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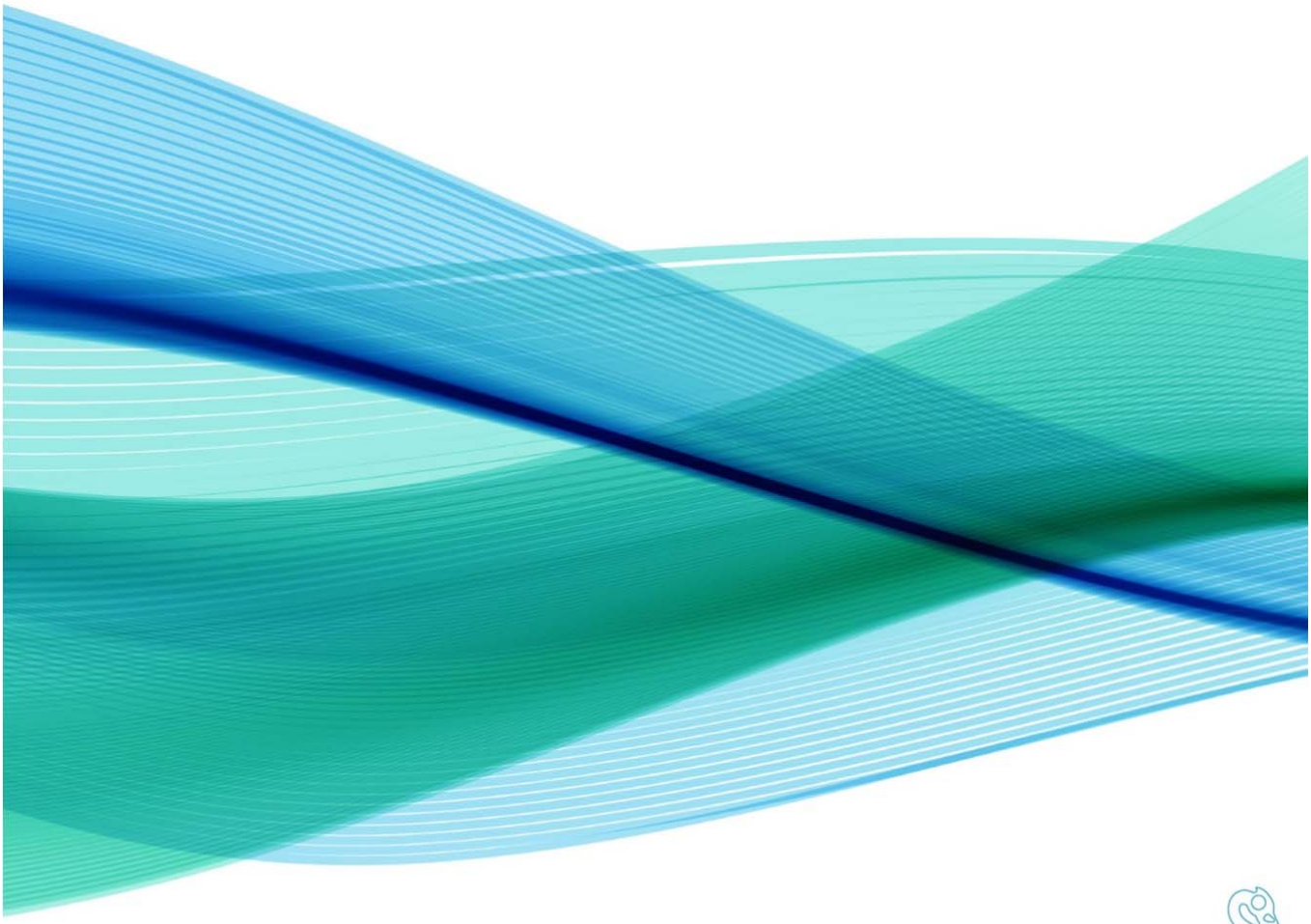
Marine Pollution Risk Assessment for Fiji

February 2015



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Maritme New Zealand
PO Box 25620
Wellington 6146
enquiries@maritimenz.govt.nz
www.maritimenz.govt.nz

Secretariat of the Pacific Regional Environment Programme (SPREP)
PO Box 240
Apia, Samoa
sprep@sprep.org
www.sprep.org

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Marine Pollution Risk Assessment for Fiji

February 2015

An oil spill risk assessment for Fiji's major ports and transfer terminals including an evaluation of existing oil spill response capability with recommendations for further development.

Project Team

Paul Buisson	Senior Technical Advisor **Maritime New Zealand**
Dayne Maxwell	Planning Leader (Marine Pollution Response Service) **Maritime New Zealand**
Anthony Talouli	Pollution Advisor **Secretariat of the Pacific Regional Environment Programme**
Scott Willson	Marine Pollution Officer **Secretariat of the Pacific Regional Environment Programme**

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Glossary

AFS 2001	International Convention on the Control of Anti-Fouling Systems on Ships
APASA	Asia Pacific Applied Science and Associates
BUNKER	Convention on Civil Liability for Bunker Oil Pollution Damage
BWM 2004	International Convention for the Control and Management of Ship's Ballast Water and Sediments
CITES	Convention for the International trade in Endangered Species
DCVG	Direct current testing
DOE	Department of Environment
EDS	Environmental Data Server
FAL Convention 1965	Convention on Facilitation of International Maritime Traffic
FLMMA	Fiji locally managed marine areas
GT	Gross tonnage
HFO	Heavy fuel oil
HM	Harbour Master
IALA	International technical association
IMO	International Maritime Organisation
IOPPC	International Oil Pollution Prevention Certificate
ISGOTT	International Safety Guide for Oil Tankers and Terminals
JSA	Job Safety Analysis
MARPOL	International Convention for the Prevention of Marine Pollution from Ships
MARPOL73/78	International Convention for the Prevention of Pollution from Ships
MNZ	Maritime New Zealand
MPRS	Marine Pollution Response Service
MSAF	Maritime Safety Authority of Fiji
MTD	Maritime Transport Decree
NATPLAN	Republic of Fiji Marine Spill Contingency Plan
NDT	Non-destructive testing
OPRC	International Convention on Oil Pollution Preparedness Response and Cooperation
OPRC – HNS Protocol 2000	Protocol on Preparedness, Response and Cooperation to Pollution incidents by Hazardous and Noxious substances
PACPLAN	Metropolitan Pacific Islands Regional Marine Spill Contingency Plan
PSC	Port State Control
RNZAF	Royal New Zealand Air Force
Salvage Convention 1989	International Convention on Salvage
SAR Convention 1979	International Convention of Maritime Search and Rescue
SOP	Standing Operating Procedure

SPREP	Secretariat of the Pacific Regional Environment Program
UNCLOS	United Nations Convention on Law of the Sea

Disclaimer

The conclusions and recommendations provided in this report are based on the views and opinions of the project team participants and do not necessarily represent the views of MNZ or SPREP. The responsibility and liability for the implementation of any recommendations in this report lies entirely with the Government of Fiji.

Executive summary

The Secretariat of the Pacific Regional Environment Programme (SPREP) and Maritime New Zealand (MNZ) were engaged to assist the Maritime Safety Authority of Fiji (MSAF) with an oil spill environmental risk assessment. The project team visited Fiji's major ports and transfer terminals. The aim of this exercise was to provide recommendations to support Fiji's commitment to improve oil spill prevention and response.

The social, economic and environmental resources of Fiji are particularly vulnerable to oil spills. Mangrove environments dominate the shoreline and may take decades to recover. Fiji is home to many species of marine mammal, sea snakes, turtles and birds and has globally recognized important conservation areas. This natural environment supports a vibrant Fijian culture along with a very successful tourism industry which generates up to 25% of Fiji's GDP. Fiji also has a large textile and sugar industry and the economic climate indicates shipping is likely to continue to increase bringing with it an increased risk of oil spills.

The risk of a significant oil spill was found to be moderate. Fiji is party to the main conventions of the Tokyo Memorandum of Understanding (Tokyo MOU) and is operating a system of Port State Control (PSC). The risk of waste oil discharge from vessels was found to be high. However Fiji has recently acceded to the International Convention for the Prevention of Marine Pollution from Ships (MARPOL). Implementation and enforcement of Annex I of MARPOL through PSC in accordance with the Tokyo MOU may reduce the risk of intentional and unintentional discharge to more acceptable levels.

In general the risk associated with bunkering was found to be moderate. We recommend that bunkering procedures be monitored and audited regularly to ensure procedures are in place and are in accordance with the International Safety Guide for Oil Tankers and Terminals (ISGOTT). The risks associated with a heavy fuel oil (HFO) ship spill in Suva port, was found to be high. There is a current lack of a coordinated approach to identifying risks, implementing controls and allocating roles and responsibilities in Suva port. We recommend consideration is given to the development of a port and harbour safety system to provide measures for the safe management of shipping activity in Fiji ports.

The risk associated with a spill from any of the main transfer terminals was found to be low. Planned maintenance systems were robust and international standards were being followed. Oil companies had well stocked Tier I oil spill response stock piles that were well maintained. Oil spill response training of terminal staff was found to be sporadic and we recommend that MSAF work with this industry to ensure staff training is on-going. We recommend that MSAF develop an audit and inspection program, to ensure oil transfer site operators maintain appropriate response capability through training, exercise and contingency planning.

The Maritime Transport Decree (MTD) 2013 sets out an effective framework for the development of oil spill response capability and gives effect to the National Plan and Municipal/Provincial Plans. To develop the National Plan further, personnel who will fill the incident command and control functions should be identified and trained, a national equipment stockpile should be developed and located in Suva, logistical and administrative arrangements should be developed, and further environmental information necessary for decision making should be identified. Municipal and Provincial Plans should be developed and include clear criteria for escalation to a national response. We recommend equipment stockpiles be located at Lautoka, Malau and Levuka to service Tier II spills.

New Zealand is the Metropolitan Pacific Islands Regional Marine Spill Contingency Plan (PACPLAN) member which provides primary assistance to Fiji, with Australia providing backup support. New Zealand, through MNZ's Marine Pollution Response Service (MPRS) has available trained oil spill responders and an equipment stockpile that could be quickly mobilised to provide assistance to a large oil spill. We recommend that Fiji and New Zealand develop a standing operating procedure (SOP) for mobilising assistance from New Zealand in line with the PACPLAN. We recommend regular exercises are held with New Zealand to establish relationships and to improve collaboration. We recommend that Fiji and New Zealand continue to work together to ensure an effective response to a Tier III incident in Fiji.

Summary list of recommendations

The following is a summary of recommendations from the risk assessment. The background and full analysis for each of the following recommendations is contained in the relevant section of the main body of this report.

Legislation, regulations and agreements

1. Compliance and enforcement - Provisions of the decree to be implemented as soon as possible. This will enable MSAF to ensure adequacy of response capability and to enforce penalties of $10000 for an individual and $100 000 for a body corporate (MTD 195, 196) if plans are not followed.

2. Fiji to consider ratifying the Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKER). The Convention was adopted to ensure that adequate, prompt, and effective compensation is available to persons who suffer damage caused by spills of oil, when carried as fuel in ships' bunkers. This will enable Fiji to claim costs associated with a bunkers spill.

Resources at risk, social, economic and environmental

3. Prioritise the development of a media plan to manage the potential damage of an oil spill on Fiji's tourism market.

4. Contingency plans should identify important marine mammal migratory routes and breeding areas. This information should include seasonal variation.

5. Important bird areas in Fiji that have been mapped should be included in contingency plans. Further information on the spatial and seasonal distribution of bird species vulnerable to oil spills, particularly waders should be included in contingency plans.

6. A wild life response capability should be developed with support from New Zealand response partners. Consideration should be given to wildlife response capability at a national and international level. There are opportunities to work with New Zealand providers of this capability. MNZ contracts specialist support from Massey University.

7. As pelagic and reef fish will be largely unaffected by oil, Tier II contingency planning should focus on mapping the location of aquaculture facilities and intertidal fisheries that are vulnerable to oil.

8. Information regarding important fisheries such as Fiji Locally Managed Marine Areas (FLMMA) should be included in Tier II contingency plans.

9. Information on the spatial distribution of important fisheries areas such as FLMMA sites should be included in contingency plans.

10. Spatial information on important foraging and breeding areas for reptiles in Fiji including sea grass meadows should be included in contingency plans.

11. Contingency plans should include information on known important mangrove and sea grass habitats.

12. Information regarding the spatial distribution of important coral systems should be included in contingency plans.

Risk 1: Oil spill from a ship in open waters

13. The risk of a foreign flagged vessel intentionally discharging waste oil is considered to be high. Port State Control Officers to be adequately trained and resourced to implement MARPOL Annex I. Consideration to be given to increasing the number of ships inspected in co-operation with the Tokyo MOU.

14. Actions to ensure fishing vessels are fit for purpose, crew are competent and risks are being adequately managed to be a priority. Enforcement of MARPOL to include fishing vessels.

Risk 2: Oil spill in port resulting from collision or vessel operations

15. Discharge of oily bilge and waste oil from fishing vessels and other vessels in Suva harbour has been identified as a high risk. MSAF to consider implementing a control plan and to enforce MARPOL.

16. Bunkering procedures to be monitored and audited regularly to ensure procedures are fit for purpose and are being followed.

17. Carryout an audit of the dry dock in Suva Port and focus on spill risk associated with chemicals along with oil. Implement an appropriate pollution control plan, regularly audit for compliance.

18. Carryout a detailed risk assessment of operations at Suva port and implement appropriate controls.

19. Consider implementing a port and harbour safety code for Fiji. The New Zealand Port and Harbour Marine Safety Code provides measures for the safe management of ships in ports and harbours. It also includes measures to prevent serious harm to people and protection for the marine environment. A Fiji port and harbour safety code may reduce the likelihood of this event by identifying risks, implementing appropriate controls and allocating roles and responsibilities.

Risk 3: Oil transfer operations resulting in an oil spill

20. MSAF to carryout routine audit and inspection of transfer terminals to ensure planned maintenance systems and processes are being followed.

21. Ensure all bunkering operations (including mobile tanker trucks) have appropriate contingency plans and response arrangements in place.

Oil spill response requirements

Tier I response capability

22. Oil transfer sites with an inadequate oil spill response capability identified during the site assessments be required to enhance their Tier I response capability to an appropriate level based on risk.

23. MSAF to develop an audit and inspection program to ensure that oil transfer site operators establish and maintain an appropriate Tier I response capability through regular equipment maintenance, personnel training and exercising, and contingency planning.

24. MSAF to undertake combined oil spill response exercises with oil transfer site operators to enhance cooperative response arrangements.

Tier II response capabilities (municipal/provincial)

25. MSAF equipment stockpiles be established at Lautoka, Malau and Levuka as outlined in appendix 2.

26. Oil Spill Response teams are established at these locations to respond to Tier II oil spills.

27. Municipal / provincial oil spill contingency plans be developed and SOP's for response to identified spill scenarios at high risk locations be established.

National response system (Tier II response capability)

28. Establish a National Tier II Equipment Stockpile in Suva in line with recommendations in appendix 2.

29. Establish a National Response Team of trained responders with necessary skills to deploy specialist equipment.

30. Undertake national oil spill response exercises.

31. The National Plan to be considered a 'living document' and a maintenance, review and enhancement program developed to support this.

32. To enhance the National Plan by:

    a) Identifying response personnel who will fill the incident command and control functions;

    b) Including MSAF oil spill response equipment and locations;

    c) Providing environmental information necessary to assist decision making during an oil spill response;

    d) Outlining the logistical arrangements in place to support an oil spill response, e.g. mobilization and transport of equipment, waste management, communications, Incident Command Centre locations; and

    e) Outline the administrative and financial arrangements in place to assist with an oil spill response, administrative and financial requirements during an oil spill response.

PACPLAN (Tier III with international assistance)

33. PACPLAN exercise with New Zealand to establish relationships.

34. Establish SOP for requesting and mobilising assistance from New Zealand.

35. Consider short term secondment of MSAF Pollution Response team to MPRS to assist with the development equipment maintenance requirements, training and exercise programs and National Plan development and maintenance.

Chemical oil dispersants

36. Dispersant oil monitoring capability to be sourced from international partners. Monitoring is used to determine efficacy and end fate of oil dispersant mixtures.

37. System for approving the use of dispersants for use in Fiji based on environmental toxicity to be developed.

Recommendations for high risk locations

Suva Port

High

- MSAF to ensure a pollution control plan is developed and implemented effectively and incidents of oil discharges are recorded to measure success of the control plan;
- Enforce MARPOL requirements such as oily water separators and International Oil Pollution Prevention Certificate (IOPPC) for vessels over 400GT;
- For vessels under 400GT, audit and enforce MARPOL to ensure waste products are being appropriately transferred to waste reception facilities;
- Carryout an audit of the dry dock and focus on spill risk associated with chemicals along with oil. Implement an appropriate control plan, regularly audit for compliance;
- Carryout a detailed risk assessment of operations at Suva port operations and implement appropriate controls; and
- Consider implementing a port and harbour safety code for Fiji. The New Zealand Port and Harbour Marine Safety Code provides measures for the safe management of ships in ports and harbours. It also includes measures to prevent serious harm to people and protection for the marine environment. A Fiji port and harbour safety code may reduce the likelihood of this event by identifying risks, implementing appropriate controls and allocating roles and responsibilities.

Moderate

- Bunkering procedures to be monitored and audited regularly to ensure procedures are being followed; and
- Carryout a more detailed risk assessment of tanker operations at Suva port and implement appropriate controls.

Low

- MSAF to carryout routine audit and inspection of oil transfer terminals to ensure planned maintenance systems and processes are being followed.

Oil Spill Response Recommendations

- MSAF to ensure an oil spill response capability for the port is developed in accordance with recommendations for Tier I operators;
- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk;
- MSAF to ensure operators have appropriate Tier I terminal contingency plans;
- MSAF to implement adequate monitoring of terminal operators oil spill response training and exercising; and
- MSAF to establish a national equipment stockpile in Suva in line with recommendations in appendix 2.

Wairiki Port near Bua

High

- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately; and
- Consider implementing a port and harbour safety code.

Low

- MSAF to ensure operators get an appropriate discharge hose and coupling and that fuel tanks are appropriately bunded.

Oil Spill Response Recommendations

- Require Mobile Tanker truck operations to have an appropriate Tier I oil spill response contingency plan, transfer procedures and appropriate spill response capability.

Malau Port

High

- MSAF to ensure mooring system is adequately maintained;
- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately; and
- Consider implementing a port and harbour safety code.

Low

- MSAF to carryout routine audit and inspection of oil transfer terminals to ensure planned maintenance systems and processes are being followed.

Oil Spill Response Recommendations

- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk;
- MSAF to ensure operators have appropriate Tier I terminal contingency plans;
- MSAF to implement adequate monitoring of terminal operators oil spill response training and exercising;
- MSAF to visit the sugar site to evaluate spill risk and response measures; and
- MSAF to establish Tier II stock pile at this location in line with recommendations in appendix 2.

Malanga Port

Moderate

- MSAF to ensure mooring system is adequately maintained;
- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately; and
- Consider implementing a port and harbour safety code.

Low

- MSAF to carryout routine audit inspection oil transfer terminals to ensure planned maintenance systems and processes are being followed.

Oil Spill Response Recommendations

- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk;
- MSAF to ensure operators have appropriate Tier I terminal contingency plans; and
- MSAF to implement adequate monitoring of terminal operators oil spill response training and exercising.

Denerau Port

Low

- MSAF to manage bunkering through routine audit and inspection.

Moderate

- MSAF to ensure port is managing bilge discharges through routine audit and inspection.

Oil Spill Response Recommendations

- Port Denerau Marina and Pacific Energy to improve Tier I oil spill contingency plan for the site;
- Tier I response staff to be provided with appropriate oil spill response training;
- MSAF to ensure terminal operator equipment stockpiles are stocked to appropriate standards based on risk.
- MSAF to review Tier I terminal contingency plans; and
- MSAF to implement adequate monitoring of training and exercising.

Vuda Point

Moderate

- MSAF to ensure mooring system is adequately maintained;
- MSAF to ensure discharge pipeline is appropriately inspected and maintained;
- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately; and
- Consider implementing a port and harbour safety code.

Low

- MSAF to ensure that appropriate bunkering procedures are in place for Marina fuel stop.

Oil Spill Response Recommendations

- MSAF to ensure Marina has oil spill contingency plan in place including standard operating procedures for bunkering spills;
- An appropriate Tier I response capability should be established to contain any oil spilled within the marina;
- MSAF to ensure operators review and update their oil spill contingency plans to be more site specific and provide standard operating procedures for identified oil spill scenarios;
- Total to review the adequacy of their equipment stockpile and enhance accordingly if HFO transfers proceed in the future; and
- MSAF to ensure terminal operator equipment stockpiles are stocked appropriate standards based on risk.

Lautoka

Moderate

- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately; and
- Consider implementing a port and harbour safety code for Fiji. The *New Zealand Port and Harbour Marine Safety Code* provides measures for the safe management of ships in ports and harbours. It also includes measures to prevent serious harm to people and protection for the marine environment. A Fiji port and harbour safety code may reduce the likelihood of this event by identifying risks, implementing appropriate controls and allocating roles and responsibilities.

Low

- MSAF to ensure that appropriate procedures are in place for mobile tanker truck bunkering operations.

Oil Spill Response Recommendations

- MSAF to undertake maintenance of the existing MSAF oil spill response equipment located at the port;
- Establish enhanced MSAF equipment stockpile at the port as per the equipment recommendations;
- Establish an oil spill contingency plan for the port;
- Ensure that tanker truck operators bunkering vessels at the port have an oil spill contingency plan and appropriate Tier I response capability; and
- Require Fiji Sugar Co to have a spill contingency plan and response capability for Molasses spills.

Levuka

Moderate

- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately;
- Consider implementing a port and harbour safety code;
- MSAF to ensure the port is managing bilge discharges through routine audit and inspection;

Low

- MSAF to ensure operators fuel tanks are appropriately bunded; and
- MSAF to ensure that oil transfer pipeline is appropriately maintained.

Oil Spill Response Recommendations

- Establish MSAF equipment stockpile at Port;
- Undertake combined training and oil spill response exercising with FEA, PafCo, Fire and Fiji Gov staff;
- Ensure Total has adequate Tier I response equipment and a site specific marine oil spill contingency plan;
- Ensure PafCo has an oil spill contingency plan; and
- Ensure Levuka Port has an oil spill contingency plan.

Taveuni

Low

- MSAF to ensure berthing procedures are adequate and are being followed through routine audit and inspection.

Oil Spill Response Recommendations

- MSAF to ensure Total's storage tank bunding is improved;
- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk;
- MSAF to ensure operators have appropriate Tier I terminal contingency plans; and
- MSAF to implement adequate monitoring of terminal operators oil spill response training and exercising.

Savusavu

Moderate

- MSAF to ensure the port is managing bilge discharge discharges through routine audit and inspection.

Low

- MSAF to manage bunkering through routine audit and inspection.

Oil Spill Response Recommendations

- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk;
- MSAF to ensure operators have appropriate Tier I terminal contingency plans; and
- MSAF to implement adequate monitoring of terminal operators oil spill response training and exercising.

Introduction

Spills of oil into the marine environment from ships and land based sources are a major threat to economies and marine environments. Recent events such as the *Rena* (2011) in Tauranga New Zealand, the grounding of *Forum Samoa II* in Apia (2009) and the sinking of the ferry *Princess Ashika* off Tonga (2009) reinforce the importance of marine pollution response preparedness in the Pacific. Fiji is a PACPLAN member which provides a framework for regional co-operation and response to major marine spills in the Pacific region. The PACPLAN sets out priorities for preparedness and identifies responsibilities of member countries to assist in the event of major spills that exceed the response capabilities of one country alone. The PACPLAN does not cover spills that are within the capability of individual countries to manage.

In Fiji, marine pollution is regulated by the MTD 2013. The MTD has recently been reviewed and provides MSAF with powers to ensure implementation of a national oil spill response framework. The MTD gives effect to the Republic of Fiji Marine Spill Contingency Plan (NATPLAN). The NATPLAN defines three tiers of spills:

- Tier I spills are those within the response capability and resources of an individual port or terminal. These tier I spills are covered by oil terminals or port specific response plans;
- Tier II spills are those that are not cleaned up adequately, or that are beyond the capability of an individual operator to respond to, and are covered by either the NATPLAN or Provincial / Municipal Plans; and
- Tier III spills are defined as those beyond Fiji's national capability and would engage an international response, with New Zealand providing primary support (PACPLAN).

As part of Fiji's commitment to protecting its valuable coastal resources from an oil spill, the SPREP and MNZ were engaged to assist the MSAF with an oil spill environmental risk assessment. The purpose of this oil spill risk assessment was to evaluate the existing prevention and oil spill response systems in Fiji against a risk framework, and to provide recommendations for further development of prevention and response measures. The project team consisted of SPREP and MNZ staff experienced with oil spill response. The team was assisted by MSAF and the Department of the Environment personnel with experience in shipping and environmental risk assessments.

To evaluate oil spill risks and to identify gaps in the existing prevention and response measures the project team visited Fiji's major ports, transfer terminals and other sites with oil spill risk potential. Based on the information gathered during this exercise, recommendations to improve prevention and response systems are provided.

Legislation, regulations and agreements

Oil spill response

There are a number of agreements and conventions that require Fiji to support international partners on marine protection initiatives. At an international level, the framework convention is the United Nations Convention on Law of the Sea (UNCLOS) from which many instruments take their guidance such as the International Convention on Oil Pollution Preparedness Response and Cooperation (OPRC) and the Protocol on Preparedness, Response and Cooperation to Pollution incidents by Hazardous and Noxious substances (OPRC – HNS Protocol 2000). Fiji has presented accession documents to the OPRC – HNS Protocol 2000.

At a regional level Fiji is a Party to the Convention for the Protection of Natural Resources and the Environment of the South Pacific Region 1986 and associated Protocols (Noumea Convention).

At a domestic level The Maritime Transport Decree (2013) provides the legislative framework enabling MSAF to regulate risks to the marine environment associated with shipping. The MTD includes regulations to control marine pollution from ships and requires industry and municipalities / provinces to maintain oil spill response capability.

Designated authority for distinct spill situations

Tier I

The MTD gives powers to MSAF to require contingency plans and response capability from industry at a Tier I level. The NATPLAN clearly specifies that industry is responsible for Tier I level spills.

Tier II

The MTD gives powers to MSAF to require contingency plans and response capability to oil spills that are either beyond the capability of the persons who have caused the spill or have not been responded to appropriately by such persons. The NATPLAN does not specify which provinces require contingency plans.

Tier III

The NATPLAN is a sub plan of the National Disaster Risk Management Plan 2006. The designated authority in the case of a Tier III oil spill is clearly MSAF.

Compliance and enforcement

Legislation that supports response planning with specific requirements, timeframes and penalties for non-compliance is critical. The MTD requires that plans are prepared in accordance with provisions of the decree.

MTD 161. Shipboard and site marine contingency plans shall be prepared, reviewed and kept in accordance with the provisions of the decree.

Recommendation

- Provisions of the decree should be implemented as soon as possible. This will enable MSAF to ensure adequacy of response capability and to enforce penalties of $10 000 for an individual and $100 000 for a body corporate (MTD 195, 196) if plans are not followed.

International conventions

Fiji has ratified the CLC Protocol 1992 and the Fund Protocol 1992 these Conventions have been incorporated into the MTD. This will enable Fiji to recover costs from tanker oil pollution events.

The Fijian Cabinet has agreed that Fiji ratify seven International Maritime Organisation (IMO) Conventions. The Conventions include the International Convention for the Prevention of Pollution from Ships (MARPOL73/78); the International Convention of Maritime Search and Rescue (SAR Convention 1979); the International Convention for the Control and Management of Ship's Ballast Water and Sediments (BWM 2004); the International Convention on the Control of Anti-Fouling Systems on Ships (AFS 2001); the Convention on Facilitation of International Maritime Traffic (FAL Convention 1965); the OPRC – HNS Protocol 2000; and the International Convention on Salvage (Salvage Convention 1989).

Fiji has not ratified BUNKER 2001. The Convention was adopted to ensure that adequate, prompt, and effective compensation is available to persons who suffer damage caused by spills of oil, when carried as fuel in ships' bunkers.

Recommendation

- Ratify BUNKER 2001.

Resources at risk, social, economic and environmental

The primary purpose of responding to an oil spill is to minimise the impacts on people, the economy and the environment. It is important to understand the distribution of resources that may be impacted by an oil spill so that these resources can be protected and cleaned. The most opportunity to make a difference exists in the early stages of an oil spill. Resource information should be used in contingency plans to determine response priorities, treatment guidelines and end point criteria. Generally the location of economic resources that could be impacted such as the location of ports and marinas, tourism developments and aquaculture facilities are well known and relatively straight forward to include in contingency planning. Sites of social and environmental importance are often not as well-known and will require further investigation when more detailed regional contingency planning is carried out.

Tourism

The Fijian bureau of statistics reported that in 2013 Fiji earned 1.3184 billion Fijian dollars from tourism. Most of this tourism 1.067 billion Fijian dollars is from holiday tourism. GDP at constant basic prices in 2012 was 5.016 billion Fijian dollars. Holiday based tourism therefore generates between 20 and 25% of GDP for Fiji. There is potential for a large oil spill to deter travellers from holidaying in Fiji which may have significant impact on the Fijian economy. If a large spill does occur it will be critical to implement an effective media plan to mitigate impacts on tourism.

Recommendation

- Prioritise the development of a media plan and capability to manage the potential damage of an oil spill on Fiji's tourism market.

Marine mammals

Fiji waters provide migratory routes for twelve species of cetacean. Four of these species are considered to be endangered or vulnerable by the International Union for Conservation of Nature (IUCN) red list, namely the blue whale (*Balaenoptera musculus*), sei whale (*Balaenoptera borealis*), humpback whales (*Megaptera novaeangliae*) and the sperm whale (*Physeter macrocephalus*).

Marine mammals may be affected in different ways from external oiling. In general there is an absence of direct evidence of whales and dolphins being affected by an oil spill. Known breeding grounds and resting areas are an important consideration when considering the use of dispersants. Dispersant oil combinations are more toxic to marine mammals than oil alone.

Recommendation

- Contingency plans should identify important marine mammal migratory routes and breeding areas. This information should include seasonal variation.

Fiji locally managed marine areas (FLMMA)

In 1989 the government of Fiji began to establish and re-establish several FLMMAs in an effort to support local management to stem the deterioration of inshore fisheries. Local groups now fish specific areas and are responsible for sustainability. It will be important to consult with local groups in control of FLMMAs to establish the distribution of important resources and to include key contact information for these areas in regional contingency plans.

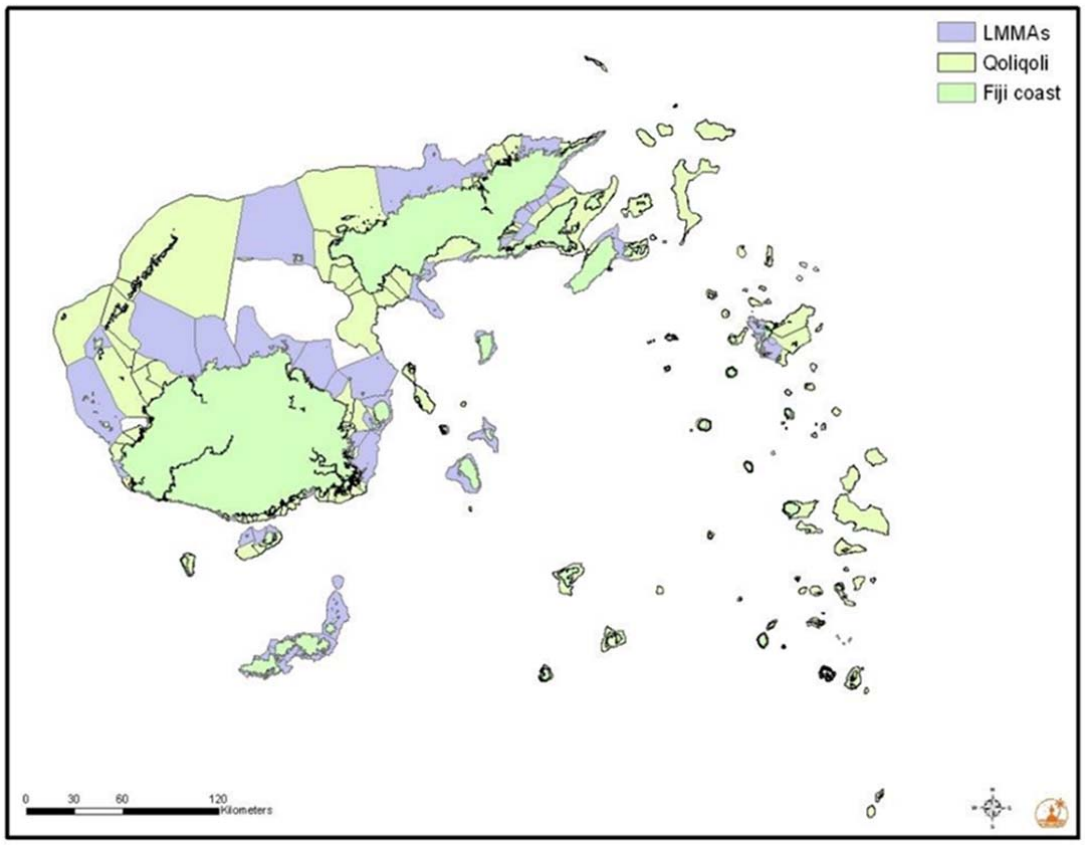


Figure 1 Distribution of locally managed marine areas and Qoliqoli

In December 2003, over 80 local and overseas stakeholders were convened to discuss biodiversity and associated threats to Fiji's marine environments. Thirty five priority conservation areas were identified and agreed by stakeholders. Five areas were ranked to be globally important due to their uniqueness endemism and high levels of diversity. Fifteen areas were considered to be of national importance and 15 of sub regional importance. The published report brings together knowledge of coastal vegetation, coral reefs, inshore ecosystems, open pelagic ecosystems and species of concern to identify priority sites for conservation. This report was a valuable resource when carrying out this oil spill risk assessment to determine environmental consequences (WWF 2003).

Birds

Fiji has an extensive and diverse range of marine habitats which include estuaries, mangroves, wetlands, sea grass beds, coral reefs, protected and exposed soft shores, lagoons and sand dunes. These habitats provide important feeding and breeding areas for about 10 species of migratory and resident sea birds, including frigate birds (Sula sula) and the Fiji Petrel (*Pseudobulweria macgillivrayi*).

When birds are oiled, feathers may lose their ability to trap air and repel water. This results in birds becoming hypothermic and a loss of buoyancy. Oil is also highly toxic to birds through both ingestion and direct absorption through the skin. Badly oiled birds usually die.

The mudflats around Suva point are an important wintering area for migrant and staging shorebirds. Their numbers have been monitored since 1998 and up to 1,000 migrant shorebirds visit each year (Watling 2013). Some of these species are globally threatened and in decline.

Recommendations

- Important bird areas in Fiji that have been mapped been should be included in contingency plans;
- Further information on the spatial and seasonal distribution of birds species vulnerable to oil spills, particularly waders should be included in contingency plans; and
- A wild life response capability should be developed with support from New Zealand response partners.

Fish

In general fish are unaffected by oil, although when oil spills into shallow or confined waters, effects may be more substantial. Eggs and larvae in shallow bays may suffer heavy mortalities under slicks, particularly if oil disperses through the water column. There is limited evidence to suggest that oil spills significantly affect adult fish populations in the open sea. Aquaculture facilities such as fish farms in pens may be impacted by spills.

Recommendations

- Tier II contingency planning should focus on mapping the location of aquaculture facilities and intertidal fisheries that are vulnerable to oil; and
- Information regarding important fisheries such as FLMMA should be included in Tier II contingency plans.

Invertebrates

It is also estimated that 15 species of sea cucumber of commercial or subsistence value are found in Fiji. Eighty species of marine amphipod are currently known and substantial collections of shallow water amphipods have been described, 41% of all taxa endemic to Fiji. Crab species found in Fiji include the coconut (*Birgus latro*), mud (*Thalassina anomala*), black mangrove (*Metopograpsus messor*), land crab (*Cardisoma carnifex*), red clawed (*Gesarma erythrodactyla*), swimmer (*Thalamita crenata*), the three spot reef crab (*Carpilius maculatus*), and the redeye crab (*eriphia sebana*). Lobster species include the golden rock lobster, *Panulirus penicillatus*, and the banded prawn killer (*Lysiosquilla maculate*).

Oiling of invertebrates species may result in heavy casualties.

Recommendation

- Information on the spatial distribution of important fisheries areas such as FLMMA sites should be included in contingency plans.

Reptiles

Sea grass meadows and sandy beaches provide feeding and breeding areas and migratory routes for five of the world's seven species of marine turtles – the Green (*Chelonia mydas*), hawksbill (*Eremochelys imbricata*), loggerhead (*Caretta caretta*), Olive Ridley (*Lepidochelys olivacea*) and leatherback (*Dermochelys coriacea*). All of these species are listed on the Convention for the International trade in Endangered Species (CITES).

Fiji's estuaries, mangroves, wetlands, sea grass beds, coral reefs, protected and exposed soft shores, lagoons and sand dunes also provide important habitats for three species of sea snakes, including the banded sea snake (*Laticauda colubrine*), the black banded robust sea snake (*Hydrophis melanocephalus*) and the yellow bellied sea snake (*Pelanis platurus*).

The potential impact of an oil spill on reptiles in Fiji is high. Habitats and breeding areas are highly vulnerable to oil. Oiled wildlife is likely to be a factor during a significant oil spill in Fiji. Specialist expertise and equipment is required to capture, clean and rehabilitate animals.

Recommendations

- Spatial information on important foraging and breeding areas for reptiles in Fiji including sea grass meadows should be included in contingency plans; and
- Consideration should be given to wildlife response capability at a national and international level. There are opportunities to work with New Zealand providers of this capability. MNZ contracts specialist support from Massey University.

Mangroves and sea grass

Mangrove and sea grass species arevulnerable to oil and oiling can cause widespread die back in mangrove and sea grass habitats and associated species. These habitats may take decades to recover. Mangroves and sea grass beds provide critical habitat for a range of fish and other species including recreational and commercially harvested fish species along with reptiles. Intertidal sea grass meadows are highly vulnerable to oil.

Recommendation

- Contingency plans should include information on known important mangroves and sea grass habitats.

Corals

Corals are an essential and dominant part of coral reef communities, and play a key role in determining the composition and nature of reef systems. Knowledge of Fijian corals remains incomplete, with the most detailed description to date being that of 198 species from the Mamanucas and southern Viti Levu. Other notable descriptions include:

- 100 species of stony coral identified from the Great Astrolabe Reef, Kandavu,
- (15) species of zooanthids described from Viti Levu, and
- Five species of gorgonian corals or sea fans.

Shallow corals less than 10m in depth may be vulnerable to oil. Dispersant oil combinations may result in impacts on coral beyond 10m in depth and therefore information regarding the condition and ecological services provided by coral is essential to the response.

Recommendation

- Information regarding the spatial distribution of important coral systems should be included in contingency plans.

Oil spill risk assessment methodology

This risk assessment addresses both prevention and oil spill response measures. The risk assessment team visited ports and oil transfer sites on Vanua levu, Viti levu, Levuka and Taveuni. At each site the following activities were carried out:

- Discussion with key staff to identify risk and evaluate existing oil spill prevention and response capability;
- Marine pollution prevention measures were reviewed and high risk activities were identified;
- Identification of local environmental resources that could be impacted in the case of a spill;
- Inventory of existing oil spill response measures including equipment stockpiles, contingency plans, training and exercising; and
- For each site information on past incidents and resources at risk was collected with the support of Fiji Government Departments and Non-Government Organisations.

A number of comprehensive guides exist for the assessment of oil spill response capability (Steen, Meza et al. 2008, IMO 2010, IMO 2011, ARPEL 2014). A common theme to effective oil spill response is the existence of a contingency plan that considers the risk of a spill and associated threats to marine resources, providing clear response recommendations. The plan must be tested and exercised regularly to ensure staff are familiar with the plan and its implementation. Spill support functions such as equipment maintenance and legal and media engagement strategies are also important and there is general recognition that a systematic approach to marine pollution will involve both prevention and preparedness activities. The team used best practice recommendations from available published guides on oil spill response systems in this risk assessment. The team also used the New Zealand oil spill response framework as a model of a successful response system that could be implemented in Fiji.

The AS/NZ ISO 2001 standard for risk assessment model was used in this risk assessment. The steps taken were to:

Identify oil spill scenarios

The risk assessment team identified a range of oil spill scenarios. An oil spill anywhere in Fijian waters outside of a port, a ship to ship collision in port, a ship to terminal collision in port and operational procedures such as bunkering and back-loading from tankers to terminals are some of the scenarios that were assessed. These scenarios included small medium and large spills of persistent and non-persistent oil.

Determine the likelihood of the scenario

Once the scenario was identified the level of risk was assessed against the following descriptors. First the likelihood of the scenario occurring was determined and given a rating between 1 and 5. Details of past incidents and information collected during site visits was used to inform this rating.

Rating	Description	Likelihood of occurrence
1	Rare	Highly unlikely, but it may occur in exceptional circumstances. It could happen, but probably never will.
2	Unlikely	Not expected, but there's a slight possibility it may occur at some time.
3	Possible	The event might occur at some time as there is a history of occurrence.
4	Likely	There is a strong possibility the event will occur as there is a history of frequent occurrence.
5	Almost certain	Very likely. The event is expected to occur in most circumstances as there is a history of regular occurrence.

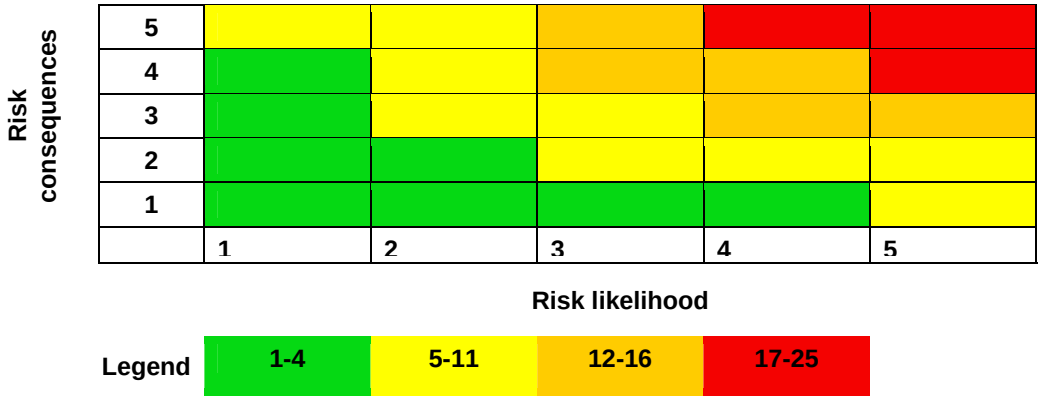
Consequence descriptors

The potential consequence of each scenario was then evaluated against the following matrix and given a rating of between 1 and 5. Economic, social and environmental consequences along with recovery time were the key factors considered. Known impacts from past oil spill spills in the Pacific and around the world were used to inform this rating.

Rating	Description	Consequence
1	Very low	Undetectable and negligible impact on species, habitats, economy or people.
2	Low	Less than 10% of a species or important habitat is destroyed. Some impact on social values. Less than one million economic loss. Recovery time is less than one year.
3	Moderate	Up to 20% of a species or important habitat is destroyed. Moderate impact on social values. Up to 30 million dollars economic loss. Recovery time is between one and five years.
4	High	30-50% of a species or important habitat is destroyed. High impact on social values. Between 30 and 100 million dollars economic loss. Recovery time is between 5 and 10 years.
5	Very high	Greater than 50% of a species or important habitat is destroyed. Extremely high impact on social values. Over 10 years to recover. Over 100 million dollars economic loss

Risk descriptor

The level of risk was then determined for each scenario by combining the likelihood of occurrence rating with the consequences rating. Scenarios were then given a score from 1 to 25 and attributed either a low, medium, high or extreme risk rating.



Risk rating descriptors and actions

This table specifies a recommended level of action in response to each of the four levels of risk. Any risk that is rated as High or Extreme should have additional controls applied to it in order to reduce it to an acceptable level. What the appropriate additional controls might be, whether they can be afforded, what priority might be placed on them is something for MSAF to determine.

Rating	Description	Action
L	Low	Acceptable; unlikely to require specific application of resources; Manage by routine procedures, monitor and review.
M	Moderate	Generally acceptable; may require some application of resources to maintain acceptable risk level . Prevention and response procedures to be developed and implemented by responsible parties. Manage by specific monitoring, audit and inspection.
H	High	Not acceptable; senior management attention needed and management responsibility specified. Treatment plans to be developed and reported to the most senior management.
E	Extreme	Not acceptable; Immediate action required. Must be managed by senior management with a detailed treatment plan to reduce the risk to acceptable levels.

Scenarios in Fiji that could lead to an oil spill

For the purposes of this risk assessment, risks of oil spills have been separated into the following three broad categories:

- Risk 1: Oil spill from a ship in open waters;
- Risk 2: Oil spill in port resulting from collision or vessel operations; and
- Risk 3: Oil spill from oil transfer operations.

Risk 1: oil spill from a ship in open waters

This scenario includes damage to a vessel, sinking, accidental and intentional discharge of oil outside of port limits. This scenario could happen anywhere in Fijian waters where shipping is present. Recorded ship tracks for different classes of vessels are displayed in figures 2-6. Figure 2 shows that shipping traffic is present throughout Fijian waters and therefore an oil spill could occur anywhere. Shipping traffic in general is most dense around Suva and Lautoka ports and the south cost corridor between these two ports. Cruise vessels are the exception with routes more evenly spread throughout Fijian waters but also concentrating on the Mamanucas Islands and off the Nadi coast.

Maritime incidents are recorded by the MSAF and figures for 2013 are displayed in table 3. Thirty nine maritime incidents were recorded in 2013. Of these there were 12 groundings, seven collisions and six sinkings. The data as presented does not indicate there is an area or specific location where incidents are more likely to occur. Marine pollution incident reporting provided by MSAF indicates that the majority of spills in Fiji are either from oil bilge discharge or from engine oil discharges.

Fiji has a marine EEZ of 1, 290,000 km2 and as an island national relies heavily on shipping for trade. Fiji has a large tourism industry as well as large sugar and textile industries and has one of the more developed economies in the Pacific region. Shipping traffic is likely to increase in a number of sectors including cruise vessels. There are also proposals to build a diesel refinery along with a copper mine which will bring associated increases in shipping traffic.

A technical assessment of aids to navigation was carried out by IALA in February 2014. The consultants found that shipping traffic and the degree of risk in Fijian waters was moderate on a global scale. Aids to navigation maintenance were found to meet international standards in many areas and in other areas maintenance was not up to standard due to training and resourcing issues. A number of recommendations were made for improvements which are currently being implemented by MSAF.

MSAF has established regulatory systems in place to achieve safety, protection of the marine environment and to carryout search and rescue. Fiji is party to a list of international conventions to ensure safety of life at sea. MSAF have also presented accession documents to MARPOL Annexes I, II, IV and V. To ensure compliance with the maritime international conventions and domestic maritime legislation that gives effect to these conventions MSAF staff carryout port state control audits and inspections. Fiji is party to the Tokyo MOU. The main objective of the memorandum is to establish an effective port state control regime in the Asia-Pacific region through co-operation of its members and harmonization of their activities, to eliminate the substandard shipping so as to promote maritime safety, to protect the marine environment and to safeguard working and living conditions on board ships. In 2013 Fiji carried out 27 port state control inspections representing 0.09% of visiting ships. The regional average for the Asia-Pacific region of detention per port state control inspections was 4.5%. Fiji did not detain any ships during 2013.

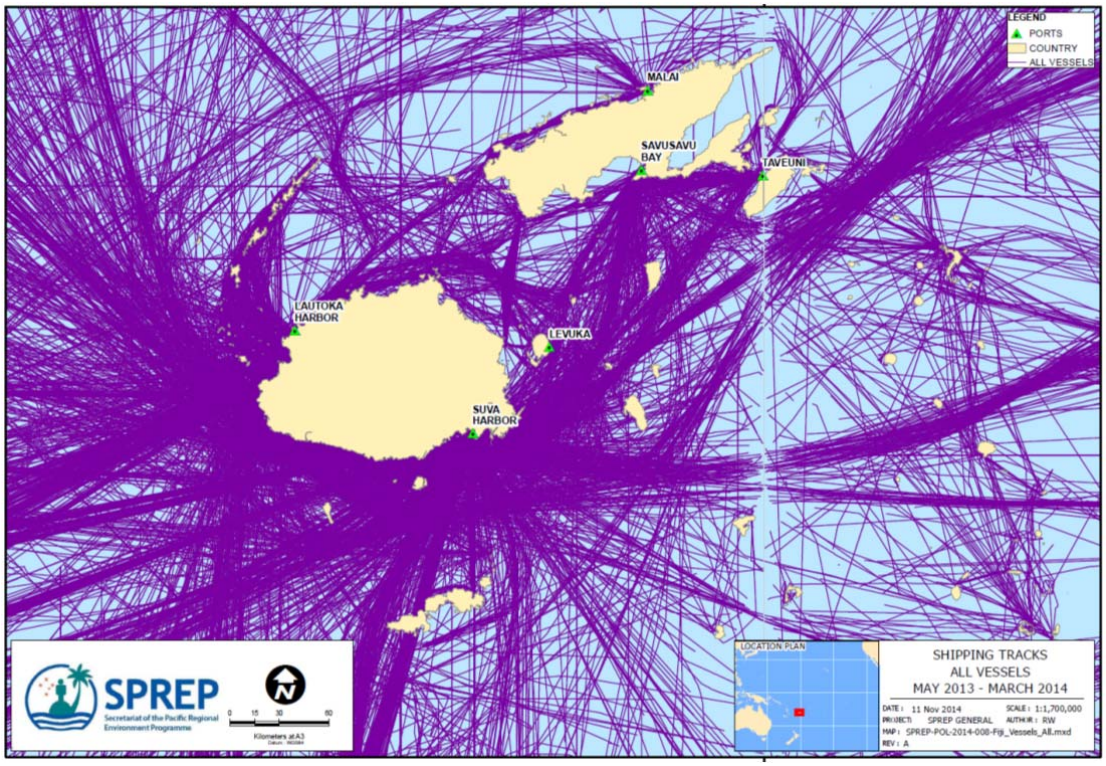


Figure 2 Recorded tracks for allvessels in Fijian waters from May 2013 – March 2014.

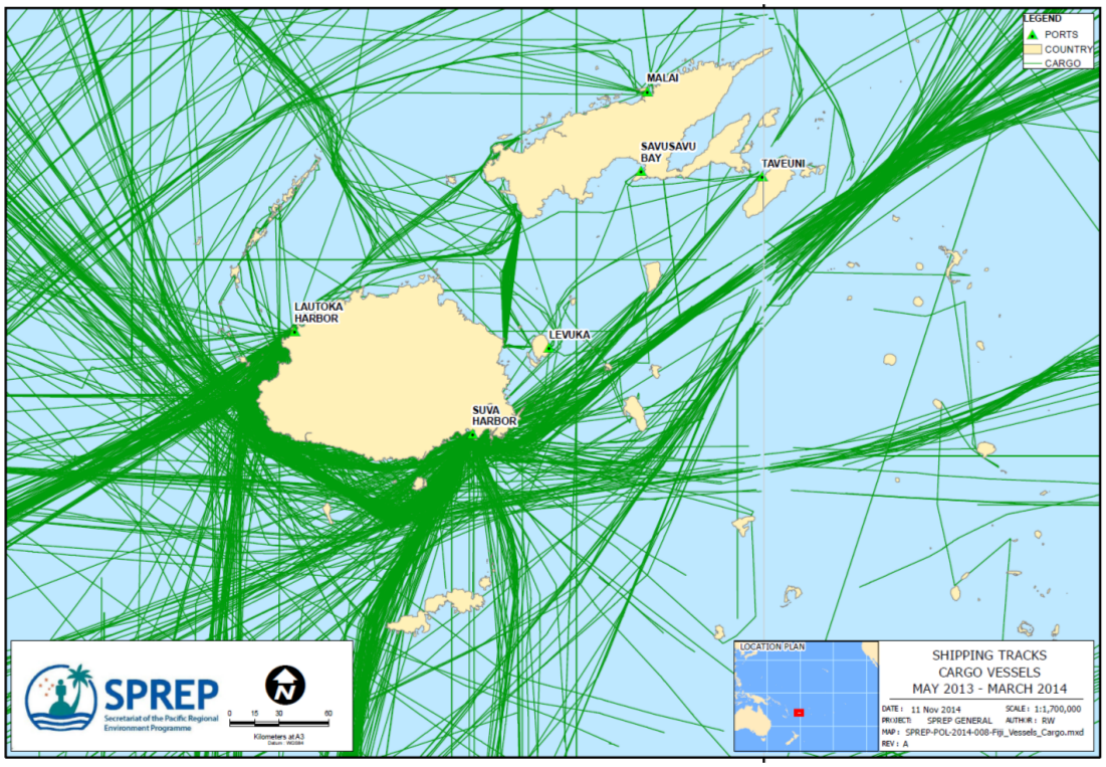


Figure 3 Recorded tracks for cargo vessels in Fijian waters from May 2013 – March 2014.

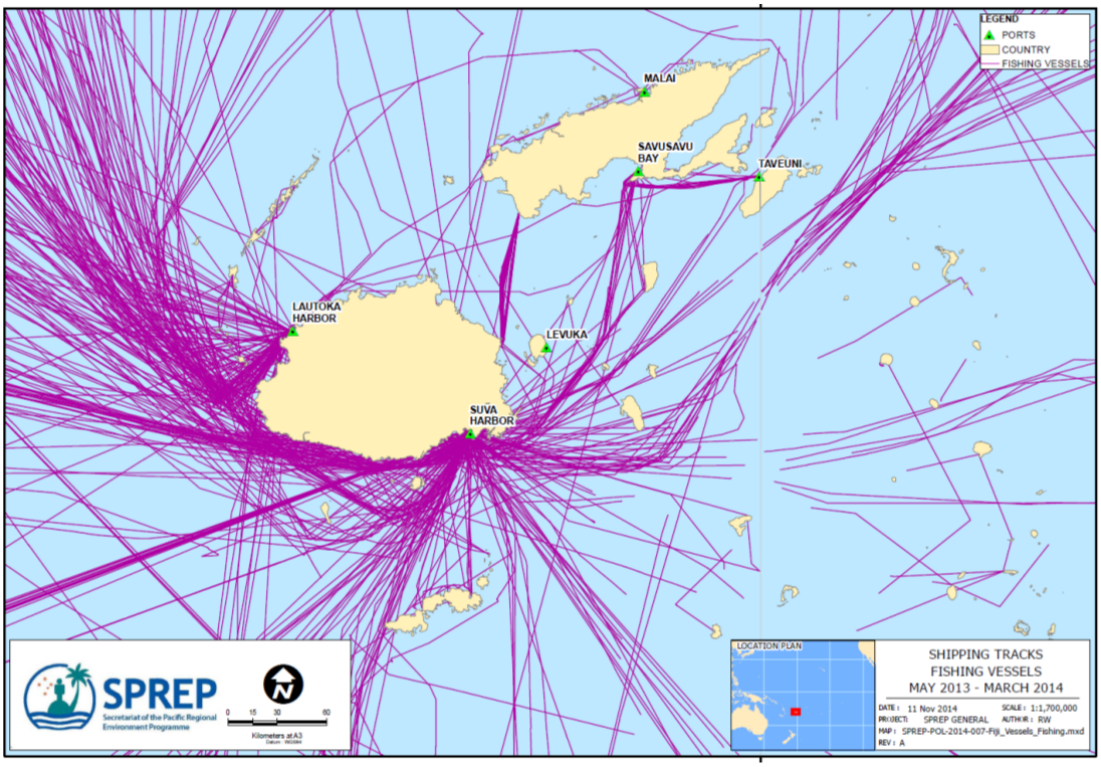


Figure 4 Recorded tracks for fishing vessels in Fijian waters from May 2013 – March 2014.

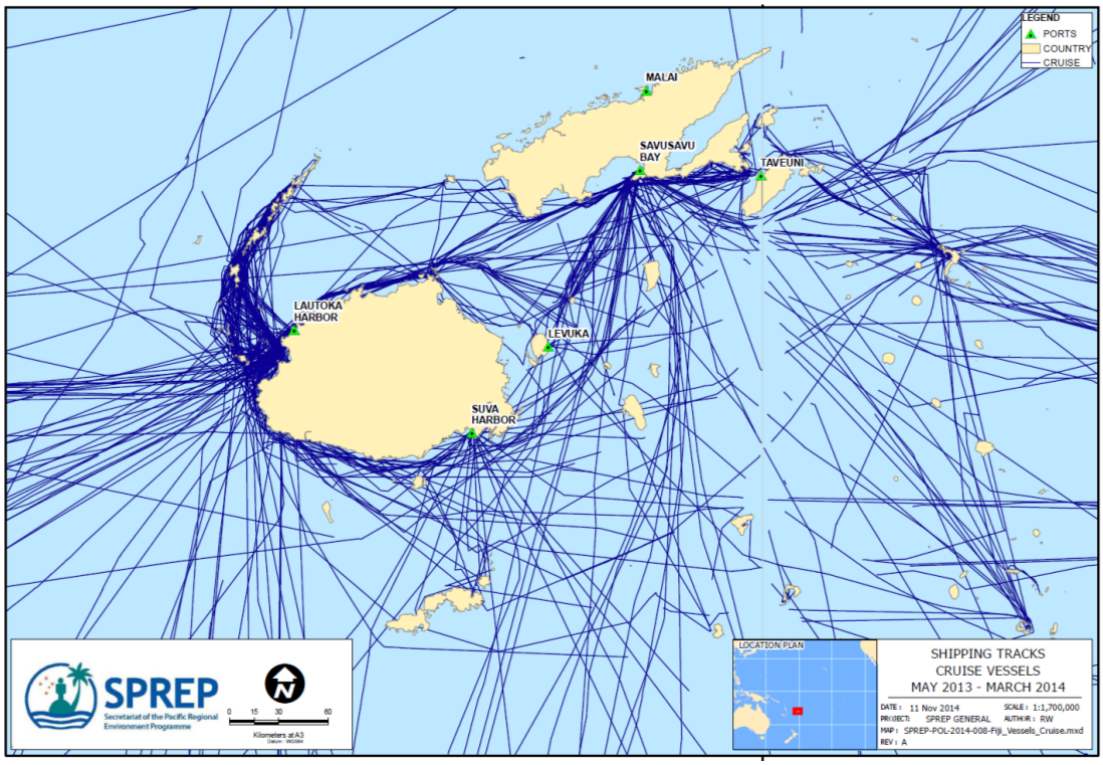


Figure 5 Recorded tracks for cruise vessels in Fijian waters from May 2013 – March 2014.

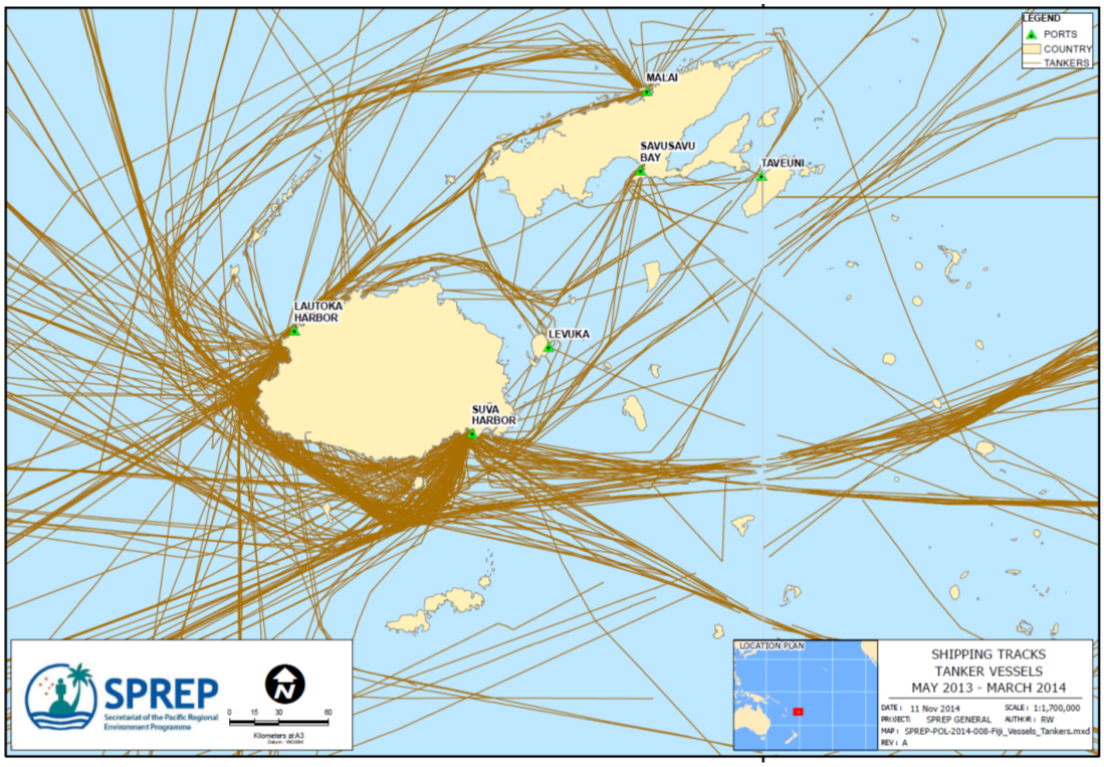


Figure 6 Recorded tracks for tanker vessels in Fijian waters from May 2013 – March 2014.

International and domestic shipping traffic for Fiji data is given in tables 1 and 2. Suva and Lautoka are Fiji's busiest ports followed by Levuka and Malau. Shipping traffic in Fiji has increased significantly since 2008 and can be expected to continue to increase in coming years.

SUVA

VESSEL - FOREIGN	2005	2006	2007	2008	2009	2010	2011
Cruise	17	18	26	25	28	29	26
Dry Bulk	17	19	16	16	14	16	15
Lo Lo	277	296	281	304	289	261	243
LoLo / RoRo	28	29	24	24	24	21	21
Ro Ro	4	0	3	1	0	0	0
Car Carrier	11	9	7	6	9	8	2
Tankers	66	60	82	108	112	102	105
Cable	0	0	0	1	6	2	0
Research	0	0	2	6	4	5	3
Fishing	229	176	227	173	225	352	348
Naval	16	7	0	1	0	1	0
Sugar	0	0	0	0	0	0	0
Pine Chip	0	0	0	0	0	0	0
Others	37	43	32	47	73	28	29
Total Foreign	**702**	**657**	**700**	**712**	**784**	**825**	**792**
VESSEL - LOCAL							
RORO/Tourist	321	371	348	301	320	334	310
Cargo /Passenger	275	151	136	127	76	94	82
Fishing/Others	684	1086	1499	1332	1724	1886	1762
Total Local	1280	1608	1983	1760	3809	4051	4099
Total Suva Calls	**1982**	**2265**	**2683**	**2472**	**4593**	**4876**	**4891**

Table 1 Vessel calls to Suva from 2005 to 2011

LAUTOKA

VESSEL - FOREIGN	2005	2006	2007	2008	2009	2010	2011
Cruise	4	12	9	12	9	14	9
Dry Bulk	4	5	5	3	5	3	2
Lo Lo	141	171	160	170	197	204	141
LoLo / RoRo	44	23	24	22	21	20	21
Ro Ro	0	0	0	0	0	0	0
Car Carrier	0	0	0	0	0	0	0
Cargo	0	0	0	0	0	0	0
Tankers	118	118	131	137	140	148	139
Cable	0	0	0	0	0	0	0
Research	0	0	0	0	0	0	0
Fishing	2	0	1	1	0	0	64
Naval	0	2	0	0	0	0	0
Sugar	13	7	7	9	7	4	4
Pine Chip	7	7	7	7	5	6	7
Others	0	3	3	4	4	11	18
Total Foreign	**333**	**348**	**347**	**365**	**388**	**410**	**405**
VESSEL - LOCAL							
RORO/Tourist	531	668	367	350	392	285	245
Cargo /Passenger	1211	985	1285	753	357	337	333
Fishing/Others	1	200	212	235	686	962	1191
Total Local	1743	1853	1864	1338	1435	1584	1769
Total Lautoka Calls	**2076**	**2201**	**2211**	**1703**	**1823**	**1994**	**2174**

Table 2 Vessel calls to Lautoka from 2005 to 2011

LEVUKA

VESSEL - FOREIGN	2005	2006	2007	2008	2009	2010	2011
Cruise	0	0	1	0	1	1	0
Dry Bulk	0	0	0	0	0	0	0
Lo Lo	5	0	0	0	0	0	0
LoLo / RoRo	0	0	0	0	0	0	0
Ro Ro	0	0	0	0	0	0	0
Car Carrier	0	0	0	0	0	0	0
Cargo	0	0	0	0	0	0	0
Tankers -Non Working	8	4	6	5	5	8	2
Cable	0	0	0	0	0	0	0
Research	0	0	0	0	0	0	0
Fishing	93	76	84	194	264	237	149
Naval	0	0	0	0	0	0	0
Sugar	0	0	0	0	0	0	0
Pine Chip	0	0	0	0	0	0	0
Others	2	0	0	1	0	0	1
Total Foreign	**108**	**80**	**91**	**200**	**270**	**246**	**152**
VESSEL - LOCAL							
RORO/Tourist	13	0	0	64	73	28	51
Cargo /Passenger	173	0	19	155	172	125	119
Fishing/Others	24	0	0	1	0	0	6
Total Local	210	0	19	220	245	153	176
Total Levuka Calls	**318**	**80**	**110**	**420**	**515**	**399**	**328**

Table 3 Vessel calls to Levuka from 2005 to 2011

MALAU

VESSEL - FOREIGN	2005	2006	2007	2008	2009	2010	2011
Cruise	0	0	0	0	0	0	0
Dry Bulk	0	0	0	0	0	0	0
Lo Lo	0	0	0	0	0	0	0
LoLo / RoRo	0	0	0	0	0	0	0
Ro Ro	0	0	0	0	0	0	0
Car Carrier	0	0	0	0	0	0	0
Cargo	0	0	0	0	0	0	0
Tankers	34	33	30	34	30	31	33
Cable	0	0	0	0	0	0	0
Research	0	0	0	0	0	0	0
Fishing	1	0	0	0	0	0	0
Naval	0	0	0	0	0	0	0
Sugar	5	4	4	6	5	4	4
Pine Chip	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0
Total Foreign	**40**	**37**	**34**	**40**	**35**	**35**	**37**
VESSEL - LOCAL							
RORO/Tourist	0	0	0	0	0	0	0
Cargo /Passenger	0	0	0	0	0	0	0
Fishing/Others	0	0	0	0	0	0	0
Total Local	0	0	0	0	0	0	0
Total Malau Calls	**40**	**37**	**34**	**40**	**35**	**35**	**37**

Table 4 Vessel calls to Levuka and Malau ports from 2005 to 2011.

Incidents	Total Cases
Grounding	12
Collision	7
Sinking	6
Overloading	1
Capsizing	1
Machinery failure	3
Breach of manning	2
Death on board	3
No pilotage	1
Fire on board	1
Near miss	1
Man overboard	1
Total	**39**

Table 5 Recorded shipping incidents in Fijian waters 2013

Scenario	Likelihood	Consequence	Risk
1. Foreign flag ship over 400GTcasualty large HFO Spill	2	4	Moderate
2. Foreign flag ship over 400GT casualty large MDO Spill	2	3	Moderate
3. Foreign flag fishing vessel casualty large MDO spill	3	2	Moderate
4. Foreign flag vessel accidental discharge of waste oil	2	2	Low
5. Foreign flag vessel Intentional discharge of waste oil	4	3	High
6. Domestic vessel accidental discharge of diesel	4	1	Low

Table 6 Scenarios that could cause an oil spill in open Fijian waters outside of port and a risk assessment based on likelihood and consequence.

Extreme Risk

No risks were identified in this category. Fiji is operating a system of Port State Control and is Party to the main conventions of the Tokyo MOU. A recent aids to navigation assessment indicates the risk of a navigational incident in Fijian waters is moderate.

High Risk

Not acceptable: Senior management attention needed and management responsibility specified. Treatment plans to be developed and reported to the most senior management.

Recommendation

- The risk of a foreign flagged vessel intentionally discharging waste oil is considered to be high. Disposal of waste oil ashore is expensive and can be time consuming. Internationally, illegal disposal of waste oil is an environmental problem in the absence of effective regulation. Fiji has acceded to MARPOL Annexes I, II, IV and V. This will allow Fiji to enforce compliance and to control marine pollution from ships. Effective implementation of MARPOL should be treated as a priority to reduce this risk level to acceptable levels. Port State Control Officers should be adequately trained and resourced to implement MARPOL Annex I. Consideration should be given to increasing the number of ships inspected and ships should be detained if non-compliant in co-operation with the Tokyo MOU.

Moderate Risk

Generally acceptable: May require some application of resources to maintain acceptable risk level. Prevention and response procedures to be developed and implemented by responsible parties Manage by specific monitoring audit and inspection.

Recommendations

- The risk of a foreign flag ship casualty over 400GT resulting in a large HFO/MDO Spill. Ensure the implementation of an effective system of port state control. Consider increasing the number of inspections and detain when appropriate in co-operation with the Tokyo MOU; and
- Foreign flagged fishing vessel casualty resulting in a large MDO spill. International conventions that control safety do not apply to fishing vessels. Actions to ensure fishing vessels are fit for purpose, crew are competent and risks are being adequately managed should be a priority. MARPOL does apply to fishing vessels and enforcement should be a priority to prevent discharge of waste oil.

Low Risk

Acceptable: unlikely to require specific application of resources; Manage by routine procedures, monitoring and review.

Recommendations

- Foreign flag vessel accidental discharge of waste oil. Ensure compliance with MARPOL Annex I through port state control; and
- Domestic vessel accidental discharge of diesel. No action necessary.

Risk 2: oil spill in port resulting from collision or vessel operations

This scenario includes damage to a vessel or sinking of a vessel while navigating in port. A risk assessment for this category has been carried out for each port in Fiji and is included in the relevant section later in this report. Spills associated with port / tanker terminal operations are likely to be the result of vessel accidents or inappropriate vessel operations. Inappropriate vessel operations such as oily bilge discharges or on board fuel transfers can result in relatively small spills of fuel oils, lube and hydraulic oils.

Although there is a low incidence of oil spills resulting from accidents occurring while vessels are in port and are manoeuvred to and from a terminal berth, such accidents can give rise to large oil spills especially if the vessel involved is a tanker. A worst case oil spill scenario involving a tanker grounding incident at Suva or Vuda Point could result in the release of up to >1000 tonnes of fuel oil.

There are three main accident scenarios which could develop during port / terminal operations; grounding, collision and accidents during berthing. The vessel draught limitations and tug escort and traffic management procedures which are applied by Fiji Ports reduce the probability of grounding and vessel collision incident. Accidents during port / terminal operations would probably be associated mostly with the berthing of tankers at the Suva and Vuda Point terminals; for example, a tug landing heavily on the hull of a tanker preparing to sail from the berth.

Risk 3: oil spill from oil transfer operations

This scenario includes oil spills resulting from operational procedures such as bunkering, discharge and back loading from tanker terminals and oil transfer sites. This risk includes discharge of oily bilge and illegal discharges of oily mixtures. The risk assessment for this section is also included in the relevant section later in this report.

Most oil spill incidents occur during routine oil transfer operations such as product discharges and back-loading and these typically result in small oil spills. Examples of incidents which can result in oil spillage from tanker discharges and back-loading include: the overflow of cargo tanks during tanker back-loading operations; tankers drifting off their moorings causing the disconnection of oil loading arms and consequent oil spillage; leaks from hoses and pipelines used for transfers; and tanker hull fractures.

Vessels are bunkered at most ports and marinas in Fiji. Petrol and Diesel are available at all ports and marinas via fixed bunkering facilities or road tankers but HFO is only bunkered at the Port of Suva. Examples of spill scenarios from bunkering operations include overfilling of bunker tanks, leaks from hoses and pipelines, and leaks from coupling breaks.

Oil spill response requirements

Oil spill response requirements are based around the tiered response structure and the identified oil spill risks, and spill scenarios that the various tiers are established to be able to respond to.

Tier I response capability

Spills from oil transfer sites, such as the oil terminals and vessel refuelling operations, are the responsibility of the operator to respond to. Operators are required to prepare and keep site marine spills contingency plans in accordance with the provisions of the MTD, and have a response capability sufficient to respond to common operational spills such as spills during oil transfers due to pipeline leaks, or tank overflows. For more significant incidents, for example vessel grounding and collisions or pipeline ruptures, if the spill exceeds the operator's response capability then the response will be escalated and a response undertaken in accordance with the relevant provincial, municipal or national marine spill contingency plan.

Potential response options:

On-water oil containment and recovery:

- Booming of vessel; and
- On-water recovery.

Shoreline Protection:

- Shoreline protection booming; and
- Near shore on-water containment and recovery.

Shoreline Clean-up:

- Manual recovery of oil;
- Mechanical recovery of oil; and
- Natural recovery of oil.

Equipment requirements

- Sorbent pads and booms.
- Containment booms.
- Oil recovery skimmer.
- Shoreline protection booms.
- Temporary oil storage.
- Vessel for deployment.

The majority of large higher risk oil transfer sites visited (oil terminals and ports) have a Tier I response capability to provide a suitable first strike response capability to a spill from their site, and a capability to respond adequately to a small to medium sized spill, based on the equipment and personnel available, as well as offering a 'first strike' capability for more significant spills.

All the oil terminal operators held a good stockpile of equipment appropriate for the spill risks they pose. At most terminal sites with multiple oil companies involved, they all had a separate equipment stockpile and showed a willingness to support the other operators during a spill which creates an excellent response capability at these sites.

Recommendations

- Oil Transfer sites with an inadequate oil spill response capability identified during the site assessments be required to enhance their Tier I response capability to an appropriate level;
- MSAF develop an audit and inspection program to ensure that oil transfer site operators establish and maintain an appropriate Tier I response capability through regular equipment maintenance, personnel training and exercising, and contingency planning; and
- MSAF undertakes combined oil spill response exercises with oil transfer site operators to enhance cooperative response arrangements.

Tier II response capability municipal/provincial

Spills that are beyond the capability of an operator to effectively respond to, or from an unknown source within ports and harbours are defined as Tier II spills. Response to these spills would come under either the provincial or municipal plans or the NATPLAN. Potential spill scenarios include all scenarios previously identified (maritime casualty, vessel operations in port, oil transfer operations). To ensure an appropriate and timely response capability is provided for, response equipment needs to be located at the high risk locations and suitable for the likely response activities undertaken.

Potential response options:

- Salvage Operations to remove / minimise risk of oil spill.
- Salvage capability to be sourced and provided by vessel owner.

On-water Oil Containment and Recovery:

- Booming of vessel; and
- On-water recovery.

Shoreline Protection:

- Shoreline Protection Booming; and
- Near shore on-water containment and recovery.

Shoreline Clean-up:

- Manual recovery of oil;
- Mechanical recovery of oil; and
- Natural recovery of oil.

Equipment requirements:

- Sorbent pads and booms.
- Containment booms.
- Oil Recovery Skimmer.
- Shoreline Protection Booms.
- Temporary oil storage.
- Vessel for deployment.

Recommendations

- MSAF equipment stockpiles to be established at Lautoka, Malau and Levuka as outlined in appendix 2.
- Response teams are established at these locations to respond to Tier II oil spills;
- Municipal / provincial oil spill contingency plans be developed and SOP's for responses to identified spill scenarios at high risk locations be established; and
- Municipal / provincial plans should include criteria for escalation to a national response.

National response system (Tier II response capability)

Spills that are beyond the capability of an operator or provincial municipal plan are defined come under the National Plan. Potential spill scenarios include all scenarios previously identified (maritime casualty, vessel operations in port, oil transfer operations). To ensure an appropriate and timely response capability is provided for, specific national response equipment needs to be available to enhance the provincial / municipal stockpiles. This equipment should be located in an area which presents the highest spill risk, as well as offering an effective base for rapid mobilisation anywhere in Fiji.

Likely response activities undertaken:

- Salvage operations to remove / minimise risk of oil spill.
- Salvage capability to be sourced and provided by vessel owner.
- Oil transfer pumps.
- On-water oil containment and recovery.
- Booming of vessel.
- On-water recovery.
- Dispersant application.
- Shoreline protection.
- Shoreline protection booming.
- Near shore on-water containment and recovery.
- Shoreline clean-up.

Equipment requirements:

- On-water collection capability (e.g. bow collector or similar).
- Vessel suitable for use with bow collector e.g. MSAF or oil company response barges.
- On-water oil storage capability.
- Fence boom suitable for use offshore.
- Shoreline Protection Booms.
- Skimmers.
- Shoreline clean up equipment (e.g. shovels, rakes, plastic bags, skips, heavy machinery etc.).
- Dispersant.
- Dispersant application capability via vessel (e.g. AFEDO system).
- Aerial Dispersant capability (private operators).
- Wildlife triage.

Contingency plan requirements:

- Shoreline clean-up equipment sourced from local suppliers.
- Aircraft and spray equipment sourced from private operators.
- Vessel of opportunity for on-water dispersant application.

Recommendations:

- Establish a National Tier II Equipment Stockpile in Suva in line with recommendations in appendix 2;
- Establish a National Response Team of trained responders with necessary skills to deploy specialist equipment;
- Undertake national exercises;
- The National Plan should be considered a ‘living document’ and a maintenance, review and enhancement program developed to support this; and

- The National Plan should be enhanced by:
  - Identifying response personnel who will fill the Incident Command and Control functions;
  - Including MSAF oil spill response equipment and locations;
  - Providing environmental information necessary to assist decision making during an oil spill response;
  - Outlining the logistical arrangements in place to support an oil spill response, e.g. mobilization and transport of equipment, waste management, communications, Incident Command Centre locations; and
  - Outline the administrative and financial arrangements in place to assist with an oil spill response, administrative and financial requirements during an oil spill response.

PACPLAN (Tier III with international assistance)

Spills that are beyond the response capability and resources of MSAF and spills that threaten to impact two or more SPREP island members.

Likely response activities undertaken.

- As per the above Tier II response activities.

Equipment requirements:

- As per above Tier II response equipment requirements.

New Zealand is the Metropolitan member which provides primary assistance to Fiji, with Australian offering secondary assistance. New Zealand through Maritime New Zealand's MPRS has available trained oil spill responders and an equipment stockpile that could be quickly mobilised to provide assistance to an oil spill response in Fiji. In addition to MPRS staff New Zealand has a National Response Team consisting of approximately 110 specialist trained oil spill responders who could also be available. The MPRS equipment is packaged so that it can fit into RNZAF C130 Hercules for international deployment.

New Zealand's ability to provide rapid oil spill response support in the pacific was proven during the oil spill response to the grounding of the container ship Forum Samoa II in Apia in 2009. Four NRT members and 11 tonnes of oil spill response equipment were mobilised and arrived in Samoa within 24 hours of initial notification of the incident.

Recommendations

- PACPLAN exercise with New Zealand to establish relationships;
- Establish SOP for requesting and mobilising assistance from New Zealand; and
- Consider short term secondment of MSAF Pollution response team to MPRS to assist with the development equipment maintenance requirements, training and exercise programs and National Plan development and maintenance.

MSAF oil spill response equipment considerations

We propose that MSAF establish four equipment stockpiles at the following locations:

- Suva;
- Lautoka;
- Levuka; and
- Malau.

The equipment stockpile at Suva would provide a response capability for the spill risks within Suva Harbour and the surrounding waters, as well as a National capability for shipping incidents anywhere in Fijian waters. The three other stockpiles would provide a response capability to spills within these ports, and surrounding waters, as well as a Tier II response capability for a spill from an operator's site which is beyond their Tier I response capability.

The equipment recommendations are outlined by the equipment packages described in appendix 2 of this report. When purchasing equipment, emphasis should be given to compatibility with current resources and those of neighbouring organisations, which may be called upon to provide additional resources in the case of a larger incident.

Familiarisation training is required for response personnel who will be deploying equipment at the locations of the stockpiles. An annual training and exercising program should be developed to ensure that a full equipment deployment exercise occurs at least twice per year.

A suitable maintenance schedule should be adopted to ensure that the equipment is rehabilitated following all training and response deployments and also to ensure that the equipment is maintained in a state of readiness at all times. Guidance on maintenance has been given in the main body of this report. Additional information to assist in the development of an appropriate maintenance schedule should be sought from equipment manufacturers or suppliers.

This report does not provide specific performance specifications for equipment outlined in the packages above. When developing performance specifications, consideration must be given to compatibility of new equipment with existing resources and those of Tier III support providers. Advice and support for the development of performance specifications should be discussed with SPREP metropolitan member countries prior to any equipment being purchased.

MSAF should develop a maintenance schedule for the equipment they own. This should include a task list for each piece of equipment to be completed at the suggested intervals. Equipment manuals and maintenance intervals should be sought from suppliers at the time of purchase to assist in the development of a maintenance schedule.

Additional capability recommendations and considerations

- Asia Pacific Applied Science and Associates (APASA) to construct a tidal current model for the Fiji Islands which would be imbedded into the Environmental Data Server (EDS) for future use by MNZ for SAR and spill Modelling purposes;
- As part of the Suva stockpile an on-water skimmer (bow skimmer or side skimmer) is suggested. This requires a suitable vessel to use this from. It is an assumption that the MSAF barge be suitable for this operation;
- A limited amount of containment boom has been recommended, based on containment operations inside ports. No sensitive areas have been identified that would require a substantial shoreline protection booming operation based on the limited environmental information we have collected. This recommendation may change when regional contingency plans are developed; and
- Shoreline clean-up is a likely response option in most spills of persistent oil. The associated response activities do not typically require specialist oil spill response equipment, but equipment that is readily available from commercial hardware suppliers. It is assumed that equipment such as shovels, rakes, plastic bags, PPE etc. would be accessible from commercial suppliers at short notice during a response.

MSAF oil spill response personnel considerations

Personnel requirements for an oil spill response depend on the size and complexity of the incident. Sufficient oil spill response personnel should be readily available to respond to a smaller Tier II spill in it's entirely, or form the initial response to a larger spill while additional personnel resources are being mobilised. Accordingly it is appropriate to establish oil spill response trained teams at the locations where spills are likely to occur. For locations with Tier I response teams in place, these may be sufficient for dealing with spills from these sites and require no additional support unless the response escalates to a Tier II.

The required size and make-up of response teams will depend upon the likely spill scenarios that they will be responding to, and the equipment quantity and type that they have available to deploy. Trained response teams may be supplemented with additional untrained labour sources if the nature of the response activities allows. Trained responders are likely to have other employment responsibilities that mean they are not always available to respond to a spill when required. As this is the case the size of the trained response team should include a redundancy allowance so that a minimum amount of personnel will always be available.

It is assumed that all trained personnel will form a pool of responders that will be available for a national spill response either in their own, or in another region. A greater degree of personnel expertise and organisational structure will be required for a national response therefore personnel identified as key parts of a national response will require an appropriate level of training.

Personnel recommendations

- Regional response teams to be established in Suva, Lautoka, Levuka and Malau;
- A national response team (NRT) be established for Fiji;
- Oil industry personnel be considered to be part of the regional and national response teams; and
- Recommended trained personnel numbers are:
    - Suva 26
    - Lautoka 18
    - Malau 12
    - Levuka 12
    - NRT 30 (to be made up of trained staff from the above locations)

Chemical oil dispersants

- Dispersant are internationally recognised as a key response option to mitigate the impact of an oil spill on shorelines. However dispersants used in the wrong situation may do more harm than good. Before dispersant is used a careful analysis of environmental factors must be carried out to ensure a net environmental benefit.
- Dispersant is generally most effective in the early stages before oil has weathered and emulsified. Advice must be comprehensive and immediate and given by trained and experienced advisors.

Marine oil spill risk assessment of high risk locations

The following table is a summary of the site assessments undertaken during the risk assessment:

Location	Risk Rating	Resource Risk	Shipping Risk	Oil Transfer Sites	Tier I Response Capability Appropriate?	Oil Spill Response Capability Recommendations
Suva Harbour	H	High economic importance, high social cultural values, population centre, sensitive mangrove environments, coastal villages, important area for waders.	Fiji's busiest port with Levu pass identified as a high risk waterway and a history of groundings. High volumes of product tankers, cargo ships, fishing vessels and ferries, dry-dock.	Mobil Tanker Terminal and vessel bunkering (Diesel, ULP). Pacific Energy Terminal and vessel bunkering (HFO, Diesel, ULP). Total Terminal and vessel bunkering (HFO, Diesel, ULP) Mobile Tanker Trucks vessel bunkering (Diesel/HFO).	Yes Yes Yes No	• Establish Tier II response capability. • Establish MSAF Tier III National Equipment Stockpile. • Require Mobile Tanker truck operations to have an appropriate Tier I response capability.
Pacific Harbour	L	Tourism area, social cultural values.	Recreational and small commercial vessels.	Total Vessel Bunkering	No	Establish appropriate Tier I response capability.
Denerau Harbour	L	Tourism area, extensive mangroves.	Large commercial tourist vessels, Super Yachts, small pleasure craft.	Total / Port of Denerau Vessel Bunkering (Diesel and ULP).	Yes	Staff require training. MSAF to ensure staff are trained.

Location	Risk Rating	Resource Risk	Shipping Risk	Oil Transfer Sites	Tier I Response Capability Appropriate?	Oil Spill Response Capability Recommendations
Vuda Point	M	Marina, tourism area.	Product Tankers, recreational vessels.	Mobil Terminal. Pacific Energy Terminal. Total Terminal. Vuda Point Marina bunkering.	Yes Yes Yes No	Establish appropriate Tier I response capability at Vuda Point Marina.
Lautoka	M	High economic importance, busy port, tourism islands Mamanucas offshore.	Product Tankers (loading water), cargo ships, ferries and fishing vessels.	Mobile Tanker Trucks	No	Require Mobile Tanker truck operations to have an appropriate Tier I response capability. Establish MSAF Tier II Equipment Stockpile.
Levuka	M	Commercial Port Cannery (water intakes) Levuka World Heritage Site Tourism	Product tankers, fishing vessels, ferries	Total terminal (Diesel)	No	Existing Total equipment stockpile requires updating. Establish MSAF Tier II response capability.
Wai Riki-Bua	M	Not a tourism area, extensive mangroves shoreline, coral outcrops, mudflat, subsistence fishing, fish and mud crabs	Four ships a year loading woodchips. Bauxite vessels use the same channel come in at 14m draft. Mobile tanker truck 16000 week diesel for generators.	Tropic wood site	No	Require Mobile Tanker truck operations to have an appropriate Tier I response capability

Location	Risk Rating	Resource Risk	Shipping Risk	Oil Transfer Sites	Tier I Response Capability Appropriate?	Oil Spill Response Capability Recommendations
Malau	M	Not a tourism area, economic importance for sugar, gas and forestry. Extensive mangroves subsistence fishing	Oneship every four months One Butane ship per month Unknown no. molasses bulkers	Mobil Fiji Gas Fiji Sugar	Yes No Unknown	Staff require training. MSAF to ensure staff are trained Establish MSAF Tier II Equipment Stockpile.
Malanga	M	Pristine shoreline fronted with mangroves not tourism area. Village next bay over important for subsistence fishing.	One ship a month diesel, AV, ULP into MRs through fixed line and floating line combo.	Pacific Energy	Yes	Staff require training. MSAF to ensure staff are trained.
Taveuni	L	Social/cultural resources, moderate tourism.	Two small ferry services from the island to Taveuni. Large ferry from SUVA, but MDO. Total terminal is supplied diesel by road tankers coming over on the ferry from SUVA. IMDG issue. No bunkering or discharge from vessels. Total terminal good spill kit but staff require training. Bunding around tanks has no concrete floor.	unknown	unknown	

Risk	High

Suva Port

Site description

Suva Port is Fiji's busiest shipping port. Shipping traffic is given in table 1. Entrance to the Harbour is through Levu pass which has been identified as a high risk waterway (IALA 2014). Two substantial reef systems at the entrance of the harbour provide shelter in most weather conditions The main port facilities are located on the east side of the harbour and dominate approximately 20% of the harbour shoreline. Walu Bay and Tamavua estuary break up this section and are bordered with mangroves.

The northern shoreline is densely populated with villages and the shoreline is a mixture of intertidal mudflats interspersed with isolated coral outcrops. On the north western side is an estuarine system fed by the Veiseri River system. This arm of the estuary is connected to the rest of the harbour by a relatively narrow channel approximately 100m in width. The shoreline in this area is primarily mangrove fronted with intertidal mud flats. This area is also densely populated with villages.

Pollution in Suva has been an issue in the media. MET conditions transport pollution to the NW area, this area is populated by villages and there is subsistence fishing along the shore. Other sources of pollution into the harbour include oils from the bus station entering the storm water drains and harbour. Factories along the river and other food processing activities are discharging waste into the river which is then transported to the harbour. A number of people have reported to the risk assessment team that factory waste is being disposed of into the river feeding the harbour, however this was not verified.

Operations

- Mobil Tanker Terminal and vessel bunkering (Diesel, ULP, Jet A-1).
- Pacific Energy Terminal and vessel bunkering (HFO, Diesel, ULP, Jet A-1).
- Total Terminal and vessel bunkering (HFO, Diesel, ULP, Jet A-1).
- Mobile Tanker Trucks vessel bunkering (Diesel, HFO).
- Dry dock.

Key environmental sensitivities

Foreshore type

- Developed commercial e.g. wharfs (30%).
- Mangroves fronted with mudflats (30%).
- Inter tidal mudflats (40%).

Plants and animals

- The mudflats around Suva point are an important wintering area for migrant and staging shorebirds. Their numbers have been monitored since 1998 and up to 1000 shorebirds have been recorded at time (Watling 2013). Some of these species are globally threatened and in decline.
- Mangroves comprise 30% of the shoreline. The shoreline is sheltered, low energy and therefore this habitat is critically sensitive. Mangroves provide critical habitat for juvenile life stages of many species including commercial. Impacts to this habitat type will have flow on ecological impacts to recruitment processes for a wide range of species into adult stocks.

Economic

- Suva harbour is Fiji's busiest port and is critical to the Fijian economy. Facilities in this area support a wide range of shipping, fishing and other commercial activity. Lautoka port could provide essential services if it were closed due to a major oil spill.
- Transfer terminals take diesel, unleaded and aviation gas from tankers. This fuel is redistributed to a wide range of end users including road tankers, domestic and international vessels and commercial fishing ships.
- Cruise ships visit are a growing sector of Fiji's tourism economy and routinely visit this Suva port.

Cultural and social

- Suva is Fiji's political and administrative capital. It is the largest and the most cosmopolitan city in the South Pacific and has become an important regional centre. Students from the Pacific region and a growing expatriate community make up a significant portion of the city's population. Under authority of local government act Suva is governed and administratively looked after by Suva City Council.
- At the 2007 census, the city of Suva had a population of 85,691 including independent suburbs, the population of the Greater Suva urban area was 172,399 at the 2007 census. Suva, along with the bordering cities of Lami, Nasinu, and Nausori have a total urban population of around 330,000, over a third of the nation's population. This urban complex is known also as the Suva–Nausori corridor (not including Lami).
- Up to a third of the population of Fiji live in the area and use the harbour for activities such as swimming, canoeing, walking and general recreation.
- The area is an important subsistence fishing area for local communities.

Assessment of Risk 2 Oil Spill in Port Resulting From Collision or Vessel Operations

Discharge from fishing boats and other vessels in the harbour

- Automatic bilge float switches discharging oil. This has been reported to be a significant problem to manage in Suva Harbour and occurs regularly.
- Intentional discharge of oily bilge water and used oil into the harbour.
- The Harbour Master (HM) has identified this risk and has taken a number of initiatives. Using police patrols at night, threatening to detain vessels, planning to use media awareness for reporting of spills. No prosecutions have been taken to date however HM has been issuing fines in some cases.

Likelihood	Consequence	Risk
5	3	High

- Risk assessment indicates this is generally not an acceptable level of risk. Discharges of oily bilge water and other waste oil may be persistent and non-persistent oil types. Given the cumulative nature of discharges from vessels in the harbour over time the social, economic and environmental consequences may be serious. A plan to reduce the risk should be developed and submitted to most senior management.
- The number of fishing vessels in Suva has been greatly reduced in the past year due to HM imposing time / anchorage restrictions. Fishing ships are allowed 6 weeks anchor then the ship must depart or will be detained according to the HM.

Recommendations

- MSAF to ensure a pollution control plan is developed and implemented effectively and incidents of discharges are recorded to measure success of the control plan;
- Enforce the MARPOL requirements such as oily water separators and IOPPC for vessels over 400GT; and

- For vessels under 400GT audit and enforce MARPOL to ensure waste products are being appropriately transferred to waste reception facilities.

Oil spill resulting from bunkering operations

- There has been a history of spills when bunkering diesel into fishing vessels. Some of the issues mentioned in discussions with the Harbour Master were communication issues between the transfer terminals and foreign crews. In some cases a plastic bag was being used to cover the vent, the crew would use a filling bag to indicate the tank was full would then stop pumping fuel.
- The Harbour Master is aware of this problem and has been refining and enforcing checklists.

Likelihood	Consequence	Risk
3	2	Moderate

- Risk assessment indicates that generally this level of risk is acceptable. Manage by specific monitoring audit and inspection.

Recommendation

- Bunkering procedures should be monitored and audited regularly to ensure procedures are being followed.

Discharge of oil from floating dock

- The function is to dry dock ships. Oil is regularly entering the ocean from the dry dock and the HM is aware of this. Dry dock operations may use chemicals that are highly toxic and that may bio accumulate. Chemicals have the potential to be far more toxic than oil as affects may be persistent and toxins may bio accumulate up food chains. This risk assessment has been based on the significant potential for chemical discharges to damage social, economic and environmental resources. An audit of the facility may find chemicals are not being discharged, which will result in a large reduction in consequence and therefore risk.
- HM has requested spill plans from the dry dock. Officers are now sent to inspect and monitor transfers.

Likelihood	Consequence	Risk
4	3	High

- Risk assessment indicates this is not an acceptable level of risk. A plan to reduce the risk should be developed and submitted to most senior management.

Recommendation

- Carryout an audit of the dry dock and focus on spill risk associated with chemicals along with oil. Implement an appropriate control plan, regularly audit for compliance.

Damage to HFO ship during navigation in Suva port resulting in large HFO spill

- Two tug boats may be required at times but are not always available when vessels are docking.
- The depth at the berth is not communicated from the port regularly, draft clearance requirements for the berth are not currently known.
- There is a history of grounding occurrence in Suva harbour. Issues have been raised in the past regarding ships navigating without pilots leading to groundings.

Likelihood	Consequence	Risk
3	4	High

- This is not an acceptable level of risk. A plan to reduce the risk should be developed and submitted to most senior management. The audit of the port and operators was relatively brief and therefore there are likely other issues that have not been addressed in this report.

Recommendations

- Carryout a detailed risk assessment of operations at SUVA port operations and implement appropriate controls; and
- Consider implementing a port and harbour safety code for Fiji. The New Zealand Port and Harbour Marine Safety Code provides measures for the safe management of ships in ports and harbours. It also includes measures to prevent serious harm to people and protection for the marine environment. A Fiji port and harbour safety code may reduce the likelihood of this event by identifying risks, implementing appropriate controls and allocating roles and responsibilities.

Oil spill during oil tanker discharge back loading

- Cargo movements are happening close to the barricade and fuel transfer just on the other side. Concern was raised that ISGOTT guidelines are not being adhered to.
- Vessels bunkering are not always given slots on berth close to point of discharge. Exxon have to run extra hose. Berthing priorities, tankers are ranked number 6.

Likelihood	Consequence	Risk
3	3	Moderate

- Risk assessment indicates that generally this level of risk is acceptable. Manage by specific monitoring audit and inspection.

Recommendation

- Carryout a more detailed risk assessment of tanker operations at Suva port and implement appropriate controls.

Risk 3 oil transfer operations resulting in an oil spill

- Suva Oil Terminals – Total, Pacific Energy and Exxon Mobil terminals. These operations load and discharge HFO, diesel an unleaded via fixed lines and trucks. Worst case scenario 50 metric tonnes of HFO into the harbour due to pipeline rupture.
- These companies were found to have robust controls in place to manage the risk of spills. Total and Exxon Mobil undertake two kinds of risk assessment, scenario based and operations based. The operational risk assessment is carried out with a job safety analysis (JSA). For a new task a JSA is carried out.
- Planned maintenance for infrastructure include: inspector out of New Zealand ensures compliance with Australian/NZ standards, Non-destructive testing (NDT) (every 5 years); Direct current testing (DCVG) (every 5 years); and Corrosion / Cathodic protection (annually). For any significant project they call in ERA site consultants.
- Permit requirements include: ERA license from Department of Environment (3 years); port discharge permit (3 years); port users license (annually); and waste discharge license Department of environment (3 years).
- Fishing vessels. Same issues as identified previously. Language, manning, understanding allege, how much they need. Action from Exxon, they lock them into a fixed quantity which forces them to calculate accurately.

50 tonne spill of HFO due to pipeline rupture

Likelihood	Consequence	Risk
1	4	Low

- Risk assessment indicates risk is acceptable. Existing planned maintenance systems reduce the likelihood to rare, highly unlikely. Unlikely to require specific application of resources. Manage by routine procedures.

Recommendation

- MSAF to carryout routine audit inspection oil transfer terminals to ensure planned maintenance systems and processes are being followed.

Response: Suva oil spill response capabilityand recommendations

Tier I Suva port

- The port has limited capability to clean up a spill, they have a response boat and a small amount of boom.

Recommendation

- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk.

Terminal operators

Exxon Mobil

- Stated that all terminal staff and contractors receive oil spill training. Exxon Mobil uses a company representative to carry out oil spill response training, once every two years. The senior management team exercise emergency scenarios.
- Supposed to have training last year with AMOSC but didn't eventuate. Weren't sure of regularity of training. Estimated at every two years.
- The operators carry out special scenario training with AMOSC and have involved MSAF, Fire, Police, and other organisations in this exercising. Operators consider that AMOSC will act as their backup for a big spill. Consideration needs to be given to how AMSOC may be integrated into the Fiji tiered response system. In a Tier III spill MSAF take control and if necessary call on New Zealand capability. Needs to be clarified how AMOSC would work in with the NATPLAN.
- Emergency response equipment is located on site and is well maintained.
- In the case of a spill they will use the ports boat to deploy equipment.
- During bunkering operations the spill equipment stays on site and is deployed only if there is a spill.
- MSAF do not hold copy of the oil spill plan contingency plan or ERA.

Total

- Stated that all staff on site have been trained and the last exercise involving deployment of equipment was one year ago.
- Oil spill response equipment is held in two 20 foot containers – transportable and in good condition.
- Raised concerns about the need for on-going training as staff moved on.

Contingency Plans, equipment, training and exercising

- Terminal operators in Suva Harbour have well stocked and well maintained oils spill response equipment. They also stated that they have contingency plans and environmental risk assessments although operators would not provide these to the risk assessment team when requested. Internal procedures for these international companies seems to be maintaining good standards in this area
- While training is occurring, information regarding competence matrices of staff and occurrences of past training and future training could not be provided in all cases. This highlights the need for MSAF to ensure staff are adequately trained and exercises occur.

Recommendations

- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk;
- MSAF to ensure operators have appropriate Tier I terminal contingency plans; and
- MSAF to implement adequate monitoring of terminal operators oil spill response training and exercising.

Risk	High

Wairiki Port near Bua

Site description

The company Tropic Woods runs the port in conjunction with the agent. Ships enter the same channel as the ferry. Tugs come to assist berthing from the ferry area if a second tug is required it can be sent from SUVA however usually one tug is used. The area is a pilotage area. The port is 15m deep.

Operations

- Large pine chip export, the jetty is relatively deep. Ships come in ¾ full and then top up because the port is deep. Approximately four ships a year come to the terminal for loading.
- Ships range from 196m upwards – big ships.
- Tugs come to assist berthing from the ferry area if a second tug is required it can be sent from SUVA however usually one tug is used.
- Bauxite vessel also navigates through this area details of which can be found in the NAV aids risk assessment – we didn't visit Bauxite loading area.
- Approximately 20 people on site.
- Mobil supplies 16,000L per week diesel from road tanker. There are two 5,000L tanks down at the jetty, one at the base and the other at the end of the jetty next to a generator that drives the conveyor belt for wood chip loading.

Key environmental sensitivities

Foreshore type

The tidal range is small 1.6m. Access by road for this extensive area of coast is confined to the one road. Access vessel would be necessary. The coast is covered with extensive mangrove forest fronted with intertidal rocky / coral outcrops interspersed with mudflats.

Plants and animals

- Mangrove habitat.
- More information required.

Economic

- Tropic wood provides employment for approximately 25 people.
- Wood chip export significant earner.

Cultural and social

- Low population density.
- Nearest significant village settlement Navunievu.

Assessment of risk 2 oil spill in port resulting from collision or vessel operations

Damage to HFO ship during navigation in port resulting in large HFO spill

- The area is a high risk area and has therefore been defined as a pilotage area. Large HFO ship could go aground.
- Two tug boats may be required at times but are not always available when vessels are docking.
- Bauxite vessel comes in at 14m draft the port is 15m deep.
- The depth at the berth is not communicated from the port regularly, draft clearance requirements for the berth are not currently known.

Likelihood	Consequence	Risk
3	4	High

- This is not an acceptable level of risk. A plan to reduce the risk should be developed and submitted to most senior management.

Recommendations:

- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately; and
- Consider implementing a port and harbour safety code

Assessment of risk 3 oil transfer operations resulting in an oil spill

Diesel spill during bunkering of storage tanks

- Mobil supplies 16000L per week diesel from road tanker. There are two 5000L tanks down at the jetty, one at the base and the other at the end of the jetty next to a generator that drives the conveyor belt for wood chip loading. These tanks are fueled by trucks which back down the jetty. A make shift temporary pipe (refer photos) is used to connect to the trucks discharge hose. One pipe is jammed inside the other, this setup is a spill risk and will leak diesel into the unbunded are regularly.
- Fuel tanks unbunded.

Likelihood	Consequence	Risk
4	1	Low

- Risk assessment indicates risk is acceptable. Existing planned maintenance systems reduce the likelihood to rare, highly unlikely. Unlikely to require specific application of resources; Manage by routine procedures.

Recommendation

- MSAF to ensure operators get an appropriate discharge hose and coupling and that fuel tanks are appropriately bunded.

Response: oil spill response capability and recommendations

There is no spill equipment on site nor has there been any oil spill response training.

Recommendation

- Require Mobile Tanker truck operations to have an appropriate Tier I response capability

Risk	High

Malau Port

Site description

Port of Malau is situated on the North Western side of Fiji's second largest island, Vanua Levu, and is Fiji fourth busiest port with deep water anchorage and berthing. This is a pilotage area.

Operations

- Diesel, unleaded, gas(butane) (offload) and molasses (loading). Fiji sugar with a purpose built jetty, Mobil storage and discharge, Fiji gas and Fiji forest industries.
- In this area a mooring system (see photos) is used by three companies in the port. Sugar / Molasses company, Fiji Gas and Mobil. In 2012 there was an incident. A bulker came into the channel on a track inside the island and took a sharp turn into the mooring area. A pilot was on board who gave instructions to bow thrust, the captain bow thrust in the wrong direction and swung into the dolphin damaging the dolphin and the ship above the water line. Ships will occasionally go around the island but will usually take a line inside the island and swing as this is shorter, a pilot is required.

Fiji sugar

- There is a large storage and discharge of sugar and molasses in this area which present a significant risk to the marine environment if there is a spill. We were unable to visit this location and recommend MSAF this site to evaluate risk and response measures. Sugar can be extremely damaging to tropical marine environmental as the effects on coral is lethal. Sugar also consumes oxygen as it breaks down creating anoxic conditions in sheltered environments which can be devastating to marine ecosystems.

Recommendation

- MSAF to visit the sugar site to evaluate spill risk and response measures.

Mobil

- Ships discharge diesel and unleaded at 120 tonnes per hour via fixed piping and flexible hose combination. The fixed piping (owned by MOBIL) runs through a culvert under the road. In 2012 this hose failed the NDT (test) and the section under the road was replaced. Trucks running over the half culvert system are thought to have damaged the pipe and therefore the half culvert has been replaced with a full round culvert.
- One ship every four months.
- The MOBIL storage facility also stores TOTAL's product and discharges to road tankers. TOTAL's procedures are followed for these operations.
- No bunkering in this location.
- 3 barrels of fluofoam AFFF were present. Recommend this is changed out for a less toxic product. The AFFF when discharged will enter the drainage system and fluorinated components may not be captured by the separator.
- All drainage goes into a separation system with BOD and ppm limits before discharge.

Preventative maintenance

- Contractors maintain the mooring system, external consultants. Maintenance of the mooring system includes visual inspection annually.
- An inspection program for pipeline is in place but was not audited during this inspection.
- Discharge, pipeline is inspected and pressure tested prior to tanker discharge. Pipeline is pressure tested to 800KPI the max discharge is 600KPI.
- Ships must show a testing certificate before they are allowed to connect.

- New gaskets are changed out each time there is a fuel transfer. MOBIL sends a man on board each vessel on each occasion – currently a rope ladder is used which is very difficult and dangerous.
- Comprehensive checklist is in place – MOBIL runs an internal audit to ensure checklist process is carried out.

Fiji Gas

Operations

- 51% Origin 49% Fiji.
- Offloading 75-100 tonnes of butane per month.
- One gas tanker per month.
- Storage tanks at the facility hold butane which has a boiling point of 0 degrees Celsius. If there was a breach in any of the infrastructure, tanks piping the butane would escape as a gas and would become a safety of life issue rather than an environmental issue. For this reason environmental damage from this operation is not expected. The tanks are not bunded.
- The facility is powered by mains however they have backup diesel generators, to cope with regular power cuts from the mains systems.
- Fiji gas use the same mooring system but run a flexi hose to their own manifold system outside the own terminal.

Oil spill response capability

- No existing response equipment or training.
- An internal audit in February found no spill kit and recommended spill kit and training.

Fiji Forest Industries

- Sawmill making plywood, potentially discharging fumigant into the water, was audited the day before by Fiji's Department of Environment (DOE).
- There was a strong sulphur smell and yellow discharge under the discharge pipeline.
- Old man speaking with Phil mentioned there is no shellfish in the area any more. Also no barnacles on rocks although this was a rip rap arrangement and potentially due to the rock type used rather than to toxic effects.

Assessment of risk 2 oil spill in port resulting from collision or vessel operations

Damage to HFO ship during navigation in port resulting in large HFO spill

- The area is a high risk area and has therefore been defined as a pilotage area. Large HFO ship could go aground or collide with infrastructure.
- A near miss was recorded in 2012 bulker dolphin collision.
- A maintenance system is in place for the mooring system but there was no evidence this is being overseen by an independent third party.

Likelihood	Consequence	Risk
3	4	High

- This is generally not an acceptable level of risk. A plan to reduce the risk should be developed and submitted to most senior management.

Recommendations:

- MSAF to ensure mooring system is adequately maintained;
- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately; and
- Consider implementing a port and harbour safety code.

Risk 3 oil transfer operations resulting in an oil spill

Spill during transfer operations

Likelihood	Consequence	Risk
1	4	Low

- Risk assessment indicates risk is acceptable. Existing planned maintenance systems reduce the likelihood to rare, highly unlikely. Unlikely to require specific application of resources. Manage by routine procedures.

Recommendation

- MSAF to carryout routine audit inspection oil transfer terminals to ensure planned maintenance systems and processes are being followed.

Response: oil spill response capability and recommendations

Existing oil spill response capability

Mobil

- Good stockpile of equipment well maintained.
- Exercises. They were involved in the same big exercise carried out in 2012 involving authorities, FSE, total, Fiji gas, which involved deploying a boom around a vessel;
- The staff themselves have identified that they require more training, this training needs to be sustainable and on-going; and
- They have a small support vessel to deploy spill equipment and there are vessels of opportunity in the area.

Recommendations:

- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk;
- MSAF to ensure operators have appropriate Tier I terminal contingency plans;
- MSAF to implement adequate monitoring of terminal operators oil spill response training and exercising;
- MSAF to visit the sugar site to evaluate spill risk and response measures; and
- MSAF to establish Tier II stock pile at this location;

Risk	Moderate

Malanga – Pacific Terminal

- Small terminal in pristine bay next to village.
- Diesel 400-500 tonnes, ULP 150 tonnes, Jet A1 50 tonnes every 2 months. All products discharged to road tankers.
- Ships discharge through flexi hose and fixed piping.
- In 2005 a risk assessment was carried out.
- Ships come once a month and discharge up to 3000 tonnes. Discharges at 200kph.
- In the week before this ERA visit a tanker hose burst and lost an estimated 500L of diesel. Booms were deployed and 500L was recovered using boom and sorbent pads.
- They have been having difficulty re-stocking there spill equipment stockpile after it was used.

Resources at risk

- This area again appears to be pristine and the shoreline is fronted with extensive mangrove forest.
- Large village in the next bay around uses the area for subsistence fishing.

Assessment of risk 2 oil spill in port resulting from collision or vessel operations

Damage to HFO ship during navigation in port resulting in large HFO spill

Likelihood	Consequence	Risk
2	4	Moderate

- Risk assessment indicates that generally this level of risk is acceptable. Manage by specific monitoring audit and inspection.

Recommendations

- MSAF to ensure mooring system is adequately maintained;
- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately; and
- Consider implementing a port and harbour safety code

Risk 3 oil transfer operations resulting in an oil spill

Likelihood	Consequence	Risk
1	4	Low

- Risk assessment indicates risk is acceptable. Existing planned maintenance systems reduce the likelihood to rare, highly unlikely. Unlikely to require specific application of resources. Manage by routine procedures.

Recommendation

- MSAF to carryout routine audit inspection oil transfer terminals to ensure planned maintenance systems and processes are being followed.

Response: oil spill response capability and recommendations

Existing oil spill response capability

- Good equipment stockpile although have issues with re – stocking. Sorbent pad is not easily obtained in Fiji.
- Staff have identified that they required further spill training.
- If there was a significant spill terminal staff could call on the village for man power.

Recommendations

- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk;
- MSAF to ensure operators have appropriate Tier I terminal contingency plans; and
- MSAF to implement adequate monitoring of terminal operators oil spill response training and exercising.

Risk	**Moderate**

Savusavu

Site description

The main towns on Vanua Levu are Labasa and Savusavu. Savusavu was originally established as a trading centre for sandalwood, beech and copra, and is the site of a major copra mill. Tourism is growing in importance, owing to its SCUBA diving and yachting facilities. Savusavu is now home to a small but significant community of Americans, Australians, New Zealanders and Europeans which has helped fuel its economic development.

Operations

- Diesel bowsers for small vessels, yacht bunkering.
- Fuel supplied by road tanker from Malanga.

Key environmental sensitivities

Foreshore type

- Majority extensive mature mangrove forest
- Intertidal mudflats and coral outcrops
- Rip rap walls and developed water front in town
- Wharfs jetties

Economic

- Savusavu hosts a number of resorts.
- Tourism is growing in importance, owing to its SCUBA diving and yachting facilities.
- Proposal to develop Nawi Island into a resort
- Agriculture such as Copra
- Significant infrastructure with facilities catering to tourist and yachts

Plants and animals

- More information required.

Assessment of risk 2 oil spill in port resulting from collision or vessel operations

Commercial and recreational vessels pumping bilges

- Observation that vessels pumping bilges is an issue.Large number of yachts.

Likelihood	Consequence	Risk
3	2	Moderate

- Risk assessment indicates that generally this level of risk is acceptable. Manage by specific monitoring audit and inspection.

Recommendation

- MSAF to ensure port is managing bilge discharge discharges through routine audit and inspection.

Diesel spill during vessel bunkering

- Only non-persistent oil bunkering, which reduces potential longer term impacts.

Likelihood	Consequence	Risk
2	2	Low

- Risk assessment indicates risk is acceptable. Manage through routine audit and inspection.

Recommendation

- MSAF to manage bunkering through routine audit and inspection.

Existing oil spill response capability

The risk assessment team did not visit the transfer terminal and does not have any information regarding existing oil spill response capability.

Recommendation

- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk;
- MSAF to ensure operators have appropriate Tier I terminal contingency plans; and
- MSAF to implement adequate monitoring of terminal operators oil spill response training and exercising.

Risk	Moderate

Denerau Port

Site description

Port Denerau is Fiji's main tourism hub for tourism activities in the Mamanuca and Yasawa Island Groups. The Port marina is the base to numerous ferry, barge and day/overnight cruise operators. The marina also has 16 super yacht berths.

Operations

- Pacific Energy oil transfer site. Storage for 90,000L diesel, 20,000L ULP, 10,000L premium.
- Three docks with vessel bunkering.
- Floating jetty (all three products).
- Jetty for super yachts (two x diesel).
- Main Wharf with three diesel bunkering points.
- Waste oil reception facility.
- Commercial vessels pumping bilges is an issue.
- Cruise ships mooring four miles offshore. This area is dominated with tourist yachts. No terminals as such but bowsers supplied by road tankers.

Key environmental sensitivities

Foreshore type

- Man-made structures and surrounding waterways with rip rap walls, with mangroves in the surrounding area.

Plants and animals

- Mangrove habitat with associated fish species.

Economic

- Port Denerau Marina
- Tourism hub
- Resorts and Hotels
- Cultural and social
- Tourism activities provide local employment
- Relatively low social / cultural values.

Assessment of risk 2 oil spill in port resulting from collision or vessel operations

Commercial vessels pumping bilges

- Observation that commercial vessels pumping bilges is an issue.
- Fines in place for vessel spills and illegal discharges
- The Port Denerau Marina appears to have good oil spill deterrence and prevention measures in place.

Likelihood	Consequence	Risk
3	2	Moderate

- Risk assessment indicates that generally this level of risk is acceptable. Manage by specific monitoring audit and inspection.

Recommendation:

- MSAF to ensure port is managing bilge discharge discharges through routine audit and inspection.
- Assessment of risk 3 oil transfer operations resulting in an oil spill

Diesel spill during vessel bunkering

- Pacific Energy oil transfer site. Storage for 90,000L diesel, 20,000L ULP, 10,000L premium.
- Pipeline burst recognised as main oil spill risk.
- Only non-persistent oil bunkering, which reduces potential longer term impacts.

Likelihood	Consequence	Risk
2	2	Low

- Risk assessment indicates risk is acceptable. Very few bunkering spills have occurred which is likely due to good procedures in place for bunkering and deterrence measures such as fines for vessel spills.

Recommendation

- MSAF to manage bunkering through routine audit and inspection

Response: oil spill response capability and recommendations

Existing oil spill response capability

- Good Tier I equipment stockpile held in container.
- Further training and exercising is required

Recommendations

- Port Denerau Marina and Pacific Energy to improve Tier I oil spill contingency plan for the site;
- Tier I response staff to be provided with appropriate oil spill response training;
- MSAF to ensure terminal operator equipment stockpiles are stocked appropriately based on risk; and
- MSAF to implement adequate monitoring of training and exercising.

Risk **Moderate**

Vuda Point

Site description

Vuda Point is located approximately eight kilometres south west of Lautoka and consists of a tanker terminal operated by the three main oil companies and a marina. There are two nearby resorts and adjacent villages.

Operations

- Pacific Energy / Mobil / Total Oil Terminals with product tankers discharging from offshore mooring via subsea pipeline.
- Jet A1, Unleaded Petrol and Diesel discharges.
- There is a pipeline to the airport for Jet A1 fuel.
- Blugas Terminal discharging natural gas to shore from offshore mooring via subsea pipeline
- Vuda Point Marina. diesel and unleaded petrol bunkering
- Two local coastal tankers supply pacific islands (3000m^3 capacity).
- Future potential for bunkering operations.
- Future potential HFO discharge and storage (Total).

Key environmental sensitivities

Foreshore type

- The surrounding coast includes mangrove forest fronted with intertidal rocky / coral outcrops interspersed with mudflats and inlets. Manmade rip wraps walls in the vicinity of the terminal and marina.

Plants and animals

- Mangrove habitat with associated fish species.

Economic

- Tanker Terminal
- Resorts
- Marina

Cultural and social

- By tradition, Vuda Point was the landing site of the canoes that brought the Melanesian ancestors of the Fijian people to the country

Assessment of risk 2 oil spill in port resulting from collision or vessel operations

Tankers grounding while mooring resulting in HFO (bunker) spill or product spill

- Approximately six tanker movements per month.
- Tug on standby during mooring operations.

Likelihood	Consequence	Risk
2	4	Moderate

- Risk assessment indicates that this is an acceptable level of risk.
- Limited frequency of tanker movements and appropriate controls in place to prevent groundings.

Recommendation

- MSAF to ensure mooring system is adequately maintained.

Assessment of risk 3 oil transfer operations resulting in an oil spill

Diesel spill during tanker discharge or back loading

- Pipeline leak during discharge most likely scenario.
- Yearly maintenance of flexible hose.
- Berthing parameters in place for Tankers.
- MSAF requirement for risk assessment of tanker operations

Likelihood	Consequence	Risk
2	2	Low

- Spill volume limited by content of pipeline and impact reduced by non-persistent nature of oil.
- Risk assessment indicates risk is acceptable. Good controls in place for Tanker operations

Recommendation:

- MSAF to ensure discharge pipeline is appropriately inspected and maintained.

Diesel spill during bunker at marina

- Tank overflow while vessel bunkering most likely scenario.
- Small volume spills occurring regularly.
- Limited impact due to contained nature of the marina and small amounts of non-persistent oil spilled.

Likelihood	Consequence	Risk
4	1	Low

- Risk assessment indicates risk is acceptable however marina operator should ensure that fuel pump users are educated to reduce occurrence.

Recommendation:

- MSAF to ensure that appropriate bunkering procedures are in place for Marina fuel stop.

Existing oil spill response capability

- All three terminal operators have oil spill response equipment in containers, trailers and a response vessel for deployment.
- Further training and exercising is required.

Recommendations

- MSAF to ensure Marina has oil spill contingency plan in place including standard operating procedures for bunkering spills;
- An appropriate Tier I response capability should be established to contain any oil spilled within the marina;
- MSAF to ensure mooring system is adequately maintained;
- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately;
- Consider implementing a port and harbour safety code;
- MSAF to ensure operators review and update their oil spill contingency plans to be more site specific and provide standard operating procedures for identified oil spill scenarios;
- Total to review the adequacy of their equipment stockpile and enhance accordingly if HFO transfers proceed in the future;
- MSAF to ensure terminal operator equipment stockpiles are stocked to appropriate standards based on risk; and
- Tier I response staff to be provided with appropriate oil spill response training

Risk **Moderate**

Lautoka

Site description

Lautoka is the second largest city in Fiji and also has the second largest port. Lautoka services the shipping needs of Western Viti Levu and is the base for Fiji's Blue Lagoon Cruises and Nai's Cruises. There are several nearby offshore islands containing fishing villages and resorts, with large areas of mangroves

Operations

- Port of Lautoka is Fiji's largest Port for handling bulk cargo, specializing in bulk sugar, molasses, woodchips, petroleum, and gasFiji Ports, Tropics Wood Chips, Fiji Sugar Co, Fiji Gas, Orica).
- Diesel bunkering at wharf from tanker trucks.
- Vessel movements (cargo ships, ferries, fishing vessels).
- Tankers come in to port to take on water.
- Containerised harmful substances.
- Orica liquid caustic soda discharge (Hydrochloric and Nitric acid also on board supply tanker).
- Future Potential Iron Ore loading facility

Key environmental sensitivities

Foreshore type

The surrounding coast is covered with extensive mangrove forest fronted with intertidal rocky / coral outcrops interspersed with mudflats. The shoreline around and immediately adjacent to the port is has been modified by manmade structures and land reclamations

Plants and animals

- Mangrove habitat.

Economic

- Tropic wood and Fiji Sugar Co
- Commercial port operations (cargo vessel, ferries and fishing vessels)
- Tourism (resorts, bars and restaurants)

Cultural and social

- Sea slug harvesting
- Vio Island Fishing village

Assessment of risk 2 oil spill in port resulting from collision or vessel operations

Damage to HFO ship during navigation in port resulting in large HFO spill

- High frequency of cargo vessel movements increases likelihood of incident

Likelihood	Consequence	Risk
3	3	Moderate

- This is a generally acceptable level of risk

Bilge discharge from vessel while in port

- High frequency of visits by fishing vessel and ferries, which have a history of bilge discharges.
- Spill impacts likely to be very localized and relatively easily remediated.

Likelihood	Consequence	Risk
3	2	Moderate

Recommendations

- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately; and
- Consider implementing a port and harbour safety code for Fiji. The New Zealand Port and Harbour Marine Safety Code provides measures for the safe management of ships in ports and harbours. It also includes measures to prevent serious harm to people and protection for the marine environment. A Fiji port and harbour safety code may reduce the likelihood of this event by identifying risks, implementing appropriate controls and allocating roles and responsibilities.

Diesel spill during bunker from mobile tanker truck operators

- Tank overflow while vessel bunkering most likely scenario.
- Small volume spills occurring regularly.
- Limited impact due to contained nature of the marina and small amounts of non-persistent oil spilled.

Likelihood	Consequence	Risk
4	1	Low

- Risk assessment indicates risk is acceptable however MSAF should ensure that operator have appropriate spill prevention procedures in place.

Recommendation

- MSAF ensures that mobile tanker truck bunkering operators have appropriate spill prevention procedures in place.

Existing oil spill response capability

MSAF have oil spill response equipment in a container at the port. This equipment is poorly maintained and would have limited use in its current condition. There is an MSAF vessel normally located at the port available for use during an oil spill response.

Recommendations:

- MSAF undertake maintenance of the existing MSAF oil spill response equipment located at the port;
- Establish enhanced MSAF equipment stockpile at the port as per the equipment recommendations;
- Establish oil spill contingency plan for the Port;
- Ensure that tanker truck operators bunkering vessels at the port have an oil spill contingency plan and an appropriate Tier I response capability; and
- Require Fiji Sugar Co to have a spill contingency plan and response capability for Molasses spills.

Risk **Moderate=**

Levuka

Site description

Levuka is a town on the eastern coast of the Fijian island of Ovalau, in. It is the economic hub and the largest of 24 settlements on the island. The Port of Levuka is primarily a fishing port catering for fishing vessels that berth at Levuka to supply Levuka's Cannery managed by PAFCO. Levuka town is a UNESCO World Heritage Site and many of its buildings remain as it was built in the 1800's.

Operations

- Port operations consisting (fishing vessels, ferries, container ships, Cruise Vessels and tanker visits).
- Tankers discharging Diesel to Total terminal.
- Ferries unload drums of fuel for petrol station.
- Fishing vessels offloading Tuna at PafCoFafCo
- Oil Storage (Total, PafCo (waste oil), FEA).

Key environmental sensitivities

Foreshore type

The area in and around the port area consists of manmade structures and man modified shorelines with small land reclamations and rock walls. The wider coast is predominantly intertidal rocky / coral outcrops interspersed with mudflats and small areas of mangroves.

Plants and animals

- Lagoon and Coral reefs
- More information required.

Economic

- Pacific Fishing Company Cannery. Cannery has sea water intakes.
- Tourism

Cultural and social

- Former the Capital of Fiji
- UNESCOWorld Heritage Site

Assessment of risk 2 oil spill in port resulting from collision or vessel operations

Damage to HFO ship during navigation in port resulting in large HFO spill

- No Tug boat available at Port, must be arranged from Suva prior to vessel arrival.
- Limited visits by vessels with HFO bunkers which significantly reduces the consequences of an oil spill.

Likelihood	Consequence	Risk
2	3	Moderate

- Risk assessment indicates that generally this level of risk is acceptable. Manage by specific monitoring audit and inspection.

Recommendations

- MSAF to ensure port depth is regularly surveyed and draft restrictions managed adequately; and
- Consider implementing a port and harbour safety code.

Bilge discharge from vessel while in port

- High frequency of visits by fishing vessel and ferries, which have a history of bilge discharges.
- Spill response likely to require assistance beyond that available in Levuka.
- Spill impacts likely to be very localized and relatively easily remediated however may have wider adverse impacts from a tourism and cultural perspective.

Likelihood	Consequence	Risk
3	2	Moderate

- Risk assessment indicates that generally this level of risk is acceptable. Manage by specific monitoring audit and inspection.

Recommendation

- MSAF to ensure the port is managing bilge discharges through routine audit and inspection.

Assessment of risk 3 oil transfer operations resulting in an oil spill

Diesel spill during tanker discharge or oil transfer

- Tankers supply Total with approximately 2,000m3 of diesel every two to three months.
- Pipeline from Total site to PafCo and FEA storage tanks. This pipeline is very old (est. 1960's)
- Bunding at PafCo Fuel oil tanks requires maintenance and offers no containment capability.
- No vessel bunkering at Levuka Port

Likelihood	Consequence	Risk
3	2	Low

- Risk assessment indicates risk is acceptable. Existing procedures and maintenance systems reduce the likelihood. Any diesel spill likely to be of relatively small volume and likely to dissipate naturally in the immediate area without significant consequences.

Recommendation

- MSAF to ensure operators fuel tanks are appropriately bunded; and
- MSAF to ensure that oil transfer pipeline is appropriately maintained.

Existing oil spill response capability

Recommendations

- Establish MSAF equipment stockpile at Port;
- Undertake combined training and oil spill response exercising with FEA, PafCo, Fire and Fiji Gov staff;
- Ensure Total has adequate Tier I response equipment and a site specific marine oil spill contingency plan;
- Ensure PafCo has an oil spill contingency plan; and
- Ensure Levuka Port has an oil spill contingency plan.

Oil Spill Response Capability

- Total oil spill response equipment.
- Police have two vessels available for oil spill response activities.

Risk	**Low**

Taveuni

Site description

Taveuni (pronounced is the third-largest island in Fiji, after Vanua Levu and Viti Levu, with a total land area of 434 square kilometers. Tavenui island is separated from Vanua Levu by the Somosomo Strait.

The island of Taveuni crosses the east-west Antemeridian so the north-eastern portion of the island is located at +179°longitude and the south-western part at -179° longitude. This is often an example that causes havoc to GIS software in which a polygon geometry around the perimeter of the island is incorrectly rendered and wraps around the globe.

Operations

- There are two small ferry services from the island to Taveuni.
- Large ferry from Suva, but MDO.
- Total terminal is supplied diesel by road tankers coming over on the ferry from SUVA. IMDG issue. No bunkering or discharge from vessels.

Key environmental sensitivities

Plants and animals

- Migrating humpback whales pass the island in July
- Ravilevu Nature Preserve on the east coast, and the Taveuni Forest Preserve in the middle of the island.
- Fiji Banded Iguana and both *Platymantis vitiensis*and *Platymantis vitianus* frog species.
- Nearly all plants and animals indigenous to Fiji are found on Taveuni, which has suffered less devastation from land clearance than other areas of Fiji.

Economic

- Being volcanic in origin Taveuni's soils have supported the island's most historically significant industry, agriculture, and most significantly copra.
- Taveuni is a popular tourist destination. Tourists are attracted to the excellent diving opportunities, prolific bird life, bushwalks and waterfalls.
- The island's agricultural output is a significant contributor to the Fijian economy. Copra has been traditionally the most important crop produced on Taveuni, and has always been the staple of the local economy.

Assessment of risk 2 oil spill in port resulting from collision or vessel operations

Larger ferry from Suva damage during berthing large MDO spill

- Recently this ferry had trouble while berthing, grounded and required rescue.
- Bunkers are medium fuel oil.

Likelihood	Consequence	Risk
2	2	Low

- Risk assessment indicates that generally this level of risk is acceptable. Manage by specific monitoring audit and inspection.

Recommendation

- MSAF to ensure berthing procedures are adequate and are being followed through routine audit and inspection.

Existing oil spill response capability

- Total terminal good spill kit, well provisioned.
- Staff require oil spill training.
- Bunding around Total storage tanks has no concrete floor.

Recommendations

- MSAF to ensure Total’s storage tank bunding is improved;
- MSAF to ensure terminal operator equipment stockpiles are stocked to the appropriate standards based on risk;
- MSAF to ensure operators have appropriate Tier I terminal contingency plans; and
- MSAF to implement adequate monitoring of terminal operators oil spill response training and exercising.

References

ARPEL (2014). APREL Oil spill response planning and readiness assessment manual version 2.0. Regional Association of Oil, Gas and Biofuel Sector Companies in Latin America and the Caribbean.

DeMers A, Kahui, V (2012) An overview of Fiji's fisheries development Marine Policy 36 (2012) 174–179.

Fiji (1997) Convention on biological diversity national report to the conference of the partiesBy the Republic of Fiji Department of the Environment, Ministry of local Government, Housing andEnvironment.

Fiji (2013). Maritime Transport Decree 2013 (Decree No. 20 of 2013), Republic of Fiji.

Fiji (2014). Republic of Fiji Marine Oil Spill Contingency Plan.

IMO (2010). Manual on Oil Spill Evaluation and Risk Assessment of Response Preparedness. International Maritime Organisation.

IMO (2011). Guidance on sensitivity mapping for oil spill response (Secretariat), International Maritime Organisation

IALA WWA (2014) Report on technical visit for a need assessment mission of Aids to Navigation in Fiji.

IOSC (2008) International Oil Spill Conference Assessment of Oil Spill Response Capabilities:

A Proposed International Guide for Oil Spill Response Planning and Readiness Assessments

Technical Report IOSC-009.

SPREP (2013). PACPLAN: Pacfic Islands Regional Marine Contingency Plan. Secretariat of the Pacific Regional Environmental Program Apia Samoa.

Steen, A., et al. (2008). Assessment of Oil Spill ResponseCapabilities: A Proposed International Guide for Oil Spill Response Planning and Readiness Assessments. International Oil Spill Conference, IOSC.

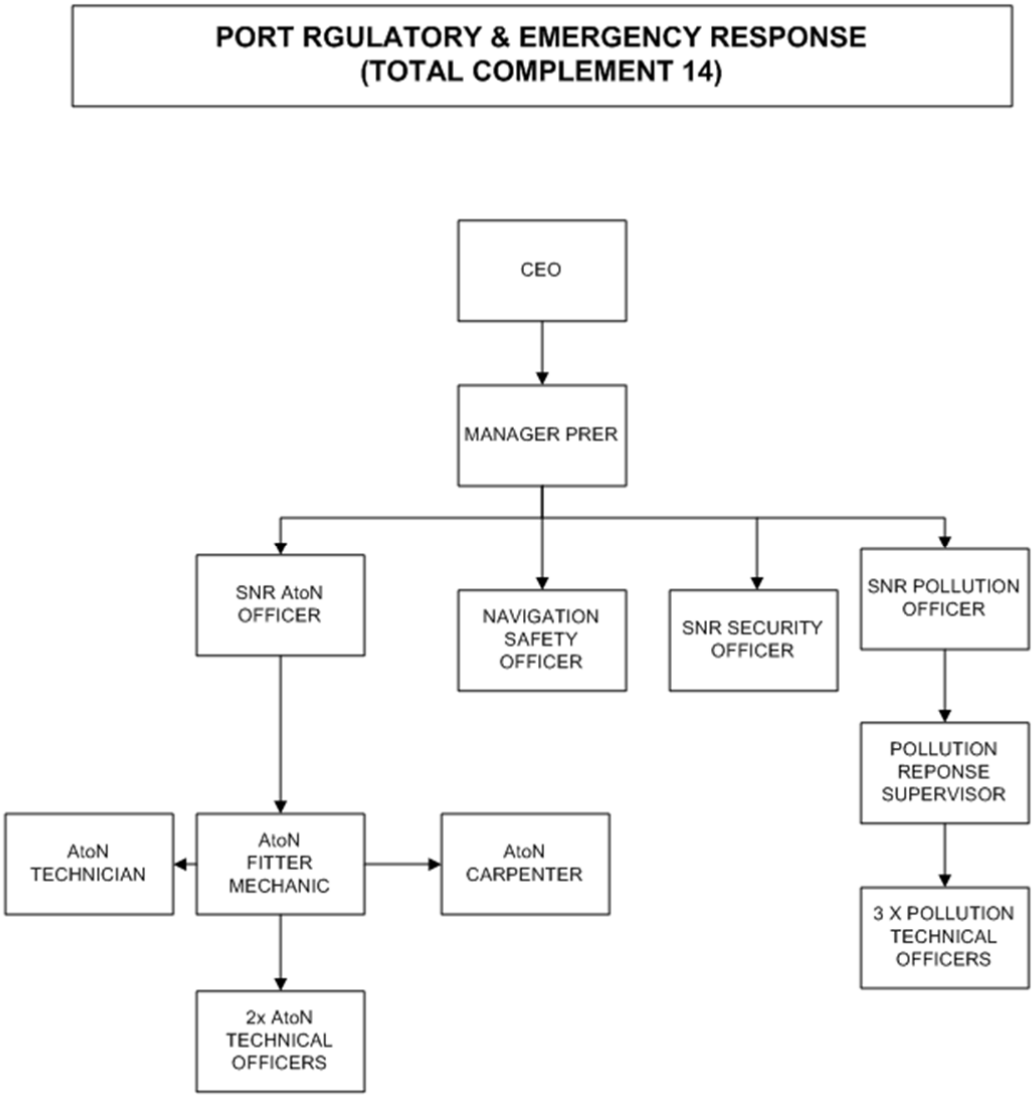
Watling, D. (2013) Fiji : state of birds, 2013 / Dick Watling. – Suva, Fiji : Nature Fiji-MareqetiViti, 2013.

44 p.

WWF (2003) Setting Priorities for Marine Conservation in the Fiji Islands Marine Eco region

Anderson, E., Judson, B., Tu'itupou Fotu, S., Thaman, B. (2003) Marine pollution risk assessment for the Pacific Islands Region (PACPOL Project RA1), South Pacific Regional Environment Program (SPREP).

Appendix 1: MSAF organisational structure



Appendix 2: Equipment recommendations for high risk sites

Site	Oil Spill Scenarios	Oil Type	Oil Spill Response Options	Equipment Stockpile Recommendations	MSAF Equipment Recommendations	Comments
Suva Harbour	Bunkering Tanker Discharges Vessel Operational Spills (Bilge discharges, oil transfers etc.) Vessel sinking Port Operations (Vessel Accidents, Collisions etc.)	HFO Diesel ULP Lube Hydraulic Bilge	On-water Oil Containment and Recovery Booming of vessel On-water oil recovery Shoreline Protection Shoreline Protection Booming Near-shore on-water containment and recovery	National MSAF Stockpile to be located at the Port of Suva	Fence Boom (600m) Rapid Deployment (200m) Shore sealing Booms (200m) Boom ancillaries (Anchor kits, anchor connectors, ropes, inflator etc.) Temporary Storage (2 x 10,000L capacity) Sorbent Pads (1000) Sorbent Booms (400m) Skimmer (1 x Disc and 1 x HFO compatible) Recovery pump (1 x standard 1 x HFO capable) On water skimmer On-water storage (10,000L) Dispersant (???L) Dispersant spray set AEDO spray set (or similar)	Equipment stockpile to respond to Spills inside Suva Harbour and adjacent regions significant spills in other ports Spills from maritime incidents in Fijian waters

Site	Oil Spill Scenarios	Oil Type	Oil Spill Response Options	Equipment Stockpile Recommendations	MSAF Equipment Recommendations	Comments
Pacific harbour	Bunkering Vessel Operational Spills (Bilge discharges, oil transfers etc.) Vessel sinking	Diesel ULP Lube Hydraulic Bilge	Booming of vessel Containment and recovery	Operator equipment	Appropriate Tier 1 equipment stockpile	
Denerau	BunkeringVessel Operational Spills (Bilge discharges, oil transfers etc.) Vessel sinkingPort Operations (Vessel Accidents, Collisions etc.)	DieselULPLubeHydraulicBilge	Booming of vesselContainment and recovery	Operator equipment	Appropriate Tier 1 equipment stockpileTotal Port Denerau Marina	
Vuda Point	Bunkering Tanker Discharges Vessel Operational Spills (Bilge discharges, oil transfers etc.) Vessel sinking Port Operations (Vessel Accidents, Collisions etc.)	HFO Diesel ULP Lube Hydraulic Bilge	On-water Oil Containment and Recovery Booming of vessel On-water oil recovery Shoreline Protection Shoreline Protection Booming Near shore on-water containment and recovery	Operators equipment: Total Pacific Energy Mobil	Appropriate Tier 1 equipment stockpile Total Pacific Energy Mobil	Operator equipment to respond to small spills and initial response to larger spills requiring outside assistance.

Site	Oil Spill Scenarios	Oil Type	Oil Spill Response Options	Equipment Stockpile Recommendations	MSAF Equipment Recommendations	Comments
Levuka: Total levuka	BunkeringTanker DischargesVessel Operational Spills (Bilge discharges, oil transfers etc.) Vessel sinkingPort Operations (Vessel Accidents, Collisions etc.)	HFO?? Diesel ULPLube HydraulicBilge	Booming of vesselContainment and recoveryShoreline ProtectionShoreline Protection Booming	Operators StockpileMSAF Stockpile to be located at the Port of Levuka	Fence Boom (200m)Rapid Deployment (100m)Shore sealing Booms (100m)Boom ancillaries (Anchor kits, anchor connectors, ropes, inflator etc.)Temporary Storage (10,000L capacity)Sorbent Pads (500)Sorbent Booms (100m)Skimmer (Disc) Recovery pump	MSAF Stockpile to respond to non-operator spills in Levuka and surrounding waters
Wai-Riki-Bua:Tropicwood	Bunkering Tanker Discharges Vessel Operational Spills (Bilge discharges, oil transfers etc.) Vessel sinking Port Operations (Vessel Accidents, Collisions etc.)	HFO Diesel ULP Lube Hydraulic Bilge	On-water Oil Containment and Recovery Booming of vessel On-water oil recovery Shoreline Protection Shoreline Protection Booming Near shore on-water containment and recovery	Operators Stockpile		

Site	Oil Spill Scenarios	Oil Type	Oil Spill Response Options	Equipment Stockpile Recommendations	MSAF Equipment Recommendations	Comments
Malanga	BunkeringTanker DischargesVessel Operational Spills (Bilge discharges, oil transfers etc.) Vessel sinkingPort Operations (Vessel Accidents, Collisions etc.)	Diesel ULP Lube HydraulicBilge	Booming of vessel?On-water oil recovery Shoreline ProtectionShoreline Protection BoomingNear shore on-water containment and recovery	Operators Stockpile	Appropriate Tier 1 equipment stockpile	
Taveuni	Bunkering Tanker Discharges Vessel Operational Spills (Bilge discharges, oil transfers etc.) Vessel sinking Port Operations (Vessel Accidents, Collisions etc.)	Diesel ULP Lube Hydraulic Bilge	Booming of vessel On-water oil recovery Shoreline Protection Shoreline Protection Booming Near shore on-water containment and recovery	Operators Stockpile	Appropriate Tier 1 equipment stockpile	

Site	Oil Spill Scenarios	Oil Type	Oil Spill Response Options	Equipment Stockpile Recommendations	MSAF Equipment Recommendations	Comments
Fijian Waters	Vessel Operational Spills (Bilge discharges, oil transfers etc.) Maritime Incidents (Collisions, Sinking's, Groundings etc.)	HFO Diesel ULP Lube Hydraulic Bilge	On-water Oil Containment and Recovery Booming of vessel On-water oil recovery Shoreline Protection Shoreline Protection Booming Near shore on-water containment and recovery Dispersant application (aerial and on-water)	MSAF National Equipment Stockpile	MSAF National Equipment stockpile	

Appendix 3: Equipment costs

Item	Cost range	Comments
Fence Boom (100m)	NZD$$12,500-$15,000 + $3000	MNZrate is $1995 per 20m section also allow $1000 for towing end/anchor bridles and $2000 for ancillaries per 100m kit
Rapid Deployment Boom (100m)	NZD$15,000 + $2000	MNZ rate is $4000 per 33m section
Shore Sealing Booms (100m)	NZD$25,000 + $2500	MNZ rate is just under $5000 per 20m section plus allow for ancillaries and towing ends and cover
Boom ancillaries (Anchor Kits, anchor connectors, ropes, inflator etc.)	NZD $3500	Kit to accompany 400m Land sea or every separate stockpile ofLand sea (pump, air fan etc.)
Temporary Storage (10,000L capacity)	NZD $10000 - $15,000	Fast tank 10m3 around GBP 5000 Covertex frame tank around NZD $12500
Sorbent Pads	NZD $200 - $250 per 100 pads	MNZ rate $1.61 per pad
Sorbent Booms	NZD $120-$150	MNZ rate around $70
Skimmer (disc)	NZD $25000 - $80,000	Komara 7k around 25,000 / 15K 35,000 / 20K $60,000 / 30K $70,000
Skimmer (HFO compatible)	NZD $80,000 - NZD $200,000+++	need a decent pump even on a small skimmer Komara 30K or DBD 16 for 50 - 70K may do LFO and light emulsions if you want a real heavy oil skimmer then suggest Helix as entry level as NZD $135,000 or Terminator at $200,000
Recovery pump (standard)	NZD $15,000	is this a separate pump? I have quoted on systems above - Price for a Spate pump

Item	Cost range	Comments
Recovery pump (HFO compatible)	NZD NZD $100,000	is this a separate pump? I have quoted systems above - price for a positive displacement submersible screw pump (such as DOP 250 ($25K plus necessary power pack 75K)
On-water skimming system (for use with VOO)	NZD $50,000 - NZD 80,000	For something like a bow collector or side collector with jib arm
On-water storage (10,000L)	NZD $20,000 - $30,000	10m tow tank
Dispersant (L)	NZD $10 - 15 per litre	Minimum order sizes may apply and unit price will drop with size of order - price for 'premium' end of market
AFEDO Spray Set	NZD $20000 - $25000	Depends on which size unit and selection of optional extras
Notes:		
Assumption that Fiji may not get the level of discount MNZ can attract		
Quotes of 'like' equipment recently supplied to or quoted to MNZ - other suppliers are available		
Quality and cost of equipment can vary considerably between suppliers - you get what you pay for!!		
Savings to be made for 'bulk' purchasing		
Operational efficiency achieved in limiting number of manufacturers		
Consider compatibility withMNZ and AMSA		
Don’t forget packing, storage and ancillary items		
Maintenance costs (opex) to be considered as well as Capex		
MNZ assistance in the form of contacts, tender specs, assessment criteria and other advice available.		

Suva	Min	Max	Quantity	Cost min	Cost max
Fence Boom (100m)	15,500	18000	6	93,000	108000
Rapid Deployment Boom (100m)	17000	17000	2	34,000	34000
Shore Sealing Booms (100m)	27500	27500	2	55,000	55000
Boom ancillaries (Anchor Kits, anchor connectors, ropes, inflator etc.)	3500	3500	1	3,500	3500
Temporary Storage (10,000L capacity)	10000	15000	2	20,000	30000
Sorbent Pads	200	250	10	2,000	2500
Sorbent Booms	120	150	130	15,600	19500
Skimmer (disc)	25000	80000	1	25,000	80000
Skimmer (HFO compatible)	80000	200000	1	80,000	200000
Recovery pump (standard)	15000	15000	1	15,000	15000
Recovery pump (HFO compatible)	100000	100000	0	0	0
On-water skimming system (for use with VOO)	50000	80000	1	50,000	80000
On-water storage (10,000L)	20000	30000	1	20,000	30000
Dispersant (L)	10	15	5000	50,000	75000
AFEDO Spray Set	20000	25000	1	20,000	25000
Total				**483,100**	**757,500**

Lautoka	Min	Max	Quantity	Cost min	Cost max
Fence Boom (100m)	15,500	18000	3	46,500	54000
Rapid Deployment Boom (100m)	17000	17000	2	34,000	34000
Shore Sealing Booms (100m)	27500	27500	1	27,500	27500
Boom ancillaries (Anchor Kits, anchor connectors, ropes, inflator etc.)	3500	3500	1	3,500	3500
Temporary Storage (10,000L capacity)	10000	15000	2	20,000	30000
Sorbent Pads	200	250	10	2,000	2500
Sorbent Booms	120	150	66	7,920	9900
Skimmer (disc)	25000	80000	1	25,000	80000
Recovery pump (standard)	15000	15000	1	15,000	15000
Total				**181,420**	**256,400**

Levuka	Min	Max	Quantity	Cost min	Cost max
Fence Boom (100m)	15,500	18000	2	31,000	36000
Rapid Deployment Boom (100m)	17000	17000	1	17,000	17000
Shore Sealing Booms (100m)	27500	27500	1	27,500	27500
Boom ancillaries (Anchor Kits, anchor connectors, ropes, inflator etc.)	3500	3500	1	3,500	3500
Temporary Storage (10,000L capacity)	10000	15000	1	10,000	15000
Sorbent Pads	200	250	5	1,000	1250
Sorbent Booms	120	150	33	3,960	4950
Skimmer (disc)	25000	80000	1	25,000	80000
Recovery pump (standard)	15000	15000	1	15,000	15000
Total				**133,960**	**200,200**

Malau	Min	Max	Quantity	Cost min	Cost max
Fence Boom (100m)	15,500	18000	3	46,500	54000
Rapid Deployment Boom (100m)	17000	17000	2	34,000	34000
Shore Sealing Booms (100m)	27500	27500	1	27,500	27500
Boom ancillaries (Anchor Kits, anchor connectors, ropes, inflator etc.)	3500	3500	1	3,500	3500
Temporary Storage (10,000L capacity)	10000	15000	2	20,000	30000
Sorbent Pads	200	250	10	2,000	2500
Sorbent Booms	120	150	66	7,920	9900
Skimmer (disc)	25000	80000	1	25,000	80000
Recovery pump (standard)	15000	15000	1	15,000	15000
Total				**181,420**	**256,400**

Total for 4 Equipment Stockpiles	Min	Max
Suva	483,100	757,500
Lautoka	133,960	256,400
Levuka	133,960	200,200
Malau	181,420	256,400
Total	**932,440**	**1,470,500**