

Section 2 – What is the Oil Pollution Levy?

Introduction

This section outlines the existing framework for New Zealand's preparedness and response to oil spills. It briefly covers the legal framework, funding and existing levy arrangements.

Framework for New Zealand's oil pollution preparedness and response

New Zealand is a party to a number of international maritime conventions that relate to oil pollution prevention, preparedness, response and liability. These include:

International Convention for the Prevention of Pollution from Ships (MARPOL). The MARPOL Convention is the main international convention covering prevention of pollution of the marine environment by ships, from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively, and has been updated by amendments through the years. New Zealand is party to MARPOL and four of its six Annexes (I, II, III and V). MARPOL I concerns the prevention of oil pollution from ships.

Intervention Convention 1969. This convention affirms the rights of coastal states to take measures on the high seas as necessary to prevent, mitigate or eliminate danger to their coastline or related interests from oil or the threat of oil pollution following a maritime casualty.

Civil Liability Convention and Protocols 1992 Fund (CLC). This protocol has been adopted to ensure that adequate compensation is available to people who suffer oil pollution damage resulting from maritime casualties involving oil-carrying ships. The protocol and its earlier convention place the liability for such damage on the owner of the ship from which the polluting oil escaped or was discharged.

International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (Fund 92). This convention provides a fund for compensation for oil pollution incidents beyond what is provided for by the CLC.

Convention on Limitation of Liability for Maritime Claims 1996 (LLMC). This convention covers liability for two types of claims for the loss of life or personal injury, and property claims such as damage to other ships, property or harbour works.

International Convention on Oil Pollution Preparedness, Response and Coordination 1990 (OPRC 90). The OPRC requires parties to establish measures for dealing with pollution incidents, either nationally or internationally. Under the OPRC, ships and operators of offshore units are required to carry oil pollution emergency plans, which must be coordinated with national systems for responding promptly and effectively to oil pollution incidents. It also requires ships to report incidents of pollution to coastal authorities, and details the actions that are then to be taken. The OPRC calls for the establishment of stockpiles of oil spill-combating equipment, the holding of oil spill-combating exercises and the development of detailed plans for dealing with pollution incidents. A final component is that parties to the convention are required to provide assistance to others in the event of a pollution emergency and provision is made for the reimbursement of any assistance provided.

About Maritime New Zealand

MNZ is a Crown entity established in August 1993. Section 431(1)(f) of the Maritime Transport Act 1994 (MTA) tasks the MNZ Authority with the function of ensuring New Zealand's preparedness for and ability to respond to marine oil pollution spills. The MTA also requires there to be a Marine Oil Spill Response Strategy (Section 283).

New Zealand's response to oil pollution is outlined in the New Zealand Marine Oil Pollution Response Strategy (2006). This document provides a framework outlining an efficient and effective response to marine oil spills in New Zealand waters. Three fundamental principles were used to develop the strategy:

1. that response capability be maintained and developed through successful relationships and partnerships between MNZ, regional councils and unitary authorities, government partners, industry and domestic and foreign agencies
2. that protection of human safety, health and welfare is of paramount importance in preparing for and responding to marine oil spills
3. that Net Environmental Benefit Assessment¹ underpins decision making.

An operational unit within MNZ, the Marine Pollution Response Service (MPRS), provides a dedicated nationwide capability for dealing with marine oil pollution spills. MPRS comprises a small team of Auckland-based specialists who manage and coordinate equipment maintenance, contingency planning, and response training and exercising. These services are provided for people and organisations likely to be involved in responding to marine oil spills.

OPAC, an advisory committee of industry and government representatives, was established by statute (MTA Section 282) and its members are appointed by the Minister of Transport to advise the MNZ Authority on:

- the New Zealand Marine Oil Spill Response Strategy
- the fixing of the Oil Pollution Levy
- the use of the New Zealand OPF
- any other matter related to oil spills that the Minister, or the Director, from time to time specifies.

Preparedness and response services in New Zealand

Consistent with established international practice, New Zealand has implemented a three-tiered approach to marine oil spill preparedness and response.

Key to any response is preparedness. Preparations include the development and ongoing review of local, regional or national response plans; the training of potential responders; the purchase, provision and maintenance of specialist equipment in regional caches and a national stockpile; and the frequent exercising of skills. New Zealand's oil spill preparedness and response services are funded by a levy on industry (see the following sections).

A Tier 1 oil spill response is managed by industry (the spiller). Should an oil spill be beyond the spiller's capability to respond, or if the spiller is unknown, the spill becomes a Tier 2 response.

Tier 2 is managed by the 17 regional councils and unitary authorities. Each council maintains trained oil spill response teams, equipment and a regional response plan. A Tier 2 spill will be controlled by a Regional On-Scene Commander, who is usually a council officer trained by MPRS. If the spill is beyond the local response team's ability to manage, or regional resources are insufficient, or where the costs are likely to be significant, a Tier 3 response may be called.

A Tier 3 response would see national resources of the MPRS mobilised. A Tier 3 spill is controlled by a National On-Scene Commander, who is appointed by the Director of MNZ. Pursuant to Sections 305 and 311 of the MTA, the On-Scene Commander has extensive statutory powers.

A number of specialist oil spill response functions have been contracted to third parties. These include oiled wildlife response, which is provided by the Institute of Veterinary, Animal and Biomedical Sciences at Massey University, and environmental and dispersant monitoring advice provided by Wriggles Ltd.

1 Net Environmental Benefit Assessment is a process of weighing the advantages and disadvantages of taking a particular course of action, including recognising the likely outcomes if a course of action is not taken. The result will determine whether there will be a net (overall) beneficial or detrimental outcome from taking an action.

Should a spill be beyond New Zealand's capacity to manage, New Zealand can call on international resources under OPRC and an agreement with the Australian Maritime Safety Authority, or under an arrangement with Oil Spill Response Ltd.

Funding of preparedness and response services

Section 330 of the MTA requires MNZ to establish and administer an OPF. The MNZ Authority is required to apply the funding (Section 331) to cover:

- the costs of OPAC
- the purchase of plant, equipment or anything else used for preparations, to implement or to assist in implementing any response to marine oil spills
- the reasonable costs of the Authority in controlling, dispersing and cleaning up any marine oil spill
- the costs of services associated with planning and responding to marine oil spills that are services provided for under a contract
- the costs of the Authority or a regional council in the performance of the other functions and duties and the exercise of other powers of the Authority, the Director and the National or Regional On-Scene Commander
- the costs to the Authority or a regional council of taking measures to avoid marine oil spills
- the reasonable costs of a regional council in investigating a suspected marine oil spill and in controlling, dispersing and cleaning up any marine oil spill
- the reasonable costs incurred by any person in assisting any animal or plant life affected by any marine oil spill, with the consent or in accordance with the requirements of an On-Scene Commander.

The basic premise of oil pollution preparedness and response is that the polluter pays. At times, the polluter may not be able to be identified. In these circumstances, the OPF is used to pay expenses from reserves set aside for that purpose.

The type and quality of preparedness and response services provided or coordinated by MNZ need to be the right services for New Zealand, and able to meet our international obligations while providing value for money. MNZ regularly conducts capability reviews of New Zealand's preparedness and response regime, seeking to provide assurance that value for money is provided. A capability review will be completed by July 2011.

This document has been prepared based on the same level of preparedness and response services being provided at the same or substantially similar cost as at present.

Oil Pollution Fund financial performance to date

At the time of introducing the MTA, a decision was made to transfer the OPF from Treasury to MNZ, and for the establishment of OPAC to provide advice on the OPF. At the time of the transfer, there were about \$12 million in reserves. Reserves are needed as an immediate contingency for response, and to cover any spill for which the polluter is not able to be identified.

It was decided that the level of reserves was too high and that an active programme should be established to reduce the reserves. The reduction in reserves was to be achieved by running annual OPF budget deficits. The MNZ Authority has advised, and the Minister of Transport has agreed, to set the reserves at \$2 million.

The cash reserves have continued to reduce, as a result of operating a deficit, and were expected to be about \$4.5 million by 30 June 2010.

Operating expenditure (including depreciation) for oil spill preparedness and response over the past five years has averaged about \$4 million per annum (see Table 1). Revenue received has remained relatively steady, but at a consistently lower level than the amount required to cover operating

expenditure. Assets are also required to be replaced or upgraded, and as a consequence this also impacts on the level of cash reserves being held.

Table 1 OPF financial information

| (\$000) | 2002/03 Actual | 2003/04 Actual | 2004/05 Actual | 2005/06 Actual | 2006/07 Actual | 2007/08 Actual | 2008/09 Actual | 2009/10 Unaudited |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------------------|
| Total revenue | 2,986 | 3,257 | 3,075 | 3,131 | 3,444 | 3,481 | 3,479 | 3,310 |
| Total expenditure | 3,903 | 3,683 | 3,701 | 3,906 | 3,914 | 4,103 | 4,207 | 4,322 |
| Surplus (deficit) | (917) | (426) | (626) | (775) | (470) | (622) | (728) | (1,012) |
| Cash reserves | 8,519 | 8,443 | 7,549 | 6,953 | 6,696 | 5,657 | 5,050 | 4,260 |

Section 4 sets out forecast financial performance for the next four financial years. In summary, the OPF is expected to incur expenses each year of approximately \$4.4 million. Personnel salaries and travel and operating costs account for approximately \$1.4 million of the total expenditure. The balance is primarily related to providing training courses and oil spill response exercises. It should be noted that this is a projection undertaken prior to the capability review. The review may identify additional costs or cost savings and this will be factored in when the levy level is set in the final phase.

Required level of funding for the OPF

Given the three-phase approach to the OPL and the capability review currently underway, this document uses existing projections of expenditure as a guide only. The capability review will clarify the amount, location and nature of services needed to fulfil New Zealand's oil pollution response obligations. The subsequent action plan will then assess the costs (or savings) associated with any change in New Zealand's preparedness and response regime.

The following overriding factors should be taken into account in determining the required level of funding for the OPF:

- There should be sufficient funds to meet any reasonably predictable level of operating and capital expenditure for oil spill preparedness.
- Cash reserves should be maintained in the OPF to meet contingency spending.

Operating and capital expenditure

The OPF's planned operating and capital expenditure has been forecast for the period 2010/11 to 2013/14 (see Table 2). Operating expenditure includes items such as equipment repairs and maintenance, staff salaries, training and exercises, and regional council expenditure. Expenditure has been reviewed for the 2010/11 financial year, and budgets will be contained at this level wherever possible for the out years.

A capability review of New Zealand oil spill preparedness and response may result in recommendations for operating expenditure and/or to purchase additional capital equipment. Where appropriate, budgets have been adjusted for inflationary increases in the out years, and this has been assumed to be 2 percent per annum.

Capital expenditure includes the purchase of equipment for responding to, containing and cleaning up oil spills. It is expected to increase in future years, and particularly in the out years. There is a long-

term asset replacement plan, and capital expenditure is projected to reach about \$2.1 million in 2014/15. This primarily relates to the replacement of land/sea booms, at a cost of \$1.3 million. The forthcoming capability review will examine capital expenditure requirements and, therefore, the asset replacement plan is likely to change.

The capital expenditure profile reflects the periodic replacement of equipment as it reaches the end of its functional life. There is currently a 15-year asset management plan in place, and this is used for planning asset replacement. In considering whether an item should be replaced, an assessment is made to determine whether the equipment could continue to function effectively. Where there is a risk that the equipment could malfunction or not perform to its capacity, a decision is made to replace the item. In deciding to replace an item, consideration is given to replacement in kind or whether that type of asset is still needed.

Table 2 OPL cash flow statement

| Cash flow statement (\$'000) | 09/10 Estimate | 10/11 Budget | 11/12 Forecast | 12/13 Forecast | 13/14 Forecast |
|--|-----------------------|---------------------|-----------------------|-----------------------|-----------------------|
| Operating revenue | 3,310 | 3,231 | 3,208 | 3,178 | 3,154 |
| Operating expenditure | 3,938 | 4,143 | 4,013 | 4,037 | 4,060 |
| Cash flow from operating activities | (628) | (912) | (805) | (859) | (906) |
| Cash flow from investing activities (capital purchases) | (162) | (232) | (150) | (709) | (661) |
| Net increase (decrease) in cash and bank | (790) | (1,144) | (955) | (1,568) | (1,567) |
| Opening cash bank and investments | 5,050 | 4,262 | 3,116 | 2,161 | 593 |
| Closing bank and investments | 4,260 | 3,116 | 2,161 | 593 | (974) |

Note: the statement assumes no increase in levy revenue.

Contingency and reserves

The Minister of Transport has set the OPF reserves at \$2 million. Reserves need to be maintained so that sufficient cash is available to rapidly fund immediate or short-term operational expenditure for an oil spill response. In such an event, national or international arrangements or resources may need to be called on, and funds would require immediate expenditure.

This expenditure may be needed to secure and then apply resources to the spill such as tugs, other salvage-related vessels or aerial dispersant-spraying aircraft. There may also be situations where not all costs will necessarily be recovered from the polluter or accepted by the insurers. It is therefore necessary to have sufficient reserves for these possible eventualities. Sufficient reserves allow expenditure to be incurred without impacting on MNZ's immediate response ability or obligations.

Should the immediate costs of dealing with an oil spill be beyond the level of reserves retained by the OPF, then MNZ would seek to call a meeting of the Officials Committee on Domestic and External Security Coordination (ODSEC) to seek funds through standard government emergency management processes. MNZ and the Government would then seek to recover any oil spill response expenditure

from the spiller or their insurer, in the first instance. Of note is that international conventions place limitations of liability on some spillers.

Given the forecast expenditure over the next six years and maintaining an OPF reserve of \$2 million, the required level of funding from the levy in 2011/12 is estimated to be \$4.4 million. For the purposes of demonstrating the levy models, an assumption is made that the level of expenditure will remain at about \$4.4 million until 2014/15. A subsequent phase will set the amount of levy needing to be recovered.

Section 3 – Current gross tonnage method of collection

Current levy charging regime

The current mechanism for levying contributors to the OPF is contained within the Oil Pollution Levies Order 1998, which sets out specific financial levies for coastal trade ships (including oil tankers), fishing vessels, offshore petroleum rigs and platforms, and oil pipelines. This order is made in accordance with Section 333(1) of the MTA.

The levy applies to coastal trade shipping, which is defined in Section 198 of the MTA. A generalised summary of the MTA definition is:

a New Zealand ship; a foreign ship on demise charter; a foreign ship that has disembarked or unloaded passengers or goods from a foreign port; or a foreign ship that has loaded or embarked goods or passengers for a foreign port.

The levy is charged at a rate based on the GT of the levied ship, plus a charge per tonne on persistent or non-persistent² oil carried as cargo; or as a flat fee for certain activities, such as offshore petroleum production installations.

Oil pollution levies on coastal trade ships and New Zealand fishing boats

The levy imposed for each year on the owner and master of every contributing ship that is a coastal trade ship or a New Zealand fishing boat is calculated at:

- a) 111 cents per gross ton of the contributing ship; and
- b) either 837 cents per gross ton of the contributing ship that is a carrier of persistent oil as cargo, or 419 cents per gross ton of the contributing ship that is a carrier of oil (other than persistent oil) as cargo.

New Zealand fishing vessel

In the case of a contributing ship that is a New Zealand fishing boat, a levy of 70 cents per gross ton of the contributing ship is charged.

Offshore oil installations and oil pipelines

Offshore oil installations and oil pipelines pay a fixed levy of \$8,889 for each installation that is producing, processing, storing or transferring oil. In the case of an offshore oil installation used or constructed for the purposes of exploring for oil, \$8,889 is charged for each oil well drilled by that installation.

Other contributing ships

A levy is imposed on the owner and master of a contributing ship (that is not a coastal trade ship or a New Zealand fishing boat) in the case of each entry of that ship into a New Zealand port from outside the harbour limits of that port.

The levy is calculated at the rate of:

- a) 1.11 cents per gross ton of the contributing ship; and
- b) either 9.78 cents per tonne of persistent oil that is carried or loaded as cargo or 4.44 cents per tonne of oil (other than persistent oil) that is carried or loaded as cargo.

There is an administrative exemption that vessels less than 24 metres in length and with GT less than 100 tonnes do not pay the levy. This arrangement has been put in place because vessels of this size do not need to record GT, and therefore there is difficulty and cost associated with collecting the levy for these smaller vessels that pose a very small threat.

2 See the Glossary.

Section 4 – A new approach to the Oil Pollution Levy

Introduction

This section provides an overview of an alternative approach to calculating the levy (proposed as Option 2 and also MNZ's preferred approach) and the rate that threat generators will pay.

Each threat generator accrues threat units, which are used to determine the amount of levy payable. At the highest level, it is proposed that the factors that influence threat form the basis of calculating the levy.

The proposed approach attributes a standardised unit of threat to threat generators (for example, a vessel), depending on the level of threat it poses. The higher the level of threat, the greater the number of threat units that accrue.

In its simplest form, under this approach the levy reduces to:

$$\text{Oil Pollution Levy} = \text{threat units} \times \text{dollar value per threat unit}$$

The dollar value of a threat unit is determined by considering the overall number of threat units occurring around the New Zealand coast, and then dividing that by the expected cost of providing oil spill preparedness and response services in New Zealand.

Threat units

The components that are evaluated in calculating the number of threat units associated with a specific coastal transaction are:

- type and volume of oil carried as bunker fuel and any carried as cargo
- environmental and human sensitivity factors of the vessel passage
- time spent in the environment (occupancy factor).

The New Zealand coastline has been divided up into cells of 20 kilometres x 20 kilometres, and each has been assigned a value for environmental and human sensitivity. The values within each cell have been determined using a detailed evaluation of these two factors.³ The resulting values or factors have been used to adjust the units derived from oil type and volume. This adjustment is intended to reflect the potential impact of a spill, which depends on proximity to the coast. Oil units are factored up in cells where a sensitivity factor is greater than one, and factored down where the value is less than one.

Potential threat is directly related to the length of time that a threat generator spends in any of the cells around New Zealand's coastline. This is known as occupancy.

Port-to-port transactions have been analysed around the coastline and, on the assumption that vessels follow the standardised route in transiting from port to port, the amount of time spent in each grid can be calculated. The time spent in a cell will vary depending on the velocity of the vessel and the length of the vessel's track within that cell. For the purposes of calculating the levy, it has been assumed that velocity is 15 knots.

Determining the Oil Pollution Levy rate

The OPF is required to provide financial support for New Zealand's marine oil spill preparedness and response capability, and to pay the costs of responding to spills where the source is unidentified.

3 The values for the environmental and human sensitivity factors used here are provided by previous work produced by MNZ in the report titled "New Zealand Marine Oil Spill Risk Assessment 2004". The value for the environmental sensitivity factor is based on factors such as shoreline character, plants and animals, and protected sites. The human sensitivity factor is based on economic, cultural, and social amenity and recreation criteria. The final report can be found at www.maritimenz.govt.nz/publications/pollution_response/risk_asmnt_final_report2004.pdf.

The levy rate is the contribution threat generators make to the OPF for every threat unit that applies to them. Determining the rate depends on the required funding level for the OPF, as per this formula:

$$\text{Dollar value per threat unit} = \frac{\text{Required funding level for a specified time period}}{\text{Aggregate threat units for a specified time period}}$$

This formula shows the components involved in determining the levy rate:

- estimation of the required funding level for the OPF
- estimation of the aggregate total threat units
- a specified time period under consideration (it is envisaged this will occur every three years).

Aggregate threat units

An assessment of the aggregate threat units is made by, first, summing the number of the threat units applying to each individual threat generator in that year and, second, summing the threat units across all the different threat generators. This provides a generalised total of threat units per annum.

Table 3 Estimated threat units for calculating the levy rate

| Type of vessel | Oil | Threat units per annum | Percentage of total threat | Assumptions |
|-------------------------------------|---|------------------------------------|----------------------------|---|
| Foreign vessels | | | | |
| Foreign cargo and passenger vessels | Bunker fuel (contributing) | 9,275,000 | | AIS vessel track data and Customs information 750 tonnes HFO 15 knots |
| Foreign tanker vessels | Bunker fuel (contributing) Cargo – non-contributing Cargo – contributing | 288,000 3,409,000 6,899,000 | | AIS vessel track data and Customs information 750 tonnes HFO 15 knots |
| Total foreign vessels | | 19,871,000 | 75.86 | |
| Domestic vessels | | | | |
| Silver Fern Torea | Bunker fuel (contributing) Cargo – non-contributing Cargo – contributing | 23,751 496,347 155,163 | | From data provided by Silver Fern Shipping Ltd |
| Silver Fern Kakariki | Bunker fuel (HFO 180) Cargo – non-contributing Cargo – contributing | 38,363 517,211 256,645 | | From data provided by Silver Fern Shipping Ltd |
| Total Silver Fern | | 1,487,480 | 5.68 | |
| PB Sea Tow Awanuia | Bunker fuel (contributing) Cargo – non-contributing Cargo – contributing Unladen return trip | 3,845 6,248 151,389 3,845 | | 89 track units 54 sailings Akl–Marsden Pt or Marsden Pt–Akl 27 cargo sailings pa 95,000 IFO 180 pa 5,000 MDO pa |
| Total PB Sea Tow | | 165,327 | 0.63 | |
| Interislander Kaitaki | Bunker fuel (contributing) Cargo – non-contributing Cargo – contributing | 252,810 0 0 | | 45 track units 1,060 sailings pa 300 tonnes of MFO |
| Interislander | Bunker fuel (contributing) | 300,267 | | 45 track units |

| | | | | |
|---|--|------------------------|--------------|--|
| Aratere | Cargo – non-contributing Cargo – contributing | 0 0 | | 2,022 sailings pa 200 tonnes MFO |
| Interislander Arahura | Bunker fuel (contributing) Cargo – non-contributing Cargo – contributing | 191,079 0 0 | | 45 track units 2,022 sailings pa 120 tonnes MFO |
| Total Interislander | | 744,156 | 2.84 | |
| Strait Shipping Santa Regina | Bunker fuel (contributing) Cargo – non-contributing Cargo – contributing | 110,160 | | 45 track units 1,326 sailings pa 150 tonnes MFO |
| Strait Shipping Monte Stello | Bunker fuel (contributing) Cargo – non-contributing Cargo – contributing | 134,508 | | 45 track units 1,122 sailings pa 150 tonnes MFO +48 Nelson – Wgtn return trips pa (2x79 track units) |
| Total Strait Shipping | | 244,668 | 0.93 | |
| Pacifica Spirit of Endurance | Bunker fuel (contributing) Cargo – non-contributing Cargo – contributing | 138,145 0 0 | | 517 track units/round trip 50 round trip pa Fuel usage data provided by Pacifica |
| Pacifica Spirit of Resolution | Bunker fuel (contributing) Cargo – non-contributing Cargo – contributing | 23,404 0 0 | | 356 track units/round trip 50 round trip pa Fuel usage data provided by Pacifica |
| Total Pacifica | | 161,549 | 0.62 | |
| Other New Zealand SOLAS vessels on standard voyage schedules | Bunker fuel (mixed types) Cargo – non-contributing Cargo – contributing | 200,000 | 0.76 | Estimate threat units (such as Golden Bay) |
| Installations | | | | |
| FPSO (including flowlines) | FPSO Umuroa FPSO Rarua | 1,310,000 1,310,000 | 10.00 | Assessed as 10% of aggregate threat |
| Pipelines, platforms and wells | Currently 10 pipelines, platforms and wells | 700,000 | 2.67 | 5 x platforms 4 x pipelines 1 x exploration well 70,000 threat units per pipeline/platform/well |
| Total threat units | | 26,194,180 | | |

Note: a sailing is a single port A to port B transaction, such as Wellington to Picton.

In the case of foreign vessels, it is assumed that all vessels use HFO as bunker fuel. New Zealand's domestic fleet uses a range of different fuel types, but predominantly marine diesel. In Table 3, the threat units for domestic coastal fleet have been calculated using the track units (Appendix 3, Table 18) multiplied by the amount of non-contributing bunker fuel (Appendix 3, Table 17) a vessel carries.

Voyage data is not available at this time for some New Zealand SOLAS vessels that have standard voyage schedules, such as the **Golden Bay**, so an estimate of 200,000 threat units has been made for this group of vessels. This estimate is for the purpose of calculating the total threat units. Under the preferred option, New Zealand SOLAS vessels such as the **Golden Bay** would be subject to a threat-based levy and would pay according to actual threat units accrued each year.

The oil exploration and production industry is very active in the offshore environment. FPSOs typically store large volumes of oil before offloading to tankers. A vessel moving from port to port traverses various cells, and depending on the sensitivity of those cells a threat profile is determined. In the case of a FPSO, it is always associated with a particular cell and therefore the threat profile is likely to be considerably different. A risk assessment conducted in 2004 estimated the threat profile of a single FPSO at approximately 5 percent of the total threat of an oil spill on the New Zealand coast. That five percent of threat can be equated to about 1,310,000 threat units for each FPSO.

There are currently 10 pipelines and platforms in New Zealand coastal waters. It is hard to quantify the threat posed by these installations. However, an estimate of 70,000 threat units per pipeline, platform or well was made, based on the historic proportion of the OPL recovered from these installations. This increase allows for these installations to meet a proportional share of the full cost recovery. The threat associated with flowlines between the wellhead and FPSO has been included in the FPSO calculation.

MNZ estimates the aggregate threat units to be about 26.2 million. The aggregate number of threat units is assumed to be constant over the levy period. The calculation of threat units is based on a number of variables, and should they change significantly, this will have an impact on the levy rate. A change of 2 million threat units would see a change of about 1 cent on the levy rate.

Required funding

A capability review of New Zealand's oil spill preparedness and response capability is currently being undertaken. Naturally, this review is likely to affect future funding requirements. However, to understand how the threat-based model works, the average funding required over a three-year period is needed, and in this case projections based on current information are provided. Once the method (gross tonnage or threat-based) has been determined, the amount of levy needing to be recovered will be set, based on the needs identified in the capability review.

As a three-year interval between levy changes has been proposed, the levy rate would be calculated using the required funding levels and aggregate threat units for three years. The following example uses 2011/12, 2012/13 and 2013/14.

Table 4 OPL revenue and expenditure forecasts

| (\$000) | 09/10 Estimate | 10/11 Budget | 11/12 Forecast | 12/13 Forecast | 13/14 Forecast |
|-------------------------------|-------------------|-----------------|-------------------|-------------------|-------------------|
| Expenditure | | | | | |
| Personnel 755 | | 750 | 764 | 780 | 796 |
| Operating 2,486 | | 2,703 | 2,559 | 2,567 | 2,574 |
| Depreciation/amortisation 384 | | 385 | 394 | 425 | 354 |
| Intergroup charges | 697 | 690 | 690 | 690 | 690 |
| Total expenses | 4,322 | 4,528 | 4,407 | 4,462 | 4,414 |
| Less | | | | | |
| Other revenue | 121 | 60 | 60 | 60 | 60 ⁴ |
| Interest 187 | | 148 | 105 | 55 | - ⁵ |
| Recoverable from levy | 4,014 | 4,320 | 4,242 | 4,347 | 4,354 |

Note: this is based on current projection and does not take into account the forthcoming capability review. Figures are exclusive of GST.

The average cost of providing oil spill preparedness and response services in New Zealand for the period 2011–2014 is \$4.423 million per annum. The threat-based model cannot be applied to some activities (see the section on exceptions). In these cases, a fixed fee is applied. Fishing and domestic coastal components are excluded from the threat-based model and do not materially impact on the levy rate.

4 Cost recovery for equipment lease and staff deployments to international spills.

5 Interest from investment of reserves.

The total contribution of non-threat-based activities is assessed to be about \$140,000 per annum and revenue from interest and other sources such as equipment hire (and therefore an offset against recovery) averages about \$113,000 per annum. Taking this into account leaves an amount of \$4.314 million that is required to be recovered from the unit-based methodology. Dividing \$4.314 million by the total threat units of 26,194,180 gives a \$/unit rate of 16.5 cents. This rate would be used for the next three years, but could change in the future subject to the outcome of the proposed three-yearly reviews. An increase of 2 million threat units or an increase in OPF expenditure of \$0.5 million would result in a levy change of about 1 cent.

The capability review will be completed in April 2011 and will help determine the scope, nature and location of New Zealand’s oil spill response. This review may identify additional cost or cost savings. With the level of threat units remaining static, the chart below provides an indication of the possible levy per threat unit.

| | \$3.5 million | \$4.0 million | \$4.5 million | \$5.0 million | \$5.5 million |
|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 26,194,830 threat units | 13.4c per threat unit | 15.3c per threat unit | 17.2c per threat unit | 19.1c per threat unit | 21.0c per threat unit |

Conclusion

An assessment of the aggregate number of oil spill threat units in New Zealand coastal waters is about 26.2 million threat units. The average expenditure forecast for New Zealand’s oil spill preparedness and response regime is currently about \$4.423 million per annum and the amount recoverable under the levy \$4.314 million. Using these factors, a levy rate is calculated of 16.5 cents per threat unit.

The examples above are indicative only, and provided to give guidance on how the calculation methodology works. At this time the levy rate is not being determined, as this will be influenced by the results of the capability review of New Zealand’s oil spill preparedness and response regime.

Section 5 – Criteria for the review of the Oil Pollution Levy

Introduction

In general, any levy collection process must be effective, equitable and efficient. A critical element of the criteria is the use of threat as a means of allocating levy charges. Here, threat is defined as any vessel or non-vessel (activity such as oil production or storage) that poses a threat to the environment and human well-being through a potential oil spillage in New Zealand's marine waters. Threat is the potential for adverse consequences, whereas risk is the likelihood of an event and consequence.

Effectiveness

An effective levy ensures that the total amount of levy paid is proportional to the potential impact a threat generator poses to the environment, human well-being and economic activity. It ensures the total levy is sufficient to fully fund the cost of providing an appropriate level of response and preparedness for oil spills.

Three main considerations need to be taken into account:

1 Threat generators should contribute to the OPF.

Threat generators can be characterised as vessel or non-vessel (activities). Vessels include tankers, international cargo/passenger vessels, coastal cargo/passenger vessels, fishing vessels and small craft. Non-vessels include offshore oil exploration and production facilities (including the Maui platforms, pipelines and FPSOs), bulk oil transfers and bunkering operations, bulk storage terminals and pipelines, and bunker lines.

An effective levy will ensure that, where appropriate, all vessel and non-vessel threat generators contribute to the OPF.⁶

2 The potential seriousness of an oil spill should be taken into account.

Oil spills do not all cause the same degree of adverse impact on the environment, human well-being and economic activity. The impact depends on the circumstances of the spill. For example:

The greater the volume of oil and the greater the persistence of the oil, the higher the impact of the spill.

An oil spill in a more environmentally sensitive area, such as where endangered species are present or a site is deemed environmentally sensitive, might result in greater harm or cost of clean-up.

An oil spillage might also have a greater negative impact on human well-being if it occurs in an area that has a higher national cultural significance or in an area where recreational and economic activities are significant.

Efficiency

An efficient levy minimises the compliance and administrative costs incurred by both those paying the levy and those administering it.

Overall, the levy should be easy to understand and simple to apply. The levy system should be easy to administer and to integrate with business-as-usual for the maritime sector and MNZ. Achieving an efficient system requires a degree of averaging. A large number of factors could be used to make the levy more equitable. There will need to be a balancing between equity and effectiveness, and efficiency. If not, the cost of the system will not be efficient.

6 Under the current and proposed levy allocation mechanism, levy charges are not imposed on all threat generators because, in some instances, the transaction costs exceed the revenue gained. Vessels less than 24 metres in length overall (LOA) and with a gross tonnage of less than 100 gross tons are not required to maintain a record of the GT. In the existing Levies Order, GT is a proxy for bunker fuel, but without GT under the Levies Order smaller ships could not be charged.

Simply, the methodology must be able to be implemented practically so that it can be used on a day-to-day basis for all concerned. To do this, it needs to:

- strike a balance between the detailed workings of the methodology and the practical requirements of using it
- be able to be represented in legislation in a straightforward manner
- enable end users to calculate the levy easily
- be simple and efficient to administer.

Equity

An equitable levy ensures that those who pose a comparable degree of threat pay a comparable rate of levy, and that those who pose a greater threat pay more than those who pose a lesser threat.

The levy should seek to treat all threat generators equitably. In other words:

- all threat generators should make a contribution to the cost of the OPF
- threat generators who pose a comparable threat to the environment, human well-being and economic activity should pay a levy that is proportional to the threat generated. For instance, two ships of different sizes (with different tonnages) but carrying the same oil volume and type and posing a comparable threat should not be paying different amounts of levy solely because of a difference in their size
- those who create a threat of pollution pay to support preparedness and response services (the polluter pays).

Special points for submission

- Are there other criteria that should be taken into account in designing how the levy is calculated?
- Are there any general comments regarding the criteria outlined above?
- What are your views about the balance of criteria – should any one be given greater weight over another?

Section 6 – Assessing the options

Introduction

This section assesses the options against the criteria of effectiveness, efficiency and equity. Under all options, threat generators currently paying into the OPF would continue to do so. It should be noted that not all threat generators currently pay a levy (see below). This is largely because for a small group of vessels, the cost of calculating, paying and collecting the levy would be greater than the revenue recovered.

Two levy options have been considered:

Option 1 – Existing model based on gross tonnage

This option sees the current GT model (as set out in the existing Levies Order) used for the allocation of the costs between relevant 'users'.

Option 2 – New threat-based model

This option applies a threat-based model to determine how costs are allocated between relevant maritime operators and increases the amount recovered to reflect forecast costs associated with the OPF. The approach for the calculation method is outlined in Section 4 and the calculations are explained in detail, with examples, in Appendix 1.

Assessment of options against the criteria

Option 1 – Existing model based on gross tonnage

Effectiveness

The current levy is calculated on the GT of vessels, which is taken as a proxy for bunker fuel volume. However, GT is a measure of cargo capacity and analysis has shown that it is not a good proxy for the threat posed by a vessel or non-vessel. Under Option 1, vessels that pose a comparable threat do not necessarily pay a comparable levy rate. The current system does not directly consider the amount of oil carried as bunker fuel, and therefore the method is not effective. The GT method makes no attempt to consider the likelihood of a spill.

Efficiency

Payment based on a vessel's GT is easy to measure and enforce in vessels greater than 24 metres in length and more than 100 tons. There is little cost of compliance, in that a vessel's GT generally does not change over time. Those subject to the levy have certainty over their costs. As a consequence, transaction costs would not change.

Equity

The current levy is calculated on vessels' GT, which is not a good proxy for bunker volume carried. Accordingly, the levy paid by each threat generator does not currently reflect the level of threat they pose to the environment, human well-being and economic activity in the event of a spill.

This current approach to levy calculation does not adequately differentiate between threat generators with differing degrees of potential adverse impact on the environment, human well-being and economic activity. However, factors such as volume of oil, location and length of time spent around the New Zealand coast do impact on the level of threat.

Under the current approach, threat generators posing a comparable level of threat to the environment, human well-being and economic activity may be paying significantly different amounts of levy. Therefore, this approach is not equitable.

Conclusion

GT is a measure of cargo capacity, and analysis has shown that it is not a good proxy for the threat posed by a vessel or non-vessel.

Option 2 – New threat-based model

Effectiveness

This method of calculating the levy differentiates more effectively between threat generators with differing degrees of potential adverse impact on the environment, human well-being and economic activity. Factors such as volume of oil, location and length of time spent in New Zealand coastal waters are included. As with any method, the range of factors with inherent variability makes it difficult and costly to assess the threat of an oil spill. From a practical perspective, the travelling time of a vessel and the amount of oil carried are used as the major variables in the levy.

Option 2 uses vessel passages as part of the levy calculation. Those vessels that do not have defined tracks, such as fishing vessels or installations, cannot easily determine the levy payable. On that basis, the new model proposes that those vessels continue with the existing system and pay either a fixed levy or one based on GT.

Efficiency

The new threat-based model proposed under Option 2 places a requirement on vessel operators to use existing voyage data they currently collect to calculate levy payments. To assist vessel operators in these processes, simplified tools would be provided, including the use of standardised voyages and tabular information.

When compared to the GT model (Option 1), the threat-based model requires some additional reporting of information such as cargo and bunker oil type. Currently, operators collect this information and report it to various other bodies, including MNZ (for the Maritime Safety Charge). As a consequence, there is no additional cost for the collection of the required information. Any additional compliance costs will come in the form of reporting information already held, and that is expected to be minimal.

Equity

The threat-based option uses a method of calculating the levy that is more equitable between threat generators, with differing degrees of potential adverse impact on the environment, human well-being and economic activity. This is because factors such as volume of oil, location and length of time spent in maritime waters are included. Therefore, threat generators posing comparable levels of threat are treated in a comparable way.

Threat generators that have a comparable threat profile to other threat generators can expect to pay a comparable levy. The inclusion of factors such as vessel track ensures that the potential impact of any spill on the environment, human well-being and economic activity is taken into account.

Conclusion

A threat-based model better apportions the costs to the operators creating the threat of an oil spill.

Summary and preferred option

The current method (Option 1) of calculating the levy is efficient (easy and low cost), but it is neither very effective nor equitable. Option 1 achieves cost recovery, but the amount recovered from operators does not reflect the threat their operations pose. As a consequence, lower-threat operators would be subsidising higher-threat operators.

Option 2 improves both equity and effectiveness to the greatest extent, and recovers sufficient revenue to ensure sustainable preparedness and response services.

In summary, this section shows that:

- the current levy is efficient (it is easy to collect), but not equitable (parties posing the same threat and consequence of an oil spill are not treated the same) or effective
- the current under-recovery policy cannot be sustained at current levels of service.

For these reasons, the MNZ Authority supports the OPAC recommendation that Option 2 should be the preferred option.

Special points for submission

- Does the current approach raise any other significant issues aside from those outlined above?
- Do you have any comment on the issues that have been outlined?
- Which option do you support, and why?
- Are there other options that should be considered?

Section 7 – Implementation

Exceptions to the model

For the majority of vessels, the proposed methodology for determining the levy payable can be readily defined and calculated using the threat-based approach. However, there are some sectors of the industry where this approach would not work satisfactorily at present, due to a lack of data or the way the vessels operate. This is because the model is premised on the fact that vessel voyages can be tracked and that information can be provided to MNZ. In the case of the fishing fleet and a small number of domestic coastal traffic vessels, this information is not readily available. Therefore, it is proposed that they be excluded from the new threat-based model. It is recognised that these operations pose a threat of spilling oil and therefore should make a contribution to the OPF.

Fishing industry

A large majority of coastal traffic behaves in a manner that is easily modelled, but fishing vessels generally do not behave in this way. These vessels do not travel directly from port A to port B along defined tracks, and therefore their voyage pattern cannot be easily translated into the threat-based allocation model.

The fishing industry only accounts for a small proportion of the overall oil spill threat (and OPF revenue). An informed estimate of fishing activity around the New Zealand coast was undertaken using Ministry of Fisheries records for 2005, 2006 and 2007. This assessment indicates the fishing industry makes up about 0.7 percent of total revenue under the GT model. It is suggested that this sector be levied using the approach defined in the existing Levies Order, based on a vessel's GT. Alternatively, the approach could be to define the number of threat units that reflect the threat posed and then apportion those units among the vessels using gross tonnage or some other means.

Currently, only 136 fishing vessels are levied. As noted earlier, vessels less than 24 metres LOA and with a GT of less than 100 gross tons are not required to maintain a GT record. Therefore, a levy cannot be applied to those vessels. In the existing Levies Order, GT is a proxy for bunker fuel, but without a record of GT smaller ships could not be charged.

Domestic coastal traffic

A significant majority of coastal traffic can be modelled using standardised tracks defined for port-to-port trips. However, as with the fishing fleet, a number of domestic coastal operators do not operate on standard voyage patterns. Some of these operators include, for example, dredges, charter yachts, barges and small freight operations on non-standard routes.

As the threat units accrued for these vessels are not significant, it is proposed that they are levied in the same method as the current Levies Order. Alternatively, the approach could be to define for this sector the number of threat units that reflect the threat posed and then apportion those units among the vessels using gross tonnage or some other means.

Specified time period

Regardless of the levy option chosen, MNZ proposes to establish a regime that reviews the levy rate at fixed and regular intervals. The advantages of such a change include:

- providing certainty and stability for threat generators, as the timing of changes would be publicly known and expected. Any change in levy rate is also likely to be smaller than if the rate is changed on an infrequent basis
- providing a levy rate that is more aligned with the required level of funding for the OPF. The more often the levy rate is revised, the lower the risk that the levy would under/over-recover.

MNZ proposes reviewing the levy rate every three years, as good management practice. This length of time is considered appropriate because the interval between changes is not so far apart that the levy rate becomes misaligned with the funding requirements. Furthermore, it is not so short that it creates an undue administrative burden.

If the preferred approach for the levy is implemented, data on the number of aggregate threat units would be collected and this would be used at the next review of the levy rate to provide greater certainty of forecast funding requirements (see below).

Implications for levy payers

Table 5 provides an estimate of the levy payable over a year, using the threat units listed in Table 3. This table is indicative only. Selected major groups or operators are shown and the levy payable will depend on actual activity.

Table 5 Comparison of existing GT method levy and the preferred option

| Type of vessel | Levy under increased GT (Option 1) | | | Levy under preferred option (Option 2) | | |
|--------------------------------|--------------------------------------|------------------------------|------------------------------|---|---|---|
| | \$3.5 million (09/10 recovery rate) | \$4.5 million (29% increase) | \$5.5 million (57% increase) | \$3.5 million (\$0.134 per threat unit) | \$4.5 million (\$0.172 per threat unit) | \$5.5 million (\$0.210 per threat unit) |
| Foreign vessels | \$2,230,881 | \$2,868,276 | \$3,505,670 | \$2,655,113 | \$3,413,716 | \$4,172,320 |
| Domestic vessels | | | | | | |
| Total Silver Fern | \$390,916 | \$502,606 | \$614,297 | \$198,753 | \$255,540 | \$312,327 |
| Total PB Seatow | \$16,379 | \$21,129 | \$25,715 | \$22,091 | \$28,402 | \$34,714 |
| Total Interislander | \$52,941 | \$68,067 | \$83,193 | \$99,432 | \$127,841 | \$156,251 |
| Total Strait Shipping | \$36,719 | \$47,210 | \$57,701 | \$32,692 | \$42,032 | \$51,373 |
| Total Pacifica | \$10,121 | \$13,013 | \$15,904 | \$21,586 | \$27,753 | \$33,920 |
| Installations | | | | | | |
| FPSO <i>Umuroa</i> * | \$44,445 | \$91,428 | \$111,746 | \$175,039 | \$225,050 | \$275,061 |
| FPSO <i>Rarua</i> * | \$26,667 | \$91,428 | \$111,746 | \$175,039 | \$225,050 | \$275,061 |
| Platforms, pipelines and wells | \$124,443 | \$159,998 | \$195,553 | \$93,532 | \$120,256 | \$146,979 |
| Domestic coastal traffic | \$54,530 | \$70,344 | \$86,612 | \$54,530 | \$70,344 | \$86,612 |
| Fishing industry | \$63,124 | \$81,430 | \$99,105 | \$63,124 | \$81,430 | \$99,105 |

Note: levy recovery of \$3.5 million, \$4.5 million and \$5.5 million is shown for each option, requiring 29 and 57 percent increases respectively using the GT method. This table is for an indicative range of vessels and installations, and not all vessels subject to the OPL are included in the table. All values are GST exclusive.

Conclusion

The purpose of this discussion document is to obtain views from the maritime sector and other interested stakeholders on proposed changes to the Oil Pollution Levy.

MNZ welcomes comments on the matters covered in this discussion document, including:

- whether there are other issues raised by the current levy approach that have not been covered
- the extent to which the proposed levy approach raised in this document addresses the issues
- the workability of the proposed Option 2 levy approach
- whether there are other levy options, approaches or modifications that should be considered
- whether there are issues with the setting of the levy rate under the proposed approach that should be addressed.

Following the receipt of submissions, MNZ will provide an analysis and recommendation to the Minister of Transport for consideration. Once the method has been determined and the capability review has identified the costs of providing the oil spill preparedness and response services, the levy rate will be set. It is proposed that a new Levies Order be introduced, to start in early to mid 2012.

Special points for submission

- To what extent does the proposed levy approach address the issues with the current approach?
- Are there any comments on the workability of the proposed approach?
- Are there other levy approaches or modifications to the proposed levy approach that should be considered?
- Are there any general comments on the proposed levy approach?
- Do the benefits of the new model outweigh the simplicity of the gross tonnage model?
- Do you agree with exempting fishing and coastal vessels from the threat-based model?
- What is your view of the level of increased costs under the threat-based model versus the current model?
- Are there other options for phasing in?

Making a submission

If you need more information about MNZ or the current levy arrangements to assist you in preparing a submission, please phone (04) 473 0111 or 0508 225 522 (toll-free) or send an email to oilpollutionlevy@maritimenz.govt.nz.

Submissions should be made by 31 January 2011.

Send your submission to:

Oil Pollution Levy Consultation
Maritime New Zealand
PO Box 27006
Wellington

Or send it by email to: oilpollutionlevy@maritimenz.govt.nz.

Submissions should indicate whether it would be acceptable for officials from MNZ to contact you to discuss your submission if required.

Submissions may be the subject of a request under the Official Information Act 1982, which could result in their publication. The withholding of particular submissions on the grounds of privacy, or for

any other reason, will be determined in accordance with the Act. Accordingly, submitters who feel that any part should be properly withheld under the Act should indicate this clearly.

Appendix 1: Methodology

Type and volume of oil

The behaviour of spilled oil depends on its type and volume. Oil dissipates at a rate and in a manner that depends not only on type and volume, but also on the characteristics of the environment into which the spill occurs (such as water temperature).

For all oil, regardless of its original density, most if not all of the volatile components dissipate within the first 24 hours after the spill occurs. Depending on the type of oil, after the volatiles have dissipated a residue may remain.

The levy methodology seeks to calculate a levy that reflects the spill threat for any given parcel of oil. The challenge is to construct a methodology that allows the direct comparison of parcels of oil, regardless of their type and volume. To do this, the methodology first derives unit standards for oil type and volume, against which an arbitrary parcel of oil may be compared. As a general rule, the unit standards need to be applicable to a wide range of oil volumes⁷ and the full range of oil types.⁸

Unit standard, oil volume

Because of the requirement to be applied to a wide range of volumes, the unit standard for oil volume was chosen to be *100 metric tonnes*.

Unit standard, oil type

The unit standard for oil type is based on the dissipation behaviour of oil. Every oil has a unique dissipation behaviour that depends on the volume of oil spilled. Dissipation occurs primarily through evaporation of volatile components. In general, the relative amount of volatile components is inversely related to oil density. That is, low-density oils (such as jet fuel or automotive petrol) have a high proportion of volatile components and, conversely, high-density oils (such as heavy fuel oil or bitumen) have a low proportion of volatile components.

For all oils, regardless of their original density, most of the volatile components dissipate within 24 hours of the spill occurring.⁹ The volumetric reduction is greater for low-density oils than for high-density oils. This arises because, in their original form, low-density oils have a larger proportion by volume of volatile components.

With these factors in mind, the unit standard for oil type was chosen to be *50 percent of spilt oil remaining 24 hours after a spill occurs*.

Volume and type standards combined

Every parcel of oil has both oil-type and oil-volume properties and these two standards operate together. The unit standard for type and volume combined may be stated as *50 tonnes remaining 24 hours after a spill occurs*.

In other words, 100 original tonnes of an oil type that reduces to 50 residual tonnes in 24 hours accrues, by definition, 1 unit of type/volume threat.

7 From a fraction of a metric tonne up to 150,000 metric tonnes.

8 From the heavy types, such as bitumen and heavy fuel oil, to the lightest, such as automotive gasoline and jet fuel.

9 Dissipation behaviour departs from this general rule for very large volumes of oil.

The number of units associated with any type/volume combination may be derived relative to this standard by:

For all type/volumes, residual oil = tonnes remaining after 24 hours

Number of units = residual oil / 50. (The factor of 50 normalises the result to the unit standard.)

The following table compares the units generated by a constant volume of different types of oil. The results (the units column) aligns with the expectation that the heavier oil (HFO) should generate more units than a lighter oil (AGO).

Table 6 Dissipation of Fuel Type 1

| Type | Volume (tonnes) | % remaining | Residual oil (tonnes) | Units |
|----------------------|-----------------|-------------|-----------------------|-------|
| Heavy fuel oil (HFO) | 100 | 90 | 90 | 1.80 |
| Murban crude | 100 | 50 | 50 | 1 |
| Diesel fuel (AGO) | 100 | 14 | 14 | 0.28 |

The following table presents the same analysis, but for non-constant volumes of oil. This table shows that parcels of oil that are unlike in type and volume can be directly compared by normalisation to a unit standard – that is, by derivation of the units. In these examples, the derived units show that even though AGO is much lighter than HFO, the greater volume involved causes the units for the AGO parcel to be greater than for the HFO parcel.

Table 7 Dissipation of Fuel Type 2

| Type | Volume (tonnes) | % remaining | Residual oil (tonnes) | Units |
|----------------------|-----------------|-------------|-----------------------|-------|
| Heavy fuel oil (HFO) | 1,500 | 94 | 1,410 | 28.2 |
| Murban crude | 500 | 54 | 270 | 5.4 |
| Diesel fuel (AGO) | 10,000 | 81 | 8,100 | 162 |

Environmental and human sensitivity factors

Under the proposed approach, environmental and human sensitivity factors are taken into account. The coastline has been divided into 20 kilometre x 20 kilometre cells and each has been assigned one value for environmental sensitivity and another for human sensitivity. The values within each cell have been determined using a detailed evaluation of these two factors.¹⁰ The cell grid has then been extended to the exclusive economic zone (EEZ) and the two factors adjusted for increasing distance from the coast. This is represented in the following diagram.

The resulting values or factors have been used to adjust the units derived from oil type and volume. This adjustment is intended to reflect the potential impact of a spill that depends on proximity to the coast. Oil units are factored up in cells where a sensitivity factor is greater than 1 and factored down where the value is less than 1.

¹⁰ The values for the environmental and human sensitivity factors used here are provided by previous work produced by MNZ. This work is presented in the report “New Zealand Marine Oil Spill Risk Assessment 2004”. The value for the environmental sensitivity factor is based on factors such as shoreline character, plants and animals, and protected sites. As for the human sensitivity factor, the value is based on economic, cultural, and social amenity and recreation criteria. The final report on the oil spill risk assessment can be found at www.maritimenz.govt.nz/publications/pollution_response/risk_asmnt_final_report2004.pdf.



Figure 1 Human sensitivity (left) and environmental sensitivity factors (right) in cells of 20 kilometres x 20 kilometres around the New Zealand coastline.

Occupancy: time spent in the environment

Potential threat is directly related to the length of time that a threat generator spends in any of the cells around the New Zealand coastline. This is known as occupancy.

Port-to-port transactions have been analysed around the coastline and, on the assumption they follow the same route each time, the amount of time spent in each grid can be estimated. The time spent in a cell will vary, depending on the velocity of the vessel and the length of the vessel's track within that cell.

For the purposes of calculating the levy, it has been assumed that velocity is 15 knots. An example of how this is built into the calculations is detailed in the worked examples in Appendix 2.

How is the levy calculated?

The existing Levies Order calculates a levy based on actual tonnage of cargo oil carried in two possible categories (persistent and non-persistent¹¹). The International Oil Pollution Compensation Fund (IOPCF) describes the concept of persistent and non-persistent oils as being related to the likelihood of the material dissipating naturally at sea, and whether or not clean-up would be required. The definition of persistent oils adopted by the IOPCF is actually defined by describing what is meant by non-persistent oil:

non-persistent oil is oil which, at the time of shipment, consists of hydrocarbon fractions

- a) *at least 50 percent of which, by volume, distils at a temperature of 340 °C (645 °F) and*
- b) *at least 95 percent of which, by volume, distils at a temperature of 370 °C (700 °F) when tested by the ASTM Method D86/78 or any subsequent revision thereof.*

A phrase often used in this context is “contributing oil”. The carriage of a contributing oil requires a contribution to be made to the IOPCF. However, the existing Levies Order does not provide for transactions that involve multiple parcels of cargo oil that do not fall into the same persistence category.

¹¹ See the Glossary.

To calculate a levy that reflects the presence of multiple parcels of oil in a single vessel, a calculation is required for the total tonnage of both persistence categories aboard the vessel (that is, the total tonnage of persistent oil and of non-persistent oil). Table 17 lists residual oil volumes for contributing and non-contributing oils over the full range of expected oil volumes. This allows for the circumstance in which a vessel is carrying multiple parcels of cargo oil of both persistence classes.

The levy chargeable is calculated based on the units accrued from each of three possible components:

1. **Bunker fuel component.** Every transaction involving a conventional vessel moving around the coast has a bunker fuel component. This assumes HFO as the fuel.
2. **Contributing cargo oil component.** The levy for this component is calculated based on the total tonnage of all parcels of oil that are contributing oil.
3. **Non-contributing cargo oil component.** The levy for this component is calculated based on the total tonnage of all parcels of oil that are non-contributing oil.

The examples illustrated in this document rely on the tables for Bunker Units, Contributing/Non-Contributing Units and Track Units (Tables 16–18). The Bunker Units table is for vessels that carry bunker fuel only.

What assumptions have been made?

The components that need to be represented in the model, with the various assumptions, are detailed below.

Table 8 Assumptions used in the calculation of threat units

| Component | Notes and assumptions |
|--|---|
| Environmental and human potential impact | The detailed model deems that conventional coastal traffic follows predetermined routes from one port to another. Each port-to-port track traverses a constant set of cells, each of which contributes constant values of environmental and human potential impact as factors to the calculation of units. In this way, the sum of the product of environmental and human potential impact is constant for each track. |
| Occupancy | Occupancy refers to the time spent in an environment where there is a finite threat associated with the activity. The unit standard for time is 1 hour. All conventional vessels are deemed to travel at a constant velocity of 15 knots. Objects that are fixed in location (such as FPSOs) have occupancy of 1 and therefore, by definition, no arithmetic effect on the number of units accrued. |
| Bunker oil, type and volume | The majority of conventional traffic operating on the coast uses HFO 180 as bunker fuel. All conventional vessels are deemed to have a constant volume of bunker fuel on board of 750 tonnes. The residual oil units for 750 tonnes of HFO 180 = 13.9. |
| Cargo oil, type | The cargo oil type is converted from actual oil type to either contributing oil (persistent) or non-contributing oil (non-persistent). The terms contributing and non-contributing come from IOPCF, and are therefore consistent with current international usage. Residual oil units for cargo oil have been calculated using equations for contributing and non-contributing oils. (The derivation of these equations is detailed in Appendix 4.) The result of these calculations is outlined in Table 17, which gives a range of oil volumes and the residual units for contributing and non-contributing oil types. If the actual volume does not appear in the table, then the next higher volume should be used. |
| Cargo oil, volume | The actual volume of cargo oil is used. |

Example of the methodology for calculating total threat units

The example below shows the calculation of threat units for a dynamic object only. This process has been simplified into tables of standardised voyages.

The unit standard for time is 1 hour. Occupancy is the fraction of 1 hour spent in a traversed cell. Note that the occupancy factor is greater than 1 if a vessel spends more than 1 hour in a cell.

Example A: Calculation of threat units for a dynamic object

This example shows how the threat units are derived and then adjusted for each occupied cell along a vessel's journey. The example is of a conventional vessel using HFO as bunker fuel. The initial volume is 1,500 tonnes. This oil volume and type attracts 28.2 residual oil threat units.¹² However, it is in a part of New Zealand waters that has some environmental sensitivity (1.5, which will factor up the threat units¹³) but poses fewer concerns for human well-being (0.5, which will factor down the threat units). The vessel required 48 minutes (0.8 hours) to traverse cell 1. The net result is 16.9 threat units for this cell – a value that encapsulates all the factors relevant to the transaction in that cell.

As the vessel moves from one cell to the next, the bunker volume decreases and so the residual oil threat units also decrease. The sensitivity factors change from cell to cell, according to the value from which they are derived at the coast. Therefore, moving into cell 2, the bunker volume has decreased through consumption and the residual oil units have also decreased. The sensitivity factors are different, reflecting the change in those factors from cell to cell. The path taken across cell 2 is longer than the path taken across cell 1, and so the occupancy is larger: 72 minutes (1.2 hours).

The total threat units accrued is the sum of the units from cells 1 and 2. This is shown in the table below, which summarises the calculation for a dynamic object.

Table 9 Example of how threat units are derived for cell 1

| Cell 1 | | | | |
|------------------------------------|---|-------|------|---------------------------|
| Oil volume | | 1,500 | | |
| Residual oil threat units | | 28.2 | | |
| Environmental sensitivity factor | x | 1.5 = | 42.3 | 28.2 factored up by 1.5 |
| Human sensitivity factor | x | 0.5 = | 21.2 | 42.3 factored down by 0.5 |
| Occupancy | x | 0.8 = | 16.9 | 21.2 factored down by 0.8 |
| Net threat units accrued in cell 1 | | | | 16.9 |

For the complete voyage, a 'mini-profile' like those shown in the preceding table is calculated for each cell traversed. The overall result for the voyage is calculated as the sum of the net threat units for each cell on the voyage.

Table 10 Example of how threat units are derived for cell 2

| Cell 2 | | | | |
|---|---|-------|------|----------------------------------|
| Oil volume | | 1,498 | | Bunker fuel consumed |
| Residual oil threat units | | 28.1 | | |
| Environmental sensitivity factor | x | 1.2 = | 33.8 | 28.1 factored up by 1.2 |
| Human sensitivity factor | x | 1.0 = | 33.8 | 33.8 factored by 1.0 (no change) |
| Occupancy | x | 1.2 = | 41.9 | 33.8 factored up by 1.2 |
| Net threat units accrued in cell 2 | | | | 41.9 |
| Total threat units accrued in cells 1 & 2 | | | | 58.8 |

12 Further details on the calculation of residual oil threat units are provided in Appendix 2.

13 Oil units are factored up in cells where a sensitivity factor is greater than 1 and factored down where the value is less than 1.

Appendix 2: Worked examples

This appendix provides indicative examples based on the need to recover about \$4.4 million. A three-phase approach is being used, with the first phase focusing on the method used to allocate levy costs, the second a capability review of New Zealand's preparedness and response regime, and the third the setting of the levy. The capability review and a subsequent action plan will identify the expenditure needed to maintain appropriate oil spill response capability. This will impact on the cost per threat unit in the following worked examples.

All coastal transactions involving conventional traffic moving around the coast involve at least two ports (port of departure and the destination port). Although many transactions involve only these two ports, there are also many transactions that involve two or more port-to-port transactions. To calculate the levy, each port-to-port transaction is calculated separately and the total levy is the sum of all these calculations.

To help you work through the examples and the respective calculations, the following information can be found in the document, either as an appendix or a table.

Units, bunker value – Appendix 3, Table 16

Residual oil, contributing – Appendix 3, Table 17

Residual oil, non-contributing – Appendix 3, Table 17

Weighted track units – Appendix 3, Table 18 for the route from A to B

Units, contributing = weighted impact units × residual oil, contributing

Units, non-contributing = weighted impact units × residual oil, non-contributing

The \$/unit value is constant and the same value is applied to all transactions.

Below are specific examples of: a vessel carrying bunker fuel only; a vessel carrying bunker fuel and a parcel of contributing cargo oil; and a vessel carrying bunker fuel, parcels of both contributing and non-contributing cargo oil and visiting multiple ports. In all of the examples, the total component units are multiplied by the unit rate of \$0.165 (16.5 cents) to derive the levy.

Example 1: Auckland to Bluff

The first example relates to a vessel that is carrying bunker fuel only and travelling from Auckland to Bluff. The vessel has a GT of 17,025 tons. In this instance, the bunker units have already been calculated, as defined in Table 16, and those units are multiplied by the cents/unit rate to obtain the levy amount. Under the existing Levies Order, the same vessel would have been levied \$189.

Table 11 Levy calculation, Auckland to Bluff

| | Bunker units (Table 16) | Contributing / non- contributing oils (Table 17) | Track units (Table 18) | Threat units by component |
|---|------------------------------------|---|-----------------------------------|--------------------------------------|
| Bunker fuel | 2,450 | 0 | 0 | 2,450 |
| Contributing oils | 0 | 0 | 0 | 0 |
| Non-contributing oils | 0 | 0 | 0 | 0 |
| Total threat units | | | | 2,450 |
| Unit rate | | | | 0.165 |
| Unit-based levy at \$0.165/threat unit | | | | \$404.25 |

Example 2: Vessel arriving from the northwest, going to Whangarei

The second example is a vessel that is carrying bunker fuel, contributing cargo oil of 50,000 tonnes, coming from the Northwest and travelling to Whangarei. The vessel has a GT of 57,226 tons. Once again, Table 16 is referenced to calculate the bunker units, which have been calculated at 825.

Table 18 is also referenced, to determine the track units weighted for velocity at 15 knots. In this instance, it equates to 59 threat units. Contributing oil of 50,000 tonnes has a residual factor of 950 units. Multiplying the track units with the residual units gives a result of 56,050 units. The combined units are then multiplied by the cents/unit rate to calculate a levy payment of \$9,384.

Under the existing Levies Order, a vessel with GT of 57,226 tons would have paid \$5,398.

Table 12 Levy calculation, Northwest to Whangarei

| | Bunker units (Table 16) | Contributing / non- contributing oils (Table 17) | Track units (Table 18) | Threat units by component |
|---|----------------------------|---|---------------------------|------------------------------|
| Bunker fuel | 825 | 0 | 0 | 825 |
| Contributing oils | 0 | 950 | 59 | 56,050 |
| Non-contributing oils | 0 | 0 | 0 | 0 |
| Total threat units | | | | 56,875 |
| Unit rate | | | | 0.165 |
| Unit-based levy at \$0.165/threat unit | | | | \$9,384.38 |

Example 3: Whangarei to Wellington to Lyttelton, bunker + contributing + non-contributing

This example is for a vessel carrying multiple parcels of cargo oil of both contributing and non-contributing types. The vessel has a GT of 27,795 tons and leaves Marsden Point carrying:

- 10,000 tonnes of LFO (light fuel oil, a contributing oil)
- 13,000 tonnes of PMS (premium motor spirit, a non-contributing oil)
- 1,000 tonnes of JP4 (jet fuel, a non-contributing oil).

Each leg is calculated separately and the results are added together. The residual oil units for 14,000 tonnes of non-contributing oil is 260 (value 16,000 is used, as the next highest value in the table).

Leg 1 (Whangarei to Wellington)

Table 13 Levy calculation, Leg 1, Whangarei to Wellington

| | Bunker units (Table 16) | Contributing / non- contributing oils (Table 17) | Track units (Table 18) | Threat units by component |
|---|----------------------------|---|---------------------------|------------------------------|
| Bunker fuel | 2,190 | | | 2,190 |
| Contributing oils | | 180 | 158 | 28,440 |
| Non-contributing oils | | 260 | 158 | 41,080 |
| Total threat units | | | | 71,710 |
| Unit rate | | | | 0.165 |
| Unit-based levy at \$0.165/threat unit | | | | \$11,832.15 |

| Existing Levies Order, Persistent | | Existing Levies Order, Non-persistent | |
|-----------------------------------|--------------|---------------------------------------|--------------|
| Gross Tonnage | 27,795 | Gross Tonnage | 27,795 |
| | Levy, ex GST | | Levy, ex GST |
| Visit contribution | \$ 245 | Visit contribution | \$ 245 |
| Persistent cargo | \$ 978 | Persistent cargo | \$ - |
| Non-persistent cargo | \$ - | Non-persistent cargo | \$ 622 |
| Invoice amount | \$ 1,223 | Invoice amount | \$ 866 |

Figure 2 Existing Levies Order, Leg 1.

In the existing system, the levy can only be charged for one of two parcels of oil – that is, either the persistent or the non-persistent, but not both. The convention is to charge on the basis of the larger amount (in this case, the persistent cargo).

In Wellington:

- 7,000 tonnes of LFO is offloaded
- 6,000 tonnes of PMS is offloaded
- 700 tonnes of JP4 is offloaded.

Leg 2 (Wellington to Lyttelton)

The vessel leaves Wellington carrying:

- 3,000 tonnes of LFO
- 7,000 tonnes of PMS
- 300 tonnes of JP4.

The calculation is done exactly the same as for Leg 1. The residual oil units for 3,000 tonnes of contributing oil is 56 (the value for 3,200 tonnes – that is, the next higher value in the table).

The residual oil units for 7,300 tonnes of non-contributing oil is 130 (the value for 7,900 tonnes – that is, the next higher value in the table).

Table 14 Levy calculation, Leg 2, Wellington to Lyttelton

| | Bunker units (Table 16) | Contributing / non- contributing oils (Table 17) | Track units (Table 18) | Threat units by component |
|---|----------------------------|---|---------------------------|------------------------------|
| Bunker fuel | 1,009 | 0 | 0 | 1,009 |
| Contributing oils | 0 | 56 | 73 | 4,088 |
| Non-contributing oils | 0 | 130 | 73 | 9,490 |
| Total threat units | | | | 14,587 |
| Unit rate | | | | 0.165 |
| Unit-based levy at \$0.165/threat unit | | | | \$2,406.86 |

| Existing Levies Order, Persistent | | Existing Levies Order, Non-persistent | |
|-----------------------------------|--------------|---------------------------------------|--------------|
| Gross Tonnage | 27,795 | Gross Tonnage | 27,795 |
| | Levy, ex GST | | Levy, ex GST |
| Visit contribution | \$ 245 | Visit contribution | \$ 245 |
| Persistent cargo | \$ 293 | Persistent cargo | \$ - |
| Non-persistent cargo | \$ - | Non-persistent cargo | \$ 324 |
| Invoice amount | \$ 538 | Invoice amount | \$ 569 |

Figure 3 Existing Levies Order, Leg 2.

In the existing system, the levy can only be charged for one of two parcels of oil – that is, either the persistent or the non-persistent, but not both. The convention is to charge on the basis of the larger amount (in this case, the non-persistent cargo).

Totals

Summarising this transaction, the results would be as shown in Table 15.

Table 15 Voyage totals

| Destination | Threat-based levy | Existing Levies Order |
|-------------------------|-------------------|-----------------------|
| Whangarei to Wellington | \$11,832 | \$1,223 |
| Wellington to Lyttelton | \$2,407 | \$569 |
| Total \$14,23 | 9 | \$1,792 |

Appendix 3: Levy tables

Table 16 Bunker units

| | | AKL | BLF | CHA | DUD | EXE | EXN | XNE | XNW | EXS | XSW | EXW | GIS | GRM | LYT | MKU | NPR | NSN | NPL | OMU | OBN | OPU | PCN | TRG | TIU | WLG | WPT | WAN | WRE |
|-----------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| Auckland | AKL | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Bluff | BLF | 2,450 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Chatham Islands | CHA | 933 | 662 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Dunedin | DUD | 2,227 | 485 | 439 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ East | EXE | 899 | 1,162 | 116 | 939 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ North | EXN | 1,412 | 2,340 | 1,129 | 2,117 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ Northeast | XNE | 550 | 1,577 | 60 | 1,355 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ Northwest | XNW | 1,473 | 2,325 | 1,190 | 2,102 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ South | EXS | 2,309 | 265 | 521 | 345 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ Southwest | XSW | 1,472 | 401 | 863 | 686 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ West | EXW | 1,458 | 425 | 1,073 | 711 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Gisborne | GIS | 1,045 | 1,572 | 198 | 1,350 | 163 | 1,241 | 172 | 1,302 | 1,432 | 1,526 | 1,484 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Greymouth | GRM | 3,141 | 777 | 1,279 | 1,062 | 1,278 | 1,749 | 1,694 | 1,734 | 842 | 385 | 266 | 1,689 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Lyttelton | LYT | 2,015 | 845 | 227 | 622 | 727 | 1,905 | 1,142 | 1,890 | 705 | 1,046 | 1,457 | 1,137 | 1,662 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Manakau | MKU | 1,984 | 2,191 | 1,372 | 1,968 | 1,372 | 592 | 629 | 577 | 2,050 | 1,437 | 561 | 1,783 | 1,600 | 1,756 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Napier | NPR | 1,144 | 1,441 | 396 | 1,219 | 336 | 1,340 | 271 | 1,401 | 1,301 | 1,395 | 1,386 | 266 | 1,558 | 1,006 | 1,652 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Nelson | NSN | 3,040 | 1,997 | 1,178 | 1,774 | 1,178 | 1,649 | 1,686 | 1,633 | 1,856 | 559 | 517 | 1,589 | 722 | 1,562 | 1,500 | 1,458 | - | - | - | - | - | - | - | - | - | - | - | - |
| New Plymouth | NPL | 1,961 | 1,900 | 1,082 | 1,678 | 1,082 | 570 | 607 | 554 | 1,760 | 1,147 | 539 | 1,492 | 1,309 | 1,465 | 421 | 1,361 | 1,209 | - | - | - | - | - | - | - | - | - | - | - |
| Oamaru | OMU | 2,056 | 507 | 268 | 285 | 768 | 1,946 | 1,184 | 1,931 | 367 | 708 | 732 | 1,179 | 1,704 | 452 | 1,797 | 1,048 | 1,603 | 1,507 | - | - | - | - | - | - | - | - | - | - |
| Oban | OBN | 2,491 | 242 | 703 | 527 | 1,203 | 2,381 | 1,619 | 2,366 | 307 | 443 | 467 | 1,614 | 818 | 887 | 2,232 | 1,483 | 2,038 | 1,942 | 549 | - | - | - | - | - | - | - | - | - |
| Opua | OPU | 1,261 | 3,040 | 978 | 2,817 | 943 | 720 | 757 | 782 | 2,899 | 781 | 766 | 1,090 | 2,449 | 2,605 | 1,292 | 1,189 | 2,349 | 1,270 | 2,646 | 3,081 | - | - | - | - | - | - | - | - |
| Picton | PCN | 2,913 | 1,519 | 701 | 1,297 | 700 | 1,521 | 1,116 | 1,506 | 1,379 | 1,116 | 1,073 | 1,111 | 1,278 | 1,084 | 1,372 | 980 | 1,178 | 1,082 | 1,126 | 1,561 | 2,221 | - | - | - | - | - | - | - |
| Tauranga | TRG | 962 | 2,077 | 560 | 1,855 | 526 | 1,158 | 505 | 1,219 | 1,937 | 1,219 | 1,204 | 672 | 2,194 | 1,642 | 1,730 | 772 | 2,094 | 1,707 | 1,684 | 2,119 | 1,007 | 1,616 | - | - | - | - | - | - |
| Timaru | TIU | 1,988 | 559 | 200 | 336 | 699 | 1,878 | 1,115 | 1,863 | 419 | 760 | 1,430 | 1,110 | 1,635 | 383 | 1,729 | 979 | 1,535 | 1,438 | 165 | 600 | 2,578 | 1,057 | 1,615 | - | - | - | - | - |
| Wellington | WLG | 1,914 | 1,444 | 626 | 1,222 | 625 | 1,446 | 1,041 | 1,431 | 1,304 | 1,041 | 998 | 1,036 | 1,203 | 1,009 | 1,297 | 905 | 1,103 | 1,007 | 1,051 | 1,486 | 2,146 | 625 | 1,541 | 982 | - | - | - | - |
| Westport | WPT | 3,075 | 830 | 1,213 | 1,809 | 1,213 | 1,684 | 1,721 | 1,669 | 896 | 439 | 200 | 1,624 | 174 | 1,597 | 1,535 | 1,493 | 657 | 1,244 | 1,638 | 872 | 2,384 | 1,213 | 2,129 | 1,570 | 1,138 | - | - | - |
| Whanganui | WAN | 2,260 | 1,698 | 880 | 1,475 | 879 | 869 | 1,295 | 853 | 1,558 | 944 | 902 | 1,290 | 1,107 | 1,263 | 720 | 1,159 | 1,007 | 429 | 1,305 | 1,740 | 1,569 | 879 | 1,795 | 1,236 | 804 | 1,042 | - | - |
| Whangarei | WRE | 1,231 | 2,465 | 948 | 2,242 | 913 | 764 | 565 | 825 | 2,324 | 824 | 809 | 1,060 | 2,493 | 2,649 | 1,336 | 1,159 | 2,392 | 1,313 | 2,690 | 2,506 | 613 | 2,265 | 977 | 2,002 | 2,190 | 2,427 | 1,612 | - |

ExNZ East East coast South America Ex NZ South Antarctica
 ExNZ North Hong Kong, Pacific Islands ExNZ Southwest Melbourne, Adelaide
 ExNZ Northeast West coast North America, Panama Canal ExNZ West S ydney, Brisbane
 ExNZ Northwest Singapore, Middle East

Table 17 Residual oil factors for contributing and non-contributing cargo oil factor by oil volume

| Oil volume (tonnes) | Contributing residual oil | Non- contributing residual oil | Oil volume (tonnes) | Contributing residual oil | Non-contributing residual oil |
|---------------------|---------------------------|--------------------------------|---------------------|---------------------------|-------------------------------|
| 32 | 0.5 | 0.4 | 21,400 | 397 | 360 |
| 40 | 0.6 | 0.5 | 22,900 | 426 | 387 |
| 50 | 0.8 | 0.6 | 24,500 | 457 | 416 |
| 63 | 1.0 | 0.8 | 26,300 | 491 | 447 |
| 79 | 1.3 | 1.0 | 28,200 | 527 | 481 |
| 100 | 1.6 | 1.3 | 30,200 | 565 | 518 |
| 130 | 2.1 | 1.6 | 32,400 | 607 | 557 |
| 160 | 2.6 | 2.0 | 34,700 | 651 | 599 |
| 200 | 3.3 | 2.6 | 37,200 | 699 | 644 |
| 250 | 4.2 | 3.3 | 39,800 | 750 | 693 |
| 320 | 5.3 | 4.2 | 42,700 | 805 | 745 |
| 400 | 6.8 | 5.4 | 45,700 | 864 | 802 |
| 500 | 8.6 | 6.9 | 49,000 | 927 | 862 |
| 630 | 11 | 8.7 | 52,500 | 995 | 927 |
| 790 | 14 | 11 | 56,200 | 1,070 | 998 |
| 1,000 | 17 | 14 | 60,300 | 1,150 | 1,070 |
| 1,100 | 20 | 16 | 64,600 | 1,230 | 1,150 |
| 1,300 | 22 | 18 | 69,200 | 1,320 | 1,240 |
| 1,400 | 25 | 20 | 74,100 | 1,420 | 1,340 |
| 1,600 | 28 | 23 | 79,400 | 1,520 | 1,440 |
| 1,800 | 31 | 26 | 85,100 | 1,630 | 1,540 |
| 2,000 | 35 | 29 | 91,200 | 1,750 | 1,660 |
| 2,200 | 40 | 33 | 97,700 | 1,880 | 1,790 |
| 2,500 | 44 | 38 | 104,700 | 2,020 | 1,920 |
| 2,800 | 50 | 42 | 105,900 | 2,040 | 1,950 |
| 3,200 | 56 | 48 | 107,200 | 2,060 | 1,970 |
| 3,500 | 63 | 54 | 108,400 | 2,090 | 1,990 |
| 4,000 | 71 | 61 | 109,600 | 2,110 | 2,020 |
| 4,500 | 80 | 69 | 110,900 | 2,140 | 2,040 |
| 5,000 | 90 | 78 | 112,200 | 2,160 | 2,070 |
| 5,600 | 100 | 88 | 113,500 | 2,190 | 2,090 |
| 6,300 | 110 | 99 | 114,800 | 2,210 | 2,120 |
| 7,100 | 130 | 110 | 116,100 | 2,240 | 2,140 |
| 7,900 | 144 | 126 | 117,500 | 2,270 | 2,170 |
| 8,900 | 162 | 143 | 118,900 | 2,290 | 2,200 |
| 10,000 | 183 | 161 | 120,200 | 2,320 | 2,220 |
| 10,700 | 196 | 173 | 121,600 | 2,350 | 2,250 |
| 11,500 | 210 | 187 | 123,000 | 2,380 | 2,280 |
| 12,300 | 226 | 201 | 124,500 | 2,410 | 2,310 |
| 13,200 | 242 | 216 | 125,900 | 2,430 | 2,330 |
| 14,100 | 260 | 232 | 127,400 | 2,462 | 2,363 |
| 15,100 | 279 | 250 | 128,800 | 2,492 | 2,392 |
| 16,200 | 299 | 269 | 130,300 | 2,521 | 2,421 |
| 17,400 | 321 | 289 | 131,800 | 2,551 | 2,451 |
| 18,600 | 345 | 311 | 133,400 | 2,581 | 2,481 |
| 20,000 | 370 | 334 | 134,900 | 2,612 | 2,511 |

This table is for vessels that also carry cargo oil, whether it is contributing or non-contributing. New Zealand is a party to the Civil Liability Convention (1992) and the Fund Convention (1992) under the IOPCF. The IOPCF was established to “provide compensation for oil pollution damage resulting from spills of persistent oil from tankers”. The terms “contributing” and “non-contributing” are defined by the IOPCF and are broadly synonymous with the older terms “persistent” and “non-persistent” respectively. The new terms are defined in IOPCF documentation and the terminology is now a de facto international standard. IOPCF proposed the new terms, presumably to avoid the ambiguity that might arise using the older, less well-defined terms. The new terms are used here in order to maintain consistency with current international standards.

Contributing and non-contributing oil means crude oil and fuel oil, as defined below:

(a) “Crude oil” means any liquid hydrocarbon mixture occurring naturally in the earth, whether or not treated to render it suitable for transportation. It also includes crude oils from which certain distillate fractions have been removed (sometimes referred to as “topped crudes”), or to which certain distillate fractions have been added (sometimes referred to as “spiked” or “reconstituted” crudes).

(b) “Fuel oil” means heavy distillates or residues from crude oil or blends of such materials intended for use as a fuel for the production of heat or power of a quality equivalent to the “American Society for Testing and Materials’ Specification for Number Four Fuel Oil (Designation D396-69)”, or heavier.

This list of contributing and non-contributing oils is intended as a guide for contributors.

| Contributing oil | | Non-contributing oil |
|------------------------------------|---------------|-----------------------------|
| <i>Crude oils</i> | <i>Cru</i> | <i>de oils</i> |
| All naturally occurring crude oils | | Natural gas liquids |
| Condensate ¹⁴ | | Condensate |
| Topped crudes | Ca | singlehead naphtha |
| Spiked crudes | Natural | gasoline |
| Reconstituted crudes | Coh | asset-panuke |
| | | |
| <i>Finished products</i> | <i>Finish</i> | <i>ed products</i> |
| N°4 fuel (ASTM) | LNG | and LPG |
| Navy special fuel | Aviation | gasolines |
| Light fuel oil | Motor | gasoline (petrol, essence) |
| N°5 fuel (ASTM) – light | | White spirit |
| Medium fuel oil | Kero | sene |
| N°5 fuel (ASTM) – heavy | | Aviation kerosene |
| Bunker C fuel oil | | – Jet 1 A |
| Heavy fuel oil | – | N°1 fuel (ASTM) |
| Marine fuel oil | | Gas oil |
| N°6 fuel oil (ASTM) | Heatin | g oil |
| Blended fuel oils by viscosity | | N°2 fuel (ASTM) |
| or sulphur content | | Lubricating oil |
| Bituminous emulsions ¹⁵ | | Marine diesel |
| and fuel oil emulsions | | |

14 To be considered as “non-contributing oil” if more than 50 percent by volume distils at a temperature of 340°C and at least 95 percent by volume distils at a temperature of 370°C, when tested by the ASTM Method D 86/78 or any subsequent revision.

15 The quantity of emulsion received should be reported with no allowance for its water content.

Contributing oil*Intermediate or process stocks*

Fuel oil blend stocks

Non-contributing oil*Intermediate or process stocks*

Straight run naphthas
Light cracked naphtha
Heavy cracked naphtha
Platformate
Reformate
Steam cracked naphtha
Polymers
Isomers
Alkylates
Catalytic cycle oil
Reformer feed
Steam cracker feed
Gas oil blend stocks
Catalytic cracker feedstock
Visbreaker feedstock
Aromatic tar

This table calculates the track values and has been weighted using a velocity of 15 knots. The numbers in the table take into account sensitivity, occupancy and so on, to derive the number of threat units that have been accrued when travelling from port to port.

Table 18 Track units

| | | AKL | BLF | CHA | DUD | EXE | EXN | XNE | XNW | EXS | XSW | EXW | GIS | GRM | LYT | MKU | NPR | NSN | NPL | OMU | OBN | OPU | PCN | TRG | TIU | WLG | WPT | WAN | WRE |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Auckland | AKL | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Bluff | BLF | 176 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Chatham Islands | CHA | 67 | 48 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Dunedin | DUD | 160 | 35 | 32 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ East | EXE | 65 | 84 | 8 | 68 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ North | EXN | 102 | 168 | 81 | 152 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ Northeast | XNE | 40 | 113 | 4 | 97 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ Northwest | XNW | 106 | 167 | 86 | 151 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ South | EXS | 166 | 19 | 37 | 25 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ Southwest | XSW | 106 | 29 | 62 | 49 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| ExNZ West | EXW | 105 | 31 | 77 | 51 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Gisborne | GIS | 75 | 113 | 14 | 97 | 12 | 89 | 12 | 94 | 103 | 110 | 107 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Greymouth | GRM | 226 | 56 | 92 | 76 | 92 | 126 | 122 | 125 | 61 | 28 | 19 | 122 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Lyttelton | LYT | 145 | 61 | 16 | 45 | 52 | 137 | 82 | 136 | 51 | 75 | 105 | 82 | 120 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Manakau | MKU | 143 | 158 | 99 | 142 | 99 | 43 | 45 | 41 | 148 | 103 | 40 | 128 | 115 | 126 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Napier | NPR | 82 | 104 | 28 | 88 | 24 | 96 | 20 | 101 | 94 | 100 | 100 | 19 | 112 | 72 | 119 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Nelson | NSN | 219 | 144 | 85 | 128 | 85 | 119 | 121 | 118 | 134 | 40 | 37 | 114 | 52 | 112 | 108 | 105 | - | - | - | - | - | - | - | - | - | - | - | - |
| New Plymouth | NPL | 141 | 137 | 78 | 121 | 78 | 41 | 44 | 40 | 127 | 83 | 39 | 107 | 94 | 105 | 30 | 98 | 87 | - | - | - | - | - | - | - | - | - | - | - |
| Oamaru | OMU | 148 | 36 | 19 | 20 | 55 | 140 | 85 | 139 | 26 | 51 | 53 | 85 | 123 | 32 | 129 | 75 | 115 | 108 | - | - | - | - | - | - | - | - | - | - |
| Oban | OBN | 179 | 17 | 51 | 38 | 87 | 171 | 116 | 170 | 22 | 32 | 34 | 116 | 59 | 64 | 161 | 107 | 147 | 140 | 39 | - | - | - | - | - | - | - | - | - |
| Opua | OPU | 91 | 219 | 70 | 203 | 68 | 52 | 54 | 56 | 209 | 56 | 55 | 78 | 176 | 187 | 93 | 86 | 169 | 91 | 190 | 222 | - | - | - | - | - | - | - | - |
| Picton | PCN | 210 | 109 | 50 | 93 | 50 | 109 | 80 | 108 | 99 | 80 | 77 | 80 | 92 | 78 | 99 | 71 | 85 | 78 | 81 | 112 | 160 | - | - | - | - | - | - | - |
| Tauranga | TRG | 69 | 149 | 40 | 133 | 38 | 83 | 36 | 88 | 139 | 88 | 87 | 48 | 158 | 118 | 124 | 56 | 151 | 123 | 121 | 152 | 72 | 116 | - | - | - | - | - | - |
| Timaru | TIU | 143 | 40 | 14 | 24 | 50 | 135 | 80 | 134 | 30 | 55 | 103 | 80 | 118 | 28 | 124 | 70 | 110 | 103 | 12 | 43 | 185 | 76 | 116 | - | - | - | - | - |
| Wellington | WLG | 138 | 104 | 45 | 88 | 45 | 104 | 75 | 103 | 94 | 75 | 72 | 75 | 87 | 73 | 93 | 65 | 79 | 72 | 76 | 107 | 154 | 45 | 111 | 71 | - | - | - | - |
| Westport | WPT | 221 | 60 | 87 | 130 | 87 | 121 | 124 | 120 | 64 | 32 | 14 | 117 | 12 | 115 | 110 | 107 | 47 | 90 | 118 | 63 | 171 | 87 | 153 | 113 | 82 | - | - | - |
| Whanganui | WAN | 163 | 122 | 63 | 106 | 63 | 62 | 93 | 61 | 112 | 68 | 65 | 93 | 80 | 91 | 52 | 83 | 72 | 31 | 94 | 125 | 113 | 63 | 129 | 89 | 58 | 75 | - | - |
| Whangarei | WRE | 89 | 177 | 68 | 161 | 66 | 55 | 41 | 59 | 167 | 59 | 58 | 76 | 179 | 191 | 96 | 83 | 172 | 94 | 194 | 180 | 44 | 163 | 70 | 144 | 158 | 175 | 116 | - |

ExNZ East East coast South America ExNZ North Hong Kong, Pacific Islands
 ExNZ Northeast West coast North America, Panama Canal ExNZ Northwest Singapore, Middle East
 ExNZ South Antarctica ExNZ Southwest Melbourne, Adelaide
 ExNZ West Sydney, Brisbane

Appendix 3: Empirical equations for residual units

The residual oil unit for a given volume of oil is calculated using an empirical equation of the form:

$$\text{tonnes remaining after 24 hours} = ae^{bx}$$

This is the equation of the trend line for a series of points calculating the tonnes remaining at 24 hours for tonnages of 1, 10, 100, 1,000 and 10,000 tonnes. The trend line is shown in blue in the following graph. The empirical equation for the blue line is shown on the graph.

The coefficients a and b, for contributing and non-contributing oils, were derived by averaging the coefficients for a range of oils within each category. The values used are as shown in Figure 4.

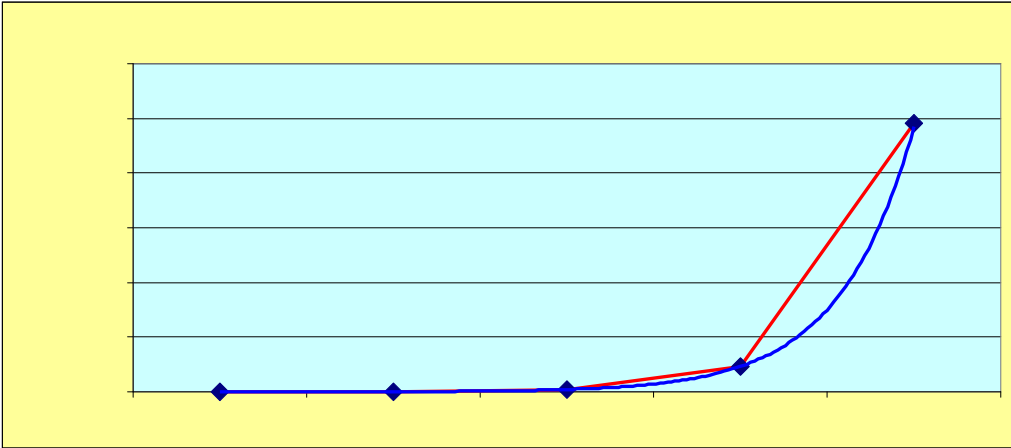


Figure 4 Dissipation curve for HFO 180. Each oil will have its own characteristic dissipation curve.

| | | |
|--------------------|--|----------|
| Non-contributing a | | 0.042716 |
| b | | 2.429653 |
| | | |
| Contributing a | | 0.070533 |
| b | | 2.354238 |

Coefficients for contributing and non-contributing oil in Table 17. These coefficients are averages for the different types.

Values of tonnes remaining must be unitised by dividing by 50:

$$\text{residual oil units} = \text{tonnes remaining after 24 hours} / 50$$

For details, see the discussion in Appendix 1.